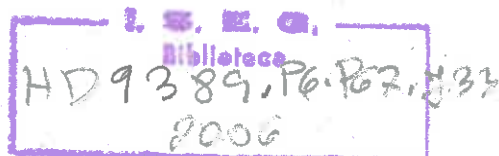




UNIVERSIDADE TÉCNICA DE LISBOA
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TECHNOLOGICAL, INSTITUTIONAL AND
MARKET STRUCTURE CHANGES AS
EVOLUTIONARY PROCESSES: THE CASE OF THE
PORT WINE SECTOR (1680-1974)

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Lisboa, Maio de 2006



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Acknowledgements

The present research has been developed over a protracted period of time, starting in October 2000, and as a result I feel I am indebted to several colleagues and Professors.

First of all, I have to thank my Ph. D. advisor, Prof. Francisco Louçã from ISEG-UTL, for his support and orientation, during the various phases of the research.

I am grateful to the following people for all the comments, support or help received throughout the development of the thesis: Professor Esben S. Andersen (Aalborg University, Denmark), Professor António Barros Cardoso (FLUP), Professor José Luís Cardoso (ISEG-UTL), Professor Robin Cowan (Merit-Unimaas), Professor Manuel Mira Godinho (ISEG-UTL), Dr. Silvestre Lacerta (ADP, Porto), Professor Helena Lastres (IE-UFRJ), Professor Conceição Andrade Martins (ICS-UL), Professor Pierre Monhen (MERIT-Unimaas), Professor Gaspar Martins Pereira (FLUP) and Professor Carlo Pietrobelli (University of Rome III).

A special mention has to be made for the support of Luísa de Castro Vasconcelos Gonçalves Jacquinet. I have also to thank several colleagues and, among them, João Carlos Caetano, Francisco Curado, Henrique Curado, Roger Phillips and Niall Power.

I am pleased to acknowledge the support of the Marie Currie Fellowship program of the European Union, that granted me a stay of six months at the Merit research center of the University of Maastricht; the support of the CGRI (Belgium); the former Ministério da Educação, for my inclusion in the Prodep program, and the Fundação Calouste Gulbenkian and the Fundação para a Ciência e Tecnologia (FCT), for granting financial support for participating at various conferences.

I accept sole responsibility for errors, omissions and misinterpretation that may be found in the pages that follow.

TECHNOLOGICAL, INSTITUTIONAL AND MARKET STRUCTURE CHANGES AS
EVOLUTIONARY PROCESSES: THE CASE OF THE PORT WINE SECTOR (1680-1974)

Abstract

The objective of the research is to understand better three distinct but interrelated issues about the Port wine sector from 1680 to 1974. Generally it is also about a better understanding of the expression "history matters", or "historical processes", and, in this perspective, see how productive, regulatory and trading structures have evolved in the long-run. In other words, the present work is a contribution to economic history combining traditional methods of the historian with concepts and economic theories related to the issues of market evolution, technological change and institutional evolution.

Starting with the hypothesis that only a long-run historical perspective allows us to understand the fundamental aspects of the transformation of an economic activity, the study focus on the Port wine industry between the end of the 17th century and the middle of the 1970s, giving explicit emphasis to three elements of the productive system: (1) the institutional structure and the regulatory activity of the sector, with a special role played by the legal institutions and the State; (2) the technological transformation of the production of Port; and, finally, (3) the evolution of the population of shipping firms.

First, the technological change has been qualified as partially path dependent given the important weight of the tradition and the way knowledge and experience is transmitted from generation to generation. Second, the regulatory system has been defined as a combination of institutions and norms that contributed to a certain kind of order between the production and the trading spheres and the State. Finally, the evolution of the market structure can be characterized as evolutionary and show much influence from the type of regulation adopted in any specific time period.

The relations between these three features of the sector were characterized as well as the factors of change and continuity. More fundamentally, the case studied supports the path dependent evolution of the regulatory structure, the technology used and the market structure. However, at the same time there is a clear evidence of path creation, alongside with the legacy of the paths of the past.

Resumo

O objectivo da presente investigação é aprofundar a compreensão do conceito de “processos históricos” partindo, nesta perspectiva, da análise de três aspectos específicos do sector do vinho do Porto num período de tempo alargado: as estruturas produtivas, as estruturas comerciais e as estruturas institucionais. Trata-se de um contributo para a história económica que combina métodos tradicionais da história com conceitos e teorias económicas relativas à inovação, à transformação tecnológica e à evolução institucional.

Partindo da hipótese de que só uma perspectiva de longo prazo permite entender os aspectos fundamentais da transformação de uma actividade económica, o trabalho centra-se no caso do sector do vinho do Porto entre finais do século XVII até aos anos 70 de Novecentos, investigando três elementos do sistema produtivo: (1) a estrutura institucional e a actividade de regulação (centrada no papel do estado) do sector, (2) a transformação tecnológica da produção de vinho, e, finalmente, (3) a evolução da população de empresas exportadoras ou firmas do vinho do Porto.

Em primeiro lugar, a transformação tecnológica foi qualificada como parcialmente “*path dependent*” dado o peso da tradição e do modo como o conhecimento e a experiência são transmitidos de geração para geração. Em segundo, o sistema de regulação, definido como combinação de normas e instituições, contribuiu para uma certa “ordem” entre os vários grupos (comerciantes, lavradores e Estado). Por último, a evolução da estrutura de mercado pode ser caracterizada como evolucionista e mostra ser muito influenciada pelo tipo de regulação que foi adoptado em épocas históricas distintas.

Foram identificadas as relações entre estes três elementos e estudados os factores de ruptura e de continuidade. Fundamentalmente, o caso estudado ilustra uma dependência do caminho (*path dependence*) da estrutura de regulação, da tecnologia utilizada e da estrutura de mercado. Além da dependência do caminho, há simultaneamente a evidência de criação de novas alternativas e de novos caminhos.

Introduction

We have still to consider the economical condition of mankind as liable to change, and indeed (in the more advanced portions of the race, and in all regions to which their influence reaches) as at all times undergoing progressive changes.

We have to consider what these changes are, what are their laws, and what their ultimate tendencies; thereby adding a theory of motion to our theory of equilibrium — the Dynamics of political economy to the Statics.

John Stuart Mill (1909/1848: 695)

It would be folly to analyze the economy from a static framework.

Lawrence R. Klein (1983: 1)

The Port wine production, at the turn of the 17th century, was one of the main – if not the main – economic sector(s) in Portugal and the main export product, if I discount commodities from Brazil. If the product was first among equals at that early time, its importance grew all through the following century, roughly from just before the Methuen Treaty to the French invasions and the ensuing liberal revolution. At that time, the Brazilian trade superseded the Asian trade and wine was the first export commodity of Continental Portugal; moreover, Port dominated the Portuguese wine trade and frequently exceeded 50% of total exports.

In the 19th century, the Port wine trade was equivalent to approximately 30% of the value of total exports and 20% of imports (and other wines altogether were half those figures), its relevance for the Portuguese economy remained. This could be surmised for two main reasons: first, as a mean to cover import expenditures and, second, as a prominent fountainhead of tax revenues for, at least, the central state treasury and the city of Porto. Then, even during the financial crises and public finance hardships of the 1890s, the Port wine was a reliable source of revenue.

In the 1930s or the 1950s, the Port wine continued to be the major wine export (in terms of value) and still made an important contribution towards the trade balance

and fiscal revenues. In the period 1950-1954, the yearly average of total wine export (including wine-spirit) was 631 million escudos, with Port fetched 316 million of that total. Those figures included exports to the overseas provinces and colonies. When excluding the colonies, the yearly exports to foreign markets were, for Port and all the other Portuguese wines (and wine-spirit), respectively 116 and 316 millions escudos (Fonseca 1956: 7-10).

Successive governments have always taken a lively interest in the Port wine industry and have tried to take an active part in the policy and decision making process. This is clearly exemplified by the parliamentary debates on wine issues.

The starting point of the research was a theoretical inquiry into the factors of technological change and the process of innovation that is now applied to a specific sector: the Port wine system. The theoretical inquiry led me to investigate further the institutional aspect of the sector, namely the regulatory entities and the overall state regulation, the production structure and its interaction with the main historical features of the last three centuries. After unavoidable refinements, the object of the research could be articulated in the following terms: what were the main transformations of the Port wine sector over a protracted period of time? To be more precise, what were the landmarks of the technological transformation, the institutional change of the sector and the evolution of the population of shipping firms? All three aspects were considered in a long-run historical perspective that span from the early 18th century to the third quarter of the 20th century.

1. Object of the research

The present dissertation deals with three interrelated and prominent issues of the Port wine sector. The first one is the technological change and the innovation processes, especially in the production area, which contributed to significant transformation of the commodity. My objective with this issue is to describe the main technological changes of the period. The second is the institutional structure, and the regulatory framework in particular, which shaped a substantial part of the sector. I intend here to describe the importance of the institutions and the regulation systems for different periods of the Port wine history. Finally, the third issue is the evolution of the market structure of the shipping firms and their relative position *vis-à-vis* the production sector based in the

Upper Douro area. What I intend here is to describe the evolution of the population of the firms and the modification of the market structure. My objective is also to relate some crucial interactions between the three object of research.

First, the main technological changes and their consequences constitute the first aspect of the Port wine system that is studied in the present thesis. Some features directly or indirectly related to the issue of technological change, such as the evolution in consumption, tastes and foreign markets are ignored as explanatory variables because of the difficulty of obtaining reliable and good data. I will limit myself here to some general remarks and overall figures that are available, and only refer briefly to the studies that have been done by several scholars, especially historians. My contribution will be to relate the technological change to the then existing institutions and the trading sub-sector of the Port wine industry, in order to give a broader picture of the technological process as part of a global transformation of the sector.

Second, the problem of the regulation of the Port wine sector and its evolution through different phases or regimes is the second issue at hand. The wine sector in general has been widely studied from the vantage point of its regulatory framework; however, the focus has generally leaned on the legal aspects as an exercise of legal reasoning. Until recently a thorough study of the regulatory scheme of the regulatory scheme of the Port industry has never been carried out, with the exception of a legal analysis on topics such as falsifications and frauds (Simões 1932). The recent study of the legal system of the Port wine by Moreira (1997) has filled an important gap in the understanding of the sector. This legal perspective, albeit valuable and original, needs, however, to be complemented by other approaches. Two considerations have to be made. First, the legal perspective does not offer a satisfactory theoretical background that can be used in the study of the origins and the evolution of the regulatory systems in the Port wine sector in particular and the wine production regions in general. Moreover, this perspective tends to use a comparative methodology with other wine regions on a contemporaneous basis, which in fact reflects a dominant practice in legal scholarship. This comparative method is often limited to contemporaneous and culturally similar countries.¹ Second, the historical analysis can be misleading. Indeed, the Port wine has changed through a long process that can be characterized by some

¹ The traditional method of comparison in legal studies has been under vigorous criticism. In history, the same evolution can be identified (Etienne 2000). My point here is just to consider a more general theoretical model for comparing different systems of regulation of wine production and trade.

landmark events such as those of 1756, 1820s, 1908, 1933 and 1974, but this process does not necessarily reflect the current state of the sector, which is much closer to the paradigm of self-organization. Indeed, the current situation often offers an obvious start for studying and interpreting the past, but as it is known, human action in the past proceeds, like today, in contexts of uncertainty and not on a basis of known outcomes beforehand with agents endowed with foreknowledge of what tomorrow is becoming. One of the central arguments in the thesis that I defend, is the importance of an historical perspective based on long run processes. That is what I intend to investigate in greater detail, especially in the second part of the thesis.

For this purpose, several studies are available from different perspectives (Martins 1998, Moreira 1998, Duguid and Lopes 1999, 2001, Pereira 2004) and they will provide the starting point of my own analysis.

Third, the general evolution of the shipping firms and the structure of the Port wine shipping market constitute the last research question. The evolution of the shipping firms as a global population has been studied according to relevant and particular cases by Paul Duguid alone or in collaboration with Teresa Silva Lopes (Duguid and Lopes 1999, Duguid 2000, Duguid and Lopes 2001). I draw on the study in the periods 1777-1786 and 1807-1834 and make use of other sources for the period 1762-63 to 1974 in order to get the information on the market structure from generation to generation. I will focus my research on a long term perspective based on the study of successive generations of shipping firms, giving an overall description of the whole population of port-shippers and a more detailed account of the major firms, in particular those that dominated the trade.

Finally, I will try to relate the three topics in the last two chapters and the conclusion of the thesis. The thread that unites these three objects of study that are related to each other consists of a long run perspective that tries to identify the main changes in each sphere and their interaction with one another.

2. Method used

The methodological problem can be divided in two parts. First, the wider issue, including the theoretical considerations and the adoption of tools from different

academic traditions. Second, the problem of the data sources, their quality and critical use in the argument of the thesis.

The data consulted and used in the present dissertation come from a wide range of sources. I have started with the widely known time series on Port wine that have been published by Conceição Andrade Martins (Martins 1990, 1998) and based on a vast array of sources. Later on, other studies were used with recently published quantitative or qualitative data that were not available in Andrade Martins (1990); here I have to refer to the works of Norman Bennett, Antonio Barros Cardoso, Paul Duguid and Gaspar Martins Pereira.² However, a substantial part of the quantitative and qualitative data came from my own research in archives (see the list of sources in the reference section of the thesis preceding the bibliography).

I have combined the data already organized by different authors with the data that I was able to collect. This is the case for the regulation issue, the evolution of shipping firms and, to a lesser extent, the technological change.

The historical method evidently can be related to the issue of the criticism of the sources for historical documents. It is also a method to grasp social and economic changes through time, attributing special attention to the variables that are part of the present study.

The critical method, when applied to the sources and documents about regulation or trade, can help to establish their authenticity and reliability for the purposes of my argument, namely as far as their quality, relevance, credibility and precision are concerned. The quality of the information encountered was high in the case of the documents of the Porto Custom House (*Alfândega do Porto*), the *Ministério da Agricultura*, the *Ministério das Obras Públicas* and the *Ministério do Reino* and the *Instituto do Vinho do Porto*.

The analysis of institutions that I will use in the thesis is much related to the design of what is now termed the American institutionalism or old institutionalism. The reason for this will become evident in the later chapters. What is important to note now is the centrality of institutions understood as not just organizations but as sets of norms relevant for social and economic life.

² I have consulted the papers and books published by these authors and made use of the time series and transcription of original documents that they contain (Pereira 1984a, 1989a, Bennett 1990, Pereira 1991, Bennett 1992, 1994, Cardoso, A. B. 1997, Duguid 2000, Cardoso, Antonio Barros 2003, Bennett 2005, 2006).

The making of an economic sector, its market structure, its technological state and its regulation are not just based on price and market mechanisms but also on a wide array of institutions.

This is obvious in the case of the modern economic regulation that is based on a legal structure of either strong or weak state intervention and either weak or strong organization by the economic actors: wine growers, investors or speculators and shippers (what is often referred to in the literature as self- or auto-organization).

Technology goes through a process of change which is highly influenced by the prevailing institutions that impact the incentive structure, the costs of transactions and the set of possible paths available to an economic decision-maker. The evolution of shipping firms, albeit close to the economics of imperfect market competition, is related to the role played by institutions.

3. Structure of the thesis

The thesis is divided into two parts. The first one is composed of theoretical and descriptive chapters which prepare and lead into the second part, which comprises three chapters on the three research questions selected for further study and analysis. The last chapter of the first part wraps up the theoretical arguments and presents a brief survey on the Upper Douro wine production area and some general themes related to the Port wine trade and production.

The first part of the thesis contains a review of the literature on the theoretical and methodological issues related to the research that will be developed in the second part. The first part is then composed of the theoretical issues: the theory of technological and institutional change, the historical and long run perspectives and the evolutionary economics of competition and industries evolution. The second part consists of the empirical data and its analysis in three chapters on regulation, technological change and the evolution of the market structure of Port wine shippers.

I have tried in the first part to give a fundamental discussion of the methodological and theoretical issues around the problems of technological change, evolutionary theory, economic history, regulation theory and institutional analysis. These elements constitute the building blocks of the theoretical model used for the interpretation of the data treated in the second part.

4. Theoretical background

My overall interest in economic change (economic history taken in a broad sense here) has not diminished throughout the research process. However, it has led me to focus on a specific economic sector. My general interest was and is about economic history and the issue of historical economics and *innovation* as a central feature of the capitalist economies and that could be defined as "the search for, and the discovery, experimentation, development, imitation and adaptation of new products, new production processes and new organizational set-ups" (Charles 1996: 5). A similar definition can be found in Giovanni Dosi (1988: 1120-1135).

In turn, technological change can be associated to what contemporary sociologists mean by "innovation" (Alter 1996, 2000). Both notions – innovation and technological change – are to be understood as socio-economic phenomena and cover the study of the dynamics of innovative processes broadly construed.

This methodology relies on a generalization of the theory of evolution and the integration of the historical specificity of technological change. Consequently, I share the view of Chris Freeman that "biological analogies can be fruitful in highlighting aspects of this selection process provided that the differences as well as the similarities between social and biological evolution are also stressed" (Freeman 1992a: 127). Another reference in the application of the theory of evolution to the study of economic change has to be made with Stan Metcalfe's study of innovation and knowledge as engines of the capitalist system (Metcalfe 1998a, 1998b, 2001b, 2002).

A central feature of the thesis, as I will stress later on, is the historical specificity of technological and institutional change, not to mention the spatial specificity. Although the geographical aspects of the production of Douro wines are important, I will only treat them briefly in the second part of the thesis, when describing the features of the Port demarcation area and relating them to the notions of local systems of production and innovation.³ In a sense, my research is also one about a local system of

³ The references are too many to mention; as an example, I can refer to the authors I have once consulted (Nosi 1991, Benko 1998, Saviotti and Nooteboom 2000, Paniccia 2002). My approach is an integration of the literature on the (national, regional or local) systems of innovation with the once-called regional science and the now much praised economic geography.

The notion of space, e.g. through the reflection on the process of globalization, is at the centre of promising strands of the sociological research. See, for some references, Law and Urry (1999). Part of the literature has been an upsurge of the sociology of science and technology as well as the actor-network research program (Callon 1993, Urry 2003). The literature on local systems of production and innovation is partly related to economic geography, with the treatment of industrial districts, *milieux innovateurs*, and

production as it is accepted by students of economic geography, technological change (or innovation) and regional science.

The historical specificity must not be understood as absolute, or that the ensuing analysis has to be devoid of generality. Historical change appears as both specific and general. The tradition of historical analysis stresses the first characteristic while the theory of evolution offers a general view on historical change.

The evolutionary perspective – which has been widely discussed within economics during the last two decades (Boulding 1981, Nelson and Winter 1982, Nelson 1987, Boulding 1991, Freeman 1992a, Freeman 1994, Ziman 2000, Foster and Metcalfe 2001, Freeman and Louçã 2001) – provides interesting insights into the study of technological change, and particularly in the subfields of inquiry such as the economic history of innovation.⁴

The theory of evolution offers more than just interesting insights: it gives us a theoretical framework and more rigorous analytical tools to study change in technology and markets.

Although the debate is still raging, I will try to draw some conclusions about technological change as an historical process, focusing on the similarities and *differences* between biological evolution and the evolution of techniques and the techno-economic paradigm.⁵ I will treat both the literature of the history of techniques, focusing on the technological system, as well as, the economics of technological change, with such notions as the techno-economic paradigm (Perez 1983, Freeman 1992a, Freeman 1994). The former has become a considerable literature of which two strands are of interest to my research purpose: that emerging out of the works of Bertrand Gille, Leroi-Gourhan, and Thomas P. Hughes and that of the sociology of techniques (the so-called SCOT movement).⁶

From a very abstract point of view, I will adopt the theory of evolution that permits to deal partially, but significantly, with the problem of time (Hodgson 2002a: 3-

to the outgrowth of the National systems of innovation applied to local production systems (Bagnasco 1977, Aydalot 1986, Becattini 1987, Camagni 1991, Benko and Lipietz 1992, Benko 1998, Becattini 2000, Pietrobelli, Guerrieri and Iammarino 2001, Pietrobelli and Rabellotti 2004).

⁴ See Bassala (1988) for the history of techniques and Foster and Metcalfe (2001) for economics.

⁵ See the works of Sober, Gille, Mokyr, Ziman and Freeman and Perez for some critical considerations.

⁶ See in particular Fox (1998) for a recent account on the state of the art in the study of the history of technology. Another series of seminal works on the evolution of early techniques are the studies made by Leroi-Gourhan (1964/1985, Leroi-Gourhan 1965/2002, 1971/1984a, 1971/1984b). I have neglected in my research the work of some authors associates with the History of Technology (HOT movement) for studying specifically the American industries and some of the recent technological changes.

40). This point can be found in several authors that contributed to the literature on the theory of evolution and its direct extensions (Laszlo 1994, Plotkin 1994, Lewontin 1998).

I discuss a *hierarchical theory of evolution*⁷ applied to the techniques and the socio-economic institutions that will be compared to the problem of history in the social sciences, and in economics in particular, as it is the object of the present research. This hierarchical theory will be related to the history of techniques.⁸

I will relate hierarchy to complexity theory (Arthur 1990, 1999) and to the theory of systems literature (Le Moigne 1990, 1999a). This makes a bridge between economics and the history of techniques (Gille 1978, Basalla 1988) and outlined in the works of Keith Pavitt and Giovanni Dosi, among others.

A key distinction between economics and history –as scientific disciplines– is the notion of imprecision or vagueness, pervasive in the method of the historian and quite absent from the method of research of mainstream economics, at least in theoretical models but not so much in applied research and econometrics.

This is a rather recent subject in philosophy – namely in the scholarship coping with science and logic – at least if I consider the explicit treatment of vagueness. The origins of this strand of philosophical problems can be traced back to the Zeno's paradoxes and, above all, the sorites paradox, often referred to as the paradox of the heap.

If the early expositions can be found in Cicero (1st century B. C.), Diogenes Laertius (3rd century A. D.), and Galen (2nd century); and more recent ones in Bertrand Russell and Max Black, it is only in the last two decades that the concept of vagueness has gained momentum in the philosophical literature on logic, language and science.

Apart from the works of Keynes and Ramsey on imprecise probabilities, economists generally have adopted the Laplace-Gauss vision of stochasticity, searching for the Holy Grail of precision. Historians, on the other hand, have accepted a momentaneous flirtation with quantitative history⁹ or a more durable adhesion to the prominent cliometrics movement in economic history, and have been searching for complex causal patterns, vague objects and imprecise variables whose measurement has

⁷ I adopt part of the approach of Plotkin on the construction and necessity of a hierarchical theory of evolution (1994). For some critical appraisal of the theory of evolution see Tort (Tort 1985, 1992).

⁸ See the works of Basalla (1988), Gille (1970), Spengler (1958) from the perspective of the history of techniques and Dosi and Pavitt from the vista of economics (Dosi 1982b, Pavitt 1984, Dosi and al. 1988, Pavitt 1998, Dosi 2000, Pavitt 2002).

⁹ I have in mind here the *histoire sérielle* in the French tradition.

always been source of concerns. This is a point I will treat briefly in two parts: first, I will discuss the literature on vagueness and imprecision in the social sciences and, second, I will give a first treatment of imprecise probability theory and connect it to the vagueness literature and the economics of technological change.¹⁰

The creation of a strong regulatory structure, which remained in place and unaltered for about two decades, or at least not losing prerogatives and even gaining power and momentum, changed the productive and commercial structure of the sector and together with the legal system, started a process of cumulative change. The demarcation area was favorable to some producers and not to others, with the result that the most favored producers found themselves in a greater position of power to survive in the competitive process of selling the wine produced in the Douro to the Porto-based merchants.

The 1756 regulation had a drastic influence on the port wine sector and profoundly disturbed the market, creating serious problems and an overall sense of uncertainty in daily production and trade as well as business management, especially around the vintage time and the selling of (grape) must and new wine (*vinho novo*).

The Upper Douro crises were at the center of the political agenda from the late 18th century to the mid 1960s. It became the first export product during most of the period under study and today still has a significant contribution to the trade balance.

This explains the existence of diverse sources of documents dealing with the Douro wine production and trade. However, that information is spread among numerous institutions and makes research a cumbersome task.

I have here used a varied sample of relevant documents that give a clear picture of a complex economic sector.

¹⁰ I have excluded in the present introduction and in the rest of the thesis references to the theory of complexity. I will insist rather on the complexity of the object of study, being of historical nature, changing through time.

Part I - The Theoretical Framework

In the first part of the thesis, I deploy the theoretical tools that I will make use of in the second part in order to study the technological change, the variegated institutional settings through time and the evolution of the population of Port shippers. I will tackle the following issues: first, the relation between economics and history (chapter I); second, the theoretical underpinnings of the three interrelated but distinct problems under review (technology, institutions and populations of firms); third, the usefulness of evolutionary theory (chapter III); and, finally, as the fourth and last chapter, a brief account of the question of historical analysis with the buildup of a theoretical model for studying the Port wine industry and its transformation in the last three centuries.

Before studying any specific data on the three research questions that I have retained (technological change, institutional framework and the evolution of shipping firms), I would like to introduce some methodological issues and a series of concepts that I hope will make clearer the analysis and interpretation of the second part of the thesis.

To answer the three research questions as defined in the introduction, I make use of some specific notions that allow me to offer a particular interpretation of each one.

Chapter I - Some theoretical issues about the nexus between Economics and History

There is a controversy and dividing line in history and the social sciences that can be expressed as the opposition between stasis and change, or equilibrium and disequilibrium. In economics, this dichotomy is clearly apparent in the distinction between processes (or dynamics) and outcomes (statics), at least since the distinction was formulated by John Stuart Mill, then reappraised by Marshall, and later reassessed by institutionalist, evolutionary and neo-Schumpeterian economists, among others. This controversy is also to be found in biology, namely evolutionary biology.

However, in this fundamental controversy there is a lack of clarification of the very concepts. For some of those that insist rhetorically on change and disequilibrium, the term dynamics or steady state equilibrium has nothing to do with radical transformation or cumulative change; steady state growth is still viewed as a constant process of change, because nothing new happens, except the constant increase in the factors of production. For some of those that stress stasis or stability, dynamics is an extension of statics, yet this does not tackle issues of change as it is understood in history, sociology, and in some quarters of the economics profession.

Here, I consider change with its distinct and radical meaning. Novelty is always combined with the existing structure, with what has been called the prevailing "equilibrium", and the novelty exerts a transformation on the extant structures. Logically, no change can be distinguished if there are no stable elements. The distinction between the two comes from their very contrast. Change needs stability as much as stability requires change. However, saying that stability is necessary and continuing to call one's theory or methodology as evolutionary cannot lead to the neglect of change, as can be interpreted by the position of Edward W. Constant (1999, 2002).

Edward Constant is right in explaining the importance of stability in the evolutionary process, especially when referring to many instances of technological change (Constant 2002). This is related mainly to the scope that is given to incremental change in an evolutionary theory of technological change. Stable design in the

emergence of new artefacts is quite common. However, this stability cannot be exaggerated; otherwise, the theory might not rightly be called evolutionary.

First, the theoretical buildup of Edward Constant's argument is based on a particular type of evolutionary model that is neither exactly the one of the modern synthesis, as represented by Ernst Mayr, nor the one of orthodox Darwinism as typified by John Maynard Smith, these two biologists being the most respected evolutionary theorists of the last four decades. Edward Constant insists on stability as an essential element of an evolutionary model but does not refer clearly to an evolutionary theory proper, but rather makes reference to variants of the evolutionary theory (Lakatos, Popper, Hull, Campbell, Kuhn, Vincenti, Hughes, etc.). Not all those authors hold the same definition of evolution as a theory and of evolutionary processes; their scope and, more fundamentally, their object of research are different. They are in fact either philosophers of science or economic historians.

Second, Edward Constant does not refer to the essential literature of evolutionary biology, neglects Maynard Smith and Mayr, and furthermore makes no reference to Darwin, Dawkins, Lewontin, Gould or Eldredge. Only the references made to Campbell, Hull, Nelson and Winter are the ones an evolutionary theorist would expect to find, but probably their work is not so rightly characterized by stability or stasis. Finally no reference is made either to the American institutionalists following Thorstein Veblen such as Paul Dale Bush, David Hamilton (Hamilton 1970 [1953]), Anne Mayhew, Warren Samuels and Marc Tool.

Third, the valuation of stability is excessive and detrimental to the importance of change. Probably, it could be valid for the analysis of the technological evolution of the airplane; but could it be a case for generalization to most of technological changes? It certainly does not apply to the wine industry when taken in a long run perspective. As a corollary, the study of Edward Constant deals with a few decades while evolutionary processes in human settings like technology take more often than not several decades more. In other words, the chosen time span is a restriction on the conclusions. For the wine industry – for example, although it could equally apply to the textile or steel industries – focusing on the period 1800-1840 or 1900-1940 would support a view of stability in the technological system while selecting the periods 1800-1900 or 1900-2000 respectively, would highlight periods of radical change.

Fourth, the economic sector chosen by Edward Constant, namely the airplane industry, is very specific, and is related both to military strategy as well as the

organization of the military industry that do not parallel the characteristics and the evolution of technologies in most economic sectors. Indeed, the stability of the engineering process and planning for the production of planes and military aircrafts is not comparable to what we can find in most industries characterized by smaller scale of production and shorter time span for research and development. Moreover, most industries are related first to the consumer market or the intermediary goods market, where firms are in the vast majority small or medium sized entities with higher probabilities of "mortality" than say, Boeing. In the case of the wine sector, the vine scourges and the wine diseases are an important source of instability, whose effects have helped to transform the way wine is made.

Finally, in order to maintain an economic activity at the firm or sectoral level, it is necessary to use quite a lot of energy; this is the role of professional associations, regulatory entities, both very active in the Port wine sector.

If evolution requires stability, i.e., diversity as a fuel for selection and reproduction of the elements through a steady mechanism, the very process of selection is characterized by change through the modification in the composition of the underlying population.

I would stress that logically and theoretically both stability and change are necessary for any theory to be called evolutionary; but stressing excessively on stability would lead to the neglect of change that can exist even in situations of inertia, either of technological or of institutional origins. I will return to this point in chapter III.

I take as a starting point, for the theoretical issues discussed here, a central characteristic of human action: its imprecise nature. I will first argue the importance of the notion of vagueness and its implications for economic and historical analysis. Then, I will extend the concept of imprecision to the notion of uncertainty and the problem of choice for both the issues of technological and institutional change and the evolution and selection of wine merchants and companies.

1. Notion of vagueness, human action and imprecise probabilities

Vagueness, or imprecision, in the philosophical and scientific literature, can be understood in three main perspectives: one is the common sense notion of imprecision related to everyday life experience and the imprecision of measuring instruments; a

second one is the philosophical concept of vagueness debated in the analytical philosophy tradition and, finally, the third one is the aptitude to think and the method of analysis that deals with complex objects, i.e., novel objects that do not have clear boundaries. The third meaning can be seen as an outgrowth of the first, as its formalization in the building of models and theories. I will treat the first and third together, because of their proximity. The second will be discussed throughout the present chapter, when dealing with the methodological issues and the problem of uncertainty.

Each of these views of vagueness has to be modified and qualified by two factors: first, the very nature of the object of study, especially when dealing with human societies that are not so prone to precision measures (Moles 1995), and, second, the importance of time that modifies not just the perception of objects but can also have an impact on their very nature.

If the literature on vagueness, ambiguity, and imprecision is not new – as is attested by Bertrand Russell,¹¹ however, the recent upsurge, by contrast, is quite different and while it returns to old questions, the issues are spread over scientific disciplines. This is especially the case in the analytical brand of philosophy, closely related to the questions that affect science and the problems of causality and probability.

The notion of vagueness is related to a couple of paradoxes that used to and still do defy reason. The most famous, and which is still being discussed in leading philosophical journals, is the Sorites' paradox or the paradox of the heap, often illustrated by the example of the pile of sand.¹²

Two main strands of the philosophical literature dealing with the concept of vagueness can be distinguished: the epistemic view and the ontic (or ontological) theory of vagueness. Between the two, obviously, other possibilities arise.¹³ Moreover, it must be clear that the ontic conception does not preclude the simultaneous existence of the epistemic view. Both are jointly possible.

¹¹ The article of Russell, entitled "Vagueness", appeared in 1923 in the *Australasian Journal of Philosophy and Psychology* (Russell 1923); while the 1937 article from Max Black was published in volume 4 of the review *Philosophy of Science*, with the title "Vagueness, an exercise in logical analysis" (Black 1937).

¹² I will discuss briefly the Sorites' paradox and I will relate it to methodological issues of historical theory in economics. This is however for a subsequent chapter. The paradox can be stated as follows and works both ways: if you have a pile of sand and take away a particle, you still have a pile of sand. But if you continue the process until the moment there are just two pieces of sand, you will still say that this is a pile of sand while at the point you are you cannot sustain that a particle of sand is still a pile of sand. Here lies the paradox.

¹³ Many-valued logic and degrees theory are closer to the ontic view.

The epistemic view poses that imprecision lies on the cognitive side of the observer: it is thus one type of ignorance, a kind of incapacity to draw the line between objects correctly. Accordingly, this view does not deal well with borderline cases but retain the advantage of maintaining the results of classical logic.

The ontic view – or what I prefer to call the ontological view in the ensuing argument – goes one step further and states that imprecision exists in the real world, not just in the cognitive faculty of the observer.

My position in relation to both extreme views is that it does exist in the real social world some undeniable degree of vagueness. The imprecision is an ontological feature of the human interaction. It comes from the following three elements: (1) human beings are partly ignorant, (2) in many concrete situations of choice, radical uncertainty prevails, and (3) time and change reinforce both (1) and (2).¹⁴ In other words, the epistemic basis of human interaction undergirds the ontic view of imprecision for the social and economic realms. The cognitive limits of human beings are one of the basic causes of vagueness in situations of interaction. Individuals, with limited knowledge, are, on the one hand, the partially ignorant observer himself or herself and, at the same time, the agent who is part of the system of action or interaction. Human beings are both observers and actors.

Here the observer is the scientist but also the actor in any situation of social interaction. This neglect of the central feature of vagueness in social interaction is not very surprising given that the philosophy of science – and especially its analytical brand – is still very much associated with physics, even though biology has been a growing center of interest for philosophers of science as can be attested by the works of David Hull, Elliott Sober, and Daniel Dennett. This transformation is also closely related with the rise of the biological sciences in their share of the total employment of scientists (Mirowski and Somefun 1998, Mirowski 2002).¹⁵

However, this conservative tradition in analytical philosophy has a serious drawback because even if reality is one, different levels or realms of the same reality do

¹⁴ Ignorance is not just about the future states of nature but also about the present state (competitors' decisions, strategies, etc.).

¹⁵ The neglect of imprecision in the economic literature on human action, in the *economic realm of being*, to use the expression of Joseph Spengler (1948: 1-3), has also to do with the definition of economics as a science of "economic choice" in face of alternative possibilities in a setting of scarcity whereas economics could be also defined in terms of action and interaction on a similar basis as Parsons did for sociology but for different realms of action and purposes (Parsons 1937: 757-775). For a critical consideration of Parsons, see the theoretical opus of Henri Janne (Janne 1968) and the works of Camic and Rocher (Rocher 1972, Camic 1986, 1987, 1991, 1996, 1998).

not suggest identical underlying processes. Evidently, these realms do not necessarily correspond to the division of scientific disciplines, quite to the contrary. The social or economic realm is characterized by changes (often of nature or essential attributes) and not just by motion. Paradoxically, some social scientists refer to motion and not to change when treating the social transformations in order to distinguish their contribution from the plethora of works labeled "social change" or "change" (Alter 2000).

Accordingly, the topic of vagueness poses a question about the limit in human reasoning, and this problem is acute in the case of social sciences and history in which imprecision is an essential feature of human action and cognition.

The notion of vagueness can be related to the theory of choice and probability theory (*i.e.*, possibility theory or imprecise probability theory). The attention of mathematicians and statisticians for vagueness, at least at an explicit and formal level, can be traced back to the interwar period with such figures as Kurt Gödel, Fernand Gonseth, Janina Hossiasson, the Polish group, among others.¹⁶

The problem of imprecision in probabilistic reasoning has already been discussed by two famous economists: John M. Keynes and Frank Ramsey (Keynes 1920, Ramsey 1931/1926, 1931/1928, 1931/1929) but has not received much attention since then – except by a handful of (heterodox or orthodox) economists, while in probability theory and applied mathematics, *e.g.*, in computer science (fuzzy set theory), the notion has not only been widely discussed and debated, but has gained academic honor and has become widely applied in engineering and computer sciences (Zadeh 1968, 1978, Dubois and Prade 1988, Walley 1991, 2000, Dubois and Prade 2001, Weatherson 2002). I will make use of fuzzy logic for the classification of part of the historical data used in the second part of the research, and imprecise probability theory for the interpretation of change and evolution.

The problem of vagueness and the recognition of its implications (imprecise human knowledge, limitations of formal models, and humility, to name a few) can be related, according to me, to a preoccupation of realism in economic research and methodology (Bhaskar 1975, Lawson 1997).

¹⁶ J. Hossiasson is one of the mathematicians that were discussing the treatment of probability by Keynes, mainly, and Ramsey, accessorially, and who, in her turn, had a strong influence – even though short lived – on the development of a imprecise probability theory. Her short life, due to her activity in the résistance and the Nazi repression (like another mathematician, Jean Cavaillès) was marked by three widely circulated papers (Hossiasson 1931, 1940, 1941). The Polish group is composed principally of Jan Lukasiewicz and to whom Alfred Tarski can be added. In a sense, they are followers of intuitionism and Henri Poincaré and L. Brouwer in particular.

However, there is more to expect from the concept of imprecision; this is one of my main claims in my thesis: history as knowledge and as reality is characterized by vagueness and both works of theory and empirical research have to assume the consequences of that, and this very attitude is converging with the methodology of the sciences of complexity.¹⁷

2. Radical uncertainty

Uncertainty, as economics students are frequently reminded, is different from risk, following the famous distinction given by Frank Knight (Knight 1921). This useful *dividing line* permits the reduction of uncertainty to its measurable part: risk. Consequently, it permits the application of classical probability theory, avoiding interesting controversies about the nature of human cognition and decision, uncertainty and probability reasoning.¹⁸

Radical uncertainty, irreducible to risk analysis and simple probability theory, as I interpret it, requires another type of probability reasoning and theory. I use probability theory as an illustration of the complexity of the decision process in a context in which information, preferences and tastes are not given. Radical uncertainty, vagueness and imprecise probability theory are concepts closely related to socio-economic phenomena; uncertainty and imprecision are central elements of human action.¹⁹

In the case of port wine, we can include factors that increase the uncertainty of the activities of the winegrowers and the wine merchants such as war, civil war, political and social unrest, revolution, wine diseases, vine blights, and climatic

¹⁷ The literature has been in great expansion in recent years (Loasby 1976, Prigogine and Nicolis 1977, Nicolis and Prigogine 1989, Wunenburger 1990, Nicolis 1995, Byrde 1997, Fikentscher 1998, Arthur 1999, Loasby 1999, Le Moigne 1999a, Arthur 2000, Axelrod and Cohen 2000, Colander 2000a, 2000b, Leydesdorff 2000, Delorme 2001, Lane 2002, Urry 2003). Nonetheless, in the social sciences and in history, applications are recent and mainly through simulation models (see the research results of the Santa Fe Institute). In empirical and historical analysis, this application is far from being straightforward and this explains why the traditional method of the historian is still widely in use.

¹⁸ The controversy around the theory of probability has gained some momentum in the 1930s till the late 1950s with the contributions of Richard von Mises, Kolmogorov, Hosiasson, Savage or Ellsberg, in parallel with the development of econometrics and economic theory. What distinguishes this period from the more recent one is the pervasiveness of the controversies, about frequentists and subjectivists, in the mainstream literature while today, the controversy on imprecise and subjective probability is out of the mainstream literature in economics and confined to mathematics, statistics and philosophy.

¹⁹ This can be related to the notion of uncertainty as defined by Frank Knight in his book on uncertainty and risk (Knight 1921).

perturbations, including flooding and heavy rains (the latter in particular during the grape harvest period).

All of these factors had and many, in fact still have considerable importance in the decision-making process of the economic actors, as it can be confirmed on the basis of historical documents (namely the archives of the Ministério das Obras Públicas, AHMOP; the Ministry of Agriculture, Ministério da Agricultura, ANTT-MOPCI; and the manuscripts of the Condes de Linhares, ANTT-CLNH) and testimony or monographs of students of the wine growing and winemaking processes in the Upper Douro, e.g., Francisco Rebelo da Fonseca, Vilarinho de São Romão and Visconde de Vila Maior.

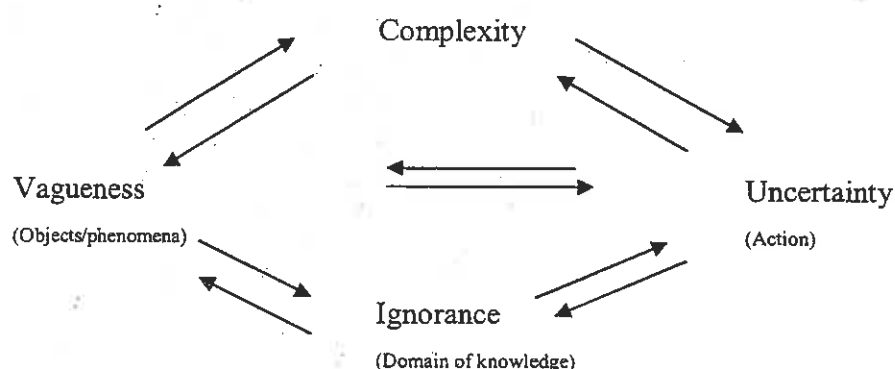


Figure 1: A characterization of the notion of complexity in socio-economic systems

The first remark I have to make has to do with the frequent confusion between complexity and completeness. Complexity is not completeness. Any science has to make the choice of reduction of reality, defining the relevant or critical structure of the phenomenon under review in order to satisfy some minimum explanatory purpose. In order to refer to complexity, I do not mean a drive for completeness but rather one of relevancy given that so many areas of our world are unknown and may be unknowable.

Complexity refers to either a reality or a method of analyzing it, or both. In the first meaning, it is an ontological argument, or hypothesis, that states how reality is or, at least, structured. The second sense has to do with the method or science of complexity that deals with complex systems, i.e., systems that can be composed of many elements. What matters is a measure of diversity of the very elements that

compose the system: the more diverse and numerous are the elements of a system, the more complex the behavior of this system could be.

The second point is that the central principle in the figure above is complexity, nurtured partially by ignorance and uncertainty of human action and decision and vagueness of human and socio-economic phenomena whose limits are not as clear-cut as in the natural world. There is a central problem with the definition of boundaries in socio-economic phenomena.

Third, there is a recursiveness of and within the whole and, in particular, of the interactions between the elements. Causality is not viewed as a one-way direction only as if it is found in Newtonian physics and its legacy in the positivist building of the social sciences, including economics, during the nineteenth and twentieth centuries. Causality is more complex, closer to what Bernard and Darwin had come to design in their own research (Cziko 2000).

3. Innovation

I will focus on techniques and technological change, the latter being less extensive than the notion of technique but more than the concept of innovation as understood in economic literature. Quite amazingly, in sociology, innovation has received a much broader meaning (Alter 1996, 2000).

Besides the technological aspects of the Port wine sector, I have also given much attention to the institutional setting, essential for understanding the transformations of the sector for the last three centuries.

Moreover, I will study the wine sector in an evolutionary perspective; especially while focusing on the population of wine shippers, which I will address in the last chapter of the second part of the thesis.

Accordingly, I will try to show the usefulness of a certain kind of historical economics, based on the integration of history and evolutionary theory into economic theory. The vantage point will be taken from history, historical theory and the theory of complexity in order to give substance to the notion of historical processes and clarify what I mean by *history matters* and what other authors mean by the same expression. It is here that appears the role of ignorance and uncertainty, both related to imprecision and open systems.

Central to the argument that history matters is the biological metaphor and the mode of explanation qualified as "evolutionary" by economists or social scientists since the time of Thorstein Veblen (1898). The problem of historical explanations dates back to the 19th century, at least in the form it has taken during the first half of the subsequent century, with figures such as: Hegel, K. Marx, A. Tocqueville, John Stuart Mill, H. Sumner Maine, F. Nietzsche, Wilhelm Roscher, Bruno Hildebrand, Karl Knies, Gustav Schmoller, Émile Durkheim, Max Weber and Georg Simmel.

The previous remarks would be incomplete if I did not mention Schumpeter, who has made important contributions to the economics of innovation, economic history, business cycles and economic theory. And this is best done in the works of Schumpeter on economic change and innovation. Schumpeter is without any doubt an inspiration for my own view of economic change and the necessity of relating economic theory and economic history.

4. Metaphors, analogy and explanation

This section constitutes a brief justification of the metaphor as part and parcel of the scientific method, especially fruitful for the development of some radical historical economics. The value of metaphor in science has already been defended by several authors. I will thus limit my argument to a modest restatement of G. Hodgson (2002a) and F. Louçã (1997) for the discussion of the evolutionary metaphor in economics, constituting an extension of the specific literature on metaphors (Black 1962, Ricoeur 1983, 2000a, 2000b). I will come back in chapter III and IV to the value of metaphor, and, more precisely, the evolutionary metaphor in economic history, considering different contributions (Basalla 1988, Mokyr 1990, Ziman 2000, Mokyr 2000a, 2002) and social history (Nisbet 1969, Elias 1997a).

My point here is to use the biological metaphor of evolution for constructing an explanation of the change in technology, institutions and population of shipping firms, which I endeavor to pursue in the second part of the thesis.

The metaphor is not just a source of inspiration; it is also part of the creation of a comparative method of inquiry through analogy and the edification of explanatory mechanisms. Without going as far as the building of a rigorous model, which would be

beyond my research objective, I intend to limit my research to the study of the evolution of the port wine industry.

I will, in the following chapters, proceed to a further discussion of the methodology and of the history of economic thought starting with the relevant literature (Backhouse 1988, Screpanti and Zamagni 1993, Backhouse 1994, 1997, Ekelund and Hébert 1997, Denis 2000) and try to concentrate on the questions of technological and institutional change.

As a requirement for the use of metaphor in science, it is essential to consider some methodological issues. Economics is being characterized by three building blocks: (substantive) rational individuals with a maximization drive, equilibrium analysis and, finally, efficiency. Bluntly put, the study of innovation is not congruent with the first two principles. Yet, the issue of innovation is also concerned with the problem of efficiency. In the innovation studies broadly construed, the question of efficiency is clearly recognized as essential (Marx, Gille) or central (Pavitt).

In the course of my analysis of innovation, I will also tackle the evolution of the institutional setting of the Port wine and the evolution of the Port shippers. In the third and fourth chapter, I will come back to both aspects. The three elements – technology, institutions and population of firms – are the very focus of the next chapter. These three problems are at the center of the evolution of the wine industry in general.

5. The issue of emergence and complexity

*The production of difference, something contrary to
general laws of thought, is rigorously unexplainable.*
André Lalande (1930: 378)

The notion of emergence has become one of the central concepts in biology, evolution, neurobiology, philosophy of the mind and philosophy of consciousness studies, and many more fields. It came from philosophy and chemistry, but was developed for a while in the philosophy of science and metaphysics before coming back to biology, the social sciences, and, finally back to philosophy with the outgrowth of the philosophy of the mind and consciousness.

The notion of emergence is important for my discussion of evolutionary theory and the use of biological metaphors – namely evolutionary theory – for creating new tools in the social sciences and history; after all, historians have always been interested in the emergence of novelty through time.

In science, emergence is a rather recent concept, in the form that is understood and debated nowadays; and one of the first figures behind the creation of its original meaning is the well-known economist, John Stuart Mill who distinguished two types of phenomena: mechanical and chemical, and two type of causal mechanisms or laws: homopathic and heteropathic.

With regard to the combination of causes, the former is a simple additive model of causes and effects while the latter implies a combinative model of causes and effects which does not permit the simple addition of causes and consequences because the total consequences are more than just the mere summation of the individual effects. This is what we call today emergent effects or perverse effects. As Mill put it in his chapter “Of the Composition of Causes” of his main treaty on the philosophy of science, *A System of Logic*:

All organised bodies are composed of parts, similar to those composing inorganic nature, and which have even themselves existed in an inorganic state; but the phenomena of life, which result from the juxtaposition of those parts in a certain manner, bear no analogy to any of the effects which would be produced by the action of the component substances considered as mere physical agents. To whatever degree we might imagine our knowledge of the properties of the several ingredients of a living body to be extended and perfected, it is certain that no mere summing up of the separate actions of those elements will ever amount to the action of the living body itself. (Mill 1843/1974: 371 et sq.)

I will not develop further the notion of emergence and its intricacies in the ensuing chapters or in the second part of the thesis, especially in relation to the problem of causality, *supervenience*, and history and complexity.²⁰ Here I just want to give a *prima facie* definition of emergence that is of practical use and will be refined later on in the second part.

The notion of emergence, defined by C. Lloyd Morgan on the basis of the distinction made by John Stuart Mill as stated above, as “the orderly sequence,

²⁰ Supervenience is the principle that states the existence of a basic and foundational level of reality at the micro level like the atom or the quarks and that any macro-phenomenon must be reduced necessarily to the basic level of explanation.

historically viewed, appears to present, from time to time, something genuinely new” (1923: 1) continues to raise interest from a range of different scholars, namely in physics and the cognitive sciences (Crutchfield 1994a, 1994b) and also among economists (Lawson 1997, Hodgson 1999a).

In the social sciences and in economics in particular, the notion of emergence is related to the concept of complexity, radical uncertainty (Loasby 1976, Hodgson 1999a, Loasby 2001b) and most importantly here to the theory of evolution. It will be through the notion of emergence (and radical or pervasive uncertainty) that I will proceed to an approximation between evolutionary economic theory and history. Following Tony Lawson, I admit that “an entity of aspect found at some level of organization can be said to be *emergent* if there is a sense in which it has arisen out of some ‘lower’ level, being conditioned by and dependent upon, but not predictable from, the properties found at a lower level” (Lawson 1997: 176).

Nevertheless, the research on the notion of emergence is still in its infancy, and I do not intend to develop it much further. While I relate the notion to the upsurge of technological innovations and to organizational changes (also called, by some authors, organizational innovations). I also try to build a model of the notion of emergence as a revelation of the limits of knowledge. This point is related to the notion of ignorance, characterized by Brian Loasby (1976), the nature of knowledge (Loasby 1976, Dolfisma 2001, Loasby 2001b) and the notion of radical uncertainty (Hodgson 1999a, 1999b, 2001).

In order to develop a model, it is useful to consider reality stratification (Lawson 1997: 62) or levels of reality as outlined by B. Nicolescu (Cazenave and Nicolescu 1994, Nicolescu 1996, 2000). They consider different levels such as the physical, the economic and the social systems that present different structures and behaviors.

Chapter II - Three related problems: technological, institutional and organizational (population) changes

I begin the present chapter with the issue of technological innovation and its treatment in economics in order to define its historical dimension and its historical nature. My perspective has evolved from a closed conception of the economic system to an open perspective that corresponds to the challenges of evolutionary economics and a genuine historical dimension within economics. I then go on with the analysis of the institutional setting as a complementary aspect of technology, before ending with the population perspective of a set of firms, in this case, the Port wine shippers.

1. The definition of technology

There are plenty of definitions of technology even if I limit myself to consider the economic literature (Dosi 1982b, Pavitt 1984, Charles, D. 1996, Freeman and Soete 1997, Dosi 2000). I can distinguish between two types of definitions: the broad ones and the narrow ones. This distinction has its importance for the present work.

Narrowly defined, technology is usually referred to as a set of tools. Broadly construed, technology can be defined as *knowledge about how to do things* (Samuels 1977b). This broad definition corresponds to that given by a central figure of current economic history, Joel Mokyr, on different occasions, and recently in an essay entitled "Natural History and Economic History" (Mokyr 2000a) or in his latest book on knowledge and technology (Mokyr 2002).

From here, we can see the importance of the history of techniques which is still plagued with quandaries left to be resolved such as the relatively few advances in most

techniques during the golden age of the Antiquity as well as the advances during the "dark ages" (800-1200 AD).²¹

Two remarks should be made in regards to Mokyr's exposition and his treatment of technological change. The author proceeds to the elaboration of a certain type of *evolutionary economic history*, choosing the techniques as the unit of selection in his biological analogy. Indeed, technological change is not as blind a process of selection as the very selection of species found in biology.

First, Mokyr does not make a clear distinction between his "evolutionary economic history" and mainstream economics, in a typical attempt to accommodate both paradigms that are conflicting on the very question of time and history, if not evolution (see the discussion of the point of view of Jack Vromen and Jan Reijnders (Vromen 1995, Reijnders 1997, Vromen 1997) and G. Hodgson (Hodgson 1997b, 1999a)). This, strangely enough, recalls Schumpeter's story about his treatment of both history (i.e., economic dynamics) and Walrasian economics (Schumpeter 1908, 1934, Schumpeter 1943/1992, Schumpeter 1954).

Schumpeter recognized the centrality of history and economic history or what he named *histoire raisonnée* for the proper conduct of economic analysis (1943/1992: 44), admitting that history is characterized by change, not equilibrium, but, at the same time, still clinging to the Walrasian notion of equilibrium and the objective of reaching pure economics.²²

Second, technology is not limited to machines – a view that corresponds to the so-called *machinism* that leads to a reductionist definition of what the nature of technology is all about. The crucial point was clearly emphasized by Jean Ladrière, Oswald Spengler, and Jacques Ellul (Spengler 1958, Ladrière 1977, Ellul 1990), considering that the technique is more general than, and cannot be reduced to the features of the machinist era while referring to the first industrial revolution in Europe.²³

²¹ See the article of the same author (Mokyr 2000a) and his two books of 1990 and 2002. For the Middle Ages, *inter alia*, see Gimpel (1976) and for a more recent perspective on industrial revolution, see the studies of Mokyr (1998) and Paulinyi (1989) and Verley (1997). The study of David Landes (1968) is still a landmark on the issue of industrial revolution; another recent study by Berg and Hudson is worth mentioning for the critical survey of recent contributions in the field and the often awkward data measurements used by economic historians (Berg and Hudson 1992, Berg and Bruland 1998).

²² Schumpeter defended pure economics (Schumpeter 1908), on the one hand, and was in favor of not just the study of history, but some historical method, which he called *reasoned history*, on the other hand (Schumpeter 1926, Schumpeter 1943/1992). For a recent treatment of the problem of history in Schumpeter's work, see Freeman and Louçã (2001).

²³ The argument is related to the evolutionary theories of technology found in the works of George Basalla and Joel Mokyr (Basalla 1988, Mokyr 1990, 2000a, 2002).

In the case of the Port wine, the technological change is related to nature, vine blights and wine spoiling, and the transformation of the traditional mode of winemaking; those changes do not fit as nicely as in the case of heavy industries or big corporation. During the period studied in the present research, winemaking has retained its essential feature as an art form whereas the technical aspect related to the vineyard and in the wineries has been slow to adapt and modernize (Baptista 1987, Radich 1996).

What matters most is the evolution of techniques which changes its very nature (Ladrière 1977); this point is also found in the *technology momentum* as conceptualized by Thomas P. Hughes (1969, 1987). As a matter of fact, techniques, today, do in fact incorporate much more science than they did in the past. Thus, modern techniques or any contemporaneous techniques at any point in time are not reducible to past techniques. Having said that, it must be pointed out that technologies are complexifying entities (Casti 1994) that consist of sundry layers of knowledge and experience transmitted through human action and other memory mechanisms such as books, mementos, instructions, etc. These layers are not kept pure and distinctive and this corresponds to the impurity principle as stated by G. Hodgson²⁴ as well as the vagueness as a feature of human action and cognition (as reviewed in the preceding chapter).

This very nature of technology, resulting from the action of time that passes, is calling for another type of rationality that has to be implemented into the research process and in the conceptualization of economic action. I will base this new type of rationality on a *principle of diversity* (similar to the condition we find in the theory of evolution) and on a principle of (human and historical) imprecision. This could be called fuzzy rationality and fuzzy logic or, even, imprecise reasoning. The former is close to the literature on fuzzy set theory and possibility theory (fuzzy probability theory, see (Dubois and Prade 1988, 2001)) and the latter is basically related to the imprecise probability theory coming from the works of Keynes and Ramsey, just to mention the main sources of the 20th century (Keynes 1920, Ramsey 1931/1926, 1931/1928, 1931/1929, Kyburg Jr. 1974, Walley 1991, Holland 1998, Walley 2000).²⁵

²⁴ See Hodgson (1999b, 2001) for more details.

²⁵ Remote origins can be traced back to Nicholas von Cusa, Leibniz and Pascal, but this is open to debate and subject to interpretation whose subtlety does not interest me here. See the second paragraph of the preceding first chapter for some other details. Some of Herbert Simon's papers can be related to the problem of complexity, ignorance, and imprecision, namely all what is about organizations and bounded and procedural rationality (Simon 1962, Simon, H A 1976, Simon, Herbert A. 1976, Simon 1983, Simon and Iwasaki 1988, Simon 1991, 2001, Simon 2002).

However, there is more than knowledge when we talk about techniques. Technology also includes artifacts, practice, and action or activity.²⁶ That is also the definition given by the historian of techniques Bertrand Gille: "techniques [...] are at the same time knowledge and activity" (Gille 1978a: vii). The use of techniques and its associated practical knowledge are essential to understand the features of technological change. Here we find a convergence between the economy as a process and the human action therein. This is the very point where *tacit knowledge* enters the picture (Polanyi 1983). And, finally, related to all this we find the notion of strategy (Spengler 1958: 44, Teece, Pisano and Shuen 1997, Tidd, Bessant and Pavitt 1997).

The issue of tacitness can be traced to the problem of ignorance. Part of the communication and the knowledge in use is tacit. This is especially true for a productive activity such as the treatment of the vineyard or the winemaking process in which tradition plays an important role. The traditional tacit knowledge is then transmitted and modified in a way that is not very clear and this leads to innumerable problems in the treatment of the primary sources. An example of this might be the lack of information about the way people were making wine and making decisions based on very rough guesses (such as the decision of interrupting the fermentation of the must).

Although the temptation to broaden the subject of my research has been frequent in the early stage – in order to meet the requirements of Marcel Mauss of a social phenomenon as a whole – which is not contrary to my conception of what a social science is all about, it must be stressed that I will limit my study to specific time and space in order to say something meaningful and relevant to economics and the history of the Port wine sector in Portugal.²⁷ The *whole* has to be taken metaphorically and not literally, since absolute knowledge is impossible, no matter how careful we are. As Theodor Adorno once put it: "the totality is a non-truth" (Adorno 1972/1980: 57). By

²⁶ See O. Spengler "La technique ne s'interprète pas en fonction de l'instrument. Ce qui importe n'est nullement la forme des choses, ni comment on les fabrique, mais ce que l'on fait avec elles, leur utilisation: ce n'est pas l'arme, mais le combat" (1958: 44).

²⁷ This *almost* all-inclusive conception of the economy is close to the one that we can find in the German Historical School (viz., Gustav Schmoller, Max and Alfred Weber) and in some posterior German economists such as Schumpeter (e.g., the seventh chapter of the first German edition of *Theorie der Wirtschaftliche Entwicklung*, with the elucidative title «*das Gesamtbild der Volkswirtschaft*», translated by Ursula Backhaus as «*The Economy as a whole*». On the German Historical School, see also, inter alia, Peukert (Peukert 2000, 2001a, 2001b, Bruhns 2002). This conception of the economy is interestingly close to the reading that Warren Samuels does of Adam Smith and the Classical School or Joseph Spengler of other classical economics, namely Malthus. Both stress the *problem of order* as broader than the scope of analysis given to economics nowadays, especially in the strand of literature following the definition of Lionel Robbins (Spengler 1948, Spengler 1968, Samuels 1977a). In either case, Smith is seen as an economist among other facets: philosopher, historian, political scientist and legal scholar. This could also be said of other figures of the Scottish Enlightenment such as David Hume.

referring to totality, it could also mean that I am aware that my analysis is only partial, as it depends on my research data, and therefore they must be interpreted as such.

In this line of argument, three remarks are adequate. First, I still have to discuss the notion of technique and technology, contrast them to such concepts as the machine, innovation, and draw upon the traditional nomenclature that can be found in the literature. Special attention will be dedicated to the debate in economics and the history of techniques. In this sense, I rely on Barbiroli, Dosi, Ellul and Gille.²⁸

Second, the conception of economics that I support is closer to the one that Schumpeter, Marshall (at least in the introduction of the first book of his *Principles*), Smith, Marx and the German and French Historical Schools have developed, all focusing on processes, that is, historical processes to be more specific.²⁹ The example of Schumpeter is central but suffers a major shortcoming, which I will try to highlight in the following pages.

Third, although I do not dedicate a specific chapter to complexity theory and the debate revolving around it, I adopt part of its perspectives and discuss them, especially in order to grasp what is implied by the integration of history in economics that goes beyond the complexity theory, the latter often called the Santa Fe approach.³⁰ In a certain sense, my perspective on method lies somewhere between history and complexity theory, joined at the interstice with evolutionary theory.

I proceed now to a summing up of the essential features of technology. First, technology is more than machines. Second, techniques are not isolated from the rest of the economy and society. Third, I focus on change and history of techniques by using the expression "technological change". Fourth, technology is knowledge and capacity of action on one's environment and, in this sense, it is closer to the notion of practice and practical knowledge, i.e., a type of knowledge which is to a great extent tacit.

It must be stressed that innovation and the technological processes are not isolated entities; they constitute systems of artifacts and knowledge bases. This requires thinking about the global context of technologies that is usually running through the academic disciplines as they are designed in the current scientific community. This

²⁸ (Gille 1978, Dosi 1982a, Dosi and al. 1988, Ellul 1990, Dosi, Giannetti and Toninelli 1992, Barbiroli 1997).

²⁹ I could have included the Austrian school with its focus on processes, but there is an obvious and delicate neglect of history and historicity in the works of his most influential authors, viz. F. von Hayek, Popper on historicism, and Ludwig von Mises in *History and Theory*, not to mention the traditional view presented of the Methodenstreit controversy between G. Schmoller and C. Menger.

³⁰ Brian Arthur is one of the main figures of the Santa Fe Institute dealing with problems of technological change that gives an overview of the problem of path dependence and lock-in (Arthur 1990, 1999).

systemic approach can be associated with systems theory (Le Moigne 1990), technological systems, paradigms or regimes (Gille 1978a, Freeman 1994, Freeman and Soete 1997, Dosi 2000) and bears heavily on the usual partial analysis as encountered in economics, issuing an attitude of necessary wariness, too often discarded.³¹

Now I will analyze in more detail what I mean by technology to complement what I have said until now, before building on the notion of technological system in the ensuing paragraph. Then in the final section I will try to associate technology to institutional change and the evolutionary perspective on a population of firms, the wine shippers (chapter III of the second part).

2. Explaining technological change

Some decades ago, in 1976, Nathan Rosenberg, a renowned economic historian of technology and economic change and growth, asked a fundamental question: « from the point of view of our understanding of the *process of economic change*, the critical, unanswered question is: what are the major causes of technological change ? » (Rosenberg 1976: p. 9). Although many answers were given, there is still a great deal of controversy about the causation mechanisms and their nature. Another question about what is meant by process of economic change, is even today one of the central economic controversies at both the theoretical and empirical levels.

My central contribution here is to put forward an argument about what is the meaning of the very notion of historical process is –i.e., economic change and technological change in the present case. Only when this is done will I be in a position to attempt an answer the question on the causal mechanisms of technological change.³²

I must stress right from the outset that, besides the institutional setting, I limit the research to the question of technological change, broadly construed – i.e., closer to the definition of innovation given by some authors like Francesco Malerba (2000),

³¹ Moreover, there are problems with the statistical data used. See Freedman (2002) for some critical assertions that can be extended to technology studies, including economics of technological change and innovation.

³² See Andrew Abbott (1995, 2001) and Elster (1989) on causal mechanisms and Boudon and Bourricaud (2000) on causality. Mechanism is taken here as a metaphor from the original meaning in physics: mechanical combination (Lalande 1930, 1991/1926), and purports to state that any process in which “we can determine, through the analysis, a series of subordinate phases and depending on one another” (Lalande 1991/1926, p. 603). It can mean –but it has not to be necessarily the case – that a class of facts or phenomena is reduced to a system of mechanical determination. For further discussion on causation and determinism and social interaction, see Boudon (1993).

among others, and which brings us to a broader concept – from a threefold and particular perspective combining: history, evolutionary theory (including above all evolutionary economics) and complexity theory. While endeavoring to make the scope of my research more precise by positive definitions, I will also exclude important but voluntarily neglected elements in order to keep the task manageable. The second part defines a future research agenda.

2.1. Definitions and inclusions

First, I will not deal with the problem related to the public good approach of innovation and knowledge, namely non-rivalry. However, the property rights approach includes the issue of non-excludability (of ideas, etc.) that I will analyze briefly. This approach “diverges into several streams” (Dowrick 1995): patent protection, institutions, market structure, etc. The former was one of the dominant approaches to innovation during the last thirty or forty years and is again gaining momentum with other focuses, methods and research; this can reveal the importance and complexity of technological change and the difficulty of one approach to settle the problem by asking the right questions and giving relevant answers.

Second, technological change and innovation are considered relatively broadly but with important distinctions. Innovation includes technological change while integrating in the analysis the context of innovation process and the interaction with other levels of reality.³³ I defend a notion of innovation and technological change that is based on two principles: first, the analytical *distinctions* of the features of a technological system (a technological paradigm in the words of Dosi) and the innovation that works within it and profoundly modifies it, and, second, the relational nature of socio-economic and technological systems. Socio-economic entities are not fixed and they interact in such a way that change results in an often-unexpected way. Social scientists are faced again with the complexity theory perspective and the denial of fixed entities and general linear reality (Abbott 1988, 2001).

Finally, technological innovation can be viewed within economics and within the economy (or better within a given socio-economic system) as an intermediary

³³ See chapter I for the definition of levels of reality. The concept of innovation process or process of innovation is not to be either trivialized as a linear process or confused with one member of the dichotomy - process innovation versus product innovation. Innovation process is the broad category of innovation in capitalist economies.



between production and consumption. Innovation occurs at both levels and lately this has been stressed by economists that recognized the overrepresentation of the production side and the deficient theoretical and empirical studies focusing on the demand side (Metcalf 2001a, Witt 2001, Loasby 2001a, Witt 2003).³⁴ Here consumption is understood as a broader concept than the demand side. Economists typically adopt a position that neglects the interactions between society and technology while, conversely, the concept of consumption permits the linking of technological change with social change. Here, the controversy between demand-pulled and supply-pushed technological change is just a curiosity and does not bear much relevance to the current discussion. This does not mean, of course, that supply and demand are negligible, but simply that technological change is not influenced by just one side of the process of economic change.

2.2. Exclusions

When I talk about techniques, I adopt a rather limited meaning. The first distinction here is between material and immaterial techniques. The second distinction is between the relevant knowledge to a specific technique and the social and cognitive context of economic action, focusing on procedural rationality and heterogeneity of behaviors.

I exclude from my treatment social aspects that are unrelated to the issue in discussion. I have chosen a relevant context and taking into account the limit of the analysis and the consequences of neglecting some aspects of society that could affect, albeit often significantly, the production and trade of wine. This means that I recognize them and do not ignore them or consider them irrelevant altogether. In other words, I state a principle of humility that considers scientific knowledge as imperfect, subject to revision and dealing with an object of imprecise nature, an imprecise ontology of human interaction and socio-economic change.

³⁴ There is a rather critical appraisal of the empirical studies on the demand side from Nathan Rosenberg that adopts an historical perspective on technological change in chapter 10 of Nathan Rosenberg book about the back box of technological innovation in economic theory and economic history (Rosenberg 1982) 193-240.

2.3. Further considerations on innovation

If innovation can be defined broadly as the “turning of ideas into concrete realities” (Kingston 1984: xi), it still and firstly must be distinguished from invention (i.e., finding new things) because, according to Schumpeter, to innovate is to get the new thing done (Kingston 1984-15) and this, from the point of view of knowledge, human cognition and action, is more than having the idea or some unelaborated prototype.³⁵ Indeed, as Nathan Rosenberg has shown, the innovation process is characterized by a complex knowledge complex, especially in what is known as the development phase in which a lot of tacit knowledge is created and tested, a phase that goes beyond invention and scientific knowledge (Rosenberg 1994), as in the case of sectors like aeronautics, the automobile industry, software programs, computer chips or processors. I will come back to the notion of technological knowledge in the next chapter.

Another central aspect of innovation and technological change, taken interchangeably, is the multifarious nature of the phenomenon and, as a corollary, the wide and diverse ensuing disciplinary spectrum that dedicates attention to it: economics, sociology of science and technology, sociology of industry and organizations, history of science and techniques, economic history, engineering, philosophy of science, etc. and within each discipline there is a vast array of schools and traditions. Indeed, innovation, as a general phenomenon, is not peculiar to the economic realm (innovators mobilize other resources) but has also a sociological and historical dimension; the latter point is the focus of the present chapter as well as the introduction and first chapter of the third part of the thesis. This point relates intimately to the notion of *path dependence* that I will treat very succinctly in the present chapter but discuss at length in chapter IV. Finally, this is also a justification of the framework of analysis developed by Joseph Spengler and Warren Samuels and other institutionalists on the problem of order.

³⁵ The difference between engineering and economics as methods of inquiry corresponds to a large extent to the difference between the technology per se (centered on the notion of invention and the mastery of technological knowledge) and the innovation or the technology that acquires much more economic significance (through notions such as market value, investment, sunk costs, diffusion, and learning). The second meaning of technology has to do with its practice on a broader scale than the mere technical functionalities. Economics and engineering, as well as innovation and invention, can thus be seen as two couples, each one with two polarities presenting a similar structure, one as body of knowledge and the other as artefacts, practices and human action.

3. The economics of technological change from closure to openness

The principle of closure of a scientific discipline is one of the concrete and logical bases of positivism, associated with a mono-causal or one-way cause effect theory, the former giving a stronger underpinning to the edifice and the latter a legacy of Newtonian science and physics in particular with several refinements such as the one provided by Comte, Laplace and Spencer, to mention just a few. Economics is no exception to the rule. Even Parsonian sociology strived to enter the closed system of social action by developing the ideas of Vilfredo Pareto on the rational study of the economy and the society. Furthermore, this point is not foreign to a controversial facet of Schumpeter as suggested by Geoffrey Hodgson and Richard Swedberg (Swedberg 1991b, Hodgson 1993, 2001) and could be linked to the relation that Schumpeter maintained with Walras' conceptions of economics and the consideration he held about Pareto's construal of economics and sociology qua sciences; this last point is treated in Shionoya's work (Shionoya 1997).

This debate is not foreign to the one that animated mathematicians and philosophers, who subsequently divided into traditionalists, such as Hilbert and Peano, and intuitionists, such as Brower, Poincaré, and Weyl.

In economics, the debate over openness is similar to other sciences and is best examined by T. Lawson (1997). There is, behind this theme, an ontological question: do we consider the world as being close or open? Either choice conveys methodological implications. If closeness is chosen, the techniques available to the researcher are easier to use but the relevance of the model might be, on the contrary, questioned. If we choose the hypothesis of openness, then we face a problem of lack of tools (to use Schumpeter's work and the interpretation given by Andersen (1994)) but a richer object of study, closer to reality. The former is either closer to empiricism or closer to positivism and the latter to the theory of complexity and the epistemological problems that we encounter in history. After all, if the choice is about either openness or closeness notwithstanding, there is always a necessity of choosing some degree of closeness at one or another level of analysis.

3.1. A process of normalization

During the 1930s, there is a normalization process within various departments of economics both in Europe and in the US. In the latter case, the symbols of the building of a normal science are Lionel Robbins at the London School of Economics and Talcott Parsons at the department of economics of Harvard University. Both define a division of labor between economics and sociology, expurgating any remnant of an historical method. Robbins defines economics as the science of rational choice between limited means and ends. This definition will be exported to sociology and other social sciences after World War II by such figures as T. Parsons, James Coleman, Gary S. Becker, and many more. The case of Parsons is rather interesting and can be related to another case: Frank Knight. Parsons was one of the American social scientists who, as a result of his intimate knowledge of German scholars, especially the members of the German historical school, introduced the works of Max Weber to the academy. Parsons and Knight translated or edited various works by Weber. However, if we compare the "early essays" of Parsons to his main treatise, *Structure of social action*, we find a marked contrast, almost a radical opposition between his early praise of historical social science and his later exposition of a formal theory of sociology, already begun in the 1930s, under the influence of Schumpeter and Pareto.³⁶

Lionel Robbins, at the London School of Economics, contributed decisively to the formalist and rational movement in economics. Contrary to the prevailing perspective, he summarized Marshall's towering influence as a strong anti-historicist, basing his case on the opposition of William Cunningham to Marshall at Cambridge.³⁷

³⁶ Schumpeter and Parsons were colleagues at Harvard's Economic department while the department of sociology was to be created. It is well known that Schumpeter reviewed the book of Parsons and that he suggested he should read Vilfredo Pareto carefully.

³⁷ Let us consider the following extract of Marshall's *Principles* that was transferred to the Appendices in later editions (Appendix B, The growth of economic science, §8):

"But though national in their sympathies, the Germans are nobly international in their studies. They have taken the lead in the "comparative" study of economic, as well as of general history. They have brought side by side the social and industrial phenomena of different countries and of different ages; have so arranged them that they throw light upon and interpret one another, and have studied them all in connection with the suggestive history of jurisprudence. The work of a few members of this school is tainted by exaggeration, and even by a narrow contempt for the reasonings of the Ricardian school, the drift and purpose of which they have themselves failed to understand: and this has led to much bitter and dreary controversy. But with scarcely an exception, the leaders of the school have been free from this narrowness. It would be difficult to overrate the *value of the work which they and their fellow-workers in other countries* have done in tracing and explaining the history of economic habits and institutions. It is one of the great achievements of our age; and an important addition to our real wealth. It has done more than almost anything else to broaden our ideas, to increase our knowledge of ourselves, and to help us to

At LSE, in 1929, after the death of Allyn Young –famous for his seminal article on increasing returns (Young 1928) which established a new tradition beyond equilibrium analysis– his successor, Lionel Robbins, was appointed chair and started his own prominent influence directly and indirectly on British and American economics.³⁸

Economics, from this viewpoint, is restricted to rational choice and there is no explicit room for historical economics. Quite to the contrary, historical ontology is open and path dependent. The objects of study in the social sciences as well as the disciplines proper exist within a context and this context is defined largely by the arrow of time, let us call it history. Present states and dynamics are much influenced by the path taken. All this reveals an open object that must be discarded if one wants to establish economics as a rigorous science.

This perspective of close systems is opposed to the very nature of history, the (capitalist) economy and the theories of evolution and complexity. Beyond the two traditional levels of openness –geographically and socially– there is openness through time, as is evidenced by human action. Even if we take stock of *path dependent* phenomena and soft determinism, human action and human choice are open in the sense that within specific contexts, human beings have genuine choice, they can choose or create alternatives, however thin and fragile they might be; this is very different from the utilitarian determinist choice of traditional economic theory. Indeed, uncertainty, in a rather radical sense, is a source of true choice (Lawson 1985, 1997).

understand the evolution of man's moral and social life, and of the Divine Principle of which it is an embodiment.

They have given their chief attention to the historical treatment of the science, and to its application to the conditions of German social and political life, especially to the economic duties of the German bureaucracy. But led by the brilliant genius of Hermann they have made careful and profound analyses which add much to our knowledge, and they have greatly extended the boundaries of economic theory'." (Marshall 1890/1949, my emphasis).

This is evident that Marshall did have more consideration for the German Historical School than it is generally thought, especially when one considers the treatment that Robbins or any of his followers gave to Marshallian economics. Here we find another paradoxical economist, the other is certainly Schumpeter. Both were familiar with the German historical school, both talked –in a rather different manner– about an evolutionary economic science but both ended reintegrated on the side of the normal science and the resulting traditional reading of their work reveals a suppressing of any pathological stance of theme: either evolution or history.

³⁸ We can see the similarity of the definition of economics given by Robbins and Samuelson (Robbins 1932/1935, Samuelson 1947, 1963). For some consideration of the notion of equilibrium in evolutionary analysis, see Metcalfe and complementarily Kaldor (Kaldor 1972, Kaldor 1977, 1981, Metcalfe 1998b).

3.2. Veblen, Marshall and Knight: some sympathy for history

I consider in this section the interests of some institutionalist economists (herein Veblen, Commons, and Knight) and other authors expressing similar preoccupations, even though in a much more mitigated form (Marshall). All authors were at least familiar with the German Historical School, the Methodenstreit and the general problem of what Hodgson called 'historical specificity' (Hodgson 2001). Marshall and Veblen explicitly defended an evolutionary science for political economy. Knight was quite familiar with German economists of an historical leaning, including Max Weber from whom he translated different texts and his conception of history is in sharp contrast with Talcott Parsons, another American scholar very familiar with German scholarship, who for some time was a colleague of Schumpeter at the department of economics of Harvard University in the 1930s and 1940s.

During that period, economics, as well as sociology, were consolidating in the American academia, both leading the division of labor in the social sciences, each in their own particular way: economics adopted axiomatization and develop econometric theories and methods while sociology, especially in the Parsonian tradition, consolidated its theoretical basis with the adoption of functional analysis.

Few of the leading economists after the 1940s adopted an historical bent, except some of those cited above. The neglect of history is becoming clear, as can be seen by the development of the history of business – a field that Schumpeter helped to promote – outside economic faculties, generally in history or business departments (Chandler 1978). Even in the institutional tradition, with Clarence Ayres as a towering figure, interest drifted toward the philosophical foundations of the research program settled by Ely, Veblen, Clark, Commons and Mitchell and analytical deepening of concepts such as technology, ceremonial institutions and the like (Ayres 1951, 1953).

In a way, what I want to highlight is the historical legacy in economics that has been wiped out or simply forgotten or neglected in subsequent generations following Veblen and Commons. What was lost was a way of thinking and the precepts of an historical method, something that has been revived in the last decades. Paul David (David 2001), for example, cites Veblen's study on Imperial Germany as a remote influence on the concept of path dependence (Veblen 1915).

The references that I use for technological change will also be used for studying the institutional transformation and the populational change in the shippers of the Port

wine sector. Most of what I have said about technology, in terms of methods used, is valid for the study of the institutions and the population of wine merchants.

4. Historical nature of technological change

One of the great classical economists that studied thoroughly the economic transformation of his time and the history of techniques and modes of production is Karl Marx. Let us analyze a note on Italian technological transformation in the first volume of the *Capital*:

[...] A critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual. Hitherto there is no such book. Darwin has interested us in the history of Nature's Technology, i.e., in the formation of the organs of plants and animals, which organs serve as instruments of production for sustaining life. Does not the history of the productive organs of man, of organs that are the material basis of all social organisation, deserve equal attention? And would not such a history be easier to compile, since, as Vico says, human history differs from natural history in this, that we have made the former, but not the latter? Technology discloses man's mode of dealing with Nature, the process of production by which he sustains his life, and thereby also lays bare the mode of formation of his social relations, and of the mental conceptions that flow from them. (Marx 1867/1906: 406)³⁹

First, this text reveals Marx as one of the economists that is almost cyclically reappraised, such as Smith, Ricardo, Stuart Mill, Bentham, Malthus, Babbage, and, more recently, John M. Keynes, N. Kaldor, R. Harrod and Joseph Schumpeter. These reappraisals and reinterpretations reveal what science is about: controversies and co-evolution of schools and intellectual traditions.

Second, commenting in a footnote on the history of Italian technology, Marx calls for a "critical history of technology" in 1867, ahead of its time and reconfirmed by Nathan Rosenberg in the recent decades (Rosenberg 1976, 1994). The historiography of techniques, since the time of the *Encyclopédie* and thereafter the *Académies*, was an unmanageable plethora of either technical writings about the *arts et métiers*, transmitting practical knowledge for apprenticeship, or erudite works of scholarship

³⁹ The citation, which appears in a footnote in a chapter on machinery, is preceded by the following sentence that I have omitted: "Before his time, spinning machines, although very imperfect ones, had already been used, and Italy was probably the country of their first appearance".

which were rather too descriptive and unrelated to the social and economic context. There is a third genre of literature viewing inventors as heroes reincarnating personages of the Iliad or Odyssey and other mythical figures that rearrange facts so as to fit in some nice story. This last category can be useful and is found in the business literature but it does not help to get to what matters explanation of change and understanding of complex phenomena.

Third, related to this last remark, but contrary to the expectations of an assiduous reader of Jon Elster's interpretation of Karl Marx as a defendant of methodological individualism, and quite opposed to the passive historiography of fact-gathering describing events and techniques, we find a condemnation of the analysis of inventors as autonomous individuals. This criticism of individuals as autonomous and unrelated to their environment is not new and is even frequent before Marx. Adam Smith in his *Theory of Moral Sentiments* (1759) defended the notion of sympathy right in the first chapter as something that binds the individuals together in a collective and this does not correspond to the view of the invisible hand and a utilitarian reading of the author based mainly on a selective reading of the *Wealth of Nations*.⁴⁰ Christian DeBresson demonstrates that entrepreneurs cannot innovate alone, since coordination requires a network of relatively independent organizations (DeBresson 1999).

Fourth, if we can find in Marx a relatively determinist view of technology, acknowledging a causal relation from technology to social and economic variables, there is also more ambiguities given the vast and heterogeneous nature of Marx's writings ranging from polemics, philosophy, ontology, logic, economics, sociology and history. Maybe the dispute will never die around the theme of causality and determinism in science.

Next, modern economists and economic historians have recognized the value and interest of Marx's analysis of technology. This is the case of Nathan Rosenberg who sees in Marx an early and serious student of technological change (Rosenberg 1976, 1982, 1994). If Marx cites Vico and Darwin, this is seemingly a detail, but in regard to the present and the next remark, it makes sense that Marx could be referred to as a rigorous scholar, knowing what historical processes were and what could be understood by the evolutionary process. A recent book edited by John Ziman discusses

⁴⁰ This is the recent re-discovery of the works of Adam Smith by several authors. For one perspective that I use here, see Brian Loasby (1999, 2000, 2001a, 2001b, 2002b, 2002a, 2003). Other authors are worth mentioning, and in particular Joseph Spengler (1958) and Warren Samuels (1977).

the nature of technological innovation as being an evolutionary process (Ziman 2000). The only reference made explicitly to Marx, among other economists like Smith and Babbage, is found on page 250 in a chapter on "Artefacts, knowledge and organization" by James Fleck (Fleck 2000).

Furthermore, Marx's treatment of technology and capital is one that can be associated to the cumulative process, and in this sense, he is close to Veblen, Myrdal, and others that argue for cumulative causation. This is also acknowledged by Nathan Rosenberg (1976). This cumulative process is difficult to grasp because of the great part played by qualitative elements in technological change, such as tacit knowledge that I will treat in the next chapter.

Finally, and maybe most importantly, if we connect this brief consideration on the history of technology with the other writings of Marx, we uncover a radical reading of technological and economic change: the internal transformation of the economic system that needs to transform itself in order to reproduce itself. That is what we find in the Communist Manifesto:

The bourgeoisie cannot exist without constantly revolutionizing the instruments of production, and thereby the relations of production, and with them the whole relations of society. Conservation of the old modes of production in unaltered form was, on the contrary, the first condition of existence for all earlier industrial classes. Constant revolutionizing of production, uninterrupted disturbance of all social conditions, everlasting uncertainty and agitation distinguish the bourgeois epoch from all earlier ones. All fixed, fast frozen relations, with their train of ancient and venerable prejudices and opinions, are swept away, all new-formed ones become antiquated before they can ossify. All that is solid melts into air, all that is holy is profaned, and man is at last compelled to face with sober senses his real condition of life and his relations with his kind.

The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together. Subjection of nature's forces to man, machinery, application of chemistry to industry and agriculture, steam navigation, railways, electric telegraphs, clearing of whole continents for cultivation, canalization of rivers, whole populations conjured out of the ground -- what earlier century had even a presentiment that such productive forces slumbered in the lap of social labor? (Marx 1848/1969: 105)

Marx suggests an "evolutionary reading" of technological change but, contrary to Darwinian evolution, it consists of "a process directed by willful, conscious, active people and molded by historical forces" (Basalla 1988). However, Basalla discards, in

the same reference, the hypothesis that evolution could be self-generating. I find that the qualification here is too strong a statement and ignore Marx's other writings; especially the citation from the Manifesto, which is closer to the self-sustaining mechanism. Historical forces do not exclude self-producing mechanisms within the realm of technological change. And this is an interpretation that we can make of another great reader of Marx, Joseph Schumpeter, who noticed the endogenous character of change in Marx's writings, namely, *inter alia*, in the *Manifesto* (Schumpeter 1949).

Technology changes both from within and from without. This makes it a complex variable that does not fit well into the dichotomy of endogenous and exogenous variables. From within, this is the transformation of the technological systems of paradigms that respond to internal and external motives and incentives. I take motives as a broad category of justification of human action and incentives in its traditional sense in economics of innovation. From without, the technology is shaped by society and the societal transformations. This aspect is well emphasized by the sociology of techniques (SOT) and the social construction of technology (SCOT) literatures.

Both categories are analytical distinctions and, in reality, they are related. Many transformations introduced by engineers (internal change) are, at least partly, justified by social variables (external change). This last point illustrates the interactive and open nature of technological systems that do not include everything, of course, but are subject to influences as much as they influence society and the economy. In other words, the technological system co-evolve with institutions and, more generally, with its context (Nelson 2001, Nelson and Sampat 2001). We come once up again against the relational character of economic change. This is well illustrated by the work of Alan Kirman on interactive agents, learning, the working of markets and networks (Kirman 1983, Kirman 1993, Kirman 1997).

This brings me once more to the difficulty of historical economics. The relations between individuals and organizations are more often than not transient and unstable, especially over protracted periods of interaction. One problem is the lack of records from history that can testify to the existence and more arduously the nature of the relations. In relation to the techniques, we have adequate knowledge about their form and function, even during the pre-historical times (Leroi-Gourhan 1971/1984a). The main problem is the scant evidence we have about the relationship and the

interactions between the techniques, the technological systems and the individuals and the society. This is complicated by the changing nature of those interactions, during the lifetime of individuals as well as between successive generations.

There is no easy solution to this problem. But treating the interactions as stable is a fiction and does not do justice to the complexity and the historical character of the interactive processes. The very notion of identity of relations is subject to deep interrogation. Indeed, the logic underlying the modifications of interactions is one of change, as was illustrated by Heraclitus.

The problem of treating relations as fixed entities comes from the Aristotelian logic that discards the possibility of change through time. Entities are fixed. If we talk about relations, this cannot hold anymore. We need a principle of "complex identity" that can be based on the principle of included middle. This is the story of Theseus' ship. Theseus leaves his homeland with a ship that will travel across the seas and go during that period of time through a replacement of every single original piece by a new one. The question is: when Theseus comes back does he returns with the same boat? The answer, from Aristotelian logic should be no, but for most people, whether on the boat or in dock, it is the same ship. Without entering into philosophical questions, this example illustrates the principle of included middle, T as an entity that changes through time and space and can be and cannot be A at the same time.

The nature of the relations between the varied elements of a technological system or paradigm (Dosi 1982a, Freeman and Perez 1983, Perez 1983) are best characterized by the principle of included middle. The relations are defined within the system and can be modified through time from within and from without. Here is the link between complexity theory, history, and open systems.

5. Dialectics of innovation and institutions: Another reading of technological change from the point of view of history and evolutionary economics

The present section deals with the necessity of developing the discussion about the nature of the historical and the evolutionary processes kindred to technological change. Innovation is admittedly considered a non-linear process, and even though the linear model of innovation is not acceptable to everyone, it continues to be influential,

notably through the general influence of the linear reality paradigm (Abbott 2001). However, although this recognition is broadly accepted, the research on non linearity is still in its infancy and does not easily distinguish between mechanical and human causalities, the latter having a *sui generis* feature: the complexity of human and social history (Fontana 1976, 1982, 1992).⁴¹ This brings to the fore the problem of historicity or the nature of historical processes.

In order to threat this uniqueness of the historical and socio-economic phenomena that are far from having disclosed, I will distinguish evolutionary from historical processes. The former will be treated in the next chapter. The latter has a more complex and social feature, without counterpart in the physical world. The mechanical analogies used in economics do not take into account sufficiently the interactions between the elements of what could be called a *complex and historical adaptive system* (CHAS), extending the study of complex adaptive systems (CAS) typified by John Holland (Holland 1997).

Since the time of Giambattista Vico, one of the first voices against Cartesian reductionism, there has been a recurrent discussion about the drifting apart of Humanities from formal and natural sciences. Undoubtedly, two of the most important linchpins of this separation that change the ground rules of knowledge building are substantiated by the Positivist paradigm and Descartes' philosophical and methodological system based on radical doubt and reductionism.

In the current century, the debate has not calmed down. On the contrary, in economics, for instance, the mechanical metaphors have transformed the way economists used to model the economy, in a very different way than the one used during the French and Scottish Enlightenment of the Eighteenth century and throughout the early Nineteenth century. The growing interest in the study of metaphors can first debunk fallacies, like the physical metaphors in economics (Mirowski 1989 and Louçã 1997) or can help to build new areas of research such as the theory of evolution in economics.

From the time of the marginalist revolution onwards, economics and other social sciences such as sociology have adopted one or another way of *formal modeling* as the foundation for a sounder knowledge of social phenomena (e. g., the formal sociology of

⁴¹ The same author extended the argument in subsequent works (Fontana 1999a, 2001, 2002).

Georg Simmel (1981) before World War I, or the foundation of econometrics in the 1930s and 1940s).⁴²

This transformation has accentuated the overlooking of the historical features in the model building process. The discussion of history is not, according to me, deprecating the formalization, but, on the contrary, it is one of the most powerful ways for renewing formal models while getting them closer to reality and concrete problems such as those described by decision and game theory. It is to this central problem that I turn my attention in the next paragraph.

I will present my opinion on the problem. After that, I will consider the usefulness of evolutionary theory, broadly construed, in order to build the first underpinnings of a methodology that takes into account historical processes on the basis of biological metaphors. Finally, I discuss the type of work that is necessary to bring the methodological quandary to a relative success, i. e., a response that generates an explanatory power to the study of technological change.

5.1. Statement of the problem of historical processes

The divorce between Humanities and Sciences is often bluntly put, as in the case of the often quoted essay by A. Snow (Snow 1993). Nonetheless, the facts are much less clear-cut and the dialogue - between both sides of the porous divide - is desired and has turned into a reality, however insufficient it may be. I will treat here the case of economics and history focusing on the study of technological innovation.

However, the trials of approximation are not that convincing; given the many obstacles besetting is the road to a true dialogue between Science and Humanities. The reasons for the difficult dialogue are a self-reinforcing combination of cultural, institutional and academic features such as misperception, weight of tradition and division of labor for knowledge production and destruction.

⁴² The work of Georg Simmel was of much interest for Émile Durkheim and his collaborators of the *Année sociologique*, the French sociological school, and the French historical school (of economics), the latter represented among others by Simiand.

Simmel was already well studied in France before WW I, much more than Max Weber, whose first paper in a major French journal of sociology was published in 1925 (Freund 1981, p. 7-8). The writings of Simmel are wide ranging, going from art, literature, philosophy, meals, conflicts, groups, evolution, history, money, and the economy. His view on history provides an interesting perspective for my discussion of history.

The problem is not just one of misunderstanding between two or more disciplines, one having an ideographic approach and the other adhering to a nomothetic conception of science. There is also a problem of logical framework. I will not discuss here the classical distinction between understanding (*Verstehen* and hermeneutics) on the one hand, and explanation, on the other hand. This is way beyond this short paper. I will briefly consider the type of logical system of reasoning that lies behind that distinction of disciplines.

Humanities usually cope with imprecise (human and social) phenomena while natural sciences (especially physics) try to measure precisely physical or natural phenomena. Economics, while dealing with a fuzzy reality, is adopting a methodology of precision, resulting in one of the central problems for studying technological change. Another problem is the inflexible disciplinary structure of social sciences that does not allow for a more comprehensive picture of what technological change is about. That is a problem of crossing disciplinary borders in order to grasp better the complexity of an aspect of life that does not remain the same through history. Economists such as Paul David, among others, clearly recognize this historical nature of technology. This recognition is not pacific; it even presents a certain dialectical side of a heated debate.

I consider history as a fundamental cognitive missing link between social sciences in their attempt towards understanding such a complex phenomenon as technological innovation. Evolutionary theory, coming from biology, has inspired a new approach in economics and, more particularly, in innovation studies called evolutionary economics. The study of innovation has greatly benefited from the metaphor of life. Consequently, the central notions of change and transformation inherent to life are thus discussed. Although the usefulness of mechanical metaphors is decaying, biological ones are far from having resolved the complexity of the economy and social life, not to mention history. As a matter of fact, if the application of evolution to culture is promising in such a distant field (in relation to economics) as anthropology, so it has proven to be in the study of technology. Indeed, technological change is not just an economic phenomenon but also a social one. More than that, history brings us the question of combination (and then aggregation) of old and new, underlying the issue of emergence.

Some time ago, at the beginning of the research for the thesis, I thought that I could find a safe harbor in history for proposing a simple solution to the problem of historical specificity and the issue of time in economics. Time has passed and now I

recognize that history, like economics is characterized by a plethora of schools and haunted by deep and sometimes endless controversies. One controversy that interests us is about the question of historicism (Iggers 1995, 1997). Another central issue in history is about the current crisis of the discipline, a problem that I will not consider here (Scott 1989, Fulbrook 2002).

The conclusion is the impossibility of adopting an easy solution to the problem of historical time in social sciences. Nevertheless, we can hint at some exemplary works (see the discussion of Schumpeter at the end of the present chapter) and take stock of what the philosophy of science tells us. I must refer to some scholarship that can help to build a genuine historical economics: institutionalism, economic history, narrative history, evolutionary economics (which I will treat in the next chapter), the debate on long waves (although I do not use the literature explicitly), cognitive economics (Loasby 2001a, 2001b), and the history of techniques (Gille 1978).

Finally, the lessons from the theory of complexity are central to the type of historical economics I defend. For this, I will base my argument on Simon's treatment of near decomposability. This will lead to the proposal for complex theory of technological change that I will relate to evolutionary theory in the next chapter. The ingredients of such a theory are the integration of an historical perspective, the answer to the problem of coordination and radical uncertainty, the importance of imagination and the improvisation in innovative processes, and, finally, the feedback mechanisms.

5.2. More than a problem of logic

I now proceed to a restatement of what I have said in the first section and the previous paragraph. Humanities, and social sciences, deal with imprecise phenomena. Such an example is given by technological innovation. The novelty characterizing innovation is inevitably linked to already existing objects. So the very notion of newness is not an absolute reality but something calling for a different kind of logic in order to give us a proper cognitive treatment of change: an included middle (or *tertium datur*) logic. An illustration of that kind of logic is given by the fuzzy set theory – widely applied in engineering and biology – and that defines the membership of a set as a function of a gradual or variable scale, that is, any member pertains more or less to a set according to an intensity function. Another way to grasp this logic is contained in

Stéphane Lupasco's seminal works, which are based on different principles (the principle of antagonism) and can be considered as complementary and even to a great extent equivalent if some rules of translation from one system of logic to the other are implemented (Lupasco 1947, 1987b, 1987a).

But the problem of knowledge is not closed with the integration of the *included middle* logic. Knowledge, from the complex reality and the limited human cognitive capacities, albeit in expansion, is closely linked to the challenge of fragmentation leading to the necessity of interdisciplinary work. The study of technological change is a privileged field of research that has already shown the insights that can be gained through the integration of methodologies between economics, sociology, and history. Interdisciplinarity in social sciences is not just a question of methodology but also one concerning the way we think about the problems. I will discuss the problem of knowledge in the next chapter.

5.3. Conclusions

The emergence of evolutionary theorizing in the study of technological change offers a partial answer to the challenge of integrating historical processes in the social sciences. The evolutionary theory is a method that can help economists dealing with the notion of change. The problem of history for the study of innovation is going beyond the frontiers of the existing disciplines, crossing them. It is with the integration of history that a better appraisal of technological change can be made.

In this chapter, I have above all treated the theme of technological and institutional change, focusing much more on the former. I have left out the analysis of the population of firms, a problem that I will treat in more details in the next chapter.

I have still to make a remark on the institutional analysis I have adopted.

My point of departure is the old institutionalism of both Veblen and Commons. From Veblen I put the general stress on a quest for an evolutionary economics, and, from Commons, I study the norms, forms of institutions as well as the legal system behind the productive sector.

From Veblen, I also take the concept of cumulative causation and the analysis of institutions broadly construed that shape the economic activities (Veblen 1898, 1899, 1904, 1915). Accordingly, in his famous paper of 1898, Veblen wrote "Any

evolutionary science [...] is a theory of a process, of an unfolding sequence [...] of cumulative causation" (1898: 375-376). In another text taken from the book *The Theory of business enterprise* that probably is the most important work for his definition of cumulative causation, Veblen defines the modern industrial system and relates it to cumulative causation. Veblen stated that (1904: 25-26):

the modern industrial system is a concatenation of processes which has much of the character of a single, comprehensive, balanced mechanical process. A disturbance of the balance at any point means a differential advantage (or disadvantage) to one or more of the owners of the sub-processes between which the disturbance falls; and it may also frequently mean gain or loss to many remoter members in the concatenation of processes, for the balance throughout the sequence is a delicate one, and the transmission of a disturbance often goes far. It may even take on a cumulative character, and may thereby seriously cripple or accelerate branches of industry that are out of direct touch with those members of the concatenation upon which the initial disturbance falls. Such is the case, for instance, in an industrial crisis, when an apparently slight initial disturbance may become the occasion of a widespread derangement. And such, on the other hand, is also the case when some favorable condition abruptly supervenes in a given industry, as, e.g., when a sudden demand for war stores starts a wave of prosperity by force of a large and lucrative demand for the products of certain industries, and these in turn draw on their neighbors in the sequence, and so transmit a wave of business activity.

It goes without saying that the institutional part that I adopt is an extension of the work of the American institutionalists, like Warren Samuels and Mark Tool, who have made relevant contributions either about the study of institutions or about the legal system (the institutional approach to law is in clear contrast to the law and economics tradition). Samuels does not only study institutions but also relates them to the legal and the political system into which the market and other institutions are embedded.

In the Port wine sector, institutions and what I define as the regulatory systems or regimes are characterized by a specific historical dynamic that follows what economic historians have come to call *path dependence*, and one feature of path dependence is its mechanisms of cumulative causation, whether by small or big events.

Chapter III – Economics, evolutionary theory and economic change

In this chapter, I link one theory of evolution (e.g., the theory of the major transitions of John Maynard Smith) and economics of innovation in order to set up better the second part of the thesis, which deals with historical processes of technological change. I introduce here the concept of “knowledge” with regard to the technological evolution and try to demonstrate the kinship between evolutionary economics and the literature on technological change and knowledge dynamics.⁴³ Another notion, which I intend to refer to briefly before being developed more thoroughly in the second part of the thesis is the concept of institution.

1. Economic theory and economic change

In the preceding chapter, I have discussed the notion of technological change as a historical process. Now, I will take a broader view of change: innovation, including technological change and organizational change and their interactions with the capitalist socio-economic system; and this will lead to a discussion of the problem of knowledge (viz., cognitive economics (Arthur 2000)) and the emergence of the so-called knowledge-based economy (Foray 2000, David and Foray 2001). I will treat the issue of knowledge in the ensuing sections 3 and, above all, 4.

A central problem for the social sciences is to offer a general theory of change; and even more challenging is to find a general theory of change, order and inertia. I adopt here the definition of order from Henri Atlan as introduced in his book *Entre le crystal et la fumée* (1979). This notion is coming from biology and thermodynamics and can be considered as similar to the concept of coordination without being reducible

⁴³ The interest in knowledge as a crucial variable for studying the problems of organizations, industries and growth is patent in the so-called “knowledge-based economy” literature. However, my point here is less trendy and goes back to problems of cognition, procedural rationality, imprecision and tacit knowledge and the growth of knowledge, the latter being studied by historians for centuries, with varying methodologies.

to the pervasive notion of equilibrium in economics. Indeed, in biology as well as economics, what matters are processes and evolution, not just what the equilibrium is for the sake of clear-cut analytical results.

Here, of course, I do not purport to build a general theory of change and order – but I will rather offer with the due wariness a schemata for analyzing economic change in a historical and complex perspective (North 1999). In this perspective, I adopt the characterization of the economic problem as being the *problem of order* (Spengler 1948, Samuels 1971).

A central dimension related to technological change is the set of relevant institutions that shape or define the context of productive activities and, in the case of the port wine industry, this is more than obvious, as I shall show not only in the first chapter, but also in the subsequent chapters of the second part of the thesis.

The whole argument here, and in the other sections of the present chapter, is the necessity for an evolutionary paradigm in economics that does not limit itself to equilibrium analysis because economic change and historical processes are not characterized by fixed points, but by movement and transformation.

My analysis is rooted in the evolutionary economics literature and institutionalism, both integrating the historical dimension and using the notion of cumulative causation. It is not just by chance that Veblen is associated to the three notions. This is important and I will develop the topic in the coming chapters. History has much to do with the evolutionary mode of explanation. History, as a combination and succession of processes, more or less ordered in sequences, is made of cumulative causes. Finally, the history of economies and productive activities occurs in particular institutional settings.

2. The theory of evolution and evolutionary economics

One of the most challenging general theories in science was –and still is– the far-reaching theory of evolution put forward by Charles Darwin (Mayr 1991, 2000). It did give biology a drastically new theory of evolution and can be considered as an alternative paradigm to the various brands of positivism from Cartesian, Newtonian to empiricist descent (Bréhier 1930-1938, 1932, Alexander, Louçã 1997b, Cziko 2000, Hodgson 2001). The method followed by Darwin is much closer to the one used by

historians, using hypotheses and looking for evidence on the past events, especially those of some bearing on future occurrences. There is also a similarity in the definition of distinct time periods both in history (traditional divisions as more recent ones focusing on specific realms of reality) and evolutionary biology (such as the notion of major transitions by Maynard Smith (1995, 1999)).

The point here is the similarity of the mode of explanation in evolutionary biology and social sciences, namely economics. The similarity between the two sciences is structural and not just one of coincidence or any criterion of the uniqueness of method in scientific enquiry. Both disciplines are fundamentally sciences of time and change, i.e., historical sciences, broadly construed, with distinct objects of study. Economics is based on the physical and biological layers of human behavior while biology has traditionally almost no interest in the societies or socio-economic systems.⁴⁴

Both deal with evolving populations in specific contexts. This is the fundamental argument of our methodological choice. It is also a way out of the quandaries of the covering law model of Hempel (1942) for studying history.

This reference to the theory of evolution is not merely metaphorical but draws on a description of: first, mechanisms of reproduction (or stasis) and, second, mechanisms of change. Both aspects are part of the explanations of human evolution and social and economic history. The evolutionary theory is used here as a theoretical device giving some unity to the interpretation of the evolution of three subsystems I analyze: technology, institutions and shipping firms.

In the evolution of technology and population of firms, the stable element or what has been termed "inertia" in the theory of organizations and tradition in the history of productive system, gives stability and continuity to the productive system. This is a clear element of the Port wine system and its evolution from the late 17th to the end of the 20th century.

The elements of change, that is the emergent properties of the system, are composed not just of new elements (artefacts or entrant firms) but also of a change in proportion of the populations of interest as well the modification of the entities that survive as time goes by and that over long periods of time are almost completely

⁴⁴ This is not exactly true, any more, with the rise of sociobiology in the late 1970s and early 1980s together with the application of game theory to population dynamics. There are more recently some applications of complexity theory and other tools of social sciences to the study of insect societies and population of different species like ants (Holland 1998, Bonabeau, Dorigo and Theraulaz 1999, Johnson 2001).

transformed; this is the case of the shipping firms whose names go unchanged or slightly changed through the ages but whose structure and human organization are profoundly modified.

3. Technological change and beyond

Even if innovation and technological change are not treated in all microeconomic textbooks, the issues related to them and their very nature have attracted attention from, and been questioned by economists from Colbert to Arrow, including Adam Smith and many others. The problem with change, in general, and innovation, in particular, lies in the difficulty of treating an open and (radically) uncertain phenomenon with a closed model.

The literature on technological change – in both economics and other social sciences – has been transformed radically in the last thirty years, moving to new areas of research, using new methodologies, and revealing the profound changes that the economies have gone through and are still going through. Change is a constant of economic life today, but it was also the case yesterday, as I will try to demonstrate in the case of the port wine industry.

4. From Technology studies to knowledge-based activities

In the previous section I have briefly surveyed the literature on innovation, highlighting the cognitive aspects of human action, namely in any economic activity. This evolution is not foreign to the recent focus in the economic literature on the knowledge-based economy (Gibbons, Limoges, Nowotny, Schwartzman, Scott and Trow 1994, Morck and Yeung 1998, Smith 2002).

I have already treated the methodological issues in the general introduction and first chapter. The interesting aspect about the literature on technological change is that it is closely related to some Schumpeterian insights and evolutionary economics (*e.g.*, the work of Richard Nelson and Sidney Winter). Even if fundamental authors like Nelson and Winter do not refer directly to the legacy of the old American institutionalism, the origin of Veblen's evolutionary economics is clear and the convergent interest and the similarity of theoretical concepts in institutional aspects of economic activities,

exemplified by the recent literature on the national systems of innovation, are other proofs of a common intellectual endeavor. It is on this convergence that my main theoretical statement is based for studying technological change and institutional evolution, adapting an evolutionary perspective on the object of enquiry.

Here the literature on knowledge-based economy is used to grasp some aspects related to the nature of technology, not separable from technological knowledge and the very process of technological transformation. I will also relate the notion of technological knowledge to scientific and technological paradigms that both produce norms and at the same time are made up of norms and are the basic elements on which the evolution of institutions occurs. Institutional change has to do with the destruction of, competition between and the creation of new norms.

Change and innovation are the engines of history: time is made of change. Economic activity is situated in historical time. Very often, the present change is related to some past event(s), with some more or less clear sequence of causal nexuses, one after another, constituting a particular path. This is the idea of path dependence as commonly understood.

5. Diversity of productive activities

In this chapter, I stress the diversity of the economy and introduce some of the concepts coming from the theory of evolution and evolutionary economics in order to develop an adequate theory for dealing with the issues of the second part, about the Port wine sector, the regulatory regimes, and intellectual property rights (broadly construed). The objective of the present chapter (as well as the next two) is to give a theoretical grounding for the treatment, in the following Part, of the Port wine industry

I will stress here two ideas. First, diversity is found within the economy as a whole, at the level of the sectors. Second, within the sectors, there is heterogeneity, or variety, a necessary condition for the evolution of productive activities, firms and technologies.

All the subsequent discussion must be understood as the effort to create the necessary building blocks of an evolutionary theory of Port wine history and the diversity of the economic sectors more generally.

The treatment of production activities takes place in a broad and specific context. In the European economies of the last centuries, the economy and its evolution have been associated to a particular mode of production: the capitalist system. The discussion that I undertake here is specific to the capitalist system.

As I will intend to cover the development of the Port wine from the Modern times (roughly 1680) to the post-colonial expansion, that is, from the expansion of capitalism that preceded the advent of the industrial revolution to the structural transformation that followed World War II, I would like to clarify the notions of economic growth with regard to the economic sectors.

The Western economic system or capitalism has undertaken an expansion over a time span of approximately five centuries (Wallerstein 1974, 1980, 1985, Baechler 1995a, 1995b), with an acceleration of the capital invested in the production and trade activities during the 16th century, followed by some setbacks from the mid 17th century to the beginning of the Enlightenment and a new and rapid expansion from the industrial revolution.

One key element behind this dynamism is the emergence of new activities, new sectors, the decline and reconversion of the old ones with a growing diversity of products and complexifying techniques, and all this in a context of geographical expansion as well.

I mean that behind the traditional divide (agriculture, industry, and services), there is more diversity than was originally thought, and the evolution of these three categories is not linear, especially in the case of trade. For example, the commerce of the Port wine was already well developed at the end of the 16th century, whilst most of the agriculture showed signs of backwardness. The role of the trade component for the wine in the Douro would in fact increase and be at the heart of the wine issue, often known as the Douro problem. The cause of the dispute, in a nutshell, was that the Douro was the main production area, but there was a deep-rooted rivalry between producers and merchants.

This variety of the capitalist economy is recognized first by historians. But there are also some economists that consider capitalism as a specific era of economic history. And that this particular epoch needed a particular attention in the study of economic history. This was the case of the German historical school and today it is the case of some evolutionary economists (Metcalf 1998b, 2001b, 2002).

The economic sectors do reveal divergent paths of evolution that vary between expansion and decline. The growth rates are different from sector to sector and from firm to firm. Part of this is related to the market dynamics: the structural change in demand that gives new impulses to new products and new technologies. The asymmetric effect of demand has been recognized since the time of Allyn Young as a driving force of change and increasing returns (1928).

6. Specificity of sectoral evolution

This section develops the problem of economic change within specific economic sectors. I would like to begin by introducing two general considerations. First, the definition of an economic sector can be problematic especially when the basis of the definition is the relevant market for a commodity that is composed of more or less differentiated products but sharing at least some similar attributes. For the Port wine industry, this problem is less serious because the product is well defined with boundaries that are rather clear-cut and the characteristics of the demarcated area of the Douro gives to the sector a specificity that distinguishes the Port wine from other wine producing regions. Moreover, the main market from the late 17th century to the beginning of the 20th is the British market and the internationalization of the last sixty years has extended the market while the product has remained unique, with its strong legal, social, and institutional protections.

The second remark is methodological and concerns the way an economic sector has to be approached. The sector is a population of firms, an object of study smaller than a national economy but more complicated than a sole firm. The methods of studying a sector are borrowed from both micro- and macro-economics.

Nevertheless, if I borrow concepts from both traditional micro- and macro-economics, I adopt a *population perspective*, or, in other words, an evolutionary perspective based on the population view of economic change. This includes also the use of theoretical building blocks of the evolutionary theory and institutional theory.⁴⁵

⁴⁵ See the works about the population ecology and organizational ecology following the seminal paper of Hannan and Freeman (1977) by several authors (Aldrich 1979, Hannan and Freeman 1984, 1986, Hannan 1988, Baron and Hannan 1994, Baron, Burton and Hannan 1996, Hannan 1997, Aldrich 1999, Baron 2004, Hannan, Polos and Carroll 2004).

The population perspective refers to a system of firms with a given structure characterized by emergent properties that are not apparent when one is reasoning on the basis of sampling techniques. The population of firms includes the incumbent or existing firms, the potential firms (which are still at the project stage) and the firms that are leaving the market at any point in time. Generally, however, both entries and exits of the population of incumbent firms are neglected.

However, the importance of the perspective has to do with the systemic character of the population of firms. When one leaves out some of the firms – through a sampling selection for analysis of the data available – part of the structure and interactions in the population is lost. When one firm disappears, like the demise of the *Companhia Geral do Alto Douro* which will be studied in the second part of the thesis, the whole system of interactions and the structure is changed.

Of course, some small firms might not exercise a relevant influence and could be ignored, especially for a short period of time. However, in the long run, the emergence of new and important firms comes more often than not from small entrant firms, and so, the relevance of the population perspective is more crucial for studies that deal with long historical transformations.

The whole set of firms in an economic sector can be modeled, in terms of interactions, as a population of individuals acting in a neighborhood. The sector is the context of action for the firms that compose it, in the same way as the neighborhood is the context of action for individual players. Of course, this abstracts away the institutional setting that is part of the relevant context of action. This is why that I will dedicate chapter I in the second part for the treatment of the institutional and legal frameworks of the Port wine sector.

7. Selection of firms, production units, and technologies

The objective of the study at hand is a satisfactory treatment of the notion of selection which must be here understood as a multilevel phenomenon that acts (1) on the techniques used, chosen and created (Mokyr 2002); (2) on the emergence and transformation of firms (Alchian 1950); and (3) at the level of business units or units of production (Metcalf 1998a). Indeed, in this last case, within the same firm, a separate activity can be closed or created.

I limit the use of the concept of knowledge to the techniques in use, the production and trade activities. As a matter of fact, much of a technology is embedded in useful knowledge and is not limited to the machinery, as I argued it in the introduction.

The recent literature on knowledge relevant to economic activities is booming. I will use part of the literature that fits into the theoretical framework adopted: one treating the communities of practice and the other about the epistemic communities (Amin and Cohendet 2000, Cowan, David and Foray 2000).

At this juncture, between and within these communities we find the coordination problem, and this will appear obvious when I focus my attention on the Port wine industry. Groups, social classes, and the central power use knowledge and build it to maintain a certain order. Knowledge is itself a coordination device like time schedules.

An important point is the focus on communities and not just on individuals such as in the mainstream economic literature. There is a collective and interactive aspect about knowledge and learning.

8. The firm and the Theory of evolution and complexity theory of evolution

In the previous chapters, I considered the generation of variety and the selection process as constituents of the theory of evolution and their application to economic history.

I suppose here that the mechanisms of transmission (or reproduction) are of a systemic nature: not just depending on each element selected, but also in consequence of the interaction between them.

The firm is one of the institutions supporting technological innovation and deserves much attention.⁴⁶ The question to address here could be twofold: firstly, what does it mean by “firm” in mainstream economic literature (especially industrial organization) and, secondly, what are the relevant dimensions (or variables) that have to enter into a satisfactory model? But given that both questions refer to a specific scientific framework, I will tackle them simultaneously. Nevertheless, I will not adopt a view of method, which might be conducive to big M methodology questions – as stated

⁴⁶ It is not the sole institution worth attention. The social network is a good example. Nevertheless, the question of the firm is central to the explanation of technological change in Western capitalist economies.

by Lawrence Boland. We prefer to tackle more concrete issues, leading to progress in empirical research, what Boland called the small-m-methodology versus Methodology (Boland 2001). As a matter of fact, my perspective is to defend the possibility of a theoretical history as part of the economic theory building blocks, and not to discuss endlessly the issues of the philosophy of history which is akin to getting lost in debates over Popperian economics and the great philosophical questions that leads research astray, away from concrete historical problems of the economies.

I will present sequentially two views of the firm and the innovative firm: the first one is built upon the literature on industrial organization and the second proceeds from critical consideration from the former and also integrates relevant knowledge from other disciplines like sociology of organizations and other traditions in economics like evolutionary economics. The second representation considers the innovative firm as an evolving complex system.

The firm in the neoclassical perspective of the literature on industrial organization and the so-called theory of the firm is still associated to the profit maximization problem subject to (more and more) sophisticated constraints. Innovation is treated in a general framework of rational choice and maximizing behavior leading to certain distinctive outcomes, as appears in modern game theory.

I will retain three features of the neoclassical model: first, the nature of the firm or the relevant variable and boundaries, second, the time dimension and, finally, the focus on big corporations and successful firms.

I want to reassess the definition of the firm by a modest contribution: the necessary normative, i.e., the legal component of the firm, in our societies usually related to the political power. Capitalist firms have a legal base that protects its structure and property rights. The topic will be discussed later, in chapters 1 and 2 of the second part, when dealing with the dynamics of firms and the legal structure of the sector.

The nature of the firm is of great interest for understanding the process of innovation in organizations. However, I will not treat the question in detail here (see Hodgson 1999 for further details). In the industrial organization literature, the variables retained are all economic ones with clear interpretation such as costs, R&D, inputs and profits. Not much attention is paid to other dimensions of the innovative process within the firm, such as the conflict between the bearer of the innovation and the opponents. Links to training entities and consultant firms – pervasive in the real life of modern

firms – are not considered. This is the first shortcoming of the traditional theory of the firm: it lacks “thickness”.

The second feature of the neoclassical theory of the firm is the almost exclusive focus on outcomes. The very processes of innovation, the evolution of the agents, the dynamics of knowledge destruction and creation, as well as the emphasis on the time dimension of all those processes, are neglected. Outcomes are easier to deal with than the processes that lead to them (Snooks, G. D. 1993, Aldrich 1999, Aldrich and Martinez 2001). In the processes of innovation I studied, there is more to say about the process itself than the outcomes. The process can explain how the results were reached but the reverse is not true: outcomes do not tell us what the process was. Indeed, during the critical moments of an innovation endeavor, decisions are plagued by uncertainty. The small and medium sized firms I studied, as well as nascent firms, do not offer a stable organizational structure given the continuous change in the business. The nascent firm sees its objectives moving frequently, especially after meetings with banks, financial or strategic advisors. The entrepreneurs are in a phase of searching for what he wants to do. At the beginning, they decide very often to reorient their business toward more “realistic” or credible objectives. Beyond the objectives rationally warranted, there appear other good reasons for the entrepreneurs to adopt a new technology, namely sociological motivations. Indeed, private relationships and the belonging to a personal network are usually acknowledged after a certain familiarity and experience of the researcher with the very few firms he studies at a certain point in time. Social variables are of pervasive influence. Those features are encountered in the literature on the sociology of innovation (Alter 2000).

The third issue I have selected refers to the population of the firm that has been adopted. Beyond the notion of the abstract firm and its homogeneous population, leaning either toward competitive or monopolistic features as it is referred to in the theoretical models, the representation of the population of firms is very incomplete. Even if I restrict myself to a specific sector to make my empirical research feasible, there is not much concern in economics or in sociology to nascent firms and closed firms, not to mention the usual neglect of small firms. The proportion of the total population of firms in a given sector to which economists pay attention is too narrow. Both abstract and empirical research endeavors do not adopt a populational perspective of the innovative firms. It seems to be a similar problem to the focus on outcomes rather than on processes. The firms which are selected for the study are the ones with a

positive outcome or success not the ones who failed during the innovating undertaking. The analysis of both the selection and innovation processes is partially ignored. On the one hand, little is known about firms that disappear and the very process that leads to failure. On the other hand, nascent firms, as defined by Aldrich and Martinez (2001) are receiving scant attention from economists, maybe because they are still unstructured organizations, and are rarely encountered in official data and whose failure rate, before reaching the status of an established firm, is quite low. This is a shortcoming of any historical study of the evolution of an industry.

These three shortcomings help us to understand the difficulty of defining a sufficient scope for the study of the structure of the innovative firm. Furthermore, its openness to the milieu is difficult to grasp, especially if, after having recognized the complexity and diversity of firms, I take into account studies from sociology, economic sociology, and management studies.

The economic theory of the firm still lacks realism and it is only recently that strong efforts were made to adopt another framework, a much broader one such as the one proposed by Nielsen and Johnson. The authors treat the team of institutions related to "the emergence of novelty in the economy" (Nielsen and Johnson 1998: xiii). Notions like uncertainty and interaction are treated in a broader view of knowledge creation and destruction. Knowledge is not associated here to the capital metaphor but to a complex process of creation and destruction (Dolfsma 2001).

As an extension of the discussion of the discussion of the three shortcomings outlined above, I can question the state of the literature on industrial organization and consider three basic methodological issues of organization theory developed by B. Holmstrom and J. Tirole in their chapter "The Theory of the Firm" in the *Handbook of Industrial Organization*:

Despite the tremendous progress made by organization theory over the last fifteen years, we still have a weak understanding of many important facets of organizational behavior. There are at least three outstanding problems that need attention. A first (theoretical) step is to develop and apply techniques that deal with non-standard problems such as incomplete contracts, bounded rationality and multi-lateral contracting. The second step ought to integrate observations from neighboring fields such as sociology and psychology – in a consistent (not ad hoc) way into the theoretical apparatus. The third step will be to increase the evidence/theory ratio, which is currently very low in this field.⁴⁷

⁴⁷ Bengt Holmstrom and Jean Tirole (1989) "The Theory of the Firm", conclusion of chapter 2 in R. Schmalensee and R. Willig *Handbook of Industrial Organization*, Volume I, Amsterdam: Elsevier.

This text merits some comments and might serve to summarize the situation of the study of innovation. I agree with step one and step three. First, economics has to make important theoretical advances. I think that most of them will move away from mainstream precepts with much more emphasis on explaining the reality, in our case, the dynamics of innovation. Second, empirical research is more than ever needed and qualitative methods are welcomed for both building new theories and testing old and new ones. If currently the study of innovation is currently experiencing a period such as is described in the crucial first step, the second step is still lacking in the field. I strongly disagree with step two presented by Holmstrom and Tirole for the following reason. I know what scientists mean by eschewing consistency problems via *ad hoc* manipulation; but here would "had hoc" not rather mean "not compatible with" (mainstream) economic theory? Is there just one correct (or best) way at looking at problems in industries and firms? Nevertheless, it sounds too much like a Popperian-driven principle of scientific knowledge. However, social sciences were never Popperian and in fact are currently experiencing a move away from methodological monism. Notwithstanding, I recognize and strongly advocate the dialogue between disciplines. The transdisciplinary research on innovation is more pressing than ever if we take into account the problematic position of sustainability and the adaptation to change.

The study of innovation is such a place where cross-disciplinary studies are promising. From a standard economic perspective using survey data, Sandra Black and Lisa Lynch in a recent paper are studying the relationship between workplace innovation and establishment productivity (and wages). One of the main results is the positive (and significant) relationship between productivity and variables representing the workplace innovation (proportion of non-managers using computers, employee voice in a unionized establishment, etc). If the relationships are significant, they also suggest the possible insights that could be gained from economic sociology or organization studies.

9. Technological Innovation, Knowledge Dynamics and Firms Trajectories

This section questions the method used in *industrial organization* theory and discuss a contribution for an original framework to cope with the process of innovation at the firm and at the socio-economic levels integrating the concept of knowledge beyond that currently used in economics.

The first point is the incompleteness of the research program embedded in the industrial organization literature and favors a broader perspective needed for the study of innovation *processes* and not just innovation *outcomes*. Accordingly, special attention will be given to the neglected and biased understanding of the inside features of the firms, which will introduce the problem of the next section: how to define the relevant context of the innovative firm.

The second point addresses the problem of the relevant environment of the innovative firm in order to analyze the process as well as the results of innovation, completing the arguments just outlined in the previous section. The conclusion here could be summed up as the necessity of both historical and evolutionary perspectives in understanding innovation and knowledge dynamics in organizations.

The rest of the present chapter will focus mainly on a central methodological issue in the study of innovation and knowledge that can be typified as a twofold reduction of what a firm is and what constitutes the very nature of technological innovation.

The first reduction of economics, here more specifically industrial organization, consists of viewing organizations as socially empty and as utterly rational entities, whereas sociologists tend to question the very empirical validity of such statements (Alter 1996, 2000). The second reduction is about the nature of the innovation process focusing more on outcomes (results or proceeds), neglecting the process of getting to the results. History does not matter much.

Both reductions are affected by a third problem that is common to most organization studies and which consists of a general focus on big – and very often successful firms, forgetting nascent, bankrupted and small and medium sized firms (Aldrich 1979, 1999, 2001, Aldrich and Martinez 2001, Scieur 2001). This is similar to the non-population perspective that is referred to in evolutionary economics.

One of my research aims is to build a broader methodology for the appraisal of the dynamics of innovation both at the firm and at socio-economic levels (Swedberg

1993). The latter includes the economic impact in the traditional or classical sense. The dynamics of innovation is usually considered on the verge of physical and economic change – usually firms' profits and productivity improvements – without any or not much further consideration about the time dimension and linkages with industry populations, society, culture, and humankind. The problem is that economic theory does not explain much about how we get to the results of innovation; the very process is neglected and replaced by clear-cut outcomes, as is evidenced in industrial organization literature, which is more versed toward game theoretical descriptions of the decision process leading to the adoption of innovation. That is why I defend a larger perspective and focus more on the emergent and processual or procedural nature of technology rather than the obvious features (such as increased quantities, profits, and the like, which are usually quantifiable). The former perspective is more qualitative in nature than the second one, which is closer to quantitative analysis. However, I will not discuss the importance of qualitative research here, even if part of my empirical research is based on it.⁴⁸

9.1. Technology and knowledge

As a first approximation, let me give you a working definition of *technology* which encompasses not just techniques, artifacts and the like; but also knowledge. Techniques are methods of creating new tools, their derivatives, and the capabilities for creating new artefacts. The technique cannot be separated from its conception and its usage, *i. e.*, its genesis. Furthermore, conception, diffusion, and usage of technique, all entail knowledge and skills. Here we find an important point, which has still received scant attention: knowledge is embedded in machines and tools, not just at the time of their creation, production and diffusion, *but also during their usage* (Dolfsma 2001, Flichy 1995).

This is related to the relevant context (see the next section) that takes into account the technological dimension closer to the innovator, the firm and the social needs, values and usage. The innovation process and the firm are both influenced by

⁴⁸ I leave to the annex a description of the features of the qualitative methodology as well as the comparison with the quantitative methods more familiar to the economist.

social and natural resources as well as the social ethos (favorable or not to the entrepreneur's creative activity).

9.2. What does the notion of relevant context mean?

The context of technological change taken at firm level should be understood in a broad sense. The framework I adopt is going beyond the inclusion of formal notions of market, laboratories and institutions (in the senses of specific organizations playing a definite role) which make up the formal networking and context in order to include the societal settings of the innovation process that form the informal organization or structure of the technological change such as the informal networking (Gordon 1989). More often than not, the context is reduced to the formal relationships, which are more apparent, while the informal links and relationships remain in the sideline.

The usefulness and appropriateness of the context, as heuristic tool, is due to the complexity of the technological innovation. As Richard Gordon and other researchers of the GREMI (*Groupe de Recherche Européen sur les Milieux Innovateurs*) put it (Gordon 1989, 1991), innovation has a fundamental spatial dimension. Innovation differs across regions and this is one more argument for the usefulness of qualitative methods. We can see the development of studies looking at the national systems of innovation as a response to the problem of space specific features of technological change.

My definition of the context is closely related to the notion of complexity. The context is an analytical tool giving a broad setting to the problem under investigation: it includes mainly the *spatial*, the *social*, the *economic*, and the *historical* dimensions of innovation. The work done by the GREMI has already paid much attention to the spatial and even the social dimension. An overview can be found in *Innovation networks: spatial perspectives*, edited by Roberto Camagni (Camagni 1991). The focus here will fall, on one hand, on the socio-economic and on the other hand, on the historical dimension of the innovation processes.⁴⁹

⁴⁹ A recent economic study on social networks, learning and innovation by Liebeskind L. G. et al. "Social networks, learning, and flexibility: Sourcing scientific knowledge in new biotechnology firms", NBER Working Paper n° 5320, October 1995; is in line with the other studies cited in the present paper. The

First, for the relevance of the social and economic contexts, I can consult the works in the economic sociology (Swedberg 1993 and Granovetter 1998), the economics of networks (Economides 1996) and the economics of innovation (Dosi et al. 1988 and 1998, Freeman and Soete 1997 and Johnson and Nielsen 1998 and Nelson and Winter 1982). For the social dimension, very much intertwined with the geographic space, I will limit myself to informal networking, a topic which is still very often neglected in the literature, which privileges the formal links between organizations and institutions. Formal contracts are important and should be studied. However, besides these, there are also informal networks, which are not always obvious but which qualitative research through life stories and interviews could uncover quite satisfactorily. I have limited my research here to archive of firms and regulation entities to try have an understanding of the evolution of the Port shipping firms.

Second, the historical dimension has been stressed by historians like Joel Mokyr, or by economists such as Paul David. The study of innovation – with phenomena like learning, creation and destruction of knowledge, the interaction between science, society and technology – has to get insights from economics and sociology, but also from history. As Paul David puts it: “economics could be a source of intellectual satisfaction if it becomes an historical social science” (David 1993a).

However, history has to resolve two shortcomings: a theoretical effort already under way and, as Raymond Aron once said: “to restore to the past the uncertainty of the future” (1986: 182). Indeed, the superficial study of path-dependence and the building of a certain history of techniques can give us a sense of fatality or obviousness in the evolution of techniques. Once more, this “fatality” is another name for neglecting processes and limiting oneself to the *outcomes*, that is, those that have already occurred.

My conception of history is related to the one of complexity and I do not follow the main premises of cliometrics, which are usually quantitative and unprepared to integrate issues such as emergence.

If history can help us to get a clearer idea of long-term processes (such as already upheld by the German sociologist Norbert Elias) and can help to further a more comprehensive theoretical effort, it is not a clear-cut predictor for the future. Marc Bloch wrote: “history is, in essence, science of change. She knows and teaches that two events never reproduce themselves in the same and exact way because the conditions do

main finding is the wide use of channels of exchange of scientific knowledge outside formal market contracts.

not coincide exactly. [...] She can better discover the parallel movements of back and forth between the cause and the effect.”⁵⁰ This was written at the time of the French defeat in 1940 whilst the reproduction of the First World War strategy, which gave victory to the Allied Forces, failed lamentably.

Finally, it is important to stress the importance of a populational perspective for studying innovative organizations in order to grasp the diversity of situations and decisions which will help us to understand better the dynamics of innovation (Louçã 1997).

9.3. Knowledge-driven technology

The old word technique reflects the reality of the past in which serendipity played a greater part than is today the case today with the newer term “technology”. However it has not disappeared⁵¹ and this is one reason of the difficulty of modeling innovation. It is useful to distinguish the knowledge of how things work (the know-how) from the know-why (today it is well represented by science). Technique has integrated quite a lot of know-how but a lower content of know-why or science. Today technique has evolved into technology; it means more science and fundamental knowledge why things work in a certain way and not in another one.

As I wrote earlier, a central problem for studying technology and innovation is the combination of old and new forms of knowledge.

Thereby, following the evolution of technology, innovation is knowledge-driven. Modern technology is much more intimate with science and the plain know-how very often is not sufficient for the innovative activities. It is necessary or very useful to know why. Technology is quite a complex automaton as John von Neumann once imagined.

⁵⁰ Marc Bloch (1940/1990), studying the French defeat of 1940 in his book *L'étrange défaite*, Paris: Gallimard, p. 150-151, made some interesting consideration about history and the difficulty of human strategies to be up-dated. The French adopted the system of defense based on the 1914-1918 war, which lead to a shocking defeat. In other words, the very point here is one of unpredictability of action and the uneasiness of using the past as a clear and simple guide for action. This can also be associated by what Reinhart Koselleck called the *acceleration of history* that impairs the relevance of experience for future action. And, finally, this interpretation – that in history the reconstruction of the past that often takes the outcomes as given and goes back to the putative causes to make the story plausible – is not a correct way of conceiving the historical action characterized by uncertainty over the future outcomes.

⁵¹ Indeed, between invention and innovation, there are important and interesting events occurring and which are much neglected in the literature on innovation stressing much more outcomes than processes, and in particular historical processes. My viewpoint here constitutes a rejoinder to Snooks' arguments (Snooks 1993).

Technology is integrating knowledge with a strong inclination towards efficiency, much more than is the case with the mere practical preoccupation of old techniques as depicted before the industrial revolution of the late eighteenth century.

All the distinctions and features related to technology, technique and science are open concepts which could be much better treated by applying fuzzy logic than classical Aristotelian logic, whose three precepts are often disrespected in current research. I distinguish technology from science; thus objects like the microscope are not absolutely in one category and excluded from another. The inclusion to a set is thus relative. This logic has also the advantage to be better prepared to deal with change and the decaying of strict categories. Moreover, if I define science as aiming at truth and technique as striving for efficiency, then we enter into a reductionist view of the dynamics of science and technology, with growing interactions between the two. The “conterminous” activities and processes are of increased importance and the bounded category is losing perspicacity. The distinction between science and technology is often useful for research purpose. However, the frontier is not rigid and dividing a strict watershed between the two can lead to inconsistencies and to spurious research results. Both are characterized by links as shown by the study of networks. Nevertheless, science is much more inclined towards truth seeking than technology, which tends to be more polarized around efficiency.

Knowledge in the current perspective has to be distinguished from information. Usually, knowledge is identified or reduced to information and capital, as it appears in mainstream economics (Dolfsma 2001). However, the cognitive sciences, among other disciplines, present us with a very different picture of what knowledge is. Knowledge is dynamic and procedural (as Herbert Simon has characterized it). It is strongly dependent on the context and time. The information-driven conception of knowledge is mainly based on the computer metaphor from artificial intelligence or from a cumulative view of scientific knowledge. However, the metaphor is misleading and does not treat correctly the human-specific dimension of the cognitive processes. There are, at least, two reasons for that, which are closely linked to the notion of *context relevancy*.⁵² First, it suffices to cite the cases of interpretation and tacit knowledge – the latter well documented by Michael Polanyi – in order to grasp what is at odds with

⁵² Context relevancy is the critical definition of a context that includes the momentous variables in a dynamic (time) and complex perspective. It could be seen as the set of variables relevant to the understanding and/or solution to the problem integrating the time dimension, which bring us change or emergence.

this narrow view of knowledge. This is what we can call the imprecise understanding of human and social phenomena. There is a gradualism (and now and then strewn with ruptures) in the transition from one situation to another or from one set to the other. Equally clearly, we are very often unsure about the validity of our knowledge which is thus uncertain.

Furthermore, the second reason is that knowledge is regarded as procedural and has a time dimension, which distinguishes it from information. The notion of process of knowledge is intrinsically linked to the history of a certain kind of knowledge, which changes over time through destruction, creation, transformation, re-discovery and re-interpretation. At the level of knowledge, my conception of complexity, which I will outline briefly hereafter, is different from the one developed in the works of Gell-Mann at the Santa Fe Institute.⁵³

Let me just make clear that the time dimension of knowledge is, according to me, the pivot of a future understanding of the role of knowledge in the economy, and more specifically of paramount importance in the innovation process. Time is not a once given feature of our lives measured in hours and referring to some substantive ontology as most philosophical discussions of time maintain. Time, as Norbert Elias has shown, is a coordinating tool with a central social dimension subject to change and uncertainties. This is a point that wraps up the discussion of the previous chapters.

The evolution of firms in an economic sector can be characterized by the term "firm trajectories". The perspective I adopted refers to complexity as a central notion in the transformation of social sciences. One of the key-feature is "emergence" and "history". Both society and the economy would be much better understood if there was not such a fundamental and even essential feature like emergence. Technological innovation is one type of emergence and we find others under the name of social change, growth, and so forth. Thereby, new phenomena, objects and the like are combined – usually not in a linear form – with old elements and relations thereby transformed. Alongside a historical path, it is hard to disentangle the new from the old.⁵⁴ Complexity here is not derived from the natural sciences, such as physics as it is often too frequently considered in social sciences, or from computational complexity

⁵³ The view of Gell-Mann can be found in *The Quark and the Jaguar* or in his article "What is complexity", *Complexity*, vol. 1 (1) 1995. See also the treatment given here on complexity at the end of the section.

⁵⁴ For a good treatment of the notion of complexity see Sergio Vilar: *La nueva racionalidad [The New Rationality]* (1997).

usually measured in time or any other measurable resource needed to solve a problem or order information.

Complexity is defined as a set of relationships between parts. *Complexus* means etymologically "what is thread together". It should not be reduced either to its parts (in this case we have individualism or strong or weak separability or decomposability, to use Herbert Simon's expression) or its whole (which is tantamount to holism) but thought on the basis of its relationships (Norbert Elias).⁵⁵ This leads us to adopt the notion of relevant context, the time dimension and the populational perspective in the research about innovative firms.

As Marcel Mauss once put it: "the unknown is located at the frontier of disciplines" (Mauss 1950). The issues of technology and innovation are such a new and fruitful frontier for the social sciences, from the outset; therefore we should not close promising avenues of research which depend on cross-fertilizing disciplines and which tackle such a complex phenomenon integrating so many diverse actors, organizations, and institutions.

The social sciences studying innovation are integrating history into their curriculum and my contribution is closely associated to this trend. To integrate emergence and complexity qualitative studies are of great help as I have tried to demonstrate. Furthermore, this initiative has to overcome conceptual shortcomings and disciplinary barriers. Through theoretical and transdisciplinary work which incorporate History, the social sciences are getting closer to reality and to the systematic definition of problems and producing knowledge about innovation and change more suitable for policy action and effectiveness.

⁵⁵ See especially the first chapter of *Die Gesellschaft der Individuen*, Frankfurt am Mainz: Suhrkamp Verlag, 1987.

Chapter IV – Conclusions – Towards a theoretical history

The present and final theoretical chapter recapitulates the starting point, the historical analysis, in order to present the theoretical background that I will use in the second part of the thesis. I argue first that the theory is not just necessary for historical analysis, but highly recommendable for giving to narratives some guarantee of rigor. Second, I will treat the issue of the importance of history for economic phenomena, i.e., what is meant by the often-quoted sentence “time matters.” For this, I will treat the notion of historical time in the first section.

1. Further considerations on historical time

The phenomena of economic life are so complex, with so many faces, that economics cannot embrace them all. Therefore, each epoch has its preferred topics, its dominating ways of approaching the problem. Would it not be necessary to get back, after a while, to the forgotten perspectives? Léon Dupriez (1982: 5)⁵⁶

As I have exposed the introduction and first chapter, *historical time* is considered here as the central challenge to economics qua realistic science. The issue was well known and is well documented amongst most classical economists such as Adam Smith, Malthus, Sismondi, Stuart Mill and Karl Marx. The historical approach was the central and distinctive feature of Marx and the German historical school as well as the French, Irish and British historical schools. “

⁵⁶ This is my translation of the text: “Les phénomènes de la vie économique sont si complexes, ils ont tant de facettes, que la science économique n’arrive guère à les embrasser toutes à la fois. Aussi chaque époque a-t-elle ses sujets de prédilection et ses modes d’approche dominants. Ne faut-il dès lors restituer, après un certain temps, les optiques oubliées? ”

Since then, the historical concern and the corresponding historical method have lost ground in economics. I can say that, without a few important exceptions, today, history is considered as mere data for testing economic history. This evolution has already started with David Ricardo or the French engineers like Cournot, Bertrand and Arsène Jules Dupuit, and it intensified with Walrasian and Paretian economics in joint concert with the marginalist school.

The evolution of economics from the 1930s onwards shows clear signs of the neglect of the historical method and all the concerns for including historical time within the research tradition, and all this is related to the metaphors from physics (Mirowski 1989) and other disciplines, namely geometry.⁵⁷

The long duration (the *longue durée*, in Braudel's terminology) has been widely neglected in traditional historiography, the one preceding the *Annales* and Norbert Elias' works, and across all the social sciences, and especially in mainstream economics. In the latter case, growth economics has taken the place of historical consciousness, focusing rather on steady states, trends (steady growth), and dedicating scant attention to irregularities of different temporalities of socio-economic phenomena.

Fernand Braudel's notion of plurality of times (Braudel 1972), inherited from George Gurvitch's concept of plurality of social times (Gurvitch 1968/1986), is of much interest to the present research; different actors, social groups, firms, institutions, power structure, etc. present a great deal of diversity of time frames, habits, and rhythms. Here lies the difficulty of discovering patterns in the economic life, whether they be stable patterns (stasis), recurrent periodic patterns (cycles) or, finally, phenomena without clear or evident patterns. Between the extreme of symmetric cycles and the complete absence of patterns, complex patterns can be identified, which may or may not lead to chaos.

As I will try to demonstrate in the following pages, the main deficiency in Braudel's treatment of historical time is twofold: (1) a lack of theorizing, and (2) either a neglect of radical contributions of his own time or an approach based on partially outdated scholarship when judged in the light of today's standards.⁵⁸ The second weakness is epitomized in the case of the imperfect imitation of Kondratiev and other business cycles as the discussion ignored much of the precursors (van Gelderen or

⁵⁷ See the case of the French engineers and the basic economic textbooks of Samuelson, Fisher and Dornbush and related concept of field, geometric locus, etc.

⁵⁸ I recognize the great contributions of the school of the *Annales* as well as their inventiveness when they first strived in historiography.

Kondratiev, as this latter was known during the 1950s).⁵⁹ Braudel almost ignored the *process theory* of Elias in his notion of civilizing processes and the theories of complexity and the theory of evolution. Elias, before World War II, was one of the great defendants of the evolutionary analogy for the social sciences, in a manner that superseded the caricature of Spencer. Evolution and history once more are conceptually close relatives. The inclination of Fernand Braudel was a study of history based on simple patterns and rhythms while many time series do not show systemic or regular patterns, except one based on randomness around a characteristic recent past value.

Let me come back to the first weakness, which is closely related to the second: I refer to the scant attention that the *Annales* have dedicated to building theories that go beyond conceptualization and mere juxtaposition of carefully elaborated concepts, no matter how rich they are for the historical inquiry. Historians and economic historians have no theory of action within a framework of radical uncertainty (see the introduction and chapter I for a definition and discussion of the concept).

In the case of innovation, shareholders, investors, workers, and managers face uncertainty in daily practice, from weak to radical or ontological uncertainty. Actors are by definition real cognitive entities that act (and not just make decisions) no matter what they ignore about their relevant environment and the unforeseeable consequences of their proper action, not to mention the action and reaction of others. Innovation is no exception to this principle, quite to the contrary. I will illustrate this point in the case of the Port wine sector and the intellectual property rights problems (see second part, chapters II and III).

I now pass to the simple proposition on the notion of time.

The first element of the definition is a rejection of single cause schemes of explanation or mono-causality. The definition, in positive terms, is based on a principle of plurality of causes that create a complex *causal context* as I referred to above (Introduction and Chapter I).

To the principle of plurality of causes, I relate another concept, the *cumulative causation* (Veblen 1898, 1904, 1912 [1899], 1915, Dopfer 1986, Coe, Helpman and Hoffmaister 1997, Argyrous 2001, Setterfield 2001). In historical time, the causes cumulate (in a non-linear way) through time. The same kind of events can accumulate

⁵⁹ I must add that George Gurvitch, who influenced Braudel, took part in the Revolution of 1917 and knew the debates of economic policy and trade cycles from that time and during the 1920s when in Russia and Germany, before emigrating to France. But to my knowledge, not much can be said about it. Documents are lacking for the support of any audacious interpretation.

with other types of causes and this makes it one of the central problems of historical analysis: to combine and sort out the different causes to a particular event or phenomenon. I will define cumulative causation in the third section. I just want to mention here that two corollaries are worth to be underlined: the notion of imprecise cause and its uncertain effects.

From all this, the method for history is necessarily one that integrates imprecision and uncertainty at its very heart. Historical time renders reality imprecise, since human action is embedded in a context of uncertainty. I distance myself from the philosophical stance of the epistemic view according to which vagueness (as it is the term generically used in the literature) or imprecision and uncertainty are characteristics of the observer. I adopt a view that does not settle the issue of vagueness here; instead, imprecision and uncertainty are assumed as partly outside human perception. In other words, I make the hypothesis of a radical uncertainty that is not just the direct result of the human mind, although I do not deny that the subject interpret imperfectly the situations that are in front of her.

Radical uncertainty has a very important implication for studying human behavior: the imprecision of the measure we can get and so the tools we use are to be adapted in consequence.

2. (Socio-)Economic structures, institutions, and agency problems

Before starting the discussion of structures and institutions, I will state the problem of agency, as it is known in the literature, and often and wrongly opposed to the notion of structure. Those are indeed distinct but highly related levels of analysis.

Economics, as a rule, considers first the agent as the only relevant unit of analysis, even in macroeconomics; the agents are either linearly aggregated or simply added through the artefact of a representative figure, the representative agent, which is homogenous and therefore easy to deal with from an analytical point of view (isolating the individuals and the basic elements of analysis, abstracting them from interaction contexts and emergent effects).

The problem of agency or individual action is central to the social sciences (see Hollis 1994 for a rather standard treatment of the problem). There are at least three basic positions: in the first only the individual level matters (methodological individualism or

atomism); the second position states that only the global level matters (holism); and the last considers that both matter but must be combined (Jacquinet 2000). In the latter case, the combination is the crux of the matter.

Economics, on the whole, is concentrated on the action of individuals. Groups, as particular entities, are abstracted away through linear and uniform aggregation procedures. In mainstream economics, there is not much room for structures, just aggregation of individual behaviors and their outcomes. Individuals are often treated as autonomous human beings.

I think that it is better to consider individuals as relatively autonomous, capable of genuine choice but acting at the same time in a context that gives sense to their action and influences the choices made. Individuals need institutions, such as language, to communicate and live in society.

A central problem for individuals consists of the coordination of their actions. Some economists consider the market to resolve the issue of coordination. Both mainstream and Austrian economists adopt this position through the mechanisms of the invisible hand and the process of spontaneous order, respectively.

For others, most of the economists outside the above-mentioned traditions, consider the problem of coordination as central. A great deal of the coordination problem can be treated by the concepts of structure and institutions. A good case is the definition and measurement of time, which, for example, permits the coordination of plane landing and takeoff, the appraisal of work effort, and in other quantifiable processes.

I take institutions in a broad sense. I do not limit it to the restricted meaning that the common sense gives to it: some specific organizations such as central banks, regulation bodies, and the like. My definition includes them but extends the set to all habits of thought and behaviors that present some stability through time or are hard to be modified in the short run. I come back to the issue in the introduction and first chapter of the second part. Structures and institutions are not fixed, but evolve through time at different rhythms, mostly because of the interaction of individuals and groups and other structures and institutions. This is a phenomenon of co-evolution that I will focus on in the following chapters as well as in the study of the Port wine sector.

Thus, I can consider the relative autonomy of structure and agents, both related through a *co-evolutionary process*. On one hand, the structures and institutions influence agents and, on the other hand, structures change because of the actions of

agents and the interactions with other institutions. A central phenomenon in the co-evolution of agency and structure is the feedback process that can reinforce or inhibit existing interactions.

The relation is what defines most of where individuals are and what they do and why they change. Besides network economics, this aspect is much neglected in the economic literature.

I focus in the present thesis on the worthiness of (socio-economic) relations as a fundamental unit of analysis that avoids treating individuals as absolutely autonomous and fixed entities. I adopt here a synthetic framework opposed to the analytical method following Descartes that divide the reality into autonomous elements of inquiry. Relations, in this perspective, are lost; but they are essential to grapple with the problems of inertia and change.

I will pass now to the discussion of the notion of time asymmetry

Asymmetry in time is the result of the arrow of time. As time flows, events are irreversible in a strong sense: once they have happened, we could never come back to the very time of their occurrence. Time is also irreversible in a weak sense: events that occurred are known but the context of their occurrence is always partially lost. In this sense, the irreversibility consists of (1) change of context and (2) consciousness of the happening and about the changes through the passing of time.

In the present study, the climatic variable and the wine diseases – such as oidium or phylloxera – have triggered irreversible changes. In the case of phylloxera, the change is so profound that the production techniques changed in relation to what they were before, as is what happened in the first half of the 19th century; a new path was created, a path that created a new type of wine.

The diversity of the elements of the Port wine system is impressive as can be seen from the following list: the economic policy of the central government, the regulation of political power, the regulatory agencies of economic activities (CGAVAD, IVP, etc.), the wine growers, the wine merchants, the technology used, and the consumption markets. Each element is itself a subsystem that is partially autonomous and has a proper rhythm of change and reproduction. All are in interaction with one another and each one influences the actions of the others as well as being influenced by them.

Time for winegrowers has not the same meaning and importance as it has for wine merchants. The former are much more limited in trying to control their stock and

lay down wine from the last vintages while waiting for the good opportunity to come. The latter, however, endowed with substantial financial wealth can wait for the good days to come, even one year or two, without having to make such dramatic sacrifices.

Finally, as noted already by Halévy in 1948, and later reinforced by Reinhart Koselleck, time, or more precisely change, has accelerated in the last centuries (Koselleck 1979, 1990, 2000, Halévy 2001 [1948]). Koselleck talks about the acceleration of time since the late 18th century on three grounds: economic (the Industrial Revolution), political (the French Revolution) and cultural and conceptual (the change of conception of human nature and the emergence of criticism and European Enlightenment).

3. *Longue durée*, long waves and cumulative causation

In Braudel's schemata, there is a clear lack of theoretical articulation between the different types of duration and the characterization of each one in terms of its proper momentum, e. g., especially for the long period, a theory of cumulative causation that we can find in Veblen's work (1899, 1904, 1915) and more recently in Gunnar Myrdal (1944, 1957, 1974) or M. Setterfield (1997, 1998, 2001, 2001a). I will come back to cumulative causation in the next paragraph to give a definition and a brief discussion, but let me first pursue my point about Braudel's *longue durée*.

Fernand Braudel advanced the idea of an (almost) immobile time, encompassing the structure of time that moves very slowly over the centuries (Braudel 1968, 1972, 1979a). This point is a good example of a lack of theorizing and articulation with other rhythms. The notion of time is often dismissed as irrelevant as I will try to show. This conception of time leads to a mistake for appraising economic change. But the problem is deeper than it seems. The notion of fixed time and the combination of different rhythms are a response of Braudel and the historian of the *Annales* to the structuralist challenge in French academia, the dominating and progressive paradigm for anthropology and sociology in that century. Nevertheless, there is something amiss with the notion of structure and its adoption into history and economic history. Of course, some elements do change so slowly they can be considered as fixed, especially in rather short periods. Most of the natural world is of this kind, but at the socio-

economic level, structures are not fixed but continually re-constructed with varied degrees of either rigidity or flexibility.

3.1. Cumulative causation

In the notion of cumulative causation, there is a fundamental idea of sequence (time matters): to be precise, a non-linear sequence of events that accumulate or combine through a complex process of creation, destruction and combination.

The current trend back to narrative and events does not do justice to the relevance of long-term changes, whilst they attracted much of Braudel's attention. Some changes are difficult to measure on a short time scale. Economists usually consider structures (when they do consider them) and tastes or preferences as fixed in the short run. However, those changes, even for technological change, are once for all events (one-shot) that do not need to be analyzed. They can be reversible or irreversible but cannot be observed as such.

However, historical time is irreversible; we cannot go back to the same choice once made but just act anew upon its current and coming aftermath. As Heraclites once put it, we cannot cross the same river twice.

I must stress that, if I give paramount importance to long-term transformations, I maintain that the notion of events is still very important for the historian. Events are not homogenous and always small, a false idea that seems implicit in some treatments of path dependence and the significance of small events. There are big events as well as small ones. Events are heterogeneous, going from small to big.

The relation between path dependence and cumulative causation is at first sight obvious, but needs more research. Here I just want to suggest that in order to move on a path, causes have to be accumulated in some way, or if not, there would be no path at all.

3.2. Multiple cycles

I distinguish a number of cycles that can be analytically identified but are related, especially from a causal perspective. Here I will limit the categories of cycles

to six: the political cycle (not included by most of the work by the *Annales* that stress the society and the economy), the institutional and cultural cycles, the business and consumption cycles, the technological cycles, the life cycles of firms and products, and, finally the long cycles or long waves of aggregate production and investment.

Let me comment first on the issue of the political cycles that received scant attention in the tradition of the *Annales*, the traditional economic history, and in Portuguese historiography. If political cycles are hard to define, it can be worth to understand at least some of the prominent political variable that interact with the economic and regulatory systems. Political factors are important (causal) variables. Moreover, this is the opportunity to build more realistic models and include the notion of events back into history and, here, historical economics and economic history.

In the case I will study the political variable(s) is (are) of paramount importance, as I will show it in chapter II of the second part for the period of the Marquis of Pombal and the ensuing socio-economic transformations of the last two centuries, including the pervasive political factors.

4. Hysteresis and path dependence

The notion of path dependence, which I will define more precisely in the second part of the thesis, has a predecessor in economics. This is the notion of *hysteresis*, coming from physics and chemistry, and adopted by new-Keynesian and post-Keynesian economists to model unemployment dynamics or, more recently, financial markets and currency fluctuations.⁶⁰

However, the concept has been fading away in the mainstream literature and now the notion of path dependence has since then superseded it in many fields of research, and much beyond economics of innovation. Nevertheless, I will treat hysteresis briefly given the importance it has for taking account of history.

Path dependence is a broader concept that can be traced back to economic history and the economics of technological change (David 1975, Flichy 1995, David 2001). In addition, both refer to a more general class of phenomena: historical

⁶⁰ Most of the literature about unemployment dynamics does not interest us here. See the next section on hysteresis.

processes that are not often possible to be couched in mathematical terms, at least in traditional calculus.

Here, like other evolutionary concepts, path dependence has also become a fad. But much more than a fad, it induces a change in perspective for some economists and economic historians. To be fair, much of the historical concept is coming from innovation studies and the history of techniques. It is implicit in the works of Maurice Daumas (1996/1962) and Bertrand Gille (1978) which were introduced them in the second chapter. What is new is the stochastic and mathematical treatment of path dependence that gives "history matters" a more specific and rigorous meaning. The notion is not free of controversies, as I will show it in the second part (see chapters I and II). I will now pass to the discussion of the notion of hysteresis.

Before, and also, simultaneously with the emergence of the concept of path dependence in the 1980s (David 1985, Arthur 1989, 1994), hysteresis consisted of a formal recognition that past events had a bearing on current phenomena. One aspect must be stressed here, while stating that history matters, "economists often subscribe to an approach that does not exploit hysteresis in a manner that reveals the full extent of its potential significance and the full impact of history on the present" (Katzner 1999: 171).

Hysteresis is very often represented by a periodic equation such as:

$$y_t = B y_{t-1} + a \quad (1)$$

and by setting $y_t = y_{t-1} = \dots = \bar{y}$, the stationary state of equilibrium is:

$$\bar{y} = a / (1 - B), \quad (2)$$

which does not depend on time t .

And this is not very appealing because the variable y_t converges to a history free value $\bar{y}$ (Katzner 1999: 173).

A more interesting case is one that makes the second element from the right hand side dependent on t like that:

$$y_t = B y_{t-1} + e_t \quad (3)$$

But this equation does not yield, in the general case ($e_t \neq 0$), a stationary state:

$$\bar{y} = e_t / 1 - a \quad (4)$$

where e_t brings irreversibility for the present and future value of y_t (Katzner 1999: 173).

There is, however, still one more general case that can be formulated in the following way:

$$y_t = f^t(y_{t-1}; e_t), \quad (5)$$

where f^t is determined at time t by interactions that change with t . This third conception of hysteresis is one that is compatible with (1) radical uncertainty, as defined in the first part of the thesis; (2) path dependence, in the sense given by Paul David; and (3) historical economics or the explanations of historical processes, with one caution: historical time is to be studied as a intertwining of various variables that have their own partial autonomy and sphere of influence with no precise borders.

Accordingly, it is clear that the case of multiple causal factors; the feedback mechanisms from the very precise process itself (y_t and its partial determination by past values); the causal interaction with and from other variables, etc.; turn the analytical and quantitative handling difficult with very few cases of data available for the relevant factors determining an historical process. This is one reason for the success of the simulation methods in evolutionary economics, but this does not diminish the relevance of careful empirical studies.

I consider this distinction between historical processes and mere mechanical reproduction mechanisms (equation 1) as fundamental which argues against the use simple methods that are based on a simple reproduction (equation 1) or a sophisticated model that "only allows parameters to vary exogenously through time" (Katzner 1993:332-33, 1999: 176).

Historical processes are tackled through different classes of tools: one is hysteresis, another, philosophically related to this first, is path dependence, and, finally, narratives are the third.

Depending on how we construe hysteresis, we can consider that it integrates path dependence, but even here the inclusion is not perfect. Path dependence, in the versions

of either Paul David or Brian Arthur), stresses the particularity of the stochastic processes (Arthur 1994, David 2001). Nonetheless, there are other differences such as the origin: path dependence comes from historical research and is applied to technological change while hysteresis is coming from physics and chemistry and has been applied above all on unemployment dynamics.

The third class of tools to analyze historical processes consists of narratives that include path dependence and hysteresis, not just as a previous discussion but also as techniques of study. Usually, narratives are more “appreciative”, to use an expression of Richard Nelson, than theoretically grounded. Most of my research will follow the path of narrative exposition and by this I mean not only the literary device of telling (hi)stories but also quantitative and qualitative techniques that fit into the overall explanation.

5. Historical time and the quest for abstraction in economics (continued from chapter I)

Let me define here the notion of *theoretical history*. If a lot of ink has been dedicated to the philosophy of history, a necessary question with an arguable answer, much less has been dedicated to theoretical work about historical processes. I adopt here a position—a philosophy of history or a theory of history, as it is usually referred to by historians—in line with the works of Fontana (1992, 1999a, 1999b) and Rodríguez de las Heras (1976) and the method and the theory of complexity. In other words, I integrate a more general conception of history that allows for greater richness in understanding reality (see chapter I and chapter III).

From a methodological point of view, I support the idea that: (1) a theoretical history is possible (and even necessary, see introduction); it is not a contradiction with the critique of sources in historiography and the high value scholarship of some historians; and (3) it is a “grounded” theory purported to explain what the historical processes are and how things change or remain the same. By *grounded*, I mean, without adopting any empiricist dogma, recognition of the complexity of reality and the necessity of empirical work for the very theoretical work. Theories do—or do not—gain legitimacy, not just on their own, but as they prove adequacy to the reality they try to

explain. At some stage of the inquiry, the theory has to be confronted with empirical cases.

6. Paths of change and tradition

In this final stage of the theoretical exposition, I want to stress the importance of path dependence both for the analysis of the transformation of technology and the institutions, and for the study of the evolution of a population of firms in a peculiar competitive market.

Let me insist on the following concepts: path dependence (much related to the notion of cumulative causation), evolutionary theory and population dynamics (reproduction, variety generation and selection), (causal) mechanisms, and institutional analysis. They are in a sense a response to the concerns about historical time, complexity, and vagueness in the socio-economic processes.

Path dependence is often referred to as the importance of small events for future development of the issue at hand, here the evolution of the Port wine system in the three spheres retained for my analysis. This importance of small events must not be exaggerated and must be clarified on two grounds: the importance of big events and the mechanisms of cumulative causation that turn small events important because they accumulate through time and make the path the way it looks.

Historical time is the combination of multiple patterns in time: first, stability, as a reproduction of the past (often defined as inertia, especially when treating organizations and firms); second, the modification of what was and has been into something different in nature or in terms of relative importance (i.e., the change of relative proportions in populations of firms for example); and, finally, the emergence of novelty that implies a change in the learning process and turns past knowledge, skills and experience into outdated and unreliable clues for further action. This third element has increasing quite clearly since the late 18th century and has turned tradition in business practice into something of a problem.

The long run perspective chosen here is justified for being able to identify the diversity of patterns and permits a fruitful application of an evolutionary analysis of

institutional and technological change, on the one hand, and the evolution of populations on the other hand.

As I have tried to show, technological and institutional changes as well as the evolution of the population of firms are characterized by both stasis (tradition in the wine production, conservation in the institutional setting and reproduction in the population of firms) and change (emergence of new shipping firms, adoption of new techniques, surfacing of new diseases and the unfolding of reactions and extraneous events).

Part II – The evolution of Port Wine sector: an Historical account from 1680 to 1974

Introduction

My objective, in the present research, is to give an account of the profound changes that the Port wine sector has undergone during the last three centuries from the point of view of technological change, institutional transformation and the insertion of this peculiar productive sector in the European capitalist economy. This integration is concomitant with an evolving international context dominated by the British industrial revolution in motion from the late 18th century.

Indeed, the sustained growth of the wine trade, generally speaking, coincides with the expansion of capitalism, characterized by two specific transformations: on the one hand, the increase of production and trade possibilities and, on the other hand, the growing demand for all consumption goods, including alcoholic beverages.

The first alteration is defined by a rapid accumulation of wealth and capital by a class of economic agents, i. e., the merchants and industrialists, who were able to reach new markets and to diversify the supply of commodities ranking from low to high prices, on a scale unseen before. This first change also represents also an overall, though unevenly distributed, increase in wealth with the ensuing effects on consumption. The changes in production and consumption are highly related and not fully understood. I will limit my treatment to the production and wine trade, neglecting the consumption side, as it lies outside the scope of my research except when related to production and commercial transformations.⁶¹

In the 17th century, wine production and wine consumption were profoundly transformed, opening up a new era for the winegrower and the wine merchant. With the

⁶¹ Problems with the access to and the inexistence of relevant data were others reasons for not studying wine consumption. This does not mean that this was not important; I hold quite the contrary opinion and consider consumption as one of the main causal factors shaping Port wine.

aggregate wealth on the increase, the upsurge in the demand for wines follows the general rise in conspicuous consumption, on one hand, and mass consumption, on the other. This diversification and the expansion of the world of consumption are related to the new momentum of the urbanization process permitting the diffusion of the worlds of consumption, to use Ben Fine's expression (Fine 2002). Port wine has successfully adapted itself to the trend towards distinction and differentiation of the conspicuous behavior (Trigg 2001).⁶²

If I do not treat the world of consumption of wine in the United Kingdom (Unwin 1991, Simpson 2004) or in Portugal (Barros Cardoso 2003), I recognize its crucial importance for the transformation of the production of wine. A great deal of the technological change and the modification of the production process have to do with the transformations in consumer taste and preferences. This is exactly the case with Port wine and the British market.

The process of change in the wine sector can be considered as a whole socio-economic process composed of many aspects interrelated aspects, but, for the sake of the manageability of the research, I will focus on only some of the mechanisms. In order to give a thorough, albeit incomplete, account of the story, and whilst being conscious of my omissions and neglects, I have emphasized what seems to me two of the essential mechanisms of the Port wine system: the production of wine and its trade. This is a first step for a proper understanding of the transformations of that very system of the Upper Douro wines.

My contribution to the study of the historical transformation of the Port wine sector relies on the definition of a twofold process, with one part intimately intermingled with the other.

On one hand, the historical change in the sector is characterized by instability of the very process of production and trade at any time with periods of major crises, alternating with moments of stasis, all contributing to a pattern of cumulative growth.

An interesting case for the Port wine is the creation and action of the *Companhia Geral da Agricultura das Vinhas do Alto Douro* (CGAVAD), usually referred to as the Royal Oporto Wine Company, the Oporto Wine Company, or *Companhia Geral* or,

⁶² I treat the differentiation of prices for low and high quality wines in the last chapter; see also the studies of Norman Bennett for some treatment on prices and quality (Bennett 1990, Bennett 2005, 2006).

simply, *Companhia*.⁶³ This *privileged and chartered company* was simultaneously a regulation and trade body for the Port wine, created by statute law. The *alvará* of 10th of September 1756 and, later on, the *alvará* of 10th of February 1761 granted it privileges and exclusive rights, not just to the organization itself, but also to its employees, members of the direction or board of administration (referred to as the *Junta*) or shareholders.⁶⁴ I will analyze this legislation and the ensuing decrees above all in the next chapter. The legal framing is one obvious channel of regulation of the economic activity, but not the only one. Other systems of norms and the level of coercion and law enforcement are important modifiers.

On the other hand, the process of change is history-dependent, or path-dependent, as defined by historians and economists of technological change (David 1975, David 1985, Arthur 1989, 1990, Cowan 1990, 1991, Arthur 1994, David 1994, Cowan and Gundy 1996, Magnusson and Ottosson 1997, Setterfield 1999, David 2001). As I will try to show, this phenomenon is not limited to technological change, but has also to do with institutional change, legal doctrine and practice, not to mention other social phenomena wherein time matters.

In the present case, the viticulture and the winemaking activities, trade and the transformation of the very production process – e. g., *aguardentação* or addition of wine spirit⁶⁵ – shows such paths: once created they can persist through time or even

⁶³ The documents on the firm are numerous, namely in the AHRCV, and the literature on its activity is impressive and frequently of a polemic character. In the English literature the Company is often referred to simply as the Company (Forrester 1854, Vizetelly 1880).

⁶⁴ See the documents at the Portuguese national archives (Arquivo Nacional da Torre do Tomo), ANTT, in the section *Ministério do Reino* (MR) Maço (mç.) 629, caixa (cx.) n° 732; mç. 630, cx. 733; mç. 632, cx. 735; mç. 638; mç. 641, cx. 745; and, the *Black Book* séries (Série Preta) volumes 2260 through 2272. Another collection, also found at the ANTT, is the *Collecção de leis or maço de leis*, caixa 6 for the second half of the 18th century. Some of the legislation during the institution and consolidation of the Companhia Geral can be found in: (Portugal. 1797). A copy of this compilation can be found at the Biblioteca Nacional, Lisboa, under references S.C. 1185 A to S.C. 1191 A. Nonetheless, these volumes are not a complete compilation of the statute law and some minor legislation, but important for the Port wine sector, is missing. For citations, I will usually refer to the national archives collections with the precise reference to the documents consulted.

⁶⁵ The Portuguese word, *aguardente*, usually translated through the word “brandy” in the specialized literature, is a distilled alcoholic beverage, a spirit, coming very often from wine, but not necessary so. In the historical documents, there are references to *aguardente de cana* on page 102 and the verso of 146 (ANTT AP lv. 277, 1777, or, alternatively, microfilm, from now on, mf. n° 2502). The pagination of the documents gives a folio number with a recto and a verso. The abbreviation used will be: fl. followed either solely by the page number for the recto and by v and the page number if the information is on the verso of the numbered sheet. For a seminal study on *aguardente*, see the book by Norman Bennett (Bennett 2005).

Aguardente covers a broader class of alcoholic beverages, including wine spirit. Therefore, if originally brandy or *brandy-wine* meant burnt wine, i.e., distilled wine, and not any kind of spirit beverage coming from a fermentation process producing alcohol; then brandy is an abuse of language. However, in

reverse to older practices or eventually change for a new start. These paths or trajectories can be characterized as the concretization of one path among different possible trajectories. A posteriori the path taken is either self-evident or it rather makes sense for the scholar studying the process after the events have occurred. However, in distinct historical contexts, such obvious unfolding of events into a path is not as evident. For instance, regulatory norms of the middle of the 18th century have opened a new path for the wine sector, a path that has not implied any strong determinism. One thing is the creation of a technological, regulatory or trade path; another is the maintenance of slow decay as time passes. The creation of a new path can be either endogenous (this is the case with the creation of the Pombaline regulation) or exogenous (such as the phylloxera invasion) or both, given a combination of the two types of factors.⁶⁶

Changes in the practices and the organization of the *shipping firms* follow similar patterns.⁶⁷ The regulatory norms settled in the 18th century have partially survived for several decades. Moreover, after some periods of decay and short-lived rebirth, the process of evolution of regulatory norms, integrating novelty, a new state-centered regulatory scheme emerged at the dawn of the 20th century.

Probably the modification of the techniques used by the winemakers and cultivators follow such patterns combining paths and bifurcations.⁶⁸ However, it must be clear that the historical record of their evolution is rather scant and dispersed in various archives with an additional problem, their sheer number, above five to forty

practice, it is widely used in the sector, and yesterday like today, the *aguardente* used is almost exclusively from grapes, so, in this case, it is brandy proper.

I will come back briefly to the emergence of the production of wine spirit and its addition to wine.

⁶⁶ In a more general system of interaction of vine culture and cultivation around the world, the phylloxera is globally endogenous to the system, but locally, as in the case of Portugal or France in the 19th century it is exogenous. As the main story goes, the phylloxera pest, which was first limited to the Americas was successfully imported in Europe by French vigneron, winegrowers and collectors of insects and plants, mainly in France and the United Kingdom first. Then it spread throughout the continent.

Briefly put, the phylloxera is a small insect (less than a millimeter) with a rather complex combination of cycles of reproduction that attacks plants, and in the present case the vine. The insect comes from the New world and was imported in Europe in the second half of the 19th century – as the oidium was a decade or two earlier – and ravaged vineyards all over the continent. I will discuss it in more detail in the second chapter.

⁶⁷ I use interchangeably the words shipper, shipping firm, wine merchant, wine trader and port shipper for the individual or company that exports Port wine. In chapter III, I will make some distinction between the wine Merchant as an individual or member of a small partnership (centered on the family business) and the export firms that are an outgrowth of the former but much more accentuating the capital and not the personality of family relations.

⁶⁸ The bifurcations correspond to what Maynard Smith and Szathmáry refer to as major transitions in evolutionary biology (Maynard Smith and Szathmáry 1995, 1997).

thousands during the period under study.⁶⁹ Therefore, I will focus on the shipping firms, which are well documented in official data, like the custom administration in Porto (*Alfândega do Porto*, henceforth referred to in the tables and notes as AP).⁷⁰

Accordingly, the first aspect of the twofold process (change and continuity) is about creativity and destruction, whilst the second is about reproduction and context dependence. Both define a process of change and evolution.

The analogy with the theory of evolution is straightforward here: socio-economic change corresponds to the principle of (biological) variation and socio-economic continuity to the principle of reproduction and replication.

In order to proceed with this twofold objective, I will now focus, in the next two sections, on the presentation of the specific theoretical framework and make some remarks about the Wine sector at the beginning of the period under study (early 18th century), presenting an evolutionary account of technological and institutional change.

1. Theoretical Framework

The theory that I use in the study of the port wine industry is based on four considerations. The first one is the treatment, in the first part of the thesis, of the notion of historical economics and theoretical history while the second consists of a definition of the concept of technology, once more focusing on its historical dimension. The third one is a critical appraisal of the so-called theories of regulation; and, finally, the fourth is a critique of the *law and economics* literature, again from an historical perspective, as can be found in some recent research of the founders of the field, such as Richard Posner (2000). Nevertheless, all this merits further argumentation and a critical appraisal of the existing theoretical traditions.

⁶⁹ See the *arrolamentos* at the AHRCV and the study of Gaspar Martins Pereira (Pereira 1986). For more recent statistics, some studies used the series of the Casa do Douro whose access has been limited.

⁷⁰ The documents of the Porto customs are referred to as *Alfândega do Porto*, or simply AP, preceded by the place where they can be found (either ANTT or ADP) followed by the book number and the date of the register, such as ANTT AP lv. 99, 1763.

1.1. Economics and history: once again

I have discussed at greater length the question of history in economics in the previous part of the thesis; what I want to do now is just to clarify my point with regard to the study of recent history – i. e., the Modern history – of the Port wine sector and the use of the concept of path dependence.

I adopt here the definition of path dependence as an non-ergodic process as understood by statisticians like Fuller (1976: 230), or, more precisely, as a “stochastic process [...] whose asymptotic distribution evolves as a consequence (function of) the process own history” (David 2001: 19). This definition is close to the conception of hysteresis given by Katzner (1993, 1999) and already discussed in chapter IV of the first part. I just want here to complement the abovementioned definition with the following considerations.

An additional comment regarding the historical method that is adopted here is necessary. My argument is twofold. First, there is a necessity of a long-run perspective in the study of socio-economic phenomena that I discuss in the subsequent paragraph. Second, the point treated here is a question of epistemology and methodology of a research that deals essentially with historical phenomena. Delicate issues are often passed on to the historians.

The framework here adopted is quite critical of both the quantitative methodologies and grand narratives (qualitative accounts) when one tends to exclude the other one. Often quantitative studies, like the cliometric movement, exclude squarely or without notice the more qualitative accounts that can be fruitful even if that those results are less clear-cut. The qualitative accounts, on the other hand, often neglect the availability of quantitative data. Between these two approaches, the method I defend for studying economic history combines both approaches. When both types of data are available, I will use them simultaneously in order to get the most plausible explanation.

Thus far, I still have to clarify the method employed here. Whereas my research falls into the category of economic history, the methodological tools I use come from economics (innovation studies), legal history, and the social history school, and here I refer mainly to the Spanish post-*Annales* historical school that is based on the

scholarship of Josep Fontana and Antonio Rodriguez de las Heras.⁷¹ The method I follow here is theoretically grounded and, at the same time can be considered as historical, in the sense given by Antonio de las Heras and Josep Fontana (Fontana 1976, 1982, 1992, 1999b, 2001).

In some respects, this social history could be connected to economics through the tradition of the late German Historical School and Marx's account of the transformation of capitalism and could constitute an answer to the critiques of lack of historical economics within the economic profession as advocated recently by various authors such as Snooks, David or Hodgson (Snooks, G. D. 1993, David 1993a, Hodgson 2001).

To illustrate my point, I draw on what Marx wrote in 1877, during a debate about the relevance of his theory of capitalism for the Russian experience:

[...] events strikingly analogous but taking place in different historic surroundings led to totally different results. By studying each of these forms of evolution separately and then comparing them one can easily find the clue to this phenomenon, but one will never arrive there by the universal passport of a general historico-philosophical theory, the supreme virtue of which consists in being super-historical. (Marx 1877/1968: 293)⁷²

This is a case for defending the study of historical specificity (Hodgson 2001) as advocated by the members of the German Historical School and by successive generations of historians. It stresses the difficulty of getting the events straight in a explanatory scheme on the basis of universal principles because of the diversity of historical events through time and places.

For most economists, the different Historical schools (i.e., the German, "English" and French traditions) and the American institutionalism are outdated. Both schools declined after World War I and almost disappeared after World War II, leaving the historical dimension aside or to some rising academic traditions such as cliometrics (Samuel Williamson 1991, Baccini and Giannetti 1997). The main position in economics with regard to institutionalism could be characterized by the point of view of the *new institutional economics*, as expressed by Oliver Williamson, who coined the term, or Ronald Coase, the founding father of this new intellectual tradition (Coase

⁷¹ I refer to other scholars, such as André-Jean Arnaud, James Willard Hurst and Lawrence M. Friedman, in the sociology and history of law as well as.

⁷² This citation, quite famous, cited by Carr and Hodgson et al., among others, is taken from the conclusion of the "Letter from Marx to Editor of the journal *Otyecestvenniye Zapiski*" written in November 1877 and translated by Donna Torr in the Marx-Engels Correspondence.

1984, Williamson 1996, Coase 1998, Williamson 2000). When comparing the old institutionalism with the new, Oliver Williamson declares: "Where they differ is that older style institutional economics was content with description, whereas newer style institutional economics holds that institutions are susceptible to analysis" (Williamson 1996: 1792). This view for anyone sufficiently knowledgeable of the history of the last hundred years of economics is erroneous. The old institutionalism presents a strong mixture of positive and normative analysis as it is understood today; this is especially the case in Veblen's writings. However, the general framework is one that does not limit itself to description or, worse, to mere subjective considerations on the socio-economic phenomena; on the contrary, it is well grounded on theoretical principles. Veblen evolutionary economics is clearly a theoretical stance and it is by today's standards underdeveloped, but for the time of its emergence, the late 1890s and early 1900s it was a breakthrough. A detailed analysis of Commons, Clark and Mitchell would lead to the same conclusion, that is, American institutionalism is also theoretically more sophisticated than when considered by current standards.

If the situation has now changed, and social scientists are increasingly acknowledging the limits of the traditional tools used by adopting a less positivist stance on methodological issues, there is still enough room for more rigorous analysis of historical phenomena, especially by increasing the theoretical content of the research programs. I have combined here theoretical principles for the study of history with empirical and archive research.

Over the last decades, in economics or sociology, the debate over historical time has kept its momentum with the defense of a historical social science through two traditions: on the one hand, within historical sociology (Elias 1997b, Goldstone 1998, Mahoney 2000, Göcke 2002, Mahoney 2004) and in some quarters of economic history (Landes 1968, Landes and Tilly 1971, Landes 1994, 1995) and, on the other hand, within a wide array of heterodox research programs like institutional and evolutionary economics and the literature on long waves (Freeman 1994, 1996, Louçã 1997b, Freeman and Louçã 1999, Hodgson 2000, Louçã and Perlman 2000, Freeman and Louçã 2001, Hodgson 2001).

1.1.1. The political factors

I would like to emphasize the importance of the political factors, including wars and changes in political systems, social unrest, and the like for giving a thorough explanation of the socio-economic transformations. In the Port wine trade and production, political factors, such as the strong legal protection, the wars, the changes of alliances at the European level (e.g., the unstable diplomatic relations between France and England throughout the seventeenth, eighteenth, and nineteenth centuries) are of paramount importance. Those factors are not necessarily exogenous, but should be part of any theoretical framework for studying the deep transformations of the sector.

Political factors are broadly understood as the following: the outcomes of the political system itself (e.g., the political and social unrests of the 1820s and 1830s); the international relations between European powers, including the insertion of Portugal in the concert of nations. The political factors consist also of (1) the definition and implementation of policies, with a content and significance that is not constant through time (Cardoso 2004), and (2) the definition of its space of action and the maintenance of order (including the integrity of the frontier, the control and organization of the territory and their people). These two last dimensions are well illustrated by the Port wine sector.

This focus on the political factor is in line with the (old) American institutionalism that considers power and policy as relevant variables for the study of the economic processes (Veblen 1899/1912, 1904, 1915, Commons 1924, 1934, Dugger 1990, Veblen 1990). For the early institutionalists and their more recent and closer followers, the economy is "much more than a system of markets" (Dugger 1990: 424). They introduce the notion of *coercion* in "economic affairs", to use the expression of John Gambs (1973: 13). This difference with the new institutionalism, namely with Oliver E. Williamson, is important for our purpose and for the building of a theory of regulation that I will approach in the first chapter.

I recognize, like the institutionalists, the importance of power, but I do not take it as the absolute concept whose pervasiveness has no limit. Their position is similar to that of Michel Foucault who sees power behind or in almost every phenomenon. It is rather a combination of traditional economic motives together with the institutional and political aspects of the problem of order in society (Spengler 1948; Samuels 1971, 1977).

I will limit the concept of power to the political and economic spheres. The explanatory potential for the concept of power does not lie in its overall pervasiveness but in its combination with other explanatory factors such as other institutions like the cultural background, the legal system, the regulation of production and trade, the taste of the consumers, the technological system and the scourges that affected the sector (i. e., vine diseases and wine spoilage).

The focus on political power versus economic and social dimensions of historical processes presents a rather cyclical character in the historiographical literature. In the last two decades, the political dimension has regained attention from scholars, namely in what has been called the new political history often to the detriment of the social and economic variables. The *Annales* emphasized the socio-economic processes some three to four decades ago and now the pendulum seems to have swung back to the political dimension.⁷³ Here, rather than abandoning the economic factors, I will study them while taking into account some neglected political factors that are relevant for the evolution of the production and regulation of the Port wine sector. Moreover, the political factors in the 18th and 19th centuries profoundly influenced the Portuguese economy in general and the wine sector in particular. All this follows from the centrality of the state in the regulatory framework in the wine production system.

Finally, I will make some use of the theory of rent-seeking not in the traditional mode of substantial rationality and optimizing agents but as one element in the interplay of economic and political forces in the international trade and the regulation of economic privileges (Ekelund and Tollison 1980, Tollison 1982, Tullock 1996, Ekelund Jr., R. B. and G. Tollison 1997, Ekelund Jr., R. B. and R. D. Tollison 1997).

1.1.2. The case for the long run perspective

Several economic historians, legal scholars versed in the evolution of the legal system, as well as scientists, have defended the adoption of a long run perspective in the study of economic, legal, and social phenomena. In economics, Snooks has defended the case for a long run perspective in economics in order to integrate time and history (1993, 1993, 1998, 1999).

⁷³ The debate in historiography is not only more complex than this pendular movement between economic and political variables, but it also appeared much before the 1940s, at least by the late 19th and early 20th centuries most of the basic issues had already been discussed.

This defense is not new: Sombart, a member of the young German historical school, in the late 1920s, took up a position in favor of theory in historical works and the broad perspective in economic history (Sombart 1929). We can see the same preoccupation in the works of such historians as Henri Pirenne and Fernand Braudel (Pirenne 1914, Pirenne 1934, Braudel 1958/1972, Pirenne 1969, Braudel 1979a).

Now the problem of historical specificity reaches a critical dimension. First, the tremendous trend for abstraction in economics has not favored the study of history, especially in all its complexity. The mainstream economic literature has become a stronghold of formalism in detriment of empirical and concrete analysis. Second, on the economic history side, either the broad view –such as the one adopted by the *Annales*– or the traditional method –as applied by David Landes on the Industrial revolution– is undergoing serious setbacks in the economic departments and publications.⁷⁴ The time of the *Annales* and the *histoire totale* has gone by and will not come back in a foreseeable future, but the historical focus remains central to the realist methodology in economics (Lawson 1985, 1997, 2003).

Even if the ambition of a complete perspective has been abandoned; I think that we can still defend the project of studying any historical phenomenon in its relevant context. In other words, I can still consider the project of Braudel as a stimulating objective (Braudel 1958/1972, 1968, 1979a, 1979b, 1979c), that is a history of economic structures. This is the point defended by Norbert Elias's theory of configuration and civilizing processes while defining a more restricted object of study (Elias 1997b).

In the last decades, new tools have been added, namely complexity theory, modern hermeneutics, dialogic, included-middle logic, many-valued logic, and so forth (Koselleck 1990, Hacking 1992, Arostegui 1995, Haack 1996, Elias 1997a, 1997b, Hacking 1997, Koselleck 1997, Hacking 1998, 1999, 2001, 2002). Ian Hacking has defended this point recently in the philosophy of science and probability theory (Hacking 2002). Besides the recognition of an historical ontology (Hacking 2002),

⁷⁴ This can be illustrated by the scant attention given to economic history by journals such as *Quarterly Journal of Economics*, *Review of Economics and Statistics*, *Journal of Political Economy* that were once much more inclined to publish papers on economic history than they are today. This lack of interest in global processes is likewise evident in journals dedicated to economic history such as the *Economic History Review*, the *Journal of Economic History* and the *European Economic History Review*. Finally, journals like the *American Economic Review* or the *Economic Journal* are still quite opened to economic history, but very often two categories dominate: (game theoretic) modeling or quantitative estimation of theoretical models.

there is nowadays a quite different pool of theories, techniques and logic systems available to us.

The traditional tools, however, like the work in archives, have retained their importance and part of the present research is based on such research. Consequently, any historical research has to ground its results on documents, i.e., on relevant evidence, knowing that the extant manuscripts and written documents are not complete. What is different, in my opinion, is the increase of (1) theoretical work and (2) interdisciplinarity of methods used.

My point is to study and defend a relevant context of socio-economic phenomena both at any point in time and throughout history. This long run view gives us the possibility of avoiding the pitfalls of what Andrew Abbott called the general linear reality (GLR) as the foundation of standard sociological and even economic methodologies with fixed entities (as in Aristotelian metaphysics) and clear causality from large to small scale (Abbott 2001).

1.1.3. Why study the Port wine sector?

The Port wine trade is an interesting case for a certain number of reasons. First, it offers a truly long-run view of a socioeconomic phenomenon that goes back at least to the 17th century for its modern form. Before that time, of course, wine production had already accumulated a long traditional basis of technique and practical knowledge; but, in those times, the system of production and trade was quite different and exports much more reduced. The end of the 17th century marks a new start for the sector, leading to its internationalization, or more exactly to its special connection with the Netherlands first and the United Kingdom afterwards.

A central issue consists of the emergence of the Port wine (*vinho do Porto*) with the addition of *aguardente*, liquor, to strengthen the alcoholic content of the beverage and differentiate it from other types of wine.⁷⁵ At a different timing and with a distinct momentum, the emergence of the Port wine has some similar features with the creation of Champagne, which was transformed from a common sparkling wine into a luxury product or into some distinctive consumption product. The institutional factors behind

⁷⁵ This differentiation is at the level of the organoleptic characteristics of the wine itself and its increased potential for ageing.

the legal protection of both products are similar, but I will not make any comparison here. I just wanted to illustrate the point that the emergence of particular wines and their success on the Dutch or British market is a more general phenomenon, with some similar factors: the legal protection from the state, the protection of the quality of the product itself, the importance of the local elites and big wine producers in the design of the institutional setting (Enjalbert 1953, 1975, Lachiver 1988, Unwin 1991). There are other important differences upon which I shall return later.

Another reason for analyzing the evolution of Port is the rather well documented research through the archives of various state and legal entities, scholars and the archives of the *Companhia Geral* on the Portuguese side and, on the British side, studies about the wine sector, the international trade relations, the Port wine and the Alto Douro abounded.

The difficulty in this research has to do with the disperse organization of the historical record, when available, especially in Portugal where the inventory of what exists has still not been thoroughly done and the accessibility to the sources is not easy. I have consulted three classes of documents: the first one is constituted of those documents already treated and researched; a second class of documents were classified but not used in previous research, and, finally, a third class is composed of documents barely classified or not classified at all, and, as a rule, not studied before.⁷⁶

1.2. The issue of technological change

For a more appropriate treatment of innovation in the second chapter, I will return to the notions of technology and innovation that I have discussed in the first part. Technological change is one of the central factors of economic growth and one that presents a systemic character, related to the other productive factors, institutional factors, and other realms of social life. This means quite obviously that techniques are deeply associated with institutions such as the market and the consumer preferences but also to other institutions such as the regulatory entities and the political system. Technological change, consequently, is not limited to efficiency problems but also to other important interactions with what can be conveniently named institutions. Technology is a variable that fits quite well into the theoretical or interpretative analysis

⁷⁶ See the annex for detailed references to the archives and documents used in the present research.

of the German historical school based on the concept of system or set of interrelated elements (e.g., the term often used: *Zusammenhang*). In the chapters that follow, I will highlight this aspect of technology, especially in relation to the institutional variables and the regulatory setting. Technological change is understood as a historical process that is difficult to explain without some knowledge of the systemic interactions among its components. In this sense, one of my arguments in the first and second chapters is also that the institutionalists are also defending a systemic approach to technology, relating technology to institutions and culture.

Citing the words of a historian of techniques: "the logic and coherence of this technological knowledge [...] are not related solely to the physical phenomena that are set into motion by a given technique. Social representations of technology are also a mixture of ideas concerning realms other than matter or energy. In short, the mental process that underlie and direct our actions on the material world are embedded in a broader, symbolic system" (Lemonier 1993: 3).

Second, part of the change in the technology relates to the stock of knowledge and its modification through discoveries and destruction of inadequate beliefs and knowledge. This complex accumulation process does not guarantee that the existing stock of knowledge be devoid of ambiguities, inefficiencies, and erroneous conceptions about the natural and technological world.

Third, technological change generates perturbations to the productive sector. This means that it engenders uncertainty through the destruction of old technologies, of outdated knowledge, and through the modification of routines and behaviors. This is the case in the Port wine sector: one change is due to the vine blights which triggered uncertainty and responses that ultimately modified the cost curve of the sector, moving them upward. The vine pests are exogenous and not technological variables proper. However, as I will argue, the history of the phylloxera and the oidium, two diseases that affected viticulture worldwide during the second half of the 19th century, suggests a more complex explanation wherein human factors and technology played a crucial role. Moreover, the consequences of these diseases have a clear technological aspect.⁷⁷

Fourth, the technological transformation triggers some dynamic effect that eventually will go through a process of normalization, that is, based on the normative

⁷⁷ First, the spread of the disease - related to increase in trade, collectionism and improvements in trans-Atlantic sea transport are the changes that most probably brought phylloxera to Portugal. Second, the adaptation and salvation of the vineyards to the new scourge brought technological changes and new investment as well a renewal of landowners dedicated to the wine production.

character of techniques and the very process of their diffusion. New techniques impose new norms or, at least suggest new ways of doing things. One of the central variables behind technological change and its stability has to do with the replication, selection and production of norms. This is a point that I will further develop when writing about regulation.

1.3 Regulation, institutions and norms

The issue of norms and institutions in economic analysis has gained particular attention in recent years (McAdams 1997, Hodgson 2004a)

There are two traditional problems in the economic literature when one speaks of institutions and norms. First, regarding institutions, the concept has a rather limited scope; they are usually understood as specific organizations having some economic relevancy for the problem of choice. However, most institutions are not organizations, they are structures of norms that are more often than not taken for granted or simply neglected, even when they are relevant for the object of analysis. At best, they are discussed in the hypotheses of the model.

Second, norms are usually considered as non-economic variables as well, but with an even lesser analytical usefulness, especially when norms are related to preferences or values.

Institutions are structured sets of norms. We can conceive of them as sets of norms and habits that do present a certain degree of permanence, even if they change, often slowly, and in a cumulative way. The same norms can be quite different among distinct historical periods of the socio-economic systems.

Institutions and norms, including legal institutions and law, are important for understanding the stability and crisis of productive sectors, e.g., the wine production and trade.

This is one of the central theoretical propositions advanced here: norms and institutions are relevant for the explanation of the behavior of economic agents taken both individually and collectively.

However, Oliver Hart, a leading figure in the economics of industrial organization and contracts, argues that norms, first, are hard to incorporate in the theory of

organizations, and, second, have "not to date greatly changed our views about the determinants of organizational form" (2001: 17). While I share partially the first point, I strongly disagree with the second. The notion of norm has already played an important role in the contributions to the knowledge of organizations (including living organisms) in other fields such as medicine and biology, business economics, law, sociology, and history (Canguilhem 1966, Arnaud 1973, 1988, Giner and *al.* 1998, Fontana 1999b).

The main problem lies in the ontological and methodological position of economists that keep defending the natural character of rationality, maximizing behavior and narrow efficiency concerns. A consequence of this methodological stance is the focus on the validity of norms for individuals, while most norms are individually relevant but are also beyond the mere consideration of individuals. Social norms are mostly emergent properties of interaction between individuals, groups and social structures, and each respectively acting with a relative autonomy.

The difficulty lies also in the correct integration of norms into a scientific endeavor. Here, I defend the possibility of studying norms as explanatory factors on an objective level; one thing is to recognize the normative character of norms and another to say that the study of norms is normative. Both statements are incomplete and wrong when they forget a third aspect. Norms are also part of the objective and real world under study. Human action occurs in a context of norms, uncertainty, institutions, and imprecise knowledge.

I will treat the norms and institutions within the framework of an open socio-economic system that includes a *regulation regime*. A regulation regime consists of a complex set of related institutions, legal systems and subsystems, habits and behavior. It consists of a system of related elements with knowledge and commodities flowing between, across, and within them.

In other words, the regime is a set of relations, norms and institutions. Indeed, the norms constitute one of the elements for the creation of institutions. I will come back to the notion of norms and institutions in the fifth section (1.5.). Here, I will limit myself to the criticism; I will come back to this point later on.

The regime can be under strain due to extraneous elements that affects the workings of the system and can induce feedback effects such as the sudden drop in export markets for the Port wine.



In the current case of the wine trade, institutions –including norms and regulation mechanisms– are at the center of the price and market mechanisms, and this happens not just at the level of price regulation, but also as explanatory factors.

For convenience, I distinguish three groups of agents in the sector: the wine producers, centered on the vineyards of the Douro, the traders (of both Portuguese and British nationalities, with some exceptions), and, finally, the consumers. The third group is the most heterogeneous and the least studied in the research on the Port wine. But this is not my focus here, and I will not study them.⁷⁸

The first group, composed by wine-growers, is highly heterogeneous and the most important in terms of number of members, varying from five to forty thousands, between the 18th and 20th centuries (Pereira 1986). There is a classical and pervasive dichotomy that can be made between the small and the major wine growers; and this dimension is relevant for the activities of production and innovation.

The traders are not a homogeneous set either. Besides the producers-“engarrafaadores” and the traditional trade firms, there have been intermediaries throughout history (Duguid 1996) that played diverse roles (speculators, commissionaires, partners, employees, etc.).⁷⁹ Across time, the traders’ population has changed from individual merchants to firms and now corporations or complex economic groups based on family ties.

This second group, the Port wine shippers, will be singled out for study in this research; and this for a number of reasons. First, they are less numerous than the wine-growers, thus making the present historical study more feasible. Second, they constitute a rather distinct population that we can follow as time goes by. Third, this group has seen its number fluctuating considerably over the centuries and the business cycles. The information that the sets of data provide is rich because of the high variability of the variables available.⁸⁰ Another reason is the applicability of the population perspective

⁷⁸ For a general reference on wine consumption in England, see Lachiver (1988), Unwin (1991) and Simpson (2004). I must also refer to the conspicuous consumption and the phenomenon of distinction associated with the drinking of (Port) wine in the period 1750-1974. The theoretical references consulted on conspicuous consumption are few to mention (Bourdieu 1979, Bagwell and Bernheim 1997, Harvey, Green and Corfield 1999, Wilson 1999, Trigg 2001).

⁷⁹ In my research I will not discuss much the issue of the “produtores-engarrafaadores”, a movement that appeared in the 1980s, beyond the time span of the period chosen (1678-1975). I will come back briefly when discussing the technological transformations (chapter II) and the structure of the Port shippers (chapter III).

⁸⁰ Namely, the number of shippers and the quantities exported varied considerably; see the Alfândega do Porto (ANTT, Alfândega de Lisboa, and Museu das Comunicações e Transporte-Porto) and IVP (Museu do Douro/ADP)

on the evolution of Port wine shippers. Fourth, all through the history of the Port wine, there is a clear concentration of the trade in the hand of some big players dominating the purchase of wine in the Douro and the sales across Europe, and especially in the United Kingdom.⁸¹ Fifth, the renewal rate is high in between succeeding generations; more than half of the traders disappeared from one generation to another (this is the case for the period between 1799 and 1825 or 1833).⁸²

The regulation authorities are another subset of actors that at some point take part in the production or trade. Here, an important intervening agent is the Portuguese state and the Ministry of Agriculture and its agencies, such as the IVP, the Port wine institute, or the *Casa do Douro*, and, for a century or so, the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, as no ministry of agriculture had yet been created.

1.4. Law and economics and the legal and economic nexus

Here my intention is to prepare the theoretical side of the study developed in the next chapter (chapter 2), through a possible answer to the ensuing question: Is there a place for Evolutionary law and economics?

In this section, I posit the need for an evolutionary *law and economics* for dealing with issues of historicity and path or time dependence (David 1985, 1993a, David 1994; Posner 2000, David 2001). Except for the general presentation of the introduction, I will restrict myself to the issue of the legal framing of an economic sector by the political power on two grounds.

First, I will make the case of an evolutionary perspective of the regulation setting of an economic sector. This is the theoretical part of the present section. I argue that, given the path dependent nature of law and the long run transformations of the economic activities, the theories of *law and economics* are not adequate for dealing with interactive systems that are composed of complex elements and where emergence and

⁸¹ This is a constant in the documents (Books of registry of exit (*Sahidas*) and duties) of the Alfândega do Porto from 1763 to 1936. With the creation of the IVP, the population of shippers is much more stable, showing signs of entry barriers, as can be confirmed with the study of the regulatory schemes and the legislation over compulsory registry and stocks.

⁸² ANTT AP lv. 872, 1799; AP lv. 1706 et seq., 1825; and AP lv. 80 & 81, 1833. See also the AHMOP, MR 5 and 35, documents referred to and commented in the second and third chapters. For the 20th century the renewal is still high, but the leading firms more stable, at least apparently. I will discuss the last century in more details in the third chapter.

historical dynamics are not just quite common, but an essential part that defines the very socio-legal and economic system. The theories that are found in the literature labeled "law and economics" are essentially an extension of neoclassical economics –and especially microeconomics– to the study of law and legal institutions. These theories include cost and benefit analysis of statute and court decisions, theories of criminality, offense, tort law, and the effect of law on economic behavior based on outcome analysis. Theories are basically static with preferences and individual attributes fixed, which is in total contrast with the observed trends in law and the legal system characterized as much today as yesterday by crises, increasing criminality, riots in prisons, etc.

The static and efficient approach does not treat correctly the evolution of the legal system and the economy as well as their co-evolution through time, contrary to a position often adopted by legal scholars (Trachtman 2004).

Second, I will distinguish different phases in the regulation of the Port wine sector and the case of regulation from the Eighteenth century onwards. At least four types of regulatory schemes can be identified and show their relevance for the productive processes. The relatively recent legislative changes in the 1980s and 1990s have reshaped part of the Port wine industry and its productive structure. I will give examples of those changes and, more emphatically, of earlier periods. For the early regulation settings of the 1750s, I will highlight the interaction between the motivation of the producers and the enforcement mechanisms of the regulatory norms. I will compare briefly the case of the second half of the 18th century and the second half of the last century.

The main results of the research sustain the hypothesis of the path dependent nature of the regulatory scheme and its interaction with the productive structure. The institutions (i. e., regulation entities, legal framework, etc.) and the productive units co-evolve.⁸³ The main economic players interact (reacting either in favor or against the new or old regulatory schemes) with the political power and the regulation structure of the sector.

The first and following section gives the general theoretical case for an evolutionary perspective in law and economics. The second treats the specificity of

⁸³ By co-evolution I mean the interdependence or relationship between two or more species that exert selective pressure on the other, thereby affecting each other's evolution. I do not define it rigorously as an extreme case of mutualism, but rather as a biological metaphor for the interaction between the shippers and the wine-makers.

economic sectors and the legal shaping of its activities. Finally, I would like to use by way of illustration, in the third section, the legal and economic nexus of the Port wine, insisting on four of the historical transitions of the productive sector.

1.4.1. General case for evolutionary law and economics

The economics of regulation and law and economics, two distinct body of literature, even if their origins date back further in the past, are recent movements in the field and constitute good examples of disciplinary specialization within the bounds of a particular academic tradition: the political economy of the post Second World War. The models used in the theory of regulation and law and economics are either of comparative statics or of weak historical interaction.

The dialog between the two fields of research is of a rather low intensity, even though they study overlapping problems. Moreover, if we add the lack or neglect of historical preoccupation, they are even further afield from some kind of historical economics. The main exceptions have been Richard Ely, John R. Commons, and Robert Hale, whose works are almost completely ignored in the mainstream law and economics literature.

Here, I would like to highlight the complementarity of (1) studying the legal system and its evolution and (2) understanding the regulation of an economic sector, both on the legal and socio-economic ground.

1.4.2. Critique of the property rights and law and economics approach

The present section studies some legal and regulatory issues with respect to the Port wine industry, adopting a critical perspective on law and economics and the literature on property rights.

First, I will proceed to a critique of the literature on property rights and law and economics. Basically, I contrast the general literature with evolutionary economics and history.

Second, I will come back to the notion of path dependence and discuss the economic analysis of law on three respects: the legal structure of the Port wine sector,

the legal protection of the demarcation of origin for the product named "Porto" and the issue with the trademarks, and, finally and above all, the discussion of the regulatory law of the sector.

The literature on property rights and law and economics is vast and interests me principally on the institutional and regulatory dimensions of the Port wine sector. In this sense, I will highlight my working hypotheses and the problems encountered in this literature that has much to do with the problems of new institutional economics.

The central problem, according to me, is to take the market as granted and to limit the analysis the institutions to the tools of neoclassical economics while ignoring radical uncertainty, bounded rationality, historical change and the importance of norms and institutions. Coase in his seminal papers criticized the lack of reality in economic models but at the same time he did not criticize the core hypotheses of economic theory (Coase 1937, 1960, Coase 1988). Even if he saw the interaction between the legal system and the economy as going in both directions from the economy to the law and from the legal system to the economy, he did not criticize the founding hypotheses of economic theory: maximizing behavior, perfect rationality and efficient market.

This view has been radicalized by Posner, extending the microeconomic tools to the study of legal institutions, but Coase has strongly rejected the interpretations of Posner of its own theoretical contributions and of market efficiency and the law as incorrect (Coase 1984, 1988, Coase 1993, Posner, E. A. 1993, Posner, R. A. 1993, Williamson 1993).

1.4.3. Path dependence and the law: the regulation in the Port wine industry

Several authors have defended, after the emergence of the idea of path dependence in technological systems (David 1975, David 1985, 1993a, David 1994, 2001), that law and legal thought are also path dependent (Posner 2000, Hathaway 2001). However, the main defendant of path dependence in law and economics, Richard Posner (2000), has also been the defender of neoclassical economics in the study of law, misrepresenting the point of view of Ronald Coase and leaving aside mathematical models developed by Gary Becker. There are still some contradictions between the rhetorical defense of path dependence and the adoption of the traditional microeconomic tools that leave no room or almost none to history.

In my opinion, there are two considerations that may help to solve this conundrum: first, the fundamental problem is not so much that path dependence is a reality in the legal scholarship and doctrine but that it is a basic feature of the legal system constituted by the courts, the legislation, and the law-making process, including the realm of legal scholars. Henceforth, the study of the legal institutions includes the social phenomena related to the law. This is the case of the principles of precedent and the role of statutes in court decisions.

Second, the path dependence of law and the legal system is best understood when we look at two groups of disciplines of the study of law: the history of law, on the one hand, and the sociology and anthropology of law, on the other hand (Arnaud 1973, Pospisil 1974, 1978, Arnaud 1988, Rouland 1988, 1995, Arnaud 1998b, 1998a, Le Roy 1999); avoiding the misperception of the law and economics movement that focuses on narrowly contemporaneous issues, neglecting the history of legal institutions and socio-economic phenomena.

1.4.4. The legal-economic nexus

For the current matter, the economics of the evolution of the Port wine sector from the middle of the 18th century until the early 1970s has gone through four important and sweeping transformations: the renewal of the populations of firms and winegrowers, changes in the consumer market, transformation of the institutional and regulatory frameworks, and evolution of the technology used both at the production level and the trading activity.

The law and legal institutions are related to each of these four sweeping transformations. For the first case, we have the creation of the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, a regulation body endowed with the function of a trading company like the shippers. This aspect of the commercial company is not void of consequences for the Douro wine trading business; the *Companhia Geral* reached 20 to 25 percent of the market share for Port wine exports between 1777 and 1786.⁸⁴

Moreover, the creation of the Company influenced the process of the creation of firms in the sector (entries in the Port wine exporting business) and probably acted as a

⁸⁴ For those two years, see ANTT, AP, lv. 272 (mf. 2502); ANTT, AP, lv. 444 (mf. 2454). For other years see the other documents of the ANTT (AP) and the AHMOP, MR, n.º 35: mfs. 28 & 29.

hurdle to the development of major Portuguese shippers before the second half of the 19th century. It acted clearly as a barrier to entry (see last chapter).

Third, the Pombaline legislation brought important consequences for the Douro wines consumer market, especially in the city limits of Porto and Lisbon.⁸⁵ The economic impact of the new regulatory system can be assessed by several indicators. First, obviously, new taxes and commissions were levied on wine transport (*subsídio literário*), increasing the cost of the wine reaching Porto either for local consumption or for export (*embarque*). Moreover, the transport of wine from the Douro river to Porto and other places of the kingdom was controlled by the *Companhia Geral* that emitted permits (*guias* or *bilhetes*) which accompanied the wine and was consulted for emitting opinions on matters related to the transport or consumption of Douro wines or wines entering Porto and the Upper Douro. Furthermore, the *Companhia* was also competent to suit transgressors of the specific legislation on the Douro wines production, transport and consumption that added costs to the overall system of quality control and selling of wine. Finally, and most importantly, the *Companhia* restricted the places that were allowed to sell the Douro wines for consumption, limiting and controlling the supply of these wines. After the installment of the Company in 1756, the sales of Douro wines to Porto was the exclusive right of the Company at a distance of three and then four leagues (*leguas*) around the city limits (*termo da cidade*) as it is stated in the statute that created the *Companhia Geral* (Mourão 1941). The number of taverns allowed selling Douro wines decreased after the establishment of the *Companhia*, leading to a less competitive market in the city of Porto.⁸⁶

Furthermore, and this will be the object of the next chapters, the regulation of the production and trade of Douro wines by the state and the *Companhia Geral* had profound effects on the history of the organization of the sector and on the very transformations of the sector: the type of wine selected (classification and selection of the wines), fixing legal prices, the demarcation of the productive area, the transportation of wine on the Douro river, the sales of wine for Porto and for the principal Brazilian markets.

⁸⁵ For the regulation of the Douro wine transport and consumption that was sent to Lisbon, see ANTT MR mç. 640 and ANTT JC mç. 70. Other recent studies give a good analysis of the wine consumption in the Porto area from 1700 to 1756 (Cardoso, Antonio Barros 2003).

⁸⁶ See the article on § 28 of the alvará of 10th of September of 1756 (ANTT Collecção de Leis, mç. 6, and MR 632, cx. 735; AHMOP, MR 5 and AHRCV 1.001 and 1.005). See also the documents of the AHRCV and ANTT JC mç 70.

Finally, the legislation concerning the cultivation, winemaking, transport and storage was indeed prolific as can be seen by the number of statutes of varying aspects of the production and beyond. Central to this legal scheme was the action of the *Companhia Geral* of Upper Douro. Some legislation prohibited the use of elder berries, sugar, and wine of other regions for blending, as well as the use of natural fertilizers for the soil. The control over the production was at the level of the definition of the demarcated area during the epochs of Pombal, Queen Maria I. and from the time of the dictatorship of João Franco onwards, but also at the level of the wine produced, i.e., the wine tasting or *prova*. Another field of heavy action for the *Companhia Geral* was the control of prices and the discrimination of red wines to the detriment of the white wines. Finally, the production, transport and sales of wine spirit were subject to control by the *Companhia* and object of specific legislation.

1.5. Theoretical propositions

In this section, I would like to bring to a close the theoretical propositions that I have advanced so far.

1.5.1. The centrality of norms in economic action

Social and economic phenomena are shaped by norms, as much as the behaviors create new norms, shape and select existing norms (Samuels 1989b, 1989a, Medema 1992, Samuels 1992, 2000). I take here norms and rules as synonymous.

Norms are a set of instructions that define a space of action and their respective admissibility from a specific criterion, e.g., efficiency, social prestige, and the like. There are different types of norms: legal norms, social norms, procedural rules, etc. Their diversity very often implies conflicts between norms.

Norms define the context of human action as much as individual preferences. They are central to the process of interaction and the reaction to the action of others.

1.5.2. Institutions based on norms

At a higher level, norms coalesce in a structured set of some perennial character that we call institutions. In other words, to use Geoffrey Hodgson's definition, *institutions are systems of established and embedded social rules that structure social interactions* (Hodgson 2004a, 2004b). The institution is a *structured set* of norms that shows some *degree of longevity* (survival) through time.

Behind the emergence, renewal, and decay of institutions, a selection process of norms presents a structured character shaped by political, economic and social structures. The institution is a structured set of rules that present a sustained stability, at least for some period of time, e.g., a regime of regulation.

If change is made of selection, then stability is based on a reproduction principle. Both are the basic mechanisms of biological evolution, together with variety creation, and, by abstraction, of social processes. Of course, the very definition of each –social and biological– process is different. We are back to the problem of change and continuity in economic history as discussed in the first part of the thesis.

1.5.3. Path dependence of institutional forms

One way to study the evolution of institutions is to study their trajectories and analyze why they are related through time and what are the mechanisms working both at the level of reproduction and change.

Especially of interest is the legal framework that settles the regulation of the wine production and trade. Through the different times of crises that characterized the wine industry, the regulatory scheme of the 1750s and 1760s opened up new paths, which aim at regulating the commercial and productive sectors. The first strong regulatory scheme of the time of Pombal has had lasting influences in the regulatory structure of the sector: the existence of an administrative regulation body, the definition of a demarcated area, control over the price and the quality of the wine and control of the quantity allowed to be produced each year.

The legal institutions and other institutions follow a path that reveals some dependence on previous events. This is not necessarily (1) an absolute dependence (i. e., it is rather a weak determinism); (2) a dependence on small events. Relative to the

first point, not much comment is required given the methodological position assumed here right from the beginning. The second point merits a clarification. First, as I will show for the Port wine sector, big or key events are crucial for the future development of the sector. Second, I have to avoid the confusion made between the notion of path dependence as an analytical tool and the descriptive category of small events, a category, which is still ill defined. Of course, small events are important, as much as incremental innovations are for the impact of technological breakthroughs. But they are important when aggregated because in that sense they acquire an historical significance, they can change or reproduce the state of matter in a particular period of history.

This implies the insufficiency of the rational choice theory for explaining the transformation of the sector. The insufficiency of rational choice has been highlighted previously (part I) and will be further developed when I will analyze the Port wine transformation in the following chapter.

1.5.4. The State-centered regulation

I turn now my attention to the traditional literature on regulation, in which I defend a definition of regulation for economic sectors like the Port wine based on a state regulated structure of action, as an essential component of the behaviors of producers and shipping firms.

The recent literature on the self-organization in the wine production sphere in different countries such as France, Italy, Germany, Spain and Portugal misses two things: first the historical evidence of the Port wine sector from the mid 18th century until now; second, the definition of an economic regulation is always based on a legal system, i.e., a system largely shaped by the State, and not just by the actors in the sector, and much less the winegrowers than the traders in our point in case.

I defend a theory of regulation based on the State, either as an actor that increases the regulation by its new action or reduces tem by decreasing its role in the organization and working of the sector. Even what is called deregulation is a new type of regulation with a stronger reliance on market mechanisms. To create a market it is necessary to create institutions and regulate behaviors through defense of property, guarantee of rights, coercion, social practice and learning.

I do not deny the existence of law outside the state and the case for legal pluralism and the coexistence of different and simultaneous sources of law or legitimacy

of the legal norms, even by social actors. Nevertheless, I think it is wrong to ignore the state as a relevant causal factor in issues such as economic regulation.

1.5.5. The population perspective and evolutionary elements of the wine trade

I have already discussed the population perspective and the theory of evolution in the first part of the thesis. I just want to clarify the meaning of population perspective and an evolutionary theory of economic change.

Taking a population perspective implies adopting a different logic of inquiry, avoiding the limitation of focusing exclusively on individual behaviors, taking into account the emergence of novelty at the population level. Besides the selection of individuals, the process of evolution occurs at the level of the population and the changes in proportions of the different types of individuals; let us call them categories or subpopulations.

In the present analysis of the Port wine industry, I will study the evolution of the technology of winemaking (chapter II) and the evolution of shipping firms (chapter III). In the last case, I will adopt a thorough populational perspective, with subpopulations (British, foreign and Portuguese shippers).

In economics, several attempts have been made, such as the one developed by Stan Metcalfe and others (Metcalfe 1998a, 1998b). Stan Metcalfe focuses his attention on the business unit as the selection unit, the critical element in the selection process. Others, like Joel Mokyr, basing his research on the history of techniques, focus the technique as the unit of selection.

Here I integrate two levels of selection: techniques and business units. There is a selection on the techniques used for producing and trading wine as well as a selection of producers and shipping firms.

The technological variable is mostly important for the winegrower whereas the business unit is crucial for the shipping firms.

I come back to the theoretical propositions and to this one in particular, in section 5.4 of the first chapter.

2. Background of the Port wine sector: some facts and relevant features

In the following paragraphs, I underline the importance of the geographic factors in shaping the Port wine and the relation between the wine-makers in the Douro and the merchants in Porto. I will then finish with some important remarks on the structure of the Port wine sector and the duality between trade and production.

2.1. The nature of the space – a theoretical proposition

The space, an imprecise concept, contrary to the tenets of economic theory, is not empty; it is neither harmonious. There used to be, in the social sciences, a contradiction between the theories of space (as harmonious or homogeneous) and the practice of space (the spatial or geographical reality). There are sound reasons to overcome that contradiction.

Regions are not just a natural phenomenon; they are constructed by human societies.⁸⁷ A space is as much a social product (Lefebvre 2000: xix) as an economic and political one. The space is not passive. It is a product that enters into the productive processes through multiple interactions (e.g., the transport system and the Douro river for the case in point). Schematically, the Douro is the production space and Porto the trade space. Each region is a particular socio-economic space with its own sets of structures and relations. Moreover, an originality of the sector is the articulation between two spaces: the mercantile city of Porto and the backward regions of the Upper Douro, the first dominating the second.

The space changes with the production systems and their evolution. In other words, there is a history of the space, e.g., the modification of the demarcation areas since 1756.⁸⁸ The space is cause and effect of the productive, social and political processes. That is why Henry Lefebvre talked about “the history of the space” (Lefebvre 2000: xxii, 337). This history is irregular, unforeseeable, with empty places and others full of (hi)stories. The local interactions take the form of competitions,

⁸⁷ This is exactly the object of the cultural geography, often trying to reconstruction the past environments. The notion of historical geographers is getting increasing acceptance. See, inter alia, the America Associations of Geographers at: http://www.aag.org/Careers/Cultural_Human_Geography.html [last access September 1 2005].

⁸⁸ See Moreira da Fonseca for a description of the evolution of the demarcation areas since the time of Pombal (Fonseca 1949a, 1950, 1951, 1996). The documents can be found at ANTT, MR: mç. 341; mç. 632 (cx. 635); mç. 641 (cx. 745), ; and the AHRCV, Sub-section 4.1 (001, 002, 007, 009 and 010).

collaborations, contradictions and conflicts. A good example of these interactions is the crisis triggered by the spread of phylloxera throughout the Douro vineyards.

All in all, the space is not neutral; it is differentiated, even in its interactions. Some winemaking regions in Portugal (and in most European countries) were more affected than others; e.g., the regions affected by the blight during the end of the 1870s or early 1880s were benefiting from the more efficacious means to combat the scourge, with much less devastation than the regions attacked during the 1860s.

The relation between the space and the productive and the other processes is complex. In the study that follows, the wine production region of the Douro changed with the production processes, and was almost reduced to a monoculture during a protracted period of its history. In short, the land and the productive activities co-evolved, with the help of human beings and techniques.

2.2. The geographical and space settings

I shall make no reference to the Spanish Duero, the Douro River is the scene of wine production from the Spanish border to the town of Mesão Frio. This region, referred to as Alto Douro or Upper Douro, is of a distinctive geographical character, both compared to the East and to the West parts of the river.⁸⁹

Above all, looking at the very location of the region in Portugal, it is important to notice the distance that exists between the Douro region, where the Port wine was and is still produced, and the City of Porto, where the wine was stocked (in Vila Nova de Gaia, to be more precise) and shipped, and where most of the trade occurred.⁹⁰ It was also in Porto that most of the resources from trade and the taxes on wine were spent or invested, reinforcing the relative position of the city with regard to the production area of the Upper Douro.

This distance between the two distinct spaces is relevant for understanding some of the changes of the sector. On the one hand, the Douro region is the place where the grapes grow and where the wine is made whilst Porto is the city where most of the trading companies and merchants were and still are, where the R&D and the technological training are concentrated.

⁸⁹ There were some historical competitors to the Port wine like the Xerex or Jerez de la Frontera, liquor that occupied an intermediary position between plain wines and whiskies and other strong liquors.

⁹⁰ I must note that from 1985 onwards, the new legislation allows for stocking the barrels of Port wine in the producing area and not necessarily in Vila Nova de Gaia where most of the store houses (lodges) or warehouses (*armazens do vinho do Porto*) are located.

The technology of blending Port was also concentrated in Porto and Vila Nova de Gaia, as it still is even today almost exclusively in Vila Nova de Gaia.

This is also the city of the Portuguese and British bourgeoisie that controlled much of the trade from the 17th century and where the first specific regulation authority was located (*Companhia Geral*) and later the IVP (Instituto do Vinho do Porto, now the IVDP, Instituto dos Vinhos do Douro e do Porto). It is also in Porto that the British Factory and the British Association were established, playing an important role in the organization of the business interests of the British wine merchants.⁹¹

The topography gives to the region a unique feature. The hills are frequently steep and made of a rather poor soil (schist), proper for grape growing, usually associated with a higher standard of quality, characteristic taste, and neat color. The land workers transformed the steep hills over the centuries into stairways of terraces (*socalcos*). During the end of the 19th and during the second half of the 20th centuries, substantial innovations and transformations were introduced in the landscape and the physical and even topological features of the vineyards. This is the case of the pre-*phylloxera* vineyards that were left abandoned (the so-called *mortórios*).

The production area extends from the Spanish border to Mesão Frio and corresponds today to its maximum extension, with the current legal area of Port wine and the Douro denomination of origin (DOC).⁹² The production and demarcated area were not always similar. With the 1756 reform, after a long history of more or less autonomous regulation within the limits of an absolutist monarchy, only one sixth of the

⁹¹ For the *Companhia Geral*, there: (Pereira 1984b, 1990, 2000, Monteiro 2003a, Sousa 2003b, 2003a). For the IVP there is still no study on its history and on the composition of its administration and advisory boards as well as its relations with the Casa do Douro, the Grémio dos Exportadores do Vinho do Porto. From the archives and what is known about the working of that institution, there is evidence of a close relationship with the trade business. Indeed, the control and promotion of the trade is made by the Instituto. Moreover, the legislation and the acting of the IVP act also as a barrier to entry. This is the case of the "Lei do Terço" (Statute law of the Third) that limits the sales of Port wine above 30 % of the stocks in Gaia and the Douro registered on the 30th of June of the previous year (Decreto-Lei 41067 of 12th April 1957). This law is modified by the Decreto-Lei 42604 of 21st of October 1959 demanding that sales be not in excess of 1/3 of the stock of last December 31st (IVP MD/ADP, Instituto do Vinho do Porto, Série 00-100-001, Constituição e Regulamentação). Still, in 1966 a new law modifies the "Lei do Terço", the Decreto-Lei 47176 of 2nd of September.

The date of creation of the Factory House or British Factory in Porto is 1727, decades after the British trading presence in the city with such merchants as Bearsley and Warre. The British Association, following the French invasions and the treaty of 1810 with Britain dissolving the Factory system, was created in 1811 and in the early 1820s started a new phase of stability and expansion of the wine trade in the hands of the English merchants. See the Book of Minutes of the meeting of the British Association (British Association, BA *Minutes of the meetings*: Ms. I – (1811–1850), Ms. II – (1851–1902), Ms. III (1903–1959).

⁹² Região Demarcada do Douro (RDD) is the generic term for the demarcation area through time. It is only in the late century that the DOC and other denominations have spread internationally and been defined with a controlling entity, here the IVP and the Casa do Douro.

current demarcation was selected by Pombal's legal demarcation, in what is called the Baixo and Cima Corgo.⁹³ Afterwards, the official geographical extension extended Eastward until the beginning of the last century, with a new delimitation by João Franco in 1907. From 1908 onwards, the legal protection for the Port wine area remains basically the same as it is now. As we will see, the expansion or restriction of the region "Douro" or "vinho do Porto" as an *appellation contrôlée*, is closely related to the crises of the sector as well as the political movements in Portugal (the rise and decline of liberalism, in the 19th century; corporatism, and state regulation in the 20th century; all creating different regulation regimes).

2.3. Basic features of the sector

The wine industry in general and the Port wine in particular are based on a strong differentiation of two distinctive –though highly related– spheres: the production in the vineyards and wineries in the Douro, and the commerce or trade in Porto, Vila Nova de Gaia and abroad, e.g., London. The producers are referred to as *agricultures* or *lavradores* and encompass the owner of the vineyard, the wine grower and the owner of a winery. This group is not homogeneous in terms of size and in terms of the type of work they do.⁹⁴

This duality in the sector spans between complementarity (and strong complementarity) and conflict (and quite often deep-rooted conflict) passing through different stages of competition or dependence. This dimension of the Port wine sector gives it a *dialectical nature*.⁹⁵

⁹³ The area of the demarcated area in the late 1750s was 40 thousands hectares while the current demarcation area is about 250 thousands hectares. I have to acknowledge the pertinacious remarks made by Gaspar Martins Pereira on a previous version of the present introduction.

⁹⁴ Some just take care of the grapes before the fermentation process and sell them to the winemakers, usually owners of greater vineyards endowed with *lagares* (usually tanks made of stone or granite serving as "wine presses") and able to organize the treading of the grape and dealing with the ensuing fermentation as well as the conservation of the wine after the end of the fermentation of the must. Others, the larger properties, do all the stages from grape picking to the bottling or conservation in casks.

⁹⁵ I will not thoroughly define dialectical here. Loosely conceived, it means that the causation model is complex, contrary to the Newtonian one-way causality principle still reigning in most applied and theoretical econometric works, the causality can be bi-directional and quite often indirect. Arguably, furthermore, the variables are following the law of included middle (*tertium datur*) in a similar way as it is encountered in the intuitionist brand of mathematics. This does not just makes reserves for the confounders or the confounding variables (Freedman 1999) but also on the very logical foundations of scientific enquiry in social sciences, integrating ambiguity and uncertainty of human phenomena. For references on this issue, see: (Brouwer 1910, Lupasco 1947, 1987a, Freedman 1999)

The main hypothesis is the following: this first dialectical aspect of the sector is a central element of its evolution throughout the last four centuries.

The actors played varying roles in the history of the sector. These actors are in interaction with their environment, influencing the very regulatory process, as was the case with the lobbying made on the Minister Sebastião José de Carvalho e Mello (Pombal) for creating a protected and regulated area for the Port wine. The outcome was the creation of the first geographical demarcation or the *avant la lettre* “appellation contrôlée” (corresponding now *mutatis mutandis* to the current term *Denominação de Origem Controlada*, today’s DOC). Nevertheless, here, this point on the origin of the regulation has still not been settled.

The attempt at controlling several economic sectors under the absolutism of the reign of Dom José, was expressed through the creation of privileged companies: the *Companhia Geral do Grão Pará e Maranhão*, following the *Companhia do Brasil* and the *Companhia da Ásia* (respectively 1649 and 1753) and preceding the *Companhia Geral de Pernambuco e Paraíba* (1759). From these facts, it clearly does not correspond well with the view that the *Companhia Geral da Agricultura das Vinhas do Alto Douro* was a suggestion made by the *lavradores* of the Upper Douro to the Marquis of Pombal. Thus, according to this view, the regulation that resulted was an early example of self-organization. However, this view is not only dubious but erroneous on several counts.

The characterization of the regulation scheme of the 1750s is a good example of faulty logic based on the transfer of contemporaneous concepts and definition to other historical periods that differ very much in terms of nature and context. From the present reading of the current regulation scheme that has an auto-regulated dimension, in Portugal and many other wine producing countries, it is convenient to infer the same nature of regulation for preceding periods.

The existence of stocks, regulated by law until the mid 1980s, in Vila Nova de Gaia, reinforced the position of the trade sector and the treatment of the wine in the Porto area.

The origin of wine in the Douro region is far remote, dating back or earlier to the Roman settlement (Cardoso 1996: 58 n6). The “Port”, this particular brand of wine, has a more recent origin, though not with the qualities that today we attribute to it. To put it bluntly, it came as a sweet wine – wine with addition of wine spirit (*aguardente vínica*)

⁹⁶— added during, after or at the end of the fermentation process sometimes in the Modern era, the end of the fifteenth and the beginning of the sixteenth century. Since then, the product has, nonetheless, evolved; not just its techniques of production, but also the very components of fermentation process and the liquor contents. These changes turn the study of the Port wine, a fortified wine with changing dosage and techniques through time, into a difficult task for interpreting the quantitative data across different historical productive systems.

This research deals with the emergence of the features of the Port wine as a result of interaction effects and network effects along the centuries between grape growers, wine producers, liquor producers (*aguardente*), the central state, the Porto city officials, the local consumers in the Douro and in Porto, the consumers in metropolis (Lisbon, Madrid, London, etc.) and the interested traders, the latter clearly dominated by British merchants.

The creation of a *fortified wine* is the result of this process of interaction that through network effects has propagated some common features: the Douro wine with liquor (*aguardente*) makes it a stronger wine often compared, although dissimilar in terms of the nature of the production process to Sherry, but not as strong as cognac and whisky.⁹⁷

The addition of liquor corresponded to the consumer preference at the dawn of the enlightenment period in the UK market and to the necessity to keep the wine proper for traveling by sea to Northern Europe and to Brazil. Another reason for adding wine spirit to the Douro wine was to enable it to age and increase its economic value at present and in the future, or at least to avoid spoiling and loss of value. Most of the wine produced (before the use of wooden casks and the art of cooperage) did not age well and was spoiled due to the oxidation process; and still in the 17th or 18th centuries, the proper technologies for ageing were not well understood. This situation changed radically as the works of Pasteur became widespread in the last quarter of the 19th

⁹⁶ I use the terms liquor and wine spirit interchangeably to mean *aguardente*.

⁹⁷ Fortified wine is the technical term used in English that is not subject to the controversy as the word brandy is. Loosely, fortified wine is the general category of the wine that has received the addition of wine spirit. Brandy is often referred to as any sort of spirit. This is not the proper use. The Portuguese term *aguardente* is synonymous of spirit and *aguardente vinica* means wine-spirit. Brandy can confuse the categories. Strictly speaking, brandy is the "burnt wine" that was demanded and commercialized by the Dutch and often consisting of wine spirit, but more recently this is not always the case.

century and gave an explanation of the usefulness of wine spirit for the conservation and "repairing" of spoiled wines.⁹⁸

The question of the wine spirit (*questão da aguardente*), as it is known in the literature and the historical documents, is at the center of the technological issue and the change of the product, as I will attempt to show. It in fact goes much further and includes other areas than the Douro region. Indeed, in order to produce one unit of liquor, five to six times the quantity of wine were required. So, as most of the liquor was obtained from other wines and grapes, they often had to come from the adjacent regions, namely the Bairrada and Dão.⁹⁹

The production of wine spirit was often the sole way out for the damaged or spoiled wine to be reconverted into any commodity of some economic value that could still be traded on the local market or to other wine-makers and wine merchants.

The wine production in earlier periods (17th and beginning of 18th centuries) was more heterogeneous in terms of the overall quality of the product and much more uncertain in terms of the characteristics of the final product. The evolution and stabilization of the production system in the second half of the 18th century have been more conservative, leading to the establishment of the *Companhia Geral* and the restricted Douro demarcation area.¹⁰⁰ This phase begins from about the end of the 17th century and continues until the beginning of the second half of the 18th century. The limits of the period are rather imprecise and the rough guesses of the scholars correspond to the fuzzy frontier of the different production processes, old and new, with or without brandy and with varying proportions of the wine-spirit in the stabilization of the Port wine after the grapes harvest.

The landmark change of 1756 lead to strong regulation and corresponded to a transformation of the Portuguese state and a mutation of the overseas empire, losing its grip on the colonies and the revenues from the trade of their produces throughout Europe. So there were strong incentives for the Portuguese Crown to find other fiscal revenues and the Port wine was an obvious opportunity that led to the creation of a quasi-monopoly with the corresponding rents that are shared by the State, the (landed)

⁹⁸ I will come back to the change of the understanding of the wine diseases after the contributions of Pasteur were made available in the wine-making process.

⁹⁹ The addition of brandy is not merely a question of the quantity of wine spirit to be added but also at what time: before or after the fermentation process, before the transfer to vats and before shipping.

¹⁰⁰ The Pombaline demarcation area culminated at the end of the 1750s and early 1760s. At that time, a great deal of the land of the valleys of the Douro and its tributaries was excluded, leaving many properties or part of them outside the Feitoria wine area of production. See the documents at the ANTTT, MR 632 and the AHRCV Sub-section 4.1.

aristocracy and the merchants, mainly British, and a small part of the Northern Portuguese bourgeoisie, mostly from Porto and the Douro, the latter living in their great majority in the city limits of Porto.

The regulation of the sector from the 1756 onwards was state centered; the organization of the sector was not the work of the Douro cultivators. The central state intervened constantly over five decades in the regulation and organization of the sector, leaving by the time of the 19th century a strong legacy of interventionism in favor of some important landowners and foreign traders. In other words, it opened a path of strong regulation and consolidated the memory of such an organization of the sector with rigid entities, which was not always adapted to the changes in production and trade. This legacy was still a recurrent theme in the debates over the problem of the Douro, still in the early 20th century.

The export market for wine consumption was already strong in the sixteenth century, especially in England, Spain and the colonial empire. Much needs to be done in order to grasp the changes of the Port consumer from the sixteenth to the beginning of the 20th centuries. My discussion of the consumption side is merely illustrative. I take as a starting point the varying preferences of consumers.

The market for wine in Europe was slowly and steadily growing in the period between the 16th and 17th centuries. The product was mainly related to the elite and the high income classes. This was a luxury product; the mass market was growing slowly but steadily. The mass market of the 19th century was much different than the one found today. From the records of the shipping firms, the widening of the difference between low export price and high export price supports the idea of the emergence of a mass market, but not as wide as it is known today. At that time, wine was relatively expensive and cheap substitutes existed like beer, distilled beverages of any kind and other adulterated wines that stiffened the competition and made the selling of cheap wines a rather uncertain business.

Preferences are neither given nor fixed in the long run and in the short run they do go through a process of change and competition between different tastes, not to mention the fads and fashions. Moreover, preferences are not reducible to a representative agent with standard features; on the contrary, the preferences in the population are varied and differ from individual to individual and group to group.

Here again, the selection among a variety of wines is related to the population dynamics of the different types of consumers. The different species of consumers and

their relative evolution through time is one of the explanatory factors behind the overall change in wine consumption and the selling of other alcoholic beverages. Each consumer has a specific preference for wine and other beverages whereas the preference structure for individuals and populations can evolve through time, and, more interestingly, the proportion of each type of consumer varies as time goes by. The belonging to a type of consumer (heavy consumer, selective consumer, snob, etc.) follows the logic of fuzzy sets. Let me say that each consumer of one type is more or less in the neighborhood of the center of the set or distribution.¹⁰¹

It must be stressed that, before the 18th century, the wine produced in the Douro region was very different from the one that we find today, especially for the Port wine that since then has received since then an addition of wine spirit, so the name often encountered in the literature is "fortified wine". It was not just different but also of very unequal quality. The first characteristic was the great diversity of the product. Most of it was even of lower quality. This story, in a way, is similar to the history of Champagne, which is a common sparkling wine that, through technological improvements and institutional change, has become a landmark in the sector with strong legal protection, social, and political support.

The wine produced in the Douro was again different in the 18th compared to the 16th centuries and, finally, before and after the phylloxera (1860s-1890s). The product was not stable through time as is demonstrated by the debate in the 18th and 19th centuries over the issue of fortification, addition of wine spirit, is clear: the practice of adding brandy has not been constant.¹⁰²

The second feature is the physical and enological characteristics of the product. We also find here also diversity in the product, mirroring the diversity on the consumption side. The heterogeneity of the quality of the product ranged from good – for export, to the Court, and upper classes – to low, for self-consumption and local trade. Some intermediary quality was also available for selling in the cities such as Oporto and also in Brazil.¹⁰³

¹⁰¹ The categories of wine consumers, such as heavy drinker or light drinker, are difficult to separate clearly on a mere quantitative basis. Factors such as habituation, height, and weight modify the boundaries between the different types of categories. These are typical fuzzy sets.

¹⁰² See the texts of Francisco Pereira da Fonseca, the Barron of Forrester, Cabral and the Visconde de Vila Maior. I will treat the issue thoroughly in the second chapter. My point of view follows the analysis made by Gaspar Martins Pereira.

¹⁰³ For a description of the situation at the turn of the 18th century, see G. M. Pereira (1991, Pereira 1998a) and N. Bennett (Bennett 1992-93, 2001).

Another feature, the third one, is the close relationship between the evolution of the Port wine and the transformation of the Portuguese nation right from its beginning. As a matter of fact, in the Crusade of 1140 the Normans passed by and stopped in the port of Porto, expecting "good and cheap wine" (Mayson 1999). The wine, as well as fruits and olive oil, was already traded in the thirteenth century for British wool and textiles.

Even in the sixteenth century, the produce was also sold to (British and other) mariners and much of it was of low quality. Nevertheless, before the end of the 18th century the wine passed through a substantial transformation. In comparison with normal wines, Port seemed to have acquired its distinctive character: a sweet and stronger drink, into which liquor or wine-spirit was added during maturation and ageing (*aguardente*).

The overall features of the sector were: a specific production process, a landed aristocracy, small properties, the necessity of a huge amount of manual work, and strong regulation institutions (legislation, institutions, etc.). The production process has essentially followed traditional techniques during most of the history of the Port, and, nowadays, this situation continues to characterize the sector for most of the producers, specifically the small ones.

However, at the same time, some technological advances have occurred, and not the least, in the very case of the Port, the addition of liquor or wine spirit. The great technological watershed of the period is the combination of the oidium and phylloxera both of which shaped another technological system for producing wine.

In the following chapters, I will treat three aspects of the Port wine sector. In Chapter I, I discuss the institutional framework and relate it mainly to the technological change in the sector. The second chapter is the proper treatment of the technological change in the winemaking process, from the work in the vineyard to the selling of wine in Porto or Vila Nova de Gaia. The final chapter is about the evolution of the shipping firms and the transformation of the structure of the trading sector.

The ensuing research is based partly on materials from private historical records and partly on public archives¹⁰⁴ to complement two distinct but intermingled questions

¹⁰⁴ The archives, manuscripts and publications used here are wide ranging. Basically, except for the Public Record Office (PRO) and the British Library and some headquarters of Port shippers in London, the records are from Portuguese or Porto based firms and local and national institutions in Portugal. See the annex relative to the archive consulted for further details and precise references (e.g., ANTT, AHMOP, AHMNE, ADP, AHRCV, MD, IVP, etc.).

relative to the Port wine sector: the transformation of the technology of production and trade, on the one hand, and the institutional and regulatory setting, on the other hand. I will focus more intensively on the institutional and legal setting, leaving most of the technological aspects for the next chapter.

A third question has to do with the evolution of the population of shipping firms from the 18th to the 20th centuries and will be the object of the third and last chapter.

Chapter I – Institutional and technological transformations of the Port wine (1680-1974): A legal and economic nexus

A vineyard producing wine of very extraordinary quality which can be produced only in relatively small quantities yields a monopoly price. The wine-grower would realise a considerable surplus-profit from this monopoly price, whose excess over the value of the product would be wholly determined by the means and fondness of the discriminating wine-drinker. This surplus-profit, which accrues from a monopoly price, is converted into rent and in this form falls into the lap of the landlord, thanks to his title to this piece of the globe endowed with singular properties. Here, then, the monopoly price creates the rent. (Marx 1894/1909: 900)

1. Introduction

In the present chapter, I describe the institutional aspect of the sector, and in the next I divide the period into different productive systems. After presenting the basic features of the sector at the beginning of the 18th century, I will divide the whole epoch in a number of periods, each being characterized by a distinct regulatory and institutional structure. These are called *regulation regimes*. This is the first part of my focus. I will also study the change in the production techniques and draw a parallel with the institutional variables; but this is for the next chapter.

The next section (2.) is about the general setting: the transformation of the Port wine production extending over more than two centuries.

In the following section (3.), I come back the theoretical framework described in the first part and in the last introduction in order to grasp the different regulatory regimes and their respective production and trade structures. I adopt here the notion of regulation regime and delimit the institutional variables that I will use in my analysis. I will not say much here about the trade firms and the wine-growers, leaving this for the next two chapters, except when treating the technological aspect of their activities. I will

not survey the literature but present a specific theoretical framework that is adapted to the case under study.

The fourth section (4.) is about the historical heritage of the Port wine at the turn of the 17th century and the period that goes from 1680 to the middle of the 18th century. At this point, the essential aspects of the sector are outlined in order to prepare for the comparative work based on the theoretical section (section 2.) which is then dealt with properly in the last sections (4. and 5.).

The fifth section tackles the different productive and regulatory regimes: the installation of a strong regulation scheme from 1756 to the end of the eighteenth century (1755-1800); the second transformation of the sector from 1800 to 1834, a period of important changes from the political and institutional sphere; the third period (1840-1907) characterized by important technological transformations and institutional crisis; the fourth regulatory period (1907-1930) with the establishment of a new "order", preparing the institutional setting of the 1930s that will last until well into the third quarter of the 20th century.

Finally, I will relate the different regimes of regulation to the production and export transformations of the sector. This last point will be brief, because I will treat it more deeply in chapters 2 and 3, in which I intend to finalize some of the comparative considerations that can be inferred from the analysis I made in the preceding section.

A special note will be made for the case of the regulatory entities in the Port wine sector, namely the General Company (*Companhia Geral da Agricultura das vinhas do Alto Douro*), the professional commissions, the Comissão de Viticultura Duriense, and the Port wine institute (Instituto do Vinho do Porto). The internal structure of these institutions will be left to further research.

What interests me, at this point, is the working of the sector in an historical perspective that will later be applied, in the next chapters, to the variation and transformation of the production and trade that the sector has passed through.

Here, the research is limited to delimiting a framework for understanding the transformation of the sector. I propose, mainly, a reading based on historical data of a sector that was central to the Portuguese economy before and throughout the seventeenth, eighteenth and nineteenth centuries. This importance was even more striking for the Northern regions of Portugal, from the Alto Douro to the Atlantic, including the privileged case of Porto, as revealed by the study of António Barros Cárdozo (2003).

The economic activity of vine-growing and wine-making in the Douro did not just sustain only its population but also the merchants and residents in Oporto more or less associated with the wine trade, and constituted a capital income for the municipality and the central government given the numerous taxes levied on the trade and transport of the Port wine, taxes implemented and collected by the municipality, the National Customs at Porto (Alfândega do Porto), and the *Companhia Geral* (Cardoso, A. B. 1997, Cardoso, Antonio Barros 2003). I will come back to this issue when treating the *Companhia Geral*.¹⁰⁵

The wine trade was the main revenue for the Porto administration and the main national tax source on the Continent for the Crown during the 18th and 19th centuries (Martins 1988, 1990).¹⁰⁶

2. General setting

Economic development in Northern Portugal from the city of Porto to the Spanish border has been intimately related to the expansion of the vineyard along the Douro River and its ensuing trade and resulting taxes and duties and resulting taxes and custom duties.

Port wine was the dominating economic activity from the 16th century, and even so from the second half of the 18th century (Martins 1990). The trade contributed to the welfare of the Upper Douro region, but also to that of the city Porto and the whole

¹⁰⁵ The documentation on the taxes and duties on the Port wine is impressive and can be found in five public records or libraries: the Archive of the Real Companhia Velha, Section 8, and Fundo da Alfândega do Porto; the ANTT Alfândega do Porto (AP); and the Arquivo Distrital do Porto (ADP); the Biblioteca Municipal do Porto, especially the manuscript section; and the central Archives of the Ministry of Finance, Lisbon. In the chapter on the Port shipper I made use of the second and third, with occasional reference to the others. To see the importance of the sector, the taxes levied in Porto on exported products of all kinds for abroad, between sixty and eighty percent came from the wine trade; see ANTT AP lv 99, 1763, lv. 277, 1777, lv. 872, 1799. For studies on the taxes and customs on wine, see A. B. Cardoso 1997, 2003. See also the studies of Francisco Ribeiro da Silva "A Alfândega do Porto: os diplomas legais que marcaram a sua evolução secular" and "O Despachante oficial: uma profissão moderna e um serviço antigo", both in *A Alfândega do Porto e o despacho aduaneiro* (Silva 1990a, 1990b).

¹⁰⁶ One source of information for the importance of the taxes is the Alfândega do Porto. See ANTT, AP from 1763 to 1833. Another important archive is the *Real Companhia Velha* or *Companhia Geral da Agricultura das Vinhas do Alto Douro*, especially the series (Secção) 8 and especially the subsections: 8.1. Academia Real da Marinha e Comércio, 8.2 Canadagem, 8.3 Casa Pia, 8.5 Direito adicional, 8.6 Entradas, 8.7 Entradas do Douro, 8.8 Fragatas de guerra, 8.9 Imposição da Cidade do Porto, 8.10 Imposição da guerra (1808), 8.11 Imposição da guerra (1811), 8.12 Imposição de Matosinhos e Leça, 8.13 Obras públicas da cidade do Porto, 8.15 Obras do Rio Douro ou Pedras do Rio, 8.16 Real de Água, 8.19 Sisa de Gaia, ..., 8.25 Sisa do Porto, 8.28 Subsídio literário, 8.29 Subsídio Militar, 8.30 Ver-o-Peso, and 8.31 Subscrições.

country. The main revenues were collected in Porto (export sales, consumption and export taxes and duties levied by the Companhia) and along the Douro rivers (taxes and commissions).¹⁰⁷

As I will try to show in the next two chapters, this evolution is closely related to the high renewal of the winegrowing activity, on the one hand, and the international trade from the 17th century, with the Dutch, and then, with the British; on the other hand. This constant renewal, at least until the 1960s, is related to the individual merchants and landowner, whilst, nowadays, big firms and international corporations are playing an increasing role in the sector, constantly opening constantly a new page in the dynamics of the sector, such as the mechanisms of high concentration. In the 18th century, the number of shippers varied from around fifty to two hundreds, out of which more than half were of British nationality. Now there are just four British firms left, and with the exception of one, they were all established before the 20th century, and have amalgamated with several of their competitors.

3. Historical heritage at the turn of the 17th century

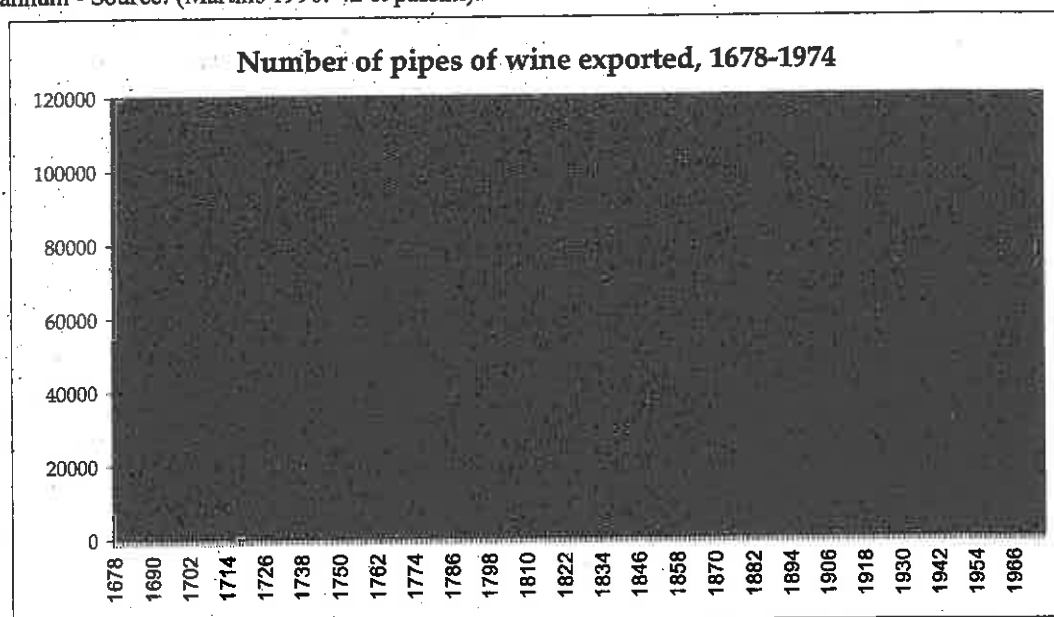
First and foremost, it is useful to explain the choice of the period I have chosen: 1680-1974. The starting date is arbitrary; I rather could have taken 1678 due to the fact that the first export records of Port wine from Porto were from that year. Nevertheless, the difference is small. Given the lack of relevant information before the 18th century and the difficulty of obtaining new data, this starting date is more than reasonable.

On the other hand, I have discarded the period of 1974-2004 for a number of reasons beyond the motive of being too recent. The chosen ending years are justified both by reduction of the scope of the study, and by the fact that the 1940s and 1950s is marked by a crisis in the sector with some lethargic features before the profound transformations of the 1960s and 1970s. Furthermore, 1974 marks the end of the Estado Novo and the economic order of the corporatist State. The later period (1974-

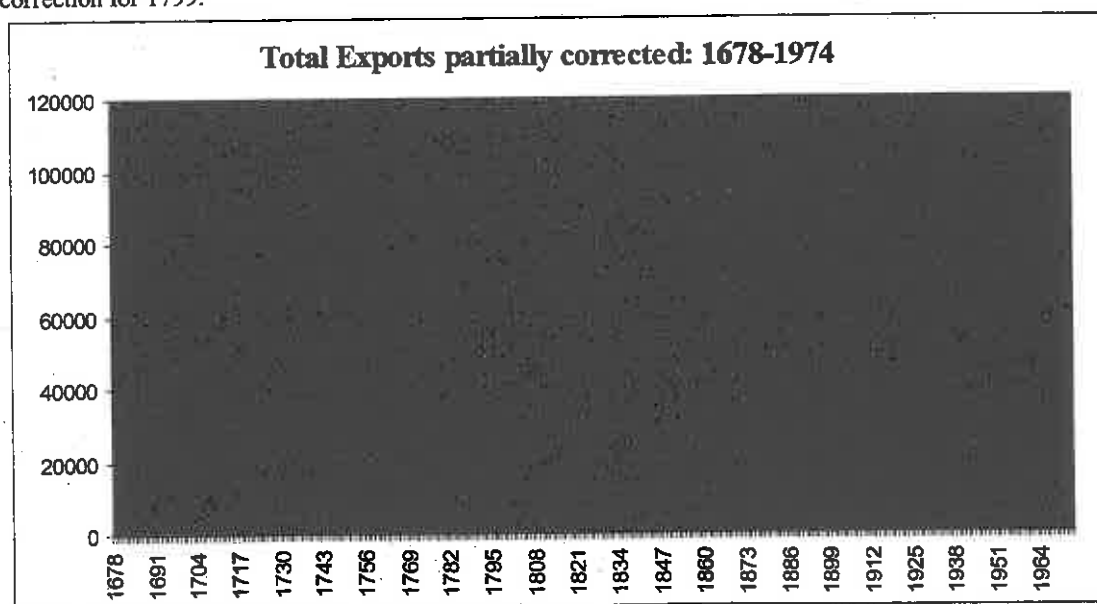
¹⁰⁷ See previous note and, once more, A. Barros Cardoso for an overview of the impact of the wine trade and duties from the public work such as the streets of Porto and the accumulation of wealth in the houses and business activities of the aristocracy and bourgeoisie living in this central economic and commercial city (Cardoso 2003).

2000) could be subject to further research that is not the object of the present research.¹⁰⁸

Graph n.º 1a: Evolution of Port wine exports to England (1678-1974) – Average thousands of pipes per annum - Source: (Martins 1990: 42 et passim).¹⁰⁹



Graph n.º 1b: Evolution of Port wine exports to England (1678-1974) – Average thousands of pipes per annum - Source: (Martins 1990: 42 et passim) with minor corrections for 1756- to 1788 and an important correction for 1799.



¹⁰⁸ In the chapter on the Port shippers, I will study the period from 1950 until 2000 on an aggregated level of the population, given the confidentiality of the data for the sub-period 1970-2000. This last period will be compared with the previous ones.

¹⁰⁹ These are the data from Conceição Andrade Martins without any correction. Later on I modify her data, especially for the year 1799 for being much different from the quantities obtained in the Alfândega do Porto (circa 100000 pipes against 53000) and the fact that existed a list of exports of the Companhia to Brazil for the years 1756 to 1788 (AHMOP, MR 35).

Contrary to some widely held view, the history of the Port wine is not one of a steady increase in average export but rather of an unstable crises-stricken, sector, moving in a changing context through the decades. This is illustrated by the variation of exports in Port wine from 1678 to 1975.

The first great increase occurs at the beginning of the period, before the Methuen Treaty, and the second, after a period of relative stagnation from the late 1720s to the middle of the 1750s, starting in about the late 1750s up to the end of the century. From about the 1800s to the 1850s, the exports stagnate once again. The 1860s mark another phase of growth of exports until the late 1880s. From 1905 to the early 1930s, another phase of growth is evident, though the years of World War I mark a sharp but temporary downturn. The last phase of growth starts later than expected, in the 1960s, much later after the timid recuperation of the late 1940s.

If over the whole period there is an upward trend, the evolution presents a much more erratic pattern of a typically unstable sector, and this I will present at the end of the section. First, I will describe the general evolution of the trade, production and prices of the Port wine during the last three centuries. However, beforehand, three preliminary remarks are necessary. First, the general trend of the figures average out the yearly and seasonal variations. Note that these fluctuations still persist in the 1970s or today, even if the market seems less volatile, with a sequence of good years which outnumber the bad ones. In terms of volume exported, in the last four decades there is a clear upward trend, but this does not mean that the trend will continue.

Second, the annual series of production and export figures clearly show periods of expansion and recession that do not fit the nice picture of a steady upward trend. In contrast to the notion of trend, the movement of quantities reflects a cumulative process. It is more correct to describe the dynamics by a succession of uneven cycles that, as time goes by, cumulatively change the general level of production and trade. The cycles build on each other.

Third, the data is also an average that hides the diversity of the product itself; the quality of the Port wine has varied enormously throughout its history. In fact, even today, despite a high level of quality control from the *Instituto do Vinho do Porto* (IVP), there are many different qualities of wine ranging from supermarket brands to vintage and reserve brands, not to mention the distinction between ruby, tawny, white, vintage, Quinta, and other features, such as the size of the bottle and other marketing refinements.

It can be reasonable to admit that the origins of the production of wine date back to times that precede the Roman settlement. The slow change of the production area, dedicated to the culture of grapes and the production of wine, is concomitant with slow technological change until the late Low Middle Ages.

At that time, most probably, there was almost no or at minimum very slow capital accumulation and the trade was limited to a small fringe of producers, those who were able to accumulate sufficient wealth through trade by investing it in land (greater estates, often contiguous properties) and artifacts for vinification (*lagar*, vat, pipes, etc.). The most significant changes in technology occurred after the late 16th and most from the 18th century onwards. Nowadays, some parts of the sector depend on modern technology whilst others, for instance at harvest time, are still highly labor-intensive.

The history of techniques revealed some important changes from the 15th century onwards with respect to the production of wine, as indicated by Daumas (1996/1962, 1996/1964). This change is generally associated with the transformation of European Agriculture. It is also highly probable that a major change occurred in the wine production that can be dated at the time of the end of the Roman empire. This change is the decay of the *provignage* or layering system that consisted in laying the vine shoots continuously in the ground. The vine was perpetually extending and the old vine was not easily distinguished from the new (Lachiver 1988).

It is only much later that the convergence of different sources of technological change occurred, more precisely, at the end of the 17th and during the early 18th centuries. This is the combined changes of early agronomy, transport efficiency, casks of wine, conservation techniques, distillation, addition of wine spirit (brandy), adulteration and bottling. The second half of the 18th, 19th and 20th centuries were characterized by three fundamental technological transformations: the experimental work, based on early chemistry and agronomy; the understanding of the biological dimension of plants, based on organic chemistry and biology.¹¹⁰ I will treat all this in greater detail in the next chapter.

Wines already differentiated across regions get differentiated within regions. This process of differentiation is related to the existence of white and red grapes, the different sorts of vines (*castas*), the development of the fermentation process, and the blend of wines of different types, color, age and alcoholic content. Of course the ageing

¹¹⁰ More recently the sector is undergoing a genetic « revolution », based on the selections of varieties and the refined chemical treatment of the wine, respectively.

process was still a problem at that time. Even today, it remains a serious problem for winemakers.

During the 16th and 17th centuries, distillation was widely diffused throughout Europe mostly due to the influence of the Dutch merchants (Lachiver 1988, Unwin 1991).; their original system would be perfected locally, in France first, then in the rest of Southern Europe throughout the 18th century, going from a simple distillation process (one loop) to a double distillation producing a purer wine spirit, of higher alcoholic content.

Despite the scant evidence and studies on the early transformations of the winemaking technique and organization of production and trade, I underline the following features of the process: (1) a slow technological change in general for the wine sector, especially before the 18th century; (2) a slow and cumulative perfection of the techniques for the productive activities; (3) a time of almost no use of science (in contrast to the second half of the 20th century); (4) a cumulative process, mostly through labor of land, e.g., terracing of hills; (5) a reduced amount of investment, beyond the acquisition of land, if required; (6) a growing diversity of the wines produced between regions and within them; (7) an imperceptible interaction between the consumers and the producers (the landed aristocracy as consumer as well as the trader as intermediary between the consumer and the producer); and, finally, (8) the central role played by the wine spirit in the transformation and definition of the features of the Port wine. I will come back to this last point in some detail later on (chapter II) and I will make use of the studies of Norman Bennett on brandy (2001, 2005).

Around the 16th century, throughout Europe, the production of wine spirit is acquired and widely diffused, and this is one remedy for the ageing of wine and avoids the problem of the wine turning into vinegar. Probably the wines at that time were more rustic and acid than today (Pereira 1999), but not much is known about the qualities of the wines produced in the Renaissance period. I mean the features of the wine and vine from the vintage point of techniques (including the selection process of vine species) used and the technological skill and knowledge in which the techniques are embedded to function properly.

For the case of the Douro wine, probably the first cases of *fortification* (aguardentação) of the wine appeared around the 16th and 17th centuries, but on an unspecified scale and with unknown proportions, not to mention the distribution of such behavior. The technique of fortification was not what we know today, given the

available scientific control and knowledge. It happened almost by a process of trial and error in a similar way as it did in the Jerez as well as the Cognac region. Later, another selection process occurred in which the British merchants and the export markets played a major role in defining the preferred characteristics of the wines (Silva 1996, Pereira 1998a, 1999).

The wine produced in Portugal and the Douro was, of course, of a varying quality, classified from poor quality to very good (Pereira 1999). However, even before the organization of the production and trade of the Port wine, there was a unequal quality of wine with different levels of quality that were destined to different social classes and consumer types.

Port wine began to have a particular association with the aristocracy, the landed gentry and the member of the royal courts, in Portugal and Spain. It also gained recognition in the British aristocracy and bourgeoisie from the 17th century onwards.¹¹¹

Another relevant factor for the rise of Port wine is the diplomatic rivalry between the United Kingdom and France. France used to be the traditional supplier of wine for the UK market, well before Italy, Spain, Portugal and Germany, at least until the end of the 17th century. When the war started between the two rival nations, the trade of French wine came to a standstill, and the other wine producers came to offset the rapid decline or suppression of imports from France.

Another factor for success of Port in England is the very quality of the wine and its symbolic value of uniqueness that satisfies the drive for distinction that we find in both the aristocracy and the bourgeoisie.

The falsification of Port wine in the 1740s and early 1750s, both in Portugal and England (Charleton 1734), is one the causes of the crisis of 1755-57, as documented by the reaction of the winemakers and traders of the Douro and their solicitation to the Minister of the King José, the Marquis of Pombal.¹¹² According to Ribeiro da Silva: "the quality of the wine produced during the 16th century was remarkable, but not

¹¹¹ Until then, the Flemish and the Dutch were amongst the principal importers of Iberian wines. Hamburg and the cities of the Hansean League also played a relevant role in the wine trade. Later, by the end of the 18th century, some countries will emerge like Brazil, Sweden, Russia, Denmark, etc. but will not attain the position of importance reached already by the United Kingdom at the turn of the 18th century. During the 20th century, there was a diversity of markets (see chapter III).

¹¹² I could relate this to the crisis the *devassa* or trial of 1771-1775, which judged and condemned hundreds of people from the Douro region and the Porto city area for not respecting the regulatory rules of the *Companhia Geral* and the monarchic legislation. The event was been synthesized two decades ago with the most relevant legislation, actors, and Court's decisions (Oliveira and Marinho 1983). I will come back to the episode when I study the *Companhia Geral*.

homogeneous [...] in Portugal there was a clear perception of a quality continuum that combined two criteria of judgment: the aroma and the age" (1996: 94). Most probably, this continues to be so until the middle of the 18th century, before the first wave of important changes.

4. Different productive and regulatory regimes ¹¹³

The production and technological characteristics of the sector have evidenced continuous and, at some critical moments, radical changes, such as the post-*phylloxera* vineyards expansion, or more recently, in the 1960s and the 1970s, with the normalization of vine varieties and the mechanization and organization of the culture of vines.

I distinguish five periods of productive structures. The first corresponds to the pre-regulatory era with a slow and then, by the late 17th century, a rapid expansion of vineyards and trade, ending with the instauration of a legal and regulatory scheme for the sector. During this period, the freedom of trade is considerable but not unfettered, with important regulatory devices related to taxes and Church incomes (e.g., the *dizima*). This period precedes the one chosen for my research, and the end of which marks the beginning of the important trade with England.

The second period begins with the transformation of the productive process in interaction with the new regulatory order posterior to 1755, ending around 1807-1820, with the French invasions and the ensuing disorders and social and economic unrest.

The next period, from 1810 until the 1850s, is characterized by expansion of trade and production and a quiet disorder in the sector and, at the national level, by socio-political unrests. This period is defined by a highly uncertain context. Some shippers will benefit more than others (e.g., Offley, Sandeman, Warre) and, in general, the traders are better positioned than the winegrowers to deal with adversities as well as interference of the *Companhia Geral*.

From the late 1840s and the early 1850s until the first decade of the ensuing century, a new phase begins with the appearance of the vine diseases, e.g., *oidium*,

¹¹³ I have made use here and in the section on wine production and exports of the thesis of Pedro Lains, especially for his treatment of the wine sector within Portuguese agriculture (Lains 1995: 90-113). I have also compared his perspective to the one of Miriam Halpern Pereira with whom I also check my data on Port wine exports (Pereira 1971, 1983). My research results are probably closer to those of Lains but much more limited in scope (Pereira 1971, Lains 1995).

mildew, and other plagues (Grande 1855); and the wine blight, the ravaging phylloxera (Ordish 1987, Campbell 2004), spreading then across Europe and reaching the Douro in the 1860s (Júnior 1872, Henriques 1880, Almeida 1884, Vilhena 1895, Machado 1983, Pereira 1989a). All these diseases transformed the production structure and process, leading to a rapid concentration in the sector in favor of the trade business (Pereira 1986, 1989b, 1990). This was also a time of high property transfer.

From 1907, there is a new regulatory pressure from some quarters of the Douro wine sector (producers and the organizations of producers),¹¹⁴ the state, and an organization of the sector around the export firms, leading to some short-lived and *frustrating stability*, which will end with the expansion of the 1960s and 1970s.

Finally, the sixth period begins late in the 1950s with the modernization and mechanization of the production process (Magalhães 1999), including the substantial changes in the vine varieties and their selection for the winemaking process.

This time division between periods of crisis and expansion is open to discussion, particularly when it is a matter of deciding where one period ends and another begins.

5. Regimes of regulation and production and the outcome of the trade

I discussed briefly the production side in the previous section and I will develop it further in the second chapter; here, I would like to focus on the periodization of the regimes of regulation. For the regulation periods, I shall distinguish:

- 1 – 1680 (or before) -1755 – weak and uncoordinated regulation;
- 2 – 1756-1834 – strong regulation with a rather slow decomposition of core elements;
- 3 – 1834-1865 – liberalization of the sector;
- 4 – 1865-1907 – production and regulation crisis;
- 5 – 1907-1932 – new regulatory design;
- 6 – 1933-1974 – return to another strong regulation regime.¹¹⁵

¹¹⁴ See the movement called the “Paladinos”, composed of some of the elite of the Douro that acted in favor of the defense of the region and its “industry”, the wine production after World War I, even though the origin of the movement is related to the emergence of the Douro question and the wine blights of the previous century (Sequeira 2000).

¹¹⁵ I have to acknowledge the critical comments made by Gaspar Martins Pereira on an earlier version of this division of historical periods. I have chosen to drop the period from 1975 to 2005 and concentrate on the years 1680 to 1974. Nevertheless I included a section on the period 1975–2005 as a mere illustration of what could be some possible future areas of research.

I have tried to use the research of Carlos Brito on network analysis and business strategies in the Port wine that he applied on the recent history that is beyond the scope of my own research. It was helpful in

I have combined the third and fourth periods under the same heading because they are characterized by chronic crises, a recurrent return to liberalization and the hesitation of the state with regard to the regulation of the sector. They also correspond to the last period of the pre-phylloxera productive system.

5.1. Regulation regimes

First of all, let me just clarify what I mean by *regulation regimes*. They constitute an integrated set of institutions, norms, and behaviors (with regard to individuals, groups and organizations) that produce historically specific coordination mechanisms between the various elements and shape or interact with the emergence of new norms and behaviors. It is through historical change and emergence of new dimensions that those regulation regimes evolve, change and enter into a crisis, often heralding another regulatory regime. It does not mean, however, that the explanatory factors are just reduced to the simple transformation of the problems of one period to their solution in the next one.

The concept I have in mind is interactionist or relational, and, contrary to the French regulation school, there is no plain holistic view of the regulation. The French regulationists are right when they highlight the systemic and, more recently, the historical character of a regime of regulation. However, they attribute to regulation a broader meaning than the one I do for the Port wine industry. My objective is more modest: to understand the workings of a sector and to analyze the technological and institutional change and at the same time look at the issue of regulation, how the system is maintained within acceptable bounds.

There is a general reading of regulation theory, at least for its first two decades, that avoids considering what is below the structure. I do accept the stress on structure, social relations (what they call *rappports sociaux*) but not at the expense of neglecting central elements of the context of emergence: the individuals, groups and organizations where part of the change occurs.

Recently, authors from the French regulation school have developed a more coordinated perspective on the individuals and the whole, and in fact some have come

orienting some of my research in archives. The network approach is important in order to understand the important transformations of the trading firms (Brito 1991, Araujo and Brito 1997, Brito 1997).

to coin or adopt the term: *holindividualism* (Boyer 2003, Chanteau 2003), in order to deal with the agency problem given that their focus was mainly on the structure.

Instead of regulation, I could have chosen the word coordination; but, given the nature of the Port wine sector, I have opted for the latter. However, the regulation school has produced quite a lot of works on the economic space and the economic geography, stressing the specific and relevant role of institutions.¹¹⁶

I now proceed to some brief considerations on mercantilism that will allow me to clarify the important institutional and political changes for the period 1700-1800. I will insist on the divide between the periods 1680-1755 and 1756-1800 for the emergence and development of two regulatory traditions: (1) the relative freedom of transactions (1680-1755) during this phase of the capitalist expansion in Portugal and its empire; and (2) the strong central regulation of the sector (1756-1777) as a consequence of the rise of Pombal and the style of power he symbolized: centralization, authoritarianism and greed for financial resources to support the Portuguese overseas empire, the monarch's court and the state bureaucracies. The last period could be extended to the Napoleonian invasions given that the period after the fall of the Marquis of Pombal and the change that followed, the so-called *viradeira*, is much exaggerated as seen from the Port wine sector. Indeed, if some legal structure was profoundly modified, much practice and acquired positions in the system remained unchanged.

5.2. A note on mercantilism relative to economic policy and the privileged companies in Pombal's time

I will discuss mercantilism briefly here, and return to it later, when treating the privileged company, the *Companhia Geral*. These considerations are centered around the interesting figure of the Marquis of Pombal and his economic policy.

Mercantilism is usually defined as an economic doctrine composed of a set of rather loose theories that correspond to the rise and expansion of the Modern states and try to give some grounding for national policies. The doctrine had a long and varied existence. It surged at the turn of the 16th century and evolved through the ensuing 17th

¹¹⁶ See the introduction and first chapter of the first part of the thesis for some consideration on the levels of reality.

and 18th centuries. Of course, there are many protagonists and the positions on specific matters have changed through the ages, e.g. the considerations about demography.¹¹⁷

However, caution must be exercised when analyzing mercantilism, as, like Janus, it had two faces: first, it consisted of an economic doctrine (often contradictory and multifaceted) with a set of principles, and, second, it was a political practice that oriented actions and concrete policies, Colbert's treatise and policy being good examples.

As a matter of fact, those historical concepts, which aim to explain a particular period in history, are of a relative nature. There is no such thing as pure historical concepts or entities, but phenomena modified by circumstances and unique environment conditions. This is accurately the case with Pombal's mercantilism. It is characterized by some of the contradictions and features of late mercantilism, an economic doctrine that has changed through a period of three centuries. The mercantilism of Pombal is first associated with absolutism, second with the changing of ideas in the Europe of the Enlightenment, and third with the diplomatic, political and cultural peculiarities of Portugal.

Pombal is the symbol of the period and the reference for the definition of the economic policy of that time. I argue here that the Marquis of Pombal had a better knowledge of economic issues and economic reform than is usually thought, contrary to the opinion of such historians as Borges de Macedo (1982b, 1982a). This can be inferred not just from his library he had in London (Barreto 1986, Pombal 1986, Marcos 1997), but also by the analysis of his writings and correspondence from the time he was Ambassador to London and Vienna to the time he was removed from office.¹¹⁸

Concretely, two aspects of the economic policy of Pombal are particularly relevant for the study of the Port wine: a political alliance within the nation state (budgetary order or relative equilibrium) and a preoccupation for external equilibrium (trade equilibrium for the economy that was complemented by diplomatic alliances to preserve the sovereignty of Portugal). The first principle place high value on the union between the political power (the State or the King) and the other social forces that

¹¹⁷ For further references on mercantilism and the history of economic thought see: Mark Blaug, Warren Samuels, Joseph Schumpeter, Ernesto Screpanti and, for Portugal, José Luís Cardoso (Schumpeter 1954, Blaug 1990, Screpanti and Zamagni 1993, Cardoso, J. L. 1997, Ekelund and Hébert 1997, Cardoso 2001, Cardoso, J. L. 2003). I have also based my argument on some classical or recent articles (Heckscher 1936, Heaton 1937, Dales 1955, Wilson 1957, Tollison 2001).

¹¹⁸ The correspondence and the memoranda he wrote can be found at the British Library, the Biblioteca Nacional and the ANTT.

matter (namely the aristocracy, the political elite of Porto and the major merchants), and this alliance gives rise to the creation of privileges and some sort of monopolies in the productive sphere.¹¹⁹ The alliance or convergence was rather a momentary compromise that would fade away in the subsequent periods of the history of the country and the sector, namely during the liberal regulatory periods (the main period being 1865-1907).

The second principle, in relation to the exterior, is the focus on the equilibrium of the trade balance with its implications for the monetary policy and the mechanisms of adjustment of the different production sectors and, not least, for the ceremonial activities of the Crown, the Court and the aristocracy.

Moreover, it is obvious that the Port wine is one element, among others, in the evolution and adaptation of Portugal and its economy to a changing world system and to a time of uncertain diplomatic moves between European powers wherein Portugal favors a stable marriage with England in this unstable concert of nations.

Pombal can be considered as a mercantilist, see above and in fact he had some of the most relevant works of this literature in his library while he was working as Ambassador in London as well as other works on trade and natural law.¹²⁰ Moreover, without doubt, he was acquainted with the works of natural law philosophers and economists, both on account of his appointments as Ambassador in London and Vienna, as well as his training in law at the University of Coimbra in keeping with most of the provincial aristocracy of that time. Despite the difficulty that Pombal had with the English language (he wrote most of his memoirs and memos in French), the mercantilist doctrines were quite well known at the time and available in many books in French about philosophy, political economy and trade. Besides, Pombal possessed some French books of his age on the trade companies (Schneider 1980, Marcos 1997). Those references could support the argument that his conception and the implementation of the trading companies for the colonies and the *Companhia Geral* were of mercantilist inspiration.

¹¹⁹ For the Aristocracy, see Nuno Monteiro (2003b, 2003a); for the trade in general, see Jorge Pedreira (Pedreira 1992, 1994, 1995); and for the merchants and elite of Porto and the Douro, see Susan Schneider, Gaspar Martins Pereira and António Barros Cardoso (Schneider 1980, Pereira 1984a, 1986, 1990, Cardoso 1996, Pereira 1999, Cardoso, Antonio Barros 2003).

¹²⁰ I can cite authors such as Colbert, Richelieu, Marquis de Louvois, Thomas Mun, William Petty, Charles Davenant, Charles King, Josiah Child for mercantilism (BNL, cód. 166, 167). There are also several books on trade and the trading companies as well as the principal authors of natural law, namely Grootius and Pufendorf (BNL, cód. 165).

See Marcos (1997) and Barreto (1996) for comments on the matter.

Moreover, according to Marcos, Pombal, while in Vienna, commented on a project of establishing a royal trading company for the commerce with the Portuguese possessions in Indian and all along the way throughout the overseas Portuguese possessions (Marcos 1997). His comments on the hypothetical chartered company in the epistolary correspondence with his cousin, a former ambassador to London, reveal that he was aware of the issue of trade through privileged companies. This leads to a revision of the study of Pombal that follows the interpretation of Borges de Macedo. This author considered that Pombal's policy had a great deal of improvisation (Macedo 1982a, 1982b). This view of Pombal is excessive and does not take into account the study of the legislation and manuscripts available at the Biblioteca Nacional, the National Archives (ANTT), the Archive of the Ministério das Obras Públicas (AHMOP), and the British Library. Borges de Macedo did not know about the existence of the lost Viennese correspondence and report found in the British Library.¹²¹

Indeed, for Borges de Macedo, Pombal did not rule with an established plan of reform but seized the opportunities along the way as they appeared to him. Part of this last point seems to be correct but excessive, especially with regard to the privileged companies. If Pombal seized the opportunity offered by the cultivators of the Douro, the particular project for the creation of *Companhia Geral* regulating the Port wine sector corresponds to a more general plan. It is also the realization of an economic policy, the regulation of an economic sector of uncertain future and that entered into a crisis (the 1740s and the early 1750s). The creation and actuation of the Company is part of a global policy within a specific context and with its successes and failures wherein Portugal strives between the diplomatic moves of the great powers of that time: France, England and Spain, and Austria.

5.3. The regulation regimes

The creation of the privileged companies in various sectors demonstrates this view. The Royal authority –in order to secure power and partly to compensate for the dismantlement of the Portuguese empire, leaving the East and consolidating its position in the West (Brazil) and coupled with the decline of some of its imports of gold and

¹²¹ AHMOP, MR 5 and 35; ANTT MR 341, 632 & 641; BNL CPA, various manuscripts (*inter alia*: cód. 165, 167, 613, and 657); BL add. ms. 20804.

diamonds)— takes a step forward in the new regulation of economic activities, of trade, and industry, mobilizing private capitals for the public good or for the accomplishment of some basic state policies. The renewal in the control of its economic activity, through the creation of trading companies, responds to challenges and a setback in the political sphere, the last upsurge of the absolutist monarchy.

The objective is the (re-)organization of economic sectors to establish order (not just in the production process) but also at the political and social levels. The monarchy is not a beneficent entity and one of its central objectives is to accrue new fiscal resources for a State that sees its revenue from Brazil dwindling while the costs of war and the simultaneous maintenance of an empire are increasing. This is clear in the case of Port and the Brazilian trading companies (like the *Companhia Geral do Grão Pará e Maranhão* or the *Companhia Geral do Pernambuco e Paraíba*); these companies will generate revenues for the state through the taxes collected on the transactions but also because of the very economic activity generated. For the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, there is a collection of different sorts of tax revenues on wine transport and wine export.

The involvement of the political power is obviously one that focuses on watching (*surveiller*) and potentially punishing (*punir*) as advanced by Michel Foucault (1975), but this is not all; the state also acts and creates (e.g., trading companies, more or less well defined legal monopolies, etc.). However, I restrict here the concept of power to the State, the monarchy and the dominant groups and individuals to the main economic forces. Common individuals, such as the small wine growers, have rather a limited power, at least, as shown by the cases of 1757 and 1771-75 in which the watching of the authorities and the severe punishment for the people infringing the legal rules and competing with the privileges of the *Companhia Geral* (Oliveira and Marinho 1983, Silva 1983, Cardoso 1996). In 1757, the creation of the Company triggered a protest and turmoil in the streets of Porto that was followed by a major enquiry and trial. Between 1771 and 1775, on the basis of the Alvará of October 1769, a major trial was organized to try to establish the facts behind the illegal activities practiced in the Douro demarcated area for Factory wine. This far-reaching enquiry led to the condemnation

of a large number of winemakers.¹²² However, if the political expression of the masses is important, albeit difficult to analyze, I will not discuss it any further.¹²³

At this point, I would like to make a brief comment on the importance of the organization of the different relevant groups for the sector: those well organized and not too numerous (merchants) and those badly organized and too numerous for effective coordination (the wine-growers).

As a primary approximation, I distinguish six different regulation regimes throughout the history of the Port wine:

- 1 – The period prior to 1756, a “self-regulated” system until the crisis of the 1740s and the early 1750s;
- 2 – The period 1756-1834, the Marquis of Pombal’s regulation and its partial but irreversible dismantlement;
- 3 – The period 1834-1865 corresponding to a primary liberalization of the system;
- 4 – The period 1865-1907, with a further deepening of the liberalization and the definite abrogation of the Companhia Geral, from then on transformed into a mere trading company;
- 5 – The period 1907-1932 is one of a re-establishment in State regulation with the creation of new mechanisms and the rebirth of the demarcated area;
- 6 – The period 1933-1974 of the return to a strong regulation with its problems during the first decade and third decade of the 20th century and the collapse of the Estado Novo and the transition to the reform of 1995.¹²⁴

The last two periods could be modified as follows: in 1908 and ending in the early 1930s, followed by the corporatist period, 1932-1974, and, finally, the last period, from 1974 to the present. This last division is not much better than the one presented above. There is legal and regulatory continuity between the periods just preceding and following the revolution of April 1974, as recognized by Vital Moreira (1998). Indeed the Instituto do Vinho do Porto was founded in the 1930s as was the Casa do Douro and

¹²² The legislation that started the process of inquiry in 1771 is the Alvará of 17 October 1769.

¹²³ For some references and a perspective on the upheaval of 1757 in Porto, see Francisco Ribeiro da Silva (1983). See also the archive of the ANTT, MR 341; and the AHMOP, MR 35.

¹²⁴ The period from 1974 to 2005 – that I do not study here – could be divided into two sub-periods: 1974-1995 and 1995-2005. See the end of the present chapter for further considerations.

neither institutions were reformed substantially before the middle of the 1980s and 1990s.

This is an exception to the repeal of the corporatist orders in the post-April 1974 Portugal, which could be interesting for another study; here I limit myself to the regulation of the sector and the interaction with the productive forces.

I would like to make some introductory remarks about the typology and the demarcation made between the different regimes of regulation.

First, according to the impurity principle adopted in the introduction and reintegrated in the theoretical propositions of the second part, there are *no pure regimes* of regulation; no distinction based on just one criterion of demarcation; instead, I had to resort to a combination of differentiating elements for characterizing each period.

Second, accordingly, the neatness of each regime varies and frontiers are not perfect, especially when features of one regime are passed on to the next one, then both periods share some common elements.

Third, each period or regime is characterized by (1) the heritage from the previous period (the institutions and their crises); (2) a gestation period at the beginning, whose length varies greatly; (3) different transitory sub-periods between and across the regimes; (4) a constitution of a set of institutions, norms and particular interaction processes; and (5) the prolongation of crises across distinct regulatory regimes (overproduction, adulteration of wine, etc.).

Finally, the regulation of the Port wine during the whole period under study could be reduced to the movement of a pendulum between two opposite extremes: on the one hand, the strong (State) regulation case or center and the weak (State) regulation pole, on the other hand. It is central to the theory to take the state as a focusing device, analytically speaking, but also as a reality-driven explanation of the change in the Port wine sector.

5.4. Theoretical propositions

I adopt for the analysis of the three research questions as defined in the introduction five theoretical principals. These are the following:

- 1 - The Veblenian principle of evolutionary analysis to deal with historical time;

2 – Centrality of institutions (of Commons principle, including legal institutions);

3 – Regulation centered on the state with important dates of transformation around which the change is settled by the intervention of the state or, to the contrary, by its failure to solve a problem (1756, the creation of the *Companhia*, following a protracted crisis of production of low quality and fraud; 1807, the havoc caused by the French invasions; 1833, with the civil war; 1865, with the definite suppression of the *Companhia*; 1907, with the creation of a new legal structure; 1933, with the creation of the Instituto do Vinho do Porto and the Casa do Douro; 1974, with the return to democracy and the end of the corporatist order and 1995, with a new legal reform of the sector).

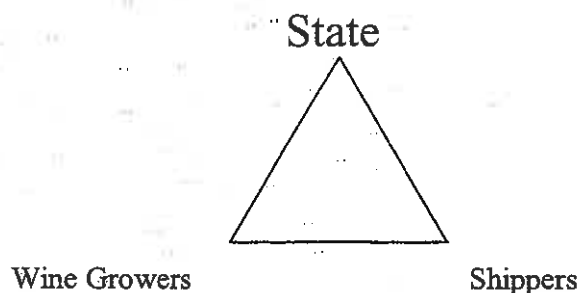


Figure n.º 2: The institutional and productive triangle of the Port wine industry¹²⁵

4 – The importance of the dynamics resulting from the economic agents [the agency problem].

Combining 1-4, an evolutionary account of the historical change in the Port wine sector is possible, without a mechanical conception of regulation.

5 – A basic movement of regulation between strong and weak state regulation. As said previously, the regulation of the Port wine during the whole period under study could be reduced to the movement of a pendulum between these two opposite extremes: the strong State regulation center (*pôle*) and the weak state regulation center. It is central to our theory to take the state as the focusing device, analytically; but also as a reality-driven explanation of the changes in the Port wine sector.

¹²⁵ This triangle is not the one that Fernando Peixoto uses to describe the three main institutional organizations of the Port wine sector from the middle of the 1930s to 1974: the *Casa do Douro*, the *Instituto do Vinho do Porto* and the *Grémio dos Exportadores do vinho do Porto* (Peixoto 1998).

5.5. Characteristics of the different regulation regimes from 1680-1974

In what follows, I analyze the different periods of regulation of the Port wine sector with the help of the theoretical concepts of the first part of the thesis and the introduction of the second part.

5.5.1. First period of regulation and first major expansion (1680-1755)

The chosen period preceding the Pombal reform of 1756 begins arbitrarily in 1678 and corresponds to the first quantitative data available on exports on a continuous basis. On the other hand, the period of interest is posterior to 1756 and the preceding era is important for comparative purposes and to settle the historical background of the present study.

It could be argued that the principle of freedom of activity in the sector is prevalent and close to the weak state regulation but not properly a unique factor. The state has started its pre-configuration of a fiscal administration and some quarters of society benefiting from taxes and privileges are important and at some times cumbersome for the productive activity. That is why I write about quasi self-regulation when I say that some (self)-regulation occurs, meaning just the imposition or creation of legal norms, rules of behavior and thinking (and habits).

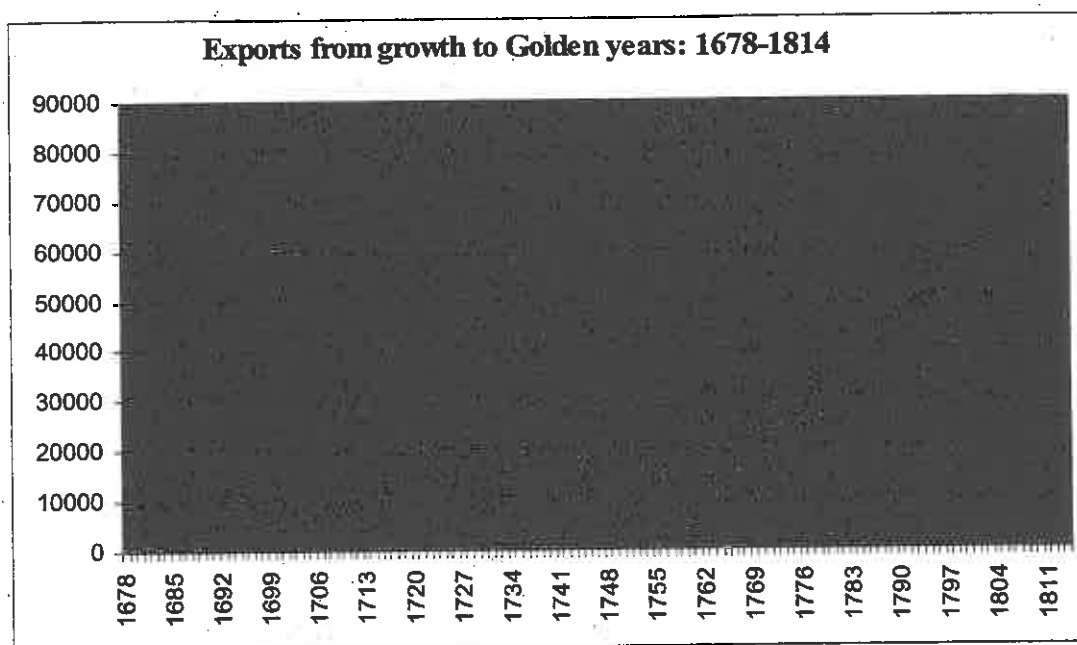
If the market is self-regulated, this does not mean that its inner forces reach a stable equilibrium, according to the hypothesis and considerations on capitalism (and more or less diverse categories of managed capitalism) as mentioned in the introduction and first chapter of the first part. This is exactly where the general evolutionary principle of diversity within a population (variety principle) differs from the neoclassical model. Still, some "evolutionary" economists adopt an equilibrium concept in order to reach a conclusion from their model, but then this position contrasts with the seminal work of Nelson and Winter (Nelson and Winter 1982) and other evolutionary economists (Metcalf 1998a, 1998b, 2001b, 2002).

What matters is the coordination of the market and socio-political forces, combined with its institutional setting and the social environment. The whole socio-economic system could be conceived as a social process of turning compatible

behaviors, attitudes, intentions, and expectations. These attempts of trials and errors for compatibility are not just about competitive intentions, but also about contradictory and cooperative habits and the resulting behaviors. At the core lies the set of interactions linked to feedback mechanisms.¹²⁶

As stated earlier (Chapter I, first part), the coordination problem is a classic one in economics, namely in game theory, but generally based on the sole individual interaction leaving (almost) no room for social structures. This is true, in game theory or any theoretical setting, there must be rules – i. e., structures – that agents have to follow in one way or another (Hodgson 1998a, 2004a). This is not new, of course; but what is different here is the focus on both the agent and the structure as semi-autonomous variables which renders modeling difficult or simply beyond reach from the analysis of historical processes.

Graph n° 2. Port exports (1678–1814)



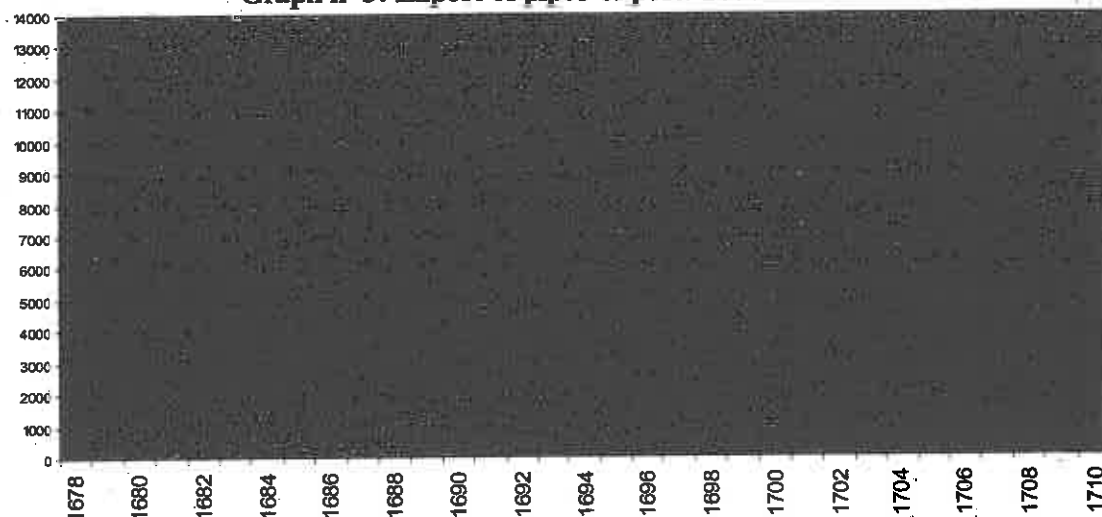
It was during this early period, before 1693 (namely the years 1686-1693, as shown by the next graph), and not after the Methuen Treaty of 1703, that the trade of the Douro wine began to increase rapidly (see the graph n° 2 above). This point is also defended by other authors recently (Martins 2003). The Treaty is not *the* sole cause of the rise of the Portuguese wine trade; Other factors to mention are the fact that the

¹²⁶ Here I adopt the idea of *process* that comes from the Austrian school without giving it the character of generating spontaneous order. For a simple exposition, see Kirzner (Kirzner 1985, Kirzner 1997).

British consumer gave preference to the Portuguese wines relative to the French wines and the overall expansion of wine and alcohol consumption in the United Kingdom (Ashton 1977, Bennett 2005).

On the graph n.º 2, the exports of 1703 correspond to 7270 pipes of wine (as indicated by a square), a much lower figure than the previous decade with figures for 1693 and 1692 being over 12 thousands pipes. However, the wine exports increased in the year following the treaty and the next decade. It is reasonable to say that the Treaty was one of the factors behind that increase. The better competitive conditions given to the Portuguese wines relative to the French wines reinforced the trend of increasing wine exports from the Douro region.¹²⁷

Graph n.º 3: Export of pipes of port: 1678-1710



Comment: The evolution of export before and after the Methuen Treaty of 1703

Source: Conceição Andrade Martins (1990: 217-224).

¹²⁷ Similarly, the data from Boody Schumpeter (1960), starting only in 1700, gives us a rather similar pattern for the years 1700-1710, with 1703 and 1704 corresponding to an increase in British imports of Port and 1704 being the highest export figure for the period 1700-1715 with 9835 tons (tuns, in the documents). The two data sets also reveal that the 1720s are another period of expansions above the level 10000 pipes (Martins 1990) or tons (Schumpeter). Other sources, for the same period, such as the *Imposição do Vinho* and the Customs of the Public Record Office (PRO, Cust 3, Books 4-56) give similar data (Cardoso 2003: 278-279). For the first two decades of the 18th century pipes and tons are probably similar measures but the difference is growing after 1720. At least for the first years of the 18th century it is reasonable to consider them as approximately similar, but even for those years the differences are significant. António Barros Cardoso gives an important reason for this difference: the absence of the figures in Schumpeter for the Port wine imports in Ireland. For the latter part of the 18th century, the differences are simply unacceptable. See the annex for a comparative table of the data of different authors.

I have to say that from 1763 onwards the data of the Alfândega do Porto is similar to the data of Guerner and Forrester, with the exception of the 1790s. See also the data of the MOPTC (AHMOP, MR 35, p. 381-392).

My point is not, however, to deny the effect of the Treaty on the Port wine trade, since it is one element that gave impetus to the Port export with a more secure UK market (Macedo 1982b: 49), but to emphasize as well other prominent factors viz.: the rivalry between England and France (and, less frequently Spain), the Brazilian market, acting often as a compensatory device for the U. K. market slumps, the collapse of the wines of Italy and the Rhine. Of course, I limit my modest considerations about the Treaty of Methuen to the wine sector, and specifically the wine from the Douro region. For views on the other Portuguese sectors, see Godinho or Macedo (Godinho 1955, Macedo 1966a, 1966b, Godinho 1968, Macedo 1982b), as *locus classicus*, or more recent works on economic history or the general history of Portugal, e.g., the volumes edited by Mattoso (1993).

But the error of focusing exclusively on the Methuen Treaty and neglecting the changes of the sector and the very dynamic of the bilateral relationships between France and England is still common and not extraneous to the ensuing curse reading of the works of Smith and Ricardo that gave an account of the absolute or comparative advantage for the trade between Portugal and England.

Paul Bairoch paradoxically overvalued the Methuen Treaty (Bairoch 1997) while at the same time defending the destruction of mythologies in the economic history (Bairoch 1999). In the first volume of his last *magnum opus*, *Victoires et déboires: Histoire économique et sociale du monde du XVI^e siècle à nos jours*, he considers that "Portugal has been related to England since 1703" and then he refers to the "precocity of the Treaty of commerce of 1703" (Bairoch 1997: vol I, pp. 521 and 522).¹²⁸

It would be better to consider the relative character of the Treaty, because Portugal maintained strong diplomatic and commercial ties with England well before the beginning of the 18th century. to illustrate this, there was the long established alliance created by the Treaty of Windsor of 1386, as well as diverse commercial treaties before 1703, namely 1642, 1654 and 1661 (Sideri 1970, Martins 1988, Cardoso, J. L. 2003).

The recent book on the Methuen Treaty edited by José Luís Cardoso (2003) contains several interesting studies. For the present purpose on the wine trade and the

¹²⁸ To avoid any confusion, I cite the original text of the second excerpt: "La précocité du traité de commerce de 1703 - signé à un moment où l'économie britannique était encore une économie traditionnelle - implique le fait que, dès que l'Angleterre s'industrialise, les effets de cette industrialisation se font sentir également sur le Portugal et notamment sur les possibilités de développement d'une industrie textile moderne" (Bairoch 1997, vol. I: 522).

economic policy, I will mention two studies. First, the contribution of José Luís Cardoso shows that the Treaty by the contemporary statesmen such as Luís da Cunha and Pombal was viewed in quite realistic terms and that the recent historiography of the 20th century had already made a critical analysis of the Treaty and its impact on the debate over industrialization and the economic backwardness of Portugal (Cardoso, J. L. 2003). The other study, by Conceição Andrade Martins, deals directly with the impact of the Methuen Treaty on the wine trade. I have nothing to add to the conclusion that the treaty did not cause the increase in the exports of Port as is often believed.¹²⁹

On the first chart [see graph n.º 4 for the years 1678-1710], we can see the upsurge of exports in the late 1680s and early 1690s, reaching a level of transactions that did not fall below, except only partially, with the decrease of exports from 1696 to 1702. In 1692, the increase of export was almost threefold in comparison to the previous year and in 1693 the volume of exported wine reached a peak of 13301 *pipes*¹³⁰ that was only surpassed in 1716 for the first time.

One of the central causes of the increase in exports of Port was the political rivalry between France and England that had a profound effect on the market conditions for the wines from France and the Iberian Peninsula. In 1660, Great Britain increased the taxes on French wines from 4 to 16 pounds the barrel. In 1667, there was even a prohibition for three years for French wines imports. This permitted the relative prices of wines to favor the Portuguese staples. In 1679, France and England were at war; the British authorities prohibited the imports of French wines for seven years. In 1686, the customs duties on French wines increased to 53 pounds a barrel, much more than the Portuguese taxes: 24 pounds. Favored by the existence of these obstacles on the main competitor, the Portuguese wine slowly increased its share of exports, in a market still

¹²⁹ There are other references on the Methuen treaty, namely in the 2003 issue of the journal *História – Revista da Faculdade de Letras da Universidade do Porto*; with the studies of António Barros Cardoso, Paul Duguid and Abílio Diniz Silva (Cardoso, António Barros 2003, Duguid 2003, Silva 2003).

¹³⁰ I use the translation of the Portuguese term *pipa* that is found in the whole literature on the Douro wines since the creation of the Company. As a rule, one pipe is generally about 5,5 hectoliters or 550 liters. Throughout the country and the history, the capacity of the pipe is not constant. In most cases it varies from 500 to 570 liters. But over the centuries, the measure has fluctuated between 500 and 600 liters. The other measures are: the *almude*, the *quartilho*, etc. The *almude* is between 1/20 of 1/22 of a pipe, but we will take the reasonable approximation of 1/20 of 550 liters or 27,5 liters, as can be confirmed when consulting the tax rates practiced on Port wine at the Custom administration of Porto, the Alfândega do Porto, in the 18th and 19th centuries. See the books “*Sahidas – Consulados e Fragatas*” of the Alfândega do Porto (ANTT-AP): lv. 99 (1763), lv. 272 (1777), lv. 444 (1786), lv. 872 (1799), lv. 903 (1800), lvs. 1600–1610 & 1642 (1825), and lvs. 80 & 81 (1833). When not indicated otherwise, I always refer in the text to the 5,5 hectoliter pipe.

used to the French wines. There is some evidence that the consumption behavior changed slowly, giving some signs of inertia. The Portuguese wine in this period was changing, compared to the preceding periods, with the increasing amounts of *aguardente* (wine spirit or liquor) that was added to it. The addition of wine spirit acted as a *focusing device* for the production of Port wine (see the next chapter for more details).¹³¹

As I said, the upsurge of exports started around 1687-88, and 1688 corresponded to the beginning of the Augsburg League War in which Great Britain, allied to Spain and Sweden, fought France for about nine years, the very period in which the exports of Port wine rose from 315 pipes in 1687 to 10295 in 1696 (in 1697 there was a slight decrease to 8650 pipes, probably due to the shift back of some consumers to French wines and the protracted effects of the war on incomes and the substitution effects to other goods).

Another variable, crucial for the period, has to be taken into account; it is the increase of either the number of the British merchants in Portugal dedicated to the Douro wine trade or their overall trade volume. In 1670, the first English firm for trading Port wine, the firm Warre, was established, followed, among others, by Dawson & Harris (also later known, in the 19th century, as Quarles Harris) and Croft in 1688. The British presence was accentuated by the capitalization and cumulative investments made by British merchants that from now on are creating capitalist firms.¹³² The merchants from other nationalities, like the Köpke family, originating from Germany, and already established since 1638, were also interested in the British market.¹³³

In addition to these factors, the context of the period preceding the reform of 1755 is important. First, European economies, after a relative high growth experience with the expansion of the trade relations between 1500 and 1600 were experiencing what Jan de Vries has called an *Age of Crisis* (1976), roughly from 1600 to 1750, and which corresponds to the *Ancien Régime*, an age of transition with restructuring of colonial empires, as in the case of Portugal, and an "exhaustion of early capitalism" based on the trade activities. The period that followed the age of crisis, after circa 1750,

¹³¹ I use the concept of focusing device as developed by Nathan Rosenberg (1969).

¹³² Other firms or merchants to mention are: Job Bearsley, established in 1692; the firm Haughton (later named Morgan Brothers); the Offley-Forrester in 1729; the join endeavor of Nash and Burmester in the following year (the former will found, with the Butlers the Nash & Butler C^o., whilst the latter the Burmester Co., established in Oporto in 1750; the Hunt, Roope Teage & C^o.; in 1751, the A. A. Ferreira Archive, A. A. A. Ferreira, Sub-serie Hunt Roope.

¹³³ The Köpke family will be associated later with the Dutch family van Zeller.

was again of relative growth in the European sphere, announcing the Industrial Revolution, firstly in the UK, then in the Northern European countries. This intermediary period was one of restructuring of the Portuguese economy and the political system; but the change was rather slow and, in a sense, painful, with a transition from the Indian trade to the Atlantic colonial empire. Port wine was just one element in this transformation. While England entered the phase of industrialization, Portugal was still under the *Ancien Régime* mode of regulation. The focus of the policy was primarily on the trade with the colonies, the granting of privileges, and the valorization or preoccupation with the question of the use of the land in which the issue of the Douro fitted in quite nicely.

There was an overall increase and centralization in the regulation of the economic activities through the creation of the *Erário Régio*, the *Junta do Comércio*, the reorganization of the customs (*Alfândegas*), and the creation of the privileged companies.¹³⁴ The function of the *Junta do Comércio* – a state agency playing the role of a kind of Ministry of industry and trade – was the regulation of economic activities and different economic professions (*artes e ofícios*) together with the *Ministério do Reino*, a super Ministry of economic, social, political, and internal matters, with responsibility for taxes, public order, justice, etc.¹³⁵

Some preliminary considerations on the Marquis of Pombal are necessary to clarify my view. The figure and its policy are still controversial in the recent historiography, namely around two set of issues: the religious reforms and the expulsion of the Jesuits, on the one hand, and its role as a founder of the modern social, political and economic Portuguese systems, on the other hand. The first point is not of our interest here, even though it is related to the debate on modernity and the transformation of the Portuguese society. The second point is central to the understanding of the emergence of the modern productive sectors and the capitalist firms, namely the privileged companies such as the *Companhia Geral da Agricultura das Vinhas do Alto Douro*. The impact of the policies of the Pombaline period on the economy, and the working of the economic policy is important, at least in the Port wine sector and in the

¹³⁴ The role played by the *Erário Régio* was important in the reorganization of the public finance but also as a control mechanism on tax collection and expenses. This institution controlled the tax receipts on the Douro wines and the tax collected and debt contracted by the *Companhia Geral do Alto Douro*. See AHTC, ER-Cartórios Avulsos, cx. 17 and cx. 18; and the ledger books ER 5446 (Conta corrente da *Companhia Geral da Agricultura das Vinhas do Alto Douro*, 1807-1830), ER 3489-3497 (Alfândega do Porto), ER 3916 and ER 3505

¹³⁵ See the archive at the AHMOP, *Junta do Comércio* and ANTT, *Junta do Comércio*.

creation of some capitalist firms like the *Companhia Geral*. The effects at the time were economically significant and that the ensuing consequences had a long lasting influence, for example in the regulation of the wine sector.

A complex actuation and regulation of power does not neatly classify Pombal as either a modern or one of the last rulers of the *Ancien Régime*. Such over-reductive typologies do not allow us to offer satisfactory explanations. His policies seem to have one foot in modern times and the other in the old mould of society regulation. His education was in many ways traditional for the small aristocracy with a rather good acquaintance with matters of political economy; he was knowledgeable of the doctrines and the past economic policies in Portugal and other European powers.¹³⁶

During that period (1680-1740), the volume of trade increased almost constantly, with some irregularities from year to year, but, on average, the quantities were trending upward and reached the level of more than twenty-one thousands pipes that would not be surpassed for years, except in 1737 and 1744. From 1744, exports were decreasing (except 1749 and 1753, years that exceed the level of 21000 pipes).

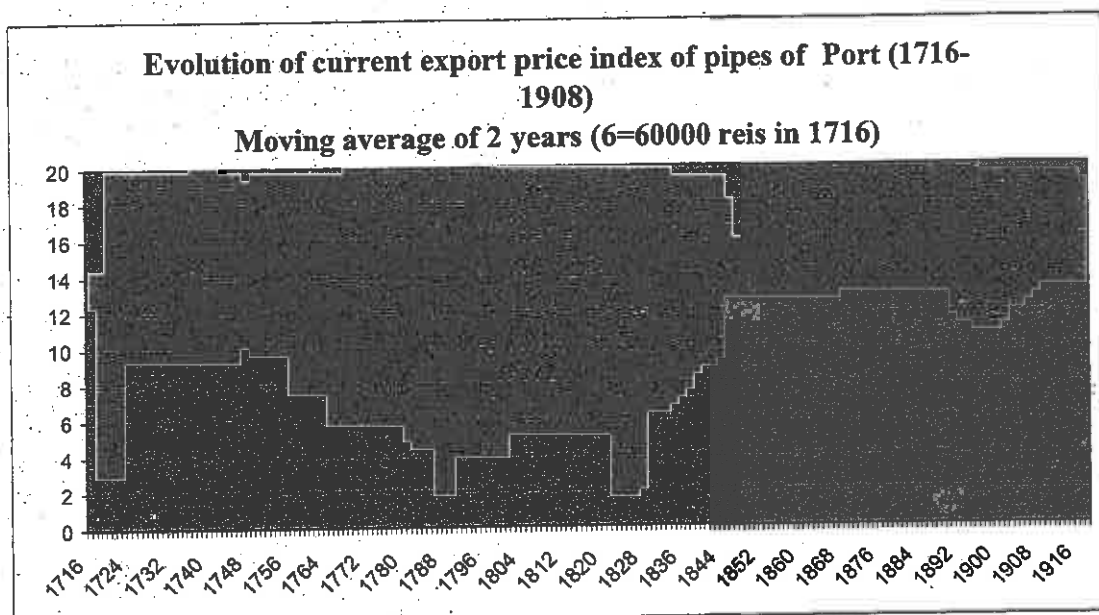
It is important to note that one of the problems of the sector is the variation from year to year of the vintage quality and quantity that influence the current prices and the expectations of both the winegrowers and the wine shippers for the following years.

After a period of expansion of the trade volume, a crisis spread throughout the sector during the 1740s and the early 1750s. During the 1740s the upward movement of exports was curbed and the prices as well as the quality of the Port wine evolved rather unfavorably, the degradation of quality is manifest. General prices dropped, the quality of the product is badly affected. The reputation of the Port wine was damaged, especially in the dominant UK market. The price of a *pipe* is then thousands *réis* in 1750, a sixth of the preceding decade or of 1716. The recuperation would happen at about 1758-59, after the instauration of the new regulation of the sector.¹³⁷

¹³⁶ Marcos 1997; British Library, add. ms. n° 20804.

¹³⁷ I have to thank Gaspar Martins Pereira and António Barros Cardoso, for their comments and questions during the 2004 APHES sessions on Port wine.

Graph n° 4. Current Export price index



Source: Conceição Andrade Martins (1990: 243-244).

The evolution of the price index is rather clear, with a decrease of the price from 1716 to 1750 and a substantial rise at the end of the century. These are of course average prices and I intend to come back to this point later. However, the data reveal one or two anomalies with the years from 1717 to 1749 missing and a more regular series that only start in 1796.

The crisis is also general for the Portuguese economy at the beginning of the second half of the eighteenth century (Bourdon 1970: 65, 71, Sideri 1970: 97), an evolution accentuated by the decline of the gold extraction from Brazil (Serrão 1993).

At the European level, the late 18th century coincides with the end of the *Ancien Régime*, particularly in France, with some signs of crisis in the mid 1750s and with a deeper economic crisis on the eve of the French Revolution. In other European countries, the economic situation is also one of crisis, before the future industrial revolution. France knows the setbacks of the drought in 1785, heavy showers in 1787 and again another drought in 1788 and harsh winter the following year. The effects of each are ambiguous: on the one hand, we find the decrease in the French production of wine, contributing to the stimulation of Portuguese exports in the UK, while, on the other hand, the reduction in French and Northern Europe total output and demand reduces the exports to the French and Northern European markets.

Of course, much of the European economy was still essentially based on agriculture, and in some countries, like Portugal, the situation was somewhat more accentuated when compared to England, for example. Agriculture was often the very last economic sector to be influenced by or even adopt the new technologies and modes of organization.

I can say that the first period of relative freedom of trade and production ends with a crisis of exports and adulteration of the quality of the product. The rise of the British market brought prosperity but in the 1740s and the early 1750s a complex crisis sets in with patent dysfunctions, namely with regard to the quality of the product.¹³⁸

5.5.2. Second period of regulation - Pombal's regulation and its dismantlement: 1756-1834

If the policy followed during the period can be admitted, as a rule, to be mercantilist, Pombal is not an epigone of Colbert, as can be found in some recent or not so recent works on economic history. A good example is encountered in the first volume of the economic history of Paul Bairoch. He compares Pombal to Colbert and defines him as an emulator (*émule*) of Colbert, the great master (*grand maître*) and a precursor of List (Bairoch 1997, Vol I.: 523).¹³⁹ If a comparison or approximation of the two figures can be justified, important differences subsist between them. Mercantilism is quite diverse and in France, and in this respect, Colbert is not Vauban or one of his successors. Pombal and Colbert, despite some similarities, follow different mercantilist policy paths, and this for a number of reasons.

First, they act in different contexts, nationally and historically. Secondly, Colbert neglected the agriculture and gave privileges to some rather large enterprises, neglecting the small factories and productive sectors like wine. Third, the Portuguese case is not a reproduction of some pre-established model, even if Pombal knew and commented on

¹³⁸ See A. Moreira da Fonseca (1955, 1957, 1962 and 1987), G. Martins Pereira (1986, 1990, 1996, 1998 and 1999), and A. Barros Cardoso (2004)

¹³⁹ Paul Bairoch makes a positive appraisal of Pombal's policies, and his economic policies in particular. The differences between Colbert and Pombal can be summarized here. First, the historical and national contexts are very different. Second, Pombal perceived some problems in the creation of privileged companies and reorganization of trade. Third, Pombal knew the policies of Colbert and Richelieu and probably learned somewhat from them, adapting them to his political projects and policies.

Colbert's policies, but did not follow the principles of these policies¹⁴⁰ The letters and the reports he wrote reveal that he knew some of the failures and difficulties of his predecessors in the creation of privileged companies. Furthermore, his policy was original in the domain of the privileged companies, namely the *Companhia Geral da Agricultura das Vinhas do Alto Douro (CGAVAD)* created in 1756, the *Companhia Geral do Grão-Para e Maranhão (CGGPM)* created in 1755, and the *Companhia Geral de Pernambuco e Paraíba (CGPP)* created in 1759. Together with the Fábrica do Rato (a silk factory), they were successful organizations, gathering capital (*cabedais*), organizing the production or trade or both, contributing to the emergence in Portugal of practices of administration and management of productive firms and trading companies. They were also the first trial of stock companies with a wide-ranging collection of capital.

A central figure in the first regulatory scheme is without any doubt the Marquis of Pombal. If the political figure of the Marquis of Pombal is controversial, his economic policy is quite well documented, at least for our purpose of explaining the regulatory setting of the second half of the 18th century, even if some controversies remain. Moreover, the Port wine sector and the privileged companies of the middle of the century are, according to me, much less controversial. There have been few studies about this topic, but those that exist include Correia, Macedo, Carreira and Marcos (Correia 1929, 1931, Macedo 1966a, Carreira 1969, 1983, Marcos 1997). The controversy is typically about the conception of mercantilism (as referred to above): how to qualify the policy of Pombal as mercantilist and also how to characterize his overall policy. My analysis of Pombal's policy is characterized by a twofold argument: (1) Pombal's policy clearly assumes the legacy of the 17th century ideals, socio-economic structure and values, i.e., a specific kind of mercantilism; and (2) assumes a

¹⁴⁰ Vide the letter of Pombal to the Cardinal da Mota dated 19 of February 1742, BNL, colecção pombalina, cód. 657, fl. 69v (BNL, PBA, cód. 657: fl. 69v). For Colbert's policy, see Pierre Clément as a reference for the history of his administration (Clément 1846).

In another manuscript *Discurso do Commercio da Azia* (1748), Pombal considered the failure and the success of the creation of the French Company of Oriental India. He wrote: "Assim servio tãoobem respectivamnete em França onde em pouco mais de meyo secculo nasceu, morreu, e se malquistou não menos de tres vezes a Sua Companhia Oriental sem obter lucro, e sem fazer progresso: e onde no tempo do grande Colbert foi necessario que aquelle illuminado Ministro empregasse em escrever hum dos primeiros genios da Academia de Paris, para bemquistar com a Nação a mesma Companhia Oriental quando procurou e conseguiu restablecella sobre os sollidos fundamentos, que depois daquelle tempo a fizeram subsistir e prosperar com o grande interesse daquelle Coroa, e daquelle Nação que hoje he notorio a toda a Europa" (Pomlial, Relação Terceira, BL, ms 20804, fl. 37, transcription).

Pombal made similar but more extensive considerations on Colbert in the referred letter to the Cardinal da Mota on 19th of February 1742, transcribed by José Barreto (Barreto 1986: 140–142).

qualified natural philosophy for the legal system (e.g., the *Lei da Boa Razão* of 1769), a mixture of liberal policy (in the sense of limits to privileges and fostering some competition between economic actors) with a more than obvious mercantilist inclination.¹⁴¹ In other words, his policy is rather complex, is organized around the concepts of centralization, absolutism, mercantilism, and reform; but it cannot be reduced to a single doctrine.

The issue of the wine—spirit of the regulation scheme of 1756 merits some brief comments. The question of the origin of the new regime of regulation and the new impulse for the Port wine sector is related to the crisis of the end of the earlier period, the 1740s and early 1750s. Mainly, this is a crisis of overproduction coupled with an evident lowering of quality with a decrease of the reputation of the product and the average price (Santos 1916: 148).¹⁴²

First, Portugal is restructuring its global trade (with India and within Europe) as well as its own economic system, formerly based on the Eastern trade and now accentuating the Atlantic routes of commerce. In this context, the decline of the Dutch and the rise of the British commercial empires have to be highlighted, and in fact this is visible in the wine trade from Porto.

Second, the Portuguese State (and related to it, the classes benefiting from privileges) is in need of financial resources, given the decline of traditional colonial products (e. g., Brazilian gold) and the large tax exemptions of the nobility.

Third, related to the other issues, there is a necessity of control over parts of society (the Douro region) and productive sectors, such as wine, gold and diamonds. This control is part of the absolutist orientation of Pombal's policy in general and the command of the key economic sectors and areas.

Fourth, there is a clear adequacy between the mercantilist economic policy adopted by Pombal, who was well informed about and knew well the issues of the privileged companies, and the solution favored by influential groups of interest in the Port wine trade and production.¹⁴³ This point is similar to that given by A. Moreira da Fonseca (Fonseca 1955, Fonseca, Galhano, Pimentel and Rosas 1987).

¹⁴¹ The *Lei da Boa Razão* (Law of right reason) subordinates the Roman law to the Portuguese law. It is viewed as a rationalization of the legal practice and doctrine in the Portuguese system of law. See the ANTT, Coleção de Leis, mc. 6.

¹⁴² See the documents of complaints such as *Comissários...* and the reply, see BNL, SA 57391 v, and at the ANTT MR 632, reproduced in Santos (1916).

¹⁴³ I should come back to this issue when analyzing the *Companhia Geral* in chapter 3.

Many of the great vineyards were in the hands of the aristocracy, different religious orders and some wealthy men who were usually related to trade activities (Pereira 1984a, 1986, 1989b). Part of the reason lies in the necessity of large amounts of capital to sustain even a minimum level of production, e.g., such expenses were typically related to land with vine, wineries with a wine press (*lagar*), vats, barrels, casks (*cascos*), transport from the Douro to Vila Nova de Gaia and Porto, the seasonal workers and recurrent jobs for the treatment of the vines all year long, the maintenance expenses during the fermentation time and ageing of the wine.

This constitutes a complex web of causes, further complicated by feedback mechanisms and interactions that still integrate additional elements such as the rivalry between the English and Portuguese merchants and the local producers in the Douro (the so called *lavradores do Douro*). Part of the new setting is coming from important players of the Douro region (landlords, big producers of wine, speculators, intermediaries for important shippers – the *comissários*) and the city of Porto (again, the aristocracy, sometimes with possession of land in the Douro), in association with the Pombal administration, e.g., the *Companhia Geral*.

The central characteristic of the second period is its regulation authority, the *Companhia Geral*, which organized and controlled the area of production of wine and liquor, the transport along the Douro river, the export to at least four of the main ports of Brazil,¹⁴⁴ the quality of the product, and the prices and quantities traded. I will study the Company in a coming chapter (chapter 3) in some detail, but now I leave aside its internal working in order to analyze its attributions and involvement in the sector.¹⁴⁵

First, during the Pombal era (1756-1777) the privileges and competences of the *Companhia Geral* were increased, and it is only after the fall of the Marquis of Pombal that the regulatory entity began to lose its prerogatives. Moreover, the regulation was pervasive with the result that the fight against smugglers and practices forbidden by state or company law was rigidly enforced. To illustrate this we can take for example

¹⁴⁴ Alvará of 10 of September 1756.

¹⁴⁵ The internal structure of the *Companhia Geral* is of much interest. One aspect is the composition of its administration, dominated by the residents of Porto and not by the residents of the Douro, revealing an institution much related to the centre of power and not so much to the local inhabitants, including the landowners residing in the Upper Douro.

the repression of the Porto turmoil of 1757 and the Severe penalties inflicted on the infringers or encroachers in the Douro (Oliveira and Marinho 1983, Silva 2001).¹⁴⁶

The impact of the *Companhia Geral* was not so much in the quantities produced or exported, given the heavy control and the more restricted production area, but in terms of the type and quality of the Port wine produced and traded; it has increased the quality and modified the type of wine to be generally produced in the Douro. The *Companhia Geral* started a process of quality control that is at the origin of the present quality measures in the sector. The quantities exported, first, were back at the levels of the 1740s and only after the end of the 1770s they reached new heights, in 1777, 1779, and 1780.

So it was only after or at the time of the fall of Pombal that production began to increase again; but this does not mean that the *Companhia Geral* and its policy did not change much in the sector. To the contrary, the principles of regulation had, since that time, been established as a tradition in the sector. The quality of the wine improved, the type of wine selected was a red wine with body and attaining a high alcoholic content, corresponding to the taste of the British consumers. These changes reveal that, by the end of the 1750s, the crisis that started at least in the 1740s was partly resolved.¹⁴⁷

Moreover, despite the fall of Pombal and the partial dismantlement of its institutional building from 1777 onwards and the limiting of its privileges, the *Companhia Geral* continues, with some important restrictions, to regulate the Port wine sector. This is the case of wine tasting for quality control for exports, which continues today much as it always has been done.¹⁴⁸

However, on top of this there are also some new activities. For example, from the late 1770s onwards, the Company is looked abroad for new markets and sent intermediaries to other countries like Russia in 1781. In addition, The export market expanded to include Sweden and Denmark. As it can be seen, these are examples of an innovation that has allowed the company to grow and expand its capacities.¹⁴⁹

¹⁴⁶ See the documents at the BNL, the ANTT and at the Real Companhia Velha archive (AHRCV). A recent treatment has been given by Francisco Ribeiro da Silva (2001) and highlights the importance of the documents as well as of the events.

¹⁴⁷ The white wine has already consumed its decline in the 1790s as can be seen by such figures as the stocks of the *Companhia Geral* at the end of December 1792: out of 2783 entire pipes of wine, 2731 were of red wine and only 52 of white wine, this is circa 2 % for white wines and 98 % for red wines (*Mappa das pipas de vinho de embarque que no ultimo de Dezembro de 1792 se acharão [...] nos Armazens da Companhia Geral do Alto Douro*, AHMOP, MR 35, mf. 29, p. 340).

¹⁴⁸ See the documents at the AHRCV 7.3, especially n° 7.3.026.

¹⁴⁹ ANTT, AP: lv. 444, 1786; lv. 872, 1799.

Another kind of innovation is the destruction of the *Cachão da Valéria*, the rock that was impeding the transport on the Douro river, and hence the transport of the barrels of wine to Vila Nova de Gaia. The natural obstacle was a portentous division that gave importance to the region of Peso da Régua near where it was located; it also acted as a division line between two regions of the Douro: the downstream one (Baixo Corgo and Cima Corgo) that included most of the area demarcated during the second half of the 18th century, and the upstream region (Douro Superior) with a smaller part of the demarcation area of that time but which would be the region of expansion for the coming two centuries, as would be the case to the rest of the Douro East to the Cima Corgo.

For lack of sources for the early 18th century, the comparison of the technological change is a difficult task. However, the few clues at the disposal of the researcher seem to indicate, in the second half to the 18th century, an acceleration in the technological change, something not extraneous to the period preceding the industrial revolution in general. For the Port wine, the change is about the use of wine spirit, quality control, geographical demarcation, and the shaping of the river for proper navigation upstream of Peso da Régua. I will come back to this in the next chapter.

The Company was also behind the increase of exports to Brazil at the end of the 18th century. In general, the other export markets, besides the UK, are growing. The demarcation area is expanded in 1788 in order to answer the pressure of the British market for more imports. Conceição Martins refers to an explosion of consumption in the British market during the last quarter of the century (Martins 1990). But to this pressure, the Port wine will not answer quickly and adequately (Martins 1990): the first decade of the 19th century is characterized by a decrease of exports to the UK.

The Port wine is still a luxury item and no mass market is existing, as we know it today, at least before the very end of the 19th century (Simpson 2004).

The transition was already under way during the last quarter of the 18th century, following the fall of Pombal and the establishment of the *viradeira*, the political changes of the end of the 18th century. These changes are reinforced by the ideas of the Physiocrats, natural law, and the criticisms against mercantilism, which made their headway into Portugal, namely through the reformed University of Coimbra (Verney 1746, 1762, Moncada 1926, 1938/2003); on the other hand, the policy change of the government of Queen Maria I, the so-called “*viradeira*”, initiates the transformation of the Pombal’s edifice of economic control of production and trade. The wine sector is

not left unaffected. If there is no liberalization proper, as we could understand it today, there is an easing of the control and regulation, with a partial abrogation of the privileges attributed to the *Companhia Geral*. In concrete terms, this refers to the beginning of the freedom of export to Brazil and Northern Europe from the regions of Viana, Aveiro, Bairrada, etc.; as well as the maintenance of the monopoly of exports to the prominent ports of Brazil exported from Porto (*barra do Douro*).

The monopoly of selling wine to taverns (*tabernas*) in the Porto area was abrogated by fiat.¹⁵⁰ This constituted a profitable activity for the Company (Pereira 1990: 7) and an important income for merchants and owners of taverns before the creation of the Company (Cardoso, Antonio Barros 2003). After the creation of the *Companhia Geral*, this market had a relative or residual importance, compensating for the bad export years or the years of bad or over-production in the Douro.

However, the importance of this change should not be exaggerated; the main market was the British one and the Porto local market was still residual, in particular during this phase of expansion of the Port wine. Before the setting up of the *Companhia Geral*, indeed, the Douro wine sold in Porto was of an inferior quality as attested by the lower local market prices relative to those for export wines. The establishment of the *Companhia*, the new regulation of the sector introduced two official types of wines: the *Feitoria* wine, on the one hand, and the *Ramo* wine, *vinho de ramo*, or *vinho refugado*, which correspond to second and third quality wine, on the other hand. The *Feitoria* wine, controlled and defined by the Company, was the only wine judged proper for exports to Northern Europe and other nations¹⁵¹, whereas the wine of second quality was destined for export either to the Portuguese colonies, mainly Brazil, or to Continental Portugal and the Atlantic Islands. In the city of Porto, the wine sold was that excluded for exports, and probably of lower quality than the one exported to Brazil or Atlantic Islands, Angola and other colonial possessions.

This transformation as well as the ones mentioned earlier were important modifications but there were also continuities between Pombal's period and the reign of Queen Maria I. One, in the sector of the Port wine, consisted in the renewal of

¹⁵⁰ Through the legislation of the *Aviso* of 22 September 1777, after two decades of control of the sales of Douro wines in the city of Porto and vicinity.

¹⁵¹ In the historical records, such as the Porto customs, *Alfândega do Porto*, usually the reference is made to "Norte"; i. e., Northern Europe. See ANTT AP various books.

prorogation of the *Companhia Geral* for another period of twenty years in 1796.¹⁵² Moreover, taxes increased at the turn of the century (Pereira 1990: 7), contradicting the idea of either a neat liberalization or, in the domain of tax receipts, a complete withdrawal of the Company.

There was, however, a clear sense of decline in the control of the Company in the sector and the regulation as compared to the time of Pombal. The system was in crisis, with growing levels of productions, excessive quantities, lower quality; moreover, the yearly variations were accentuated. The demand had jumped to levels that the system cannot handle efficiently, i.e., in terms of adequate quantities and qualities (Pereira 1990). Whilst trade and production, with the exception of the British and some national merchants, and production almost were hand in hand during the 1760s and 1770s, benefiting from the steady increase of volume, the original scheme of regulation was under accentuated strain. Demand is increasing, with a higher volatility than the previous period, and still higher for the coming regime of regulation.

At the end of the eighteenth century and the first quarter of the nineteenth century, Portugal entered into a new crisis; its absolutist State could not respond to the internal and external challenges and the French invasions would give a fatal blow to its foundations. This crisis affected the working and regulation of the wine sector. As I will show, the wine question is a constant during the whole nineteenth century, a century marked by upheavals and revolutions (Bonifácio 2002). With the French invasions and the end of the Absolutist monarchy, Portugal entered a long nineteenth century from 1807 or 1810 to 1910 characterized by great political and institutional instability. This was also the case for the Port wine.

The period ended with the French imperialist surge and the Napoleonic wars across Europe and the civil war in the Iberian Peninsula. For Portugal this meant the French invasions of 1807-1811, the opening of Brazilian trade (with the 1810 treaty with the United Kingdom), the loss of Brazil, the British occupation, the war efforts, the revolutions of the 1820s and 1830s, the civil war of 1832-1834, especially in Porto, and several *pronunciamentos*. All these events were nurturing the crisis and led to the proclamation of the republic in 1910.

With the Napoleonic Wars, and the invasion of Portugal, the international and internal settings were not especially in favor of the trade for the Port wine. The effects

¹⁵² From the origin, the *Companhia Geral* is settled for a period of twenty years and renewed in 1776 (Alvará of 28/8/1776).

of war on the Port wine trade was ambiguous. On the one hand, the rivalry between France and England typically stimulated Portuguese exports of wine to the detriments of French wines. On the other hand, the war weakened consumption and income of the countries where the main markets for wine were located. Third, there was in Portugal a disruption caused by the French occupation and the British "liberation" usually reducing the supply of wine in the Douro and in Porto and causing low levels of and fluctuating wine stocks. As a global appraisal, war exercised an ambiguous general effect on the wine trade (Hancock 2004).

The period between 1807-1865 is one of stagnation for the sector; at least vis-à-vis the growth of exports. The Napoleonic war and, more directly, the French invasions and occupation of Portugal, negatively affected the production, the stocks and the exports of Port wine. The same could be said of the British army intervening against the French occupation but imposing a heavy toll on the productive activities in Northern Portugal.

Voices against the *Compania Geral* are not new (e.g., the British merchants and the former owners of taverns in Oporto) but rose, especially in the 1820s, as can be witnessed by the parliamentary debates and the critical positions of some politicians such as António B. L. Girão, who was also a landowner in the Douro. Some influential personalities defend liberal ideas against the Company and its president (the *provedor*, Cristovão Guerner), the latter backed by radical politicians (e.g., Ferreira de Moura) and some important landowners that constitute the majority of its investors. However, the small landowners, for most of them at least, are out of the debate on regulation, excluded from direct participation. At least their voice has almost no impact on policy change, except when they can contribute to the interests of one or another party in the wine industry. This is a further argument against the view of self-regulation as a dominating characteristic of the sector from the 1750s until the end of the 20th century.

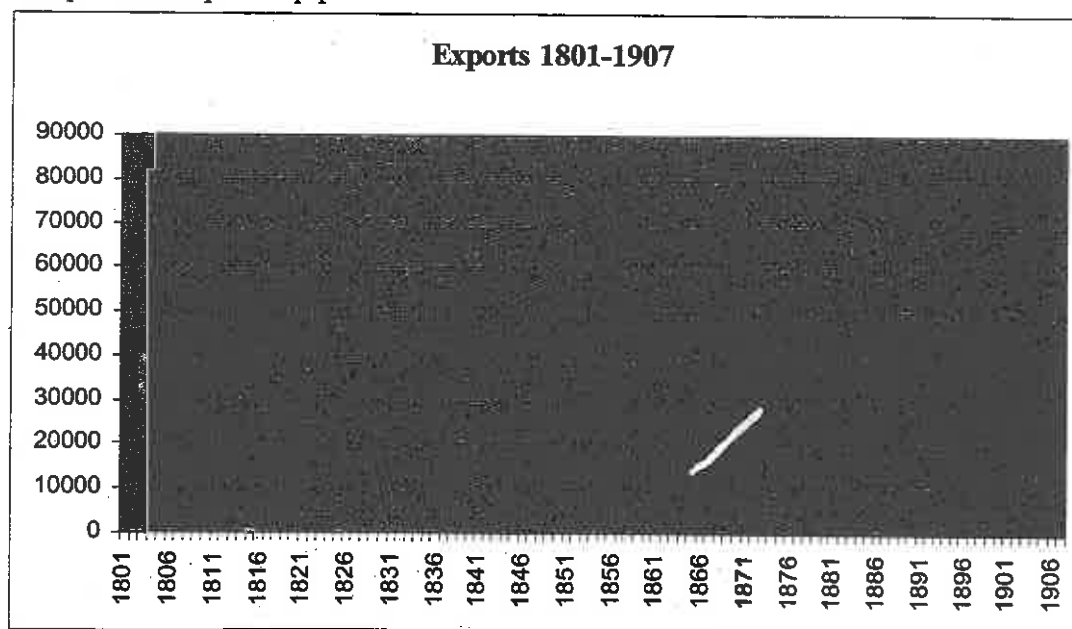
The *Company* is nevertheless maintained, but its prerogatives are diminished substantially. The direct result of this was an end of the quasi-monopoly for exports to Brazil from the Douro, end of the distinction between wine suitable for exports (*vinho de embarque*) to Northern Europe and those for the national market (common wines, *vinho de ramo*). The monopoly of production of liquor in Northern Portugal is abolished (*Ordem* of 31 of March 1821 and *Decreto* of 21 of May 1822).¹⁵³

¹⁵³ There is also the implementation of a new system of *prova*, or tasting, for the Port wine, see *Decreto* of 20 of December 1822.

Nevertheless, this first episode of liberalization is of short duration. In fact, in 1826, the *Vila Francada* and its aftermath brought back the absolutists to power. The unrest did not finished, in 1833, there was some destruction due to an explosion of the stock reserves of the *Companhia Geral* by an absolutist fearing that the wealth of the firm could benefit its opponents, the liberals. The following year the abolition of the privileges of the company is proclaimed. Between 1834 and 1865, there is great political uncertainty, which is translated into instability in the Porto and Douro regions; and, at the same time, the period is characterized by freedom of commerce. This freedom however brought serious disadvantages to the sector in general and to the wine growers in particular: impairment of the integrity of the product that, after the incentive of the excellent vintage year of 1834 (*colheita excelente*) to increase production would result in a serious crisis of overproduction, lowering of quality and fall in prices, a crisis similar to the one of the 1740s and early 1750s. During the same time, one must not overlook mounting competition from Spanish and French wines (Martins 1990).

During the years 1829-1833, the crisis of the main external markets (England and Brazil), aggravated by the civil war in Portugal and the turmoil in Porto, was severe. The year 1832 is the worst of the period, with total exports at the level of 1770.

Graph nº 5: Export in pipes from 1801 to 1907



Source: Conceição Andrade Martins (1990) and my calculations.

5.5.3. Third period – 1834-1865: In search for regulation and order ¹⁵⁴

The period started with the end of the civil war and more settled conditions in Porto. The trade had recuperated from the French invasions in the latter part of 1810 and then from the civil war onwards there was a sharp decline in the trade, markedly so in 1833¹⁵⁵.

For Port wine, the vine diseases and blights like oidium, phylloxera and mildew also meant a dramatic change. These two sets of effects combined have profoundly changed the sector and its regulatory scheme.

I distinguish two phases in this third regime of regulation from 1834 until 1865. The principle of regulation moves toward free market regulation and very unstable state regulation with many changes. Yet it is not a free market regulation but rather an unstable hybrid system with the *Companhia Geral*, at some moments more present than at others, but still playing a regulatory role, albeit diminished, as compared to its role played during the previous period.

In 1838, the restoration of the company for another period of twenty years reestablished the exclusivity of exports from the Douro (*barra do Douro*) with the approval of various sectors of society, e.g., the *Associação Comercial do Porto* (ACP).¹⁵⁶ The record of wine authorized for export, the process of wine tasting and the compulsory documents for the transport of wine in the Douro (*guias* or *bilhetes*) were reestablished. The crisis reappears in 1841-1843 and 1857-1860, the last period with a reduction of exports of more than 40 %.

There was also political and institutional instability in the country, especially during the years 1828, 1832 and 1833. In 1834, the changes were marked by the suppression of the *Companhia Geral* and the first experience of liberalization, the latter being of brief duration. Indeed, as I have just mentioned, in 1838, the company was re-established, with a very different set of functions and prerogatives while reinforcing

¹⁵⁴ In other studies I have developed the opposition of some traders and liberals to the old restrictive system, namely with the action of the Associação Comercial do Porto and its once president Joaquim A. Köpke, the Barão de Massarelos who defended free trade, suppression of the restrictive regulation and the lowering of tariffs on exports of Port wine and on the import of spirit, especially the genuine winespirit (Jacquinet 2006).

For this period and the next I checked my presentation with the one of Pedro Lains (1995) and David Justino (1989) on the agriculture of the 19th century.

¹⁵⁵ ANTT ADP lv. 80 and lv. 81.

¹⁵⁶ Carta de lei of 7 April 1838.

regulation for about a decade, until 1852, the year of the definitive suppression of the regulatory power of the *Companhia Geral*, while continuing as a mere trading firm, and the beginning of mechanisms and institutions of auto-regulation with the creation of the *Comissão Reguladora da Agricultura e Comércio do Alto Douro (CRACAD)*. The composition of the regulation body was of an inter-professional nature. The scheme survived until 1865, when the implementation of a free trade policy occurred, including the Port wine sector, under the auspices of the Ministry of public works and industry (Ministério das Obras Públicas, MOP). This was the beginning of the second phase of the period of freedom of trade (and the first and principal one after the regulatory system started with the legislative initiatives of Pombal).

In the 1850s, a decrease in production because of oidium (mentioned above) resulted in the reduction of stocks and a temporary rise in price followed by another drop. This additional crisis is one of the reasons for the suppression of the Company, which was incapable of restoring order to the sector. I will return to this when I discuss the issue of technological change in the sector.

There was continuity with the period before the first half of the nineteenth century, in terms of institutions of regulation, such as the *Companhia Geral*, but the Port wine is entering a crisis, because of the international instability and because of the reversal of the trends in the main consumer market: the United Kingdom.¹⁵⁷

In Portugal, the debates over the restrictive system, free trade and the Douro crisis were raging. The Associação Comercial do Porto favoured the free trade and the suppression of the restrictive system, as is exemplified by the arguments of the Barão de Massarelos as I have argued elsewhere (Jacquinet 2006).¹⁵⁸

¹⁵⁷ This situation has been accentuated by the unrests in Porto and the loss of Brazil, the two main residual markets that often compensated the harshness of the sectoral crisis of overproduction and low quality.

¹⁵⁸ The documents of the Parliament are either the transcriptions of the debates in the different *Diários* (Journals) and the manuscripts of section 1 on any subject (*Câmara dos Deputados*, *Câmara dos Pares*) and section 2 especially those on agriculture and wine matters (*Comissão de Agricultura*, 1833–1910, and *Comissão Especial dos vinhos*, 1833–1861). Additionally, other documents are available at the library such as the pamphlets and proposals sent by members of the *Associação Comercial do Porto*, among others. In the latter case, the arguments of the Barão de Massarelos can be found in several copies of his brochure on the port-wine system. This document can also be found in the National Archives, ANTT MOPCI maço 1008.

5.5.4. Fourth period – 1865-1907, the liberalization of the sector and dismantlement of the system of the *Companhia Geral*, vine and wine diseases and crises¹⁵⁹

The regulation scheme, based on the principle of freedom, as opposed to the traditional state control, would not be able to overcome the main problems of the sector and would end up in a new crisis that would announce the next regulatory phase of 1907-1932, and even beyond the 1930s.

The second part of the 19th century was also marked, like the previous period, by successive crises, increased competition and political unrest. The two first decades corresponded to a recuperation of the level of production of the last part of the 18th century. In 1886, the exports reached 72987 pipes while the level of 1864 was slightly more than 25 thousands pipes.

This fourth period (1865-1907) was characterized by the elimination of the regulatory role of the *Companhia Geral* and a further move to liberalization of the organization of the Port wine industry. The difficulties of the sector are enormous and both phylloxera as well as the economic crisis on top, together with the political instability, will create a possibility of return to a strong regulatory scheme as will happen between 1906-1908 with the state-centered regulation that will take decades to be settled (basically until the middle of the 1930s).

In 1863, the abolition of the demarcation and the restrictive principles of the regulation opened up the possibility of trade and especially the export from the Douro to all wines. First, there was a loss of quality resulting from phylloxera, which was weakening the vines and spreading slowly through the Douro from 1863 to 1879. The effects of the blight were to encourage the substitution of Douro wines with productions coming from other regions; this is the problem of the wines from Southern Portugal as widely and constantly complained by the Douro winegrowers. Second, the lack of control of the blended wines (*misturas*) of variegated qualities triggered discomfort about the quality and “goodness” of the Port wine produced at that time.

From circa 1810, the Portuguese wines (including the Port wine as the most important) accounted for 60 percent of the total British imports, while in 1840 it was less than 40 percent and by the end of the nineteenth century just around 20 percent. This was a marked increase and some of the causes were well known: by 1850 the French wines made a substantial come-back, approximating 40 percent of British

¹⁵⁹ G. M. Pereira (1990: 12) refers to the period of free exchange (*período de livre câmbio*).

imports. The competition between Port wine and other wines and alcoholic beverages increased. The competitors were the wines from other Portuguese regions and from the traditional producers of wine to the UK (France and Spain), as well as the several alcoholic beverages that found their way to the consumer market at that time (gin, whiskey, brandy, beer, etc.). The Port wine, as noted earlier, had not yet entered the mass market at the time. This will be a prominent change in the following century.

With the abolition of the *Companhia Geral*, there were almost no means to protect and enforce the demarcated area and the respect of the principle of origin. Still, the period of liberalization of trade was also one in which the state invested in roads, bridges, railways and subsidized chemicals (for pest control) and training schools.¹⁶⁰ One good example of the interest of the public authorities in the wine issue, almost entirely focused on the Port wine, was the creation (in 1878) and the establishment in the North of the *Commission of the Study and Treatment of the Douro wines*, directed by the Visconde de Vila Maior.¹⁶¹

At the end of the 1880s, the demand for Port wine fell and competition from other wines increases; moreover, the phylloxera threat, eliminated first in France and then in Portugal, was by then finished. In addition, all this led to excess of production.

The conflict between the producers (*lavoura*) and the merchants reappeared once again this time even more intensely. The export firms usually dominated the situation with good organization and concentration of power while the units of production (the wine growers) were highly divided. The winegrowers were numerous and most of them are small while the big producers are better coordinated and can reach joint agreements much more easily; namely, they can integrate their strategy with the wine merchants, such as the British shippers. The Ferreira family was a case in point because they would make a successful transition into the shipping business.¹⁶²

The institutional system is not apt to solve the pending issues of the sector; namely, freedom of trade does not guarantee the quality of all the bottles and *pipes* of

¹⁶⁰ Often wine and vine diseases triggered off the implementation of programs for pest control and the training of winegrowers to newer techniques of cultivation and combat to pests, as illustrated by the fight against the phylloxera.

¹⁶¹ *Comissão de Estudo e Tratamento dos vinhos do Douro*. See the first Report of the Commission whose first chapter is written by Vila Maior on the Douro region: (Vila Maior 1867). I will come back to this report in the next chapter on wine-making technology.

¹⁶² Bernardo Ferreira, the first husband of Dona Antónia A. Ferreira, obtained a contract of exclusive sales for one of his *quinta* to George Sandeman in 1844 at a moment when Sandeman is one of the rising foreign (Scottish) companies that in 10 years time became one of the main shipper of Port wine and will keep the uppermost position for most of the 20th century. I have to thank Gaspar Martins Pereira for correcting me straight on the transaction between Sandeman and Ferreira.

wine. Adulteration of wine is frequently committed. The trademark "Porto" was not protected for the fortified wines as during the preceding period. Discontentment was on the rise, especially from the producers, the *paladinos* of the Douro, which were leaders of the interests of some groups of winegrowers in the region, were asking for the reestablishment of the state regulation.¹⁶³

Between 1887 and 1905, the production stagnates and the economy is in a recession. Exports in general decrease in the years 1891-1907, especially to France and Brazil (where they plunge by more than forty percent) while the British market is slowly increasing but without compensating for the global downturn.

The government of João Franco changed the institutional setting of the sector, first, by proposing law in Parliament in 1906, which will be rejected, and, second, by imposing his plan on the sector through the instauration of a dictatorship the following year. The legislative change settles a new regime of regulation and control, which will help the overall increase in the levels of Port wine traded and bring back some credibility to the sector, especially with regard to the quality of the wine.

5.5.5. Fifth period – 1907-1932, strong regulation

The long third and fourth periods were marked by chronic problems and the crises and conflicts accumulate to the point of sturdy pressures for change and, mainly, to the return of a strong regulation and control of the Port wine production and trade. This change happens between 1906 and 1908, at the difficult final period of the monarchy. It will bring the first wave of important legislation. Once again, the regulation scheme is state centered and the new organization of the sector comes from the state and is not just the auto-organization of the sector, even though some local figures played an important role, not just during the years 1906-1907 but all through the period until the 1930s in what came to be known as the movement of the *Paladinos do*

¹⁶³ The movement of the *paladinos do Douro*, from the early 20th to the 1930s was composed of regional leaders that were defending state protection and state intervention in favour of the Upper Douro. When referring to the Douro, the *paladinos* were composed of influential individuals in the region, who organized the defence of the main product of the region, the Port wine, strived against the perceived adversities of the region and acted as intermediaries with the regional and central authorities for the design of new regulatory mechanisms in order to create a more balanced port wine sector with regard to the hegemony of the trading firms.

Carla Sequeira's study is a thorough and up to date treatment of the *paladinos* of the Douro and the institutional issues of the port wine sector in the period 1907-1933 (Sequeira 2000).

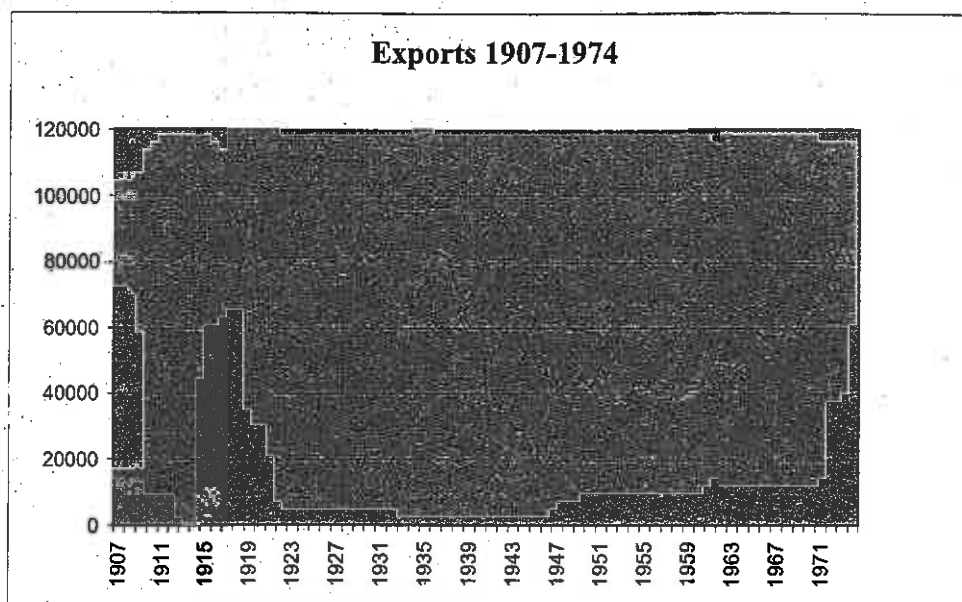
Douro. The movement from 1907 to the early 1930s begged the State for “legislative measure” in favor of the sector (Sequeira 2000: 95).

With the exception of the creation of the Entrepoto de Gaia, the demarcated area for wine stocking in Gaia, in 1926 and 1927, the second frenzy of legislation for the wine sector occurred in the 1930s, precisely around 1932 and 1933 with the development of the *Estado Novo* and its regulation entities (Peixoto 1998, 2003a, 2003b, 2006b, 2006a). There was a simultaneous movement for organization in the sector and an opportunity, from the state, to control and organize the productive sector with the corporatist mode of regulation of the *Estado Novo*. At that time, changes would be made to the institutional setting with few results, in terms of production, after the recuperation between 1910 and 1939. The sector, at the eve of the Second World War enters into a recession that will last up to 1964.

I can thus distinguish two periods between 1907 and 1974: the first, from 1907 to 1932 is one of deep political change in Portugal with the advent of the first republic and the establishment of the dictatorship. This first phase corresponds to the reinforcement of the regulation of the sector and the definition of a new demarcation area with the creation of the *Comissão de Viticultura da Região do Douro*, its regulatory body. I could have called this first phase, and the second alike, a transition (see the third regime).

The second sub-period, from 1933 to 1974 was one of difficulties and stagnation in the Port wine trade, especially from the late 1930s to the late 1960s. Contrary to the preceding period, the sector did not easily overcome the turmoil caused by the Second World War. The British market was sluggish and consumer preferences and the population structure had changed considerably since the middle of the nineteenth century.

Graph nº 6: Port wine exports from 1907 to 1974



Source: Conceição Andrade Martins (1990).

I will treat now the first attempt and settlement of new regulatory norms in the years 1907–1908.

João Franco's legislation brought back the demarcation area and the control of the product, rescuing some of the norms of the previous periods, namely the definition of the geographical areas of production and its ensuing enforcement; the creation of the regulation authority (the *Comissão de Viticultura da Região do Douro*), the Commission of agriculture and commerce, and, finally, the Commission of export inspection.¹⁶⁴

The legislation of May 1907 creates an organization for “controlling and regulating simultaneously the production and trade” and to enforce the new legislation in favor of the quality of the Port wine and to put an end to the Douro crisis, the *crise duriense* (Sequeira 2000: 45).¹⁶⁵

This regulatory entity (CVRD) implemented the legislative program of 1907 and began to enforce some sense of respect for the new legal measures for the sector. In fact, one of its principle aims was to put an end to falsifications. From then on, the CVRD, which was a new regulation body with important prerogatives and power of action had

¹⁶⁴ The first, the *Comissão Agrícola e Comercial dos Vinhos do Douro*, and the second, the *Comissão inspectora da Exportação do Vinho do Porto*, are composed of civil servants, merchants and producers.

¹⁶⁵ The Douro crisis is a continuation of the Douro question and the more general problem of the Portuguese wines of the 19th century, exacerbated by the phylloxera and oidium crises.

at the same time to control the Port wine produced and transported from the Douro to Vila Nova de Gaia while also stopping the falsifications. The *Comissão* was (1) controlling the entry of wines and wine spirit in the demarcated area of the Douro, (2) proceeding to the creation of a record of the landed properties dedicated to the production of Port wine (*vinho generoso*), (3) elaborating the statistics of generous (Port) wine in the region, (4) giving certificates of origin of the wine from the region and (5) recording the wine going out of the Douro (Sequeira 2000: 46).¹⁶⁶ The last mission was to write an annual report on the results of the legislation that created the CVRD (Decreto of May 16 1907, § 27).¹⁶⁷

The CVRD had equivalent power to the *Ministério Público* (Magistrate) for controlling and accusing the infringers of the legal rules.¹⁶⁸ It controlled the movements of Douro wines between storehouses. Some of its regulatory powers were strangely similar to the prerogatives of the *Companhia Geral*, but on a much more limited scale and in a very different historical context.

The composition of the CVRD was based on members (*vogais*) elected by the forty most important winegrowers of the *concelhos* or counties of the Douro. The members chose five of its member for the *Comissão executiva*, the administration body of the entity. The members of the CVRD received the declarations of production statements of the owners of vineyards dedicated to the production of Port wine.¹⁶⁹ These members of the CVRD were very close to the producers and were important intermediaries for the working of the control of the Port wine.

¹⁶⁶ See also the documents of the Comissão de Viticultura da Região do Douro at the Arquivo Distrital do Porto and preserved in the archive of the Instituto do Vinho do Porto (IVP), PT/MD/AC/CVRD, IVP n° 1679, for 1929-1930; 1681 for 1931; and 1685 for 1932-1933. The documents reveal the identity of the expeditor of the transfers of wine from the Douro to Vila Nova de Gaia or other destinations, their quantities, and the destination.

¹⁶⁷ The article 27 of the Decreto of May 16 1907 defines six missions for the CVRD: "1° Exercer a mais rigorosa fiscalização sobre a entrada dos vinhos e aguardentes na respectiva região; 2° Fazer o registo das propriedades que produzem vinhos generosos, segundo as declarações dos proprietários; 3° Elaborar a estatística da produção dos vinhos generosos, na região demarcada, aceitando as declarações dos proprietários, que as deverão entregar nos dias 15 de Novembro e 15 de Maio de cada anno, e empregando outros meios de informação ao seu alcance; 4° Passar certificados de procedencia aos vinhos da região, quando lhe sejam pedidos pelos proprietários, ou negociantes que os adquirirem; 5° Dar baixa na estatística do concelho, à saída dos vinhos, indicando sempre que seja possível, o local do destino, nome do destinatário e meio de transporte; 6° Elaborar um relatório annual, em que aprecie os resultados do funcionamento do presente decreto."

¹⁶⁸ Decreto of 16 of May 1907, art. 36: "A Comissão de viticultura terá legitimidade para accusar em juízo, gozando as regalias do Ministerio Público, as infracções d'este regulamento, commettidas pelos productores ou pelos commerciantes". See also Sequeira (2000: pp. 45-94) for an analysis of the CVRD.

¹⁶⁹ The declarations of the winegrowers were added to a report that these members made for the direction, the Comissão Executiva, of the CVRD.

An interesting aspect of the *Comissão de Viticultura da Região do Douro* is the exclusion of the Port wine shippers and the opposition they made to it from its very creation. In the 1930s, this situation will disappear and the IVP – together with the *Grémio dos Exportadores do Vinho do Porto* - will be the regulation entity for the trading firms while the Casa do Douro will regulate the winegrowers and register the vineyards.

The *Comissão de Viticultura da Região do Douro* (CVRD) will be dismantled in 1932 with the implementation of the legislation of the Estado Novo and the creation of the Instituto do Vinho do Porto and the Casa do Douro: the two regulatory bodies that control respectively the trade and the production spheres of the sector.¹⁷⁰

Before World War I, the problems affecting the sector will not be resolved and at the beginning of the 1930s the new legal framework purports not just to the improvement of the situation of the sector, but also to the creation of a combination of regulatory bodies and their integration into the corporatist scheme of the *Estado Novo*: the Casa do Douro, the Instituto do Vinho do Porto (IVP), and the Grémio dos Exportadores de vinho do Porto (GEVP).¹⁷¹

These organisms will bring about a new regulation scheme with a long lasting stability, beyond the revolution of April 1974. In a sense, this new period is a normalization and radicalization of the changes in the sector between 1900 and the 1920s.

5.5.6. The normalization of the regulatory scheme: 1932-1974

From the 1930s until the 1970s, or even, to many respects, until the 1980s, the institutional structure was almost unchanged, and based partially on principles from the earlier regulation regimes, including Pombal's demarcation and control entity.

For a number of reasons, the creation of the Gaia area for stocking Port (*Entrepasto*) in 1926 and its implementation in the following years and the João

¹⁷⁰ There is a third entity, created in 1933, the Grémio dos Exportadores do Vinho do Porto, the legally structured association of port shipping companies. For the creation of the Entrepasto de Gaia (1926), see the study of F. Peixoto (2006).

¹⁷¹ I translate the term « corporativismo » by corporatism and follow the consensus found in the literature on the history of economic thought on the history of the Estado Novo (Bastien and Cardoso 2004).

Franco's legislation were the main building blocs with which the new regulatory scheme started its legal and formal structure.

Several aspects of the regulation have similarities with the Pombaline system: wine tasting (*prova*), price and production controls, classification of vineyards or properties and the creation of organizations dedicated to the implementation of the institutions and norms that define the system of regulation.¹⁷²

Another aspect, similar to that of the 1750s is the recuperation of the social dynamics by the central State, which was reorganizing the national economy. An economy that was receiving much guidelines by the central government. This period and that of Pombal are characterized by the pervasiveness of the role of the State in shaping the norms and institutions that regulate important economic sectors such as the Port wine.

From the internal vantage point, the sector has not changed much, except for the increase of the concentration and the internationalization of the trade and ownership. On the one hand, we find international economic groups that specialize in alcoholic and non-alcoholic beverages and national firms in the sector of wines that enter a process of internationalization (e.g., the Sogrape company has established subsidiaries or bought vineyards abroad). On the other hand, a third aspect is the diversification of investment at the European and sectoral levels (for example the case of a French insurance company that buys a *quinta*, a vineyard, in the Douro).

The current period and the last one are characterized by a profound transformation of the technology used and the structure of the market. In other words, technology intervened throughout the production process and the trade chain and its internationalization was reinforced.

One of the great differences with the preceding period, especially after World War II, is the increased use of scientific research and the results from research and development. The process in Portugal is very recent, compared to what has been done in France, Italy or California; so that there is still no serious research done on the diversity of the vines and the features of each one. This being the matter of the ensuing chapter two, I will leave it aside now.

The whole story is not limited to the *transaction costs* aspects, as I will try to show (see next two chapters). In substance, the costs of transactions are just one part of

¹⁷² I have dealt with the theme of the regulation of the Port wine sector in a separate publication that extend the arguments presented in this chapter for the period 1755–1948 (Jacquinet 2006b).

the explanation and, above all, the historical method is not consistent with the current paradigm of transactions cost economics, as exemplified by Williamson; the economic agents and the institutions are still conceived as a-historical and individuals as bounded rational, i.e., rational in the sense of a maximization under a constrain or any cognitive limit. This is contrary to the broader concept of procedural rationality as defended by Simon (Simon, H A 1976, Simon 1978, 1992).

5.5.7. Seventh period - the last regulation regime, 1974-2005¹⁷³

This recent period is not being studied here thoroughly for lack of space and access to primary sources. I will analyze it for comparative purpose with the precedent periods and in order to discuss the issue of property rights and geographical demarcation.

The concentration in the sector was more or less regular in the 19th century, with some brief periods of higher concentration, whereas after 1974, the shipping industry enters a new phase of internationalization of markets and a concomitant concentration of ownership. The 1990s is the decade of fusions and acquisitions in the sector.

The process of fusions and acquisitions in the sector is not new, however. What has change is the process of transmission and the nature of the corporations. First, the family linkages and the transmission of partnership between families has, to a large extent, disappeared and was much a characteristic of the 18th, 19th and early 20th centuries with shippers like Ferreira, Page, Lambert, Kingston, Warre, Croft, Archer, Archdeacon, Molloy, Bearsley, Taylor, Flatgate, Bull, van Zeller, Smith, Woodhouse, Quarles Harris, Amsinck, Köpke, and many more.

Second and behind the mechanism of transmission is the transformation of the shipping firms into corporations with important and established investors. The firms are distinguishable from the family business of the past, even if some families are still very influential; most of the shippers are owned by big corporations, and not always coming from the wine industry.

This new nature of the shipping firm has transformed the transmission mechanisms through fusion and acquisitions. Firms are traded not on a family basis and

¹⁷³ For studies on this period, see among others Almeida, Araújo, Brito, Lopes, Moreira and Peixoto (Araujo and Brito 1997, Brito 1997, Lopes 1998, Moreira 1998, Almeida 1999, 2001, Araújo 2001, Almeida 2002, Lopes 2002, Peixoto 2003b).

loyalty of partners but on corporation strategies. A good example of this case is the rise of the Sogrape company and its entry from the table wine industry into the Port wine industry.

The sector is not one of a cartel, even if there is a common interest and current protection on behalf of all the producers to protect the quality of the wine in the case of new entrants as well as fake Port wines from other continents. The legal protection of the Douro wine is one aspect that I will analyze later in chapter 3.

5.6. Conclusions

The analysis of the succession of different regulatory regimes from the 18th century to the third quarter of the 20th century has revealed the prominence of the central state and its agencies in shaping the structure of the regulation of the Port wine sector. This basic assumption, the centrality of the role of the state in the definition of a regulation regime, has shown a high relevance with the facts observed.

First, the evidence for the regulation of the sector does not support the hypothesis of self-regulation, but is more inclined to support the view that the state, through its action, has created a strong regulatory path that has gone through crisis, mostly related to the incapacity of the regulatory entities and the state to find an answer to the wine or Douro crises.

Second, the regulation settled between 1755 and 1777 has opened a regulatory path with a tradition of strong intervention of the state for the definition of the demarcated area, the quality control, the definition and protection of the product, the control of prices and quantities, and the control over transport and stock of wine in the region.

The crises of the early and late 19th and early 20th centuries are related to a partial disengagement of the state in the regulation, leaving to the market and the shippers and winegrowers the organization of the sector. Here again, a central explanatory variable, relevant for understanding the crises, is the retreat of the state in the regulation of the sector.

Of course, the shippers and the winegrowers have an important role in the organization of the sector, but their behavior through the different periods of time does

not support any simple scheme of self-regulation. In times of crisis, the winegrowers call for state action, as they did in the 19th and early 20th century.

The regulation scheme interacted with the production and the trade sectors. My research results extend those of Norman Bennett, Paul Duguid, Teresa Silva Lopes and Gaspar Martins Pereira. The two periods of strong regulation were also those of tighter control of quantities produced, price practiced in the Douro and, in general, an increase or stabilization of export prices. Those periods of high regulation were more beneficial to the wine shippers than the wine-growers. The shippers were benefiting the stable supply and the expansion or stabilization of trade. As it is shown in the third and last chapter, the regulation also acted on the number and costs of entering the trade. During the periods of strong regulation, the number of firms was diminishing and the cost and control of entering was higher.

Chapter II – The technological change of the Port wine

The production of wine is composed of three basic steps: two for winemaking proper and one that lies between production and the trade business. The first step is the viticulture, that is, the complete treatment of the vine from the tilling of the soil, commonly named *surriba* in the Douro, the plantation of the vine to the maturation of the grape, and, finally, its harvest (picking and transport). Two categories of work have to be distinguished: the planting of the vine and the treatment of the soil from generation to generation and the yearly treatment of the vine and the vintage time. The phylloxera crisis has reorganized both types of work and the transformation under course since the late 1960s has also been affecting both in an unprecedented way.

The second step is the winemaking or vinification process that will produce what is called “wine”. This includes vinification in a narrow sense (fermentation of the must and its ensuing conservation in casks or vats) and all the treatment of the grapes to the must and the treatment after the fermentation as well as the conservation in casks and bottles. This work is divided between the winegrowers and the shipper, but most of it is traditionally in the hands of the winegrowers. The treatment given by the shippers is designed to correct the defects of the wine, such as spoiling and to proceed to the central process of blending the Port of different vineyards and vintages.

Finally, the last step is the trade business that extends from the exit of the wine from the winegrower storehouse, in casks, to the shippers' warehouse and then to the market and the consumer, usually in bottles.

Traditionally, the first and second steps are much intertwined because the cultivator is better placed for controlling the second step and rapidly passing from the picking of grapes to the *sensu stricto* vinification. The wine-growers that did both were able to survive better through the ages because they had reached higher scales of vine culture and wine production, permitting them to be better endowed with the capital needed, not just for producing wine, but also for selling it to Porto or to transport the wine from the Douro valleys to Vila Nova de Gaia. Indeed, when the British merchants bought wine in the Douro, after the grape harvest and the fermentation was completed,

it was the responsibility of the winegrower to transport the wine from the Upper Douro valleys to the City of Porto or Gaia.

The frontier between each step is however not always clear, both in practice and historically. In practice, today as through the ages, the vine treatment is integrated into the wine making process, especially for the large-scale operations. This is less true for small viticulturists.¹⁷⁴ This difference and integration between the work of the vine cultivation and the winemaking have suffered deep transformations but it is not easy to sort out the different elements to better understand the articulation of the three steps. As a matter of fact, part of the literature and the historical documents neglect either the vine or the wine. For the first case, as Harry Paul has put it recently in a book on the 19th century transformation of wine production in France: “the vine has suffered from periodic neglect in both production and scientific literature” (Paul 1996: 2). Nevertheless, this is a rather recent perspective on the late 19th century winemaking in France. Indeed, the author mentions that “since the mid-nineteenth century the vine has forced us to pay attention to it, by catching various frightening diseases and then dying dramatically” (Paul 1996: 2), *i.e.*, the overhaul of the wine production system of the post-*phylloxera* era.

The evolution of the interest in vine and wine problems has fluctuated through the ages and spaces. Other documents –such as the treatises and articles on “wine diseases”, which in fact often ought to be named “vine diseases”, and on early agronomy– emphasized the work in the vineyards that was given the foremost attention, insisting on the planting, tilling, grafting, fencing, and training. By contrast, the treatment of wine making was often secondary in prominence.¹⁷⁵

¹⁷⁴ I will use both *viticulturists* and *vignerons* interchangeably for the workers and owners of the vineyards. The equivalent Portuguese terms in the documents are: *lavradores*, *lavoura* (the collective or generic term, very frequent in the 18th and 19th centuries), *cultivador*, *agricultor*, *vinicultor*, and *viticultor*.

¹⁷⁵ This is evident in the works of José Maria Grande, for Portugal in the 19th century; Vicêncio Alarte, in the 18th century; and Alonso de Herrera, in the 16th century; and the works on the *phylloxera*, *oidium* and other blights that affected the vine, and consequently the production of wine both quantitatively and qualitatively. The precise references consulted are: Grande for the 19th century (Grande 1849, Grande 1855) and Herrera and Alarte for earlier periods (Herrera 1620, Alarte 1712); all consulted at the BNL or the Biblioteca da Estação Agronómica Nacional (EAN, Ministério da Agricultura, Oeiras).

All the literature around the concept of *ampélogie* (*ampelologia*), the set of disciplines that studied the vine and its problems, emphasize the diseases and the precautions to take for the grape reaching maturity and being proper for vinification. The term and the study named “ampelology” appeared in the second half of the 19th century, when the vine disease were affecting negatively the second economic sector of France and the first one in the Douro, and disappeared by the turn of the century, when the attention was back to other problems related to the chemistry of wine maturation and the mechanization of the different phases of cultivation and winemaking.

Throughout history, the frontier between winemaker and trader is also not always clear. The wine merchants, especially after the rise of the Dutch commercial empire, enter into the transformation of the wine and their treatment during ageing (maturation) while coming closer to the producers, giving orders and instructions to the winegrowers for producing the wine that corresponds to the consumer taste. Some British wine merchants, established in the United Kingdom and not those in Porto, committed wine adulteration and less scrupulous merchants made "artificial wines" from recipes (Charleton 1669, 1734). Other documents of 1754 attest to the adulteration of port wine by merchants in Porto and, most probably, winegrowers in the Douro; this is the case of the *Letter of the English wine merchants*¹⁷⁶ and the ensuing reply of the Portuguese winegrowers: *Resposta aos Commissários ingleses*.

This document is composed of two parts, one listing the complaints of the wine-shippers against the bad practices of the wine-growers. The second part is a response of some wine-growers denying the charges and reversing the grievances against the wine-merchants.

The wine-merchants accuse the winegrowers of: (1) mixing wine of low quality with Factory wines; (2) using too few people to tread the grapes and extract color and sweetness; (3) adding wine spirit during the fermentation and not right after; and (4) not separating the white and black grapes, affecting negatively the color of the wine resulting from those processes. The four grievances against the winemaker are:

[1] First, by bringing wines from inferior places or buying wines of second quality (*ramo*) and mixing them with first quality wines (*feitoria*), the bad wine spoils the good wine and all the wine is reduced to a bad mixture. The remedy is to avoid mixtures and separate the good from the bad wine because it is impossible to make something good out of something bad.¹⁷⁷

[2] Second, the winemakers usually put too few people in the (tanks?) winepress, who then work few hours and so because of that the wine that results

Two chapters on wine-making from Maria Radich (*Cultura da vinha* and *Vinificação*) were very helpful for understanding the general transformations of the agronomy and the specific scholarship that treated the works in the vineyards and the wineries (Baptista 1987).

¹⁷⁶ The document, the Carta from the Commissarios ingleses, has the following title: Carta que os commissarios ingleses residentes na cidade do Porto escreverão aos seus commissarios nos territorios do Douro sobre a factura do vinho de embarque, e outras circunstancias relativas a este comércio. See the text at the BNL, SA 57391 v.

¹⁷⁷ Translated from the original text: "trazer vinhos dos altos, e outros inferiores, e de ruins sitios, ou proprios, ou comprados, que apenas podem servir para o ramo, e os lotão com os da feitoria; e como o máo sempre prevalece, vem todo esse vinho a reduzir-se a hum estado pessimo. O remedio he não se misturarem esses vinhos, e apartar hum do outro; porque querer fazer do máo bom, he cousa impossível".

is not well produced, impossible to be a generous (sweet) wine and last the necessary time. The solution is also simple and consists of more hours in the lagar (winepress) with the sufficient number of persons to tread the wine;¹⁷⁸

[3] Third, the winemakers have the habit of interrupting the fermentation in the middle of the process, pouring wine-spirit, turning the wine unstable and risking spoiling it by making it bitter sweet and in the North [of Europe] they do not want wines below a certain age. They add wine-spirit with smoke, lees and roasting. All this is easily repaired, avoiding pouring winespirit before 11 of November and using good and unspoiled winespirit without lees [...] ¹⁷⁹

[4] [Fourth,] they do not sort the white grapes from the black ones, so the color of the wine is weakened ..., they add elderberry that gives a bad taste to wine. All those confections led the people of the North to refuse wine except those that were deemed to be safe as sufficient time had passed ... and the cost associated with the accumulated stocks. ¹⁸⁰

Two aspects are important in this document. First, the wine is not getting the right heavy color, purple-red (*vinho retinto*). Second, the resulting taste and sweetness of the wine is ambiguous: brandy added too early make the wine sweeter but less tasty and the light work in pressing the wine does not extract enough color and taste from the must.

The answer of the winegrowers is straightforward suggesting that those problems are the responsibility of the wine-merchants that adulterate the wine in order to get the color and taste with the use of non-vinous material such as elderberry.¹⁸¹

¹⁷⁸ Original: "Em segundo lugar, costumaõ os creadores metter pouca gente nos lagares, e dar poucas horas de fervura ao vinho, e fica por estas razeons mal cozido, e mal trabalhado, e não he possivel que possa ser generoso, e ter aquella duraçaõ que he precisa, A emenda he tambem facil, porque consiste em mais algumas horas de lagar, e em se metter a gente necessaria para trabalhar o vinho".

¹⁷⁹ Original: "Em terceiro lugar, costumaõ na occasiaõ, e tempo da vindima abafar os vinhos na fervura, deitando-lhes logo agua ardente, cujo invento senaõ pôde reputar por menos que diabolico, porque ficaõ os vinhos a modo de mudos, e nunca mais ficaõ quietos, até que por fim se encham de nevoas, ou se fazem agro-doces: e esta he a razaõ, porque no Norte não querem já vinhos antes de certa idade, por lhe não correrem o risco, que por muitas vezes tem corrido, e experimentado: e sobre isto lhe lançaõ agua ardente ridicula com fumo, esturro, e feita de borras. Tudo tem facil emenda, não se deitando a dita agua ardente nos vinhos antes do S. Martinho, e essa que se lhes deitar seja boa, sem vicio, e não de borra [...]"

¹⁸⁰ Original: "[...] não apartaõ a uva branca da preta, o que dá occasiaõ a perder o vinho a côr, e a ferver com facilidade, quando se a apartassem, podiaõ escusar lançar Baga que dá máo gosto ao vinho: e fazem outras confeiçoens, que reduzem o vinho a bebidas confeccionadas, tirando-lhe o seu gosto natural, e duraçaõ. Todas estas astuciosas, e prejudiciaes invençoens fizeraõ acautelar aos nossos amigos do Norte para não pedirem vinhos senaõ depois de passados aquelles annos, que consideraõ bastantes para a sua segurança: em cujos termos seguindo os mesmos vestigios, he certo não havemos de comprar em sima do Douro sem primeiro receber ordens, e seraõ os creadores obrigados a supportar o prejuizo da demora das vendas, annos, e annos: porque não he razaõ, que paguemos as suas culpas, comprando-lhes as novidades, pagando as, e correndo depois o risco nos nossos Armazens, sujeitos aos atestos, e ao damno dos juro do dinheiro, e outras varias inconveniências".

¹⁸¹ The reply of the winegrowers is as follows: « Porém quem lha pôde ter fraudado, senaõ he a Feitoria com os seus inventos, e instrucções? A razão é patente, porque o clima não se mudou, nem as plantas degenerarão, antes já se não conservão vinhas mais que nos sítios proporcionados para vinho maduro,



From these documents; it can be concluded that adulteration of Port wine is thus practiced in the United Kingdom as well as in Porto, Vila Nova de Gaia and in the Douro region.

The integration of the cultivator of the vine, preparing the grapes for reaching the mature state in the vintage period, with the winemaker treating the must to get out of it the wine proper, is a basic feature of the sector. Small producers usually limited themselves to the cultivation, whereas the prominent vineyard owners were able to add to the cultivation the wine press (*lagar*) for the grapes, to produce and control the must more efficiently, to take care of the fermentation and the transfer of the wine to the wooden vats and the ensuing work of maturation of the wine in pipes or casks. The important winegrowers were also able to sell the wine in pipes to the merchants and assume the risk of the transport on the Douro River. All these operations from vinification to transport necessitated considerable capital investments. Both the big landowners often used to work in the wine trade and the wine merchants had sufficient resources for financing all those processes, through the credit that they gave to the small landowners (Bennett 1992-93).

Moreover, the evolution of the wine industry from the late 17th century is a European phenomenon with differentiated national patterns. In what follows, it must be stressed that the Portuguese production of wine and Port wine in particular show peculiar aspects and the very adaptation and transformation processes are not just an exact copy of the French case.

The most empirically tested scientific knowledge flowed to Portugal and Spain from the leading wine producer, France, which was one of the leading scientific powers of that time, both in chemistry, botany and the art of wine making. This flow of knowledge has to be qualified with three additional considerations.

reduzindo a outro fruto as terras mais lentas, e assombradas, que o produzião verde. Pela maior parte se tem extinguido as más castas de uvas, renovado as vinhas das mais suaves, e gratas para o bom gosto do vinho. Na vindima com especial cuidado se separão as uvas sazonadas das que o não são, e se espera até que amadurecem bem. Nos lagares se trabalha o mosto com incansável fadiga; e até nos tonéis teve augmento a generosidade deste licor, fazendo-os de extraordinária grandeza, para lhe unir os espíritos, e valentia, tudo providências que d'antes se não cogitavão [...]

Desta sorte conhecerão os mercadores ingleses, que o vinho de Feitoria sobre bom tinha passado ao estado de melhor, quizerão que excedesse ainda mais os limites, que lhe facultou a natureza, e que sendo bebida, fosse um fogo potável nos espíritos, huma pólvora incendiada no queimar, uma tinta de escrever na cor, hum Brasil na doçura, e huma Índia no aromático; começarão a introduzir por favor de hum segredo, que era conveniente lançar-lhe agoa-ardente de prova na fervura para o pulso, e baga de sabugueiro, ou folhelho de uva preta para a cor. » (Resposta, 1754, BNL).

First, Portugal production traditions, mainly for Port, were already established. This tradition has maintained some national features such as the selection of the vine species. The imported knowledge in new practices did not wipe them out, either the old practices or the traditions. It had to make do with the existing species, adapted to their environment, and even if some foreign species were introduced, the local species maintained their stronghold.¹⁸²

Second, if the transmission of scientific knowledge ran mainly in the direction France-Portugal, the translation is not direct and uncritical. The Portuguese scientists and members of the Lisbon Academy of Science criticized the treatises of the French agronomists and enologists, such as Olivier de Serres, Rouelle, l'Abbé Rozier, Maupin, etc.,¹⁸³ because of their knowledge, experiments and experience in the winemaking process. Third, the interaction process in Portugal is not clear enough to state that the Douro wine production applied the scientific findings of Jean-Antoine Chaptal, Joseph-Louis Gay-Lussac or Louis Pasteur in a straightforward way. Much uncertainty that characterizes the sector – because of the unstable weather, the wars, social and political unrests, lack of financial capital, etc. – had influence on the practice and choices of the winegrowers. As we will see, the *Companhia Geral* was one of the factors of uncertainty in the sector. Its decisions on wine tasting were often considered to be arbitrary. From 1756 to 1852, namely through the definition of different qualities for the wines, from first quality proper for exports (*vinho de embarque* or *vinho de feitoria*) to middle and low quality wine, a hierarchy of prices was established according to the quality attributed.

This quality of wine had two definitions: a legal one by the *Companhia Geral* and the price on the market. The second quality wine (*vinho de ramo*) supplied the colonies and other national or foreign markets. The decisions that followed the difficult task of tasting wine and classifying them into first or second quality, or even simply refused, were often arbitrary. The *Companhia Geral* had the power to force the winegrower to compulsory selling of the wine he had in stocks at the legal prices or at the price defined by the company, through the margin the regulatory entity had in defining what wine could qualify for export and what could not.

¹⁸² See the case of the wine merchant and winegrower Archibold Allen that Francisco Pereira Rebelo da Fonseca describes in his *Memória...* (Fonseca 1789).

¹⁸³ The treatises, dealing extensively with viticulture, appear between the early 17th and late 18th centuries. I consulted in particular Rozier, Serres and Rouelle (Serres 1600, Rouelle 1750, Rozier 1784).

As a general rule, compared to the French winegrowers in the Bordelais or Champagne regions, the introduction of science in a systematic fashion comes much later, first in the late 19th century and then after the late 1940s. This point is supported by the fact that most Portuguese oenologists up to the recent past received their training in the French schools.

What is common to both French and Portuguese cases is the evolution of the science base and the knowledge base that lie behind the wine production. The knowledge base, that answers the *what* questions, what Joel Mokyr calls the omega set, represented by the symbol **W** or propositional knowledge (Mokyr 2002: 4-13), has been growing substantially since the beginning of the 18th century and accelerated since the 1800s. In addition to the knowledge base, the technology and the knowledge directly related to its full application have changed prominently in the last three centuries.

A last theoretical consideration would seem to be appropriate before entering the analysis of the production system and its transformation through time.

The relevant set of knowledge for wine-making is composed of: (1) a growing scientific base with new theories and more and more systematic experiments; (2) a production practice based on the transmission of traditional techniques; and (3) a belief system about nature, cultivation and the way business and society work. The scientific base has profoundly influenced the two other sectors.

The set of relevant knowledge for any productive activity is characterized by imprecise boundaries evolving through time. This is why the set **W** is first a set of fuzzy boundaries, or to say it another way, a set composed of elements that are more or less members of the set, with a measure of intensity for belonging to the set that varies from 0 (element lying outside the set) and 1 (element being completely in the set). Second, the set **W** is composed of a number of subsets. The three most important ones in the wine sector are: the science base (composed of two parts: *theories* about nature, vine, vine diseases and wine-making and *experiments*) and tradition composed of traditional knowledge, techniques and practices, including belief systems.

Part of the reason for the imprecise nature of the set has to do with the existence of belief systems, which often enter into conflict with one another. Another reason has to do with the uncertainty of nature, which is very important in the wine production, as well as human action in any socio-economic system.

In the wine sector, the set of relevant knowledge has gone through some important changes. Discarding the period before the 18th century, the first major change

occurs from the middle of the century to the early 19th century and corresponds to the absolutist regulatory regime of the wine sector in Portugal. The knowledge is mostly traditional and increasingly influenced by State regulation (bureaucratic entities) and the central government in conjunction with the enlargement of the scientific base, the latter often in conflict or modified by tradition.

The second change occurs during the second half of the 19th century with the *pasteurization* of the wine-making process and the reaction to the wine blights: the oidium, the mildew and, above all, the phylloxera.¹⁸⁴ The change in the knowledge base and the practice is radical and shares similarities with the positivist movement in science and scholarship. Probably, this change is more profound than the previous one.

Finally, the last great technological divide occurs after World War II and the intensification of the application of the science base in the wine industry, namely through the systematic use of the scientific knowledge to the selection of vine species, correction of the must, etc. on a scale unseen before.

I must make a final remark relative to the position of Portugal in the production of knowledge in the wine industry. Of course, France was not the only wine producer of prominence that created relevant knowledge on winemaking techniques; other countries like Italy, Germany and those of Southern Central Europe made their own contributions.

From the end of the seventeenth century onwards, as I will argue in what follows, there are basically three periods of deep technological changes in the Port wine industry. The first starts around the second quarter of the 18th century with a higher momentum during the second half of the century of the Enlightenment. It is characterized by experimentation and the first systematic results in chemistry (*e. g.*, the works of Lavoisier, Chaptal, and Gay-Lussac). The focus is on the winemaking process, with some neglect of the vine, with the exception of the selection of red grapes to the detriment of the white wine. This is much related to the action of the *Companhia Geral* that helped the selection of the red wine preferred by the British consumers and merchants. In this precise point, we have an illustration of the interaction between the institutional and technological (productive) variables.

¹⁸⁴ I mean by pasteurization the implementation of the scientific principles of Pasteur and others to the cultivation and winemaking processes and not the technique that is usually called pasteurization and that has also been applied to wine for betterment of the ageing of the wine,

The second period is centered on organic chemistry and biology from the 1850s (or maybe a little before) to the 1900s with a symbolic change with the vine blights: the phylloxera and, to a lesser extent, the oidium. The scientific anchorage to this period is Louis Pasteur with his influential and widely diffused studies on wine and vinegar, firstly published in 1863 (Pasteur 1872/1924), the year of the first outbreak of the phylloxera in France and other European countries, including Portugal.

Finally, the last period of great change comes after World War II, and still continues today, based on a deepening of the previous trends, the high development of technologies and the applied science of oenology in the sector, from the vineyards to the vinification process, and the work of maintenance and conservation that is necessary for obtaining full-blown wine before reaching the market. This last trend based on science (chemistry, biology and genetics), social sciences (organization theory, marketing), and modern technologies (bio-technology) continues and has been intensified in the two most recent decades.

This division between three watersheds must not lead us astray from a basic fact: the continuous and cumulative nature of the technological change in the wine production and its scientific base. This technological knowledge is transmitted on a generation to generation basis that reproduces much of the tradition with each generation adding something new. My first point is that this innovation becomes crucial during the phylloxera and my second has to do with the Portuguese and the Douro realities.

Accordingly, there is a continuous change in the sector before the 18th century, but its importance is due to the cumulativeness of the factors over a much longer period. This is also the point made by Gaspar Martins Pereira (1998a, 1998b, 1999). In other words, the historical heritage of the period that marks the start of my research (circa 1680) is considerable and, in this sense, I do not intend to explain the origins of the process at hand but rather to highlight the logic in the last three centuries.

Finally, these three periods are characterized by profound changes that give a very clear indication of a time before and a time after the changes. Each period, compared to the previous one, has a greater empirical and scientific content, with science playing a central role in the recent changes in the sector.

The state and the institutional setting have played an important role in the productive structure of the sector, through regulation of the productive and trading activities and the intervention in the fight against the vine blights.

1. The technological heritage at the late 17th, early 18th centuries

In this section, I rely heavily on the work of Gaspar Martins Pereira and other scholarly works on wine production and trade.¹⁸⁵ The main idea that I want to highlight is the path dependent nature of technological change by a cumulative process that combines traditions and innovations.

One and until now unique document on vine culture that gives us an idea of the techniques used before the creation of the *Companhia Geral*, is the *Book of Instructions*, the *Livro de Várias Clarezas pertencentes a regra, e governo do Serviso das quintas de Sima do Douro, e Suas Clarezas* (Pereira and Costa 1998).¹⁸⁶ This manuscript presents instructions for the culture of the vine and the winemaking in the properties of João Pacheco Pereira, the most important owner of vineyards in the Douro area (Pereira 1986: 93-118, Pereira and Costa 1998: 162).

An important aspect that the document underlines is the confirmation of the existence of widely practiced techniques that will be prohibited some years later with the setting up of the *Companhia Geral da Agricultura das Vinhas do Alto Douro* and the ensuing increase of the legislation regulating the winemaking industry; namely the addition of sugar and elder berries (*baga do sabugueiro*) as remedies to the deficiencies of the wine, lack of sugar and lack of (red) color.

The first instructions in the document described the work that has to be done after the grape harvest in the quinta do Crasto, in the region of Sabrosa (Pereira and Costa 1998: 166):

After the harvest, the same persons, twenty men or so [...] take the pieces of wood away, dig (escava) the vineyards in the beginning of November [...] once the digging is done, they begin the pruning that can be done in December or January [...] at the end of February or beginning of March, the digging and earthing up of the old vine and after the newly planted vine (bacelo) and jointly [...] with the rising (levanta) so that all is finished by the end of March to the

¹⁸⁵ The other references are: Gaspar Martins Pereira and Natália Fauvrelle da Costa (1998), Francisco Ribeiro da Silva (1996), António Barros Cardoso (2003), Álvaro Moreira da Fonseca (1968).

¹⁸⁶ The original manuscript can be found at the Biblioteca Pública Municipal do Porto (BPMP) ms. n.º 994. It is transcribed in Pereira and Costa (1998) and, if not indicated otherwise, all references in this section are made to the transcription. The exact date of the document is unknown but its content reveals that it is anterior to 1756, the year of the creation of the *Companhia Geral da Agricultura das Vinhas do Alto Douro*.

middle of April; and in the middle of June [...] they make a second dressing of the vine [...].¹⁸⁷

The reading this extract and other ones, showed that these units of production were important vineyards; in the case of the quinta do Crasto twenty men and some women work at the cleaning of the vine after the vintage from November to February and May. In the other production units (quinta dos Pachecos, quinta de Valclaro, quinta do Pego, quinta das Cortes, quinta de Marrocos, etc.), the document referred to ten or twelve and seventeen men (quinta de Valdige and quinta de Touraes) and other workers when needed (*ou os que forem necessarios*, p. 166). These numbers confirmed that the vineyards of Pacheco Pereira were important and reached a yearly production of 300 pipes of wine (Pereira and Costa 1998: 162). It was a considerable amount for that time, especially if one compared it to the total volume of exports of Port wine for the early decades of our period of study (1680-1730). Moreover, the vats used in his vineyards could contain between 10 to 12 pipes, which showed clearly at that time the amount of investment that was necessary in order to be able to produce wine fit for export, the so-called *Feitoria* wine. All the assets that were described in the documents supported the conclusion that the investment in winemaking materials was beyond most winegrowers' capacities because it required vast amounts of capital not just for the installation of the production capacity, but also for running the business from the treatment of the vineyard to the selling of the wine in pipes. Here a clear mechanism sustained the concentration of the productive activities in the sector.

The different phases of the treatment of the vine and grapes and the winemaking were: the removal of the wooden posts and cleaning of the vineyard; the *escava* or digging around the vine stock; the *poda* or pruning, the *mergulhia*, for planting and replacing the missing vine stocks; the *cava* and *erguida*, often referred to in the

¹⁸⁷ Original: "Depois da vendima ficara, a mesma gente, que serão vinte homens, ou os que forem convenientes, e começarão a tirar a madeira, e a escavar as vinhas, tudo no princípio de Novembro, e feita a escava começarão a poda que se podera fazer em Dezembro ou Janeiro conforme for bom tempo, e depois a margulha com a mesma gente, e se repartirão alguns homens para o serviso das sementeiras, e da Vareja de Azeitona, e feita a margulha, que sera emte o fim de Fevereiro, e logo no princípio de Março comessarão a Cava na Vinha Velha, e depois nos bacelos, e juntamente andarão com o serviço de alevanta para que fique tudo feito no fim de Março ate meyo de Abril pouco mais ou menos; e no meado de Junho como o vinho estiver limpo se dara uma redra as Vinhas com tempo fresco, e não com calores que não convem ou em Mayo.

E se não houver margulha poara todo este tempo andarão a por bacelo em algua parte onde for mais conveniente: Declaro que a madeira se podera dar de empreita, e as vides de as tirar se darão a molheres ou como for mais conveniente "

manuscript and in later documents as *levanta*; a third *cava*, the *redra*; and finally the grape harvest or vintage and the vinification.

The *mergulhia* (*provignage* or, more generally, *marcottage* in French) could be translated by *layering*, a process of reproduction of the vine by deviating branches and covering them with earth in order to get roots and a genetically identical second plant after cutting the part with the roots from the mother plant.¹⁸⁸

This process, at the time, was a way of compensating for the failure of the plantation and increasing the production. This process was an evolution of the layering used in Antiquity and the Roman vineyards all over their empire but the technique of layering at that time was systematic and the vine-stocks much more concentrated than in the 18th, 19th or 20th centuries (Lachiver 1988). This referred to a type of culture that renewed itself constantly, avoiding periodic replanting, and in which the original plant was not discernable.

Following the grape harvest and winemaking, the work in the vineyards began in early November (Pereira and Costa 1998), firstly with the removal of the pieces of wood (*madeira de suporte das videiras*). The wood was kept in a safe place until the next season when the branches and leaves were supported once again by the canes (posts) through a process called *erguida*. The wood was rare and expensive during the early 18th century and almost no alternative existed such as the stone or wood posts (*esteios de xisto ou madeira*) or wire (*fios de arame*) for tending the vine. The manuscript indicates the right time to buy the wood posts right after the vintage because it is cheaper (*Declaro que (a levanta) digo a redra se podera dar de empreita também, e se comprara alguma madeira logo depois da Vendima por ser mais barata*, p. 66, at the end of the section *Regra, e governo para o Serviso das quintas de Valdige*).

Another work that was done simultaneously with the cleaning of the vineyard was the *escava* or digging that consists of making a circular hole around the vine stock in order to accumulate rain water and decomposed leaves and constituting nutrients for the next season.

The second step, from December to January, was the pruning of the vine (the *poda*) and the replanting of the missing vine stocks through a process called *mergulhia*

¹⁸⁸ To be more rigorous, other technical differences are used in other cultures but in the reproduction of the vine and to get new stocks, the process of digging the branches into the earth to get roots and then cut the new outgrowth from the mother plant is the general one admitted in the wine industry, at least before the 19th century and the phylloxera revolution.

or the planting of young vine (*bacelo*). The pruning was usually done during good weather conditions to avoid the freezing of the extreme parts of the plant pruned.¹⁸⁹

The third step consisted of a twofold operation: digging the soil (*cava*) and the *levanta* or *erguida*, i. e., the introduction of wooden posts to support the vine and the fruits that it will bear. Digging the soil is a common recommendation of the treatises on agriculture of that time; it started in March or April, while the *erguida* also started also in March or April in some quintas and at the end of February in the quinta dos Pachecos and quinta das Cortes.

The last preparation for the vine was called the *redra* or *terceira cava*, third digging, and started in June, sooner or later in the month according to the average temperature of the vineyard and their exposure to the sun.

Finally, the vintage could begin when grapes had matured sufficiently. As Pereira and Costa explains: "the vintage should begin late, when the grapes were well matured. The picking should start from the vines on the sunny sloping vineyards and just after that the picking will continue in the valleys, the cooler places uphill, where the grapes needed more time to mature. Moreover, more work was needed with the selection of the bunch of grapes, eliminating all the green stems (*canganhos verdes*), especially in the vineyards of the valleys and the top of the highest hills (the *altos*), using just the red stems".¹⁹⁰

The vinification proper or winemaking process closed the cycle of the life of the vignerons. As I have already indicated above, there existed practices such as the addition of elder berries, which would be prohibited after the creation of the Companhia Geral. Another aspect of winemaking that used to be important was the protracted treading (*pisa*) of the grapes in the *lagar* and the addition of wine spirit during the fermentation of the must (Pereira and Fauvrelle 1998: 164). Pereira has maintained that the addition of wine spirit, sugar and elder berries had to do with the idea of "beneficiar" or benefitting the wine to "adequate it to the dominating English taste", a wine that was "strong, dark red, and sweet" (Pereira and Costa 1998).

¹⁸⁹ A recommendation that can be found in the treatises on agronomy and winemaking such as Herrera (1620), Aluarte (1712) and the studies of Rebelo da Fonseca and the other memorialistas of the Lisbon Academy of Sciences at the turn of the 18th century.

¹⁹⁰ The original text is: "A vindima deveria fazer-se tardiamente, quando as uvas estivessem bem maduras. Deveria começar-se pelas vinhas das encostas mais quentes e só depois se vindimaria nas vinhas dos vales, das terras mais frescas e dos altos, onde as uvas precisassem de mais tempo para amadurecer. De resto, praticava-se o escanganhamento dos cachos, rejeitando todos os canganhos verdes, sobretudo nas vinhas dos vales e dos altos, aproveitando apenas os canganhos vermelhos" (Pereira and Costa 1998: 164).

The grapes had to be well trodden by as many feet as possible to extract all the substance of the grape that gave flavor, color and taste; and if the grape were matured, the must could rest for more time (50 a 60 hours); on the contrary, if the grape was less mature (greener), the time for resting was reduced to 30 or 40 hours. In the latter case it is to avoid the transfer of chlorophyll and the green substances that could spoil the flavor and taste of the wine, especially for selling it to the British merchants. The extract of the original text is the following:

[...] after the grapes being well trodden with as much men as possible so that, to do the job well, the wine in the tank (lagar) be conveniently treated [...] well fermented (cozido) without excess. If the grape is green, 30 to 40 hours and if the grape is mature, 50 to 60 hours according to the quality of the wine and the experience winegrower knows when the wine is made and the tank can be opened.¹⁹¹

After the grapes have been trodden, the must had settled without heating too much (*porem não passe de fervura*), and the wine was poured into vats of 10 to 12 pipes capacity with an equal blending of the different musts. After 10 or 12 days, if the wine heated up, the solution was to add a small amount of good wine spirit (one *almude* for each pipe), i. e., wine spirit of first quality (*aguardente fina e de prova de azeite*) and second quality (*aguardente de escada*). In November, it was time to add the elder berries and sugar into the vat. The instruction referred to well trodden elder berries and good sugar from Bahia.

Finally, the document mentioned the practice of the addition of “tiborna” or “vinho mudo”, a wine made with some types of grapes (*malvasia* or *bastardo*), collected at the beginning of the vintage and treated according to a process called *à bica aberta*, with a treading without reaching fermentation and passing the liquid obtained in this manner to the cask with the addition of a proportion of a quarter of winespirit.

This wine, called *vinho mudo*, obtained without fermentation, was to be added progressively to the vats containing the wine that had to be treated in order to correct some of its defects of taste, alcohol and color.

The very organization of the vine growing area did not follow straight and parallel lines as it is used to today but rather the vines were planted according to an irregular pattern and the branches were bearing the fruits supported by wooden posts

¹⁹¹ Um translation of the original text : “[...] depois de bem pizadas com quantos mais homens melhor para que bem trabalhado o vinho fique, se lhe dara de lagar o que for conveniente ate estar bem feiro o Vinho que se tendo algum travor de bem cozido, porem não passe de fervura, se for mais verde trinta até quarenta horas, se for maduros cincoenta ate cecenta horas conforme a calidade do Vinho, e o anno que a gente que tem uso bem sabem quando esta feiro, e capax de se abrir ao lagar.”

(*esteios de madeira*). The process of the *erguida* was essential for the maturing of the grapes. The organization in straight lines and the use of more sophisticated support would generalize in the second half of the 19th century (Pereira and Costa 1998: 163).

The documents also illustrated the growth of a winegrower on two accounts: firstly, through the acquisitions of properties and, secondly, with the plantations of vine in places dedicated to chestnut grove (*soutos*) and sumac (*sumagral*).¹⁹² It modestly confirmed the general expansion of the vineyard in the region of the Upper Douro.

The number of properties of the Pacheco Pereira family seemed to have increased during the first decades of the 18th century; some were bought in the 1730s as indicated in the section of the document that described the quinta do Crasto (p. 168). Some of the properties acquired or inherited were transformed into vineyards. All this indicates an increase of the total land dedicated to vineyards.

Another culture that was important at that time was the olive tree and the production of olive and olive oil. Two of the *quintas* had an olive mill (*azenha de azeite*); a situation which was common in the 18th century with a diversification of the cultures and types of cultures. This diversification could be interpreted not just as the will to take advantage of all land resources (*aproveitamento de todos os produtos da terra*), but also and above all as a response to the uncertainties of Mother Nature. In the years of bad grape harvest or wine spoilage, olive oil, sumac (*sumagre*), etc. could act as compensating resources. For the vine varieties, an aspect not documented in the manuscript, but known from other sources,¹⁹³ was the diversification of vine species, such as red and white grapes, with different maturation momentums that made it possible to average out the extreme effects of the weather: a very hot summer, a very humid vintage time increasing the rotten fruits, etc.

There was behind this selection of products and vine categories another evolutionary process of the selection of the winegrowers, especially the small

¹⁹² The manuscript indicates, on page 168 of the transcription, the acquisition (*compra*, as indicated in the document) of land in 1734, 1735 and 1737. From the same document, refers to sumac, *sumagre* (*Pertence mais a esta dita quinta [de Marrocos] uma vinha que foi somagral de José da Fonseca no Serro do asno ...*) and chestnut grove (*Pertence mais a esta quinta [das Cortes] hum Souto onde chamão Mija velhas ou Ralhadoiro que foi de João Ramos de Figueiredo e hoje he vinha chamada as Barrojas ...*). The sumach or sumac was one of the main products, beyond wine, exported from the Douro, as can be seen in the documents of the Porto Customs (Alfândega do Porto), for example, the years 1763, 1777, 1799, 1800 and 1825 that we consulted at the Arquivo nacional da Torre do Tombo (ANTT, AP lvs. 99, 277, 444, 872, 903; and 1600-1610 & 1642, respectively).

¹⁹³ This practice of mixing the different types of vines is still in practice today and continues to be criticized because of the averaging out of the quality of each type of grapes, leading to poorer wines, but giving more stable production during the harvest. One problem is to get over-matured, matured and not-yet-matured grapes that will enter the wine press (*lagar*) and will produce wines of secondary quality.

winemakers that lived on credit from the merchants and had a lifestyle that was on the brink of subsistence. Once again, there was a great divide between the small and the big producers. The latter more able to mobilize resources in order to survive and compete while the small producers have to get along with the uncertainties of the nature and the production of wine with almost no wealth to offset the bad years.

The characterization of the technology used before the creation of the *Companhia Geral* had the merit of showing the importance of tradition and market in the sector and would enable us to compare what has changed in the following period and also what has stayed more or less unaltered or at least has passed onto the following generations a great deal of tradition.

2. The first technological change: 1750-1830

The second half of the 18th century was characterized by the Lavoisier revolution in chemistry and the changes in agronomy stimulated by the diffusion of the works and experiments of Jethro Tull and his followers, namely the French agronomists. Both had effects on the production of wine. Chemistry, in extending the knowledge base on winemaking and in extending its technology, such as the inventions of Gay-Lussac, a student of Berthollet, himself a collaborator of Lavoisier, contributed to a first major transformation of the work, above all in the wineries.

On the other hand, the French agronomists, following some ideas of Tull (Tull 1731/1733), drew the attention to the problems of the agriculture in a propitious period that was based, firstly, on the decay of Colbertism, which neglected agriculture to the benefit of the industry and, secondly, on the rising influence of the ideas of the Physiocrats in the economic policy sphere and their well known valuation of the agriculture as the fundamental source of wealth.

Both of these changes were paralleled by a diffusion of the works of French and European oenologists. Clear evidence of this diffusion were the numerous monographs published by the Lisbon Academy of Sciences on the work in the vineyards and the technique of winemaking.

For the first period of high technological change, one of the central players was the State and its agency for controlling the sector and collecting taxes for the central administration, that is, the *Companhia Geral*.

The very legislation on the culture of the vine, the making of wine spirit, the classification of wine quality, and the resulting constitution of a hierarchy in the prices, all led to changes in what to produce and how to produce it.

First, the demarcated areas in the time of Pombal but also in the time of Queen Maria I legally limited the places where the wine of first quality (*vinho de Feitoria*) and second quality (*vinho de ramo*) could be produced.¹⁹⁴ The first quality was the only one authorized for exports to Northern Europe, mainly Great Britain, while the second quality (or even lower quality) was sent to the colonies (Brazil) or for the national market, namely to Porto, the biggest continental market for Port wine. This distinction of one type of wine proper for exports and another one, of lower quality, just good enough for the national market was maintained, with or without the Company to the middle of the 20th century. In the last fifty years, the Portuguese market for the Port wine increased substantially and surpassed in volumes the English market.

Second, the production of wine spirit and its use in the confection of the Port wine was generalized and the *Companhia Geral* through the production and control of the wine spirit and the control of the wine (through the process of wine tasting and qualifications, the *provas e qualificações*) stabilized the way Port wine was made by orienting the proper techniques of making wine.

Third, accordingly, the definition of wine qualities corresponded to differentiated prices: one for the Feitoria wine,¹⁹⁵ with legal prices ranging from 25000 to 35000 reis; another for the *vinho de ramo*, fetching 19200 reis; and, finally, other prices for the lower qualities of *vinho de ramo* and the *vinho refugado* and the wine for brandy, i.e., *aguardente*.¹⁹⁶

Fourth, the legislation obliged the separation of vines that bear white grapes from the ones that bear red grapes. The position, decisions and actions of the *Companhia Geral* accentuated the trend that favored the red wine, which was most

¹⁹⁴ The wine was also susceptible to be excluded from the second quality and named "refugado" to be sold locally or used for the production of wine spirit (*aguardente*).

¹⁹⁵ The Feitoria wine or Factory wine is also called *vinho de carregação* or *vinho de embarque*. The legislation distinguished two qualities: a first quality (*de primeira*) with prices fetching between 25 and 30 thousands reis and a second quality with prices between 20 and 25 thousands reis.

¹⁹⁶ See the article 33 of the statute that created the *Companhia Geral* in 1756, the Alvará of September 10; published in the books at the ANTT, *Série Preta*, volumes 2260 through 2272 or in the *Collecção de leis or maço de leis*, caixa 6. The two statutes on the *Companhia Geral* are interesting for the sake of the comparison between what was expected and what seemed to be attained by its diversified and complex action.

wanted by the British merchants and their respective local clients in the United Kingdom.¹⁹⁷

Five, some traditional techniques such as the addition of elderberries to the wine, for giving it a more purple color, was prohibited with the publication of the statute of August 30 1757.¹⁹⁸ This action was to be interpreted as an intervention of the Company to define a pure or authentic wine, without such adulterations as the one cited in the document of the wine-merchants. This regulatory measure had to do with the market trend in the UK and the competition of Port wine against Jerez and other European wines. It was also something defended by the oenologists and some Portuguese writers such as Francisco Pereira Rebelo da Fonseca in his research on the work in the vineyard and the winemaking (da Silva 1788, Fonseca 1789, Telles 1790, Fonseca 1790/1991b, 1790/1991a).

This system of production still continued its way forward, following this technological path, and co-evolved with the *Companhia Geral* acting as a regulatory body. After the invasions of the 1807-1811 and the crises of the 1830s, the Pombaline structure of the Port wine industry continued to crumble, leaving more room for some kind of self-regulation in the sector. Some of the institutions, such as the Company, were contested and their scope of action reduced, following the *viradeira* and the French invasions. Such changes left more room for the interests in the sector to organize themselves, as it was the case with the creation of the British Association in 1811.¹⁹⁹ Simultaneously, the evolution of the sector was also a continuation of the main trends in the Port wine technology and art or making wine that was red, strong in alcohol, with a purple-red color, an addition of winespirit and the extension of the land dedicated to wine eastward, from Vila Real to the Spanish border.

I illustrate here the technological transformation in the port-wine sector with the evolution of the wine bottle. The glass and the bottle of wine appeared in the first half of the 17th century in Britain. It was still of limited use until the last quarter of the 18th century. What was important was that the evolution of the shape of the bottle was radical in the 18th century, acquiring its definitive shape around 1780 or 1790, as could be seen from the figures 3 and 4 (A, B, and C). Mourão insisted that the evolution of the Port wine bottle was slow but steady until the late 18th century (Mourão 1946). The

¹⁹⁷ See AHMOP, MR 35, mf 29, fl. 340-

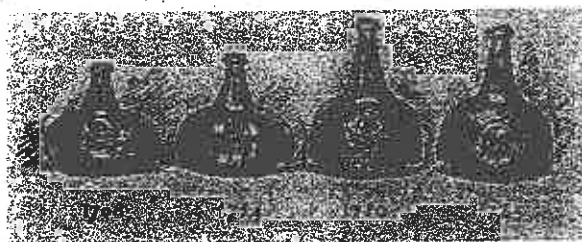
¹⁹⁸ See the *Alvará de 30 de Agosto de 1757*, ANTT *Collecção de leis or maço de leis*, caixa 6..

¹⁹⁹ See the Book I, *Proceedings of the British Association, Minutes of the Meetings of the British Association*, (1811-1850) from the British Association Library.

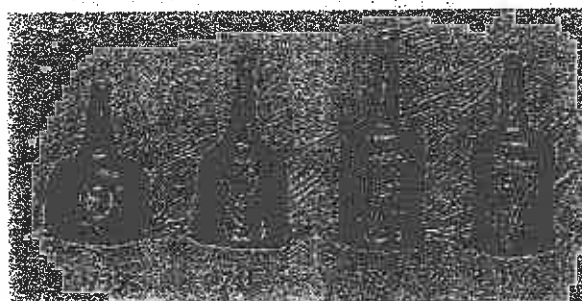
modern shape was thus acquired by 1780, and was much more suitable for transporting, stocking and conservation of the wine it contained.



Fig. n.º 3: Overall evolution of the Port wine bottle²⁰⁰



A



B



C

Fig. n.º 4: Evolution of the Port wine bottle (Source: R. Mourão/image of J. Mirão 1946)

²⁰⁰ The picture is my own adaptation from the image found at the URL "<http://www.history-of-wine.co.uk/html/bottlemaking.html>" (last accessed on 22nd May 2005) and that is most probably a streamlined adaptation from the images of the figure n.º 4 on the same page.

This transformation of the bottle of port was one aspect of the distinction that this wine acquired during the 18th century and would pursue in the following century.

The next great transformation that would accelerate some of the previous trends – such as the rise of the *Cima Corgo* and the Higher or Superior Douro²⁰¹ –, changed radically the way wine was made and finally modify the cost structure of cultivating the vine and making the wine.

3. The phylloxera and other vine and wine diseases (1850-1910)

A prosperidade da agricultura [...] tanto carece de ser melhorada nos seus processos [...] influir eficazmente para o melhoramento da crise geral em que nos encontramos. Redacção, *A Vinha Americana em Portugal*, 1897²⁰²

The *wine diseases*, as they were called in the 18th century, were already quite numerous, but at that time, they were understood in a very different way than they were a century later or, even more, today.²⁰³ Hitherto, the agronomic and vine culture and wine making treatises were still based on tradition while adding, relatively timidly, some experiments, more often than not lacking rigorous treatments. Experiments were rarely systematic before that period and the place occupied by chemistry misdirected. For example, some solutions for the wine blights, namely the use of sulphur, which was

²⁰¹ The Higher Douro or Upper Douro, in this sense refers to the regions east of the Cima Corgo, the most recent area of expansion of the vineyards. It must be distinguished by the traditional meaning of Alto Douro or Upper Douro in the historical documents of the 18th centuries or of earlier periods, because the Upper Douro was the lower part of the actual demarcation area, west and around Peso da Regua. The Portuguese term for the most recent area of expansion is the *Douro Superior* (Pereira 1990: 25-26). The Douro Superior has undergone a rather rapid expansion after the scourge of the phylloxera blight.

²⁰² This is the preamble of the volume 1, first issue, of the review *A Vinha Americana em Portugal*, published after the first attacks of the phylloxera and that shows a typical optimism for the solutions based on science for the wine blight and the fight against other diseases like the black rot (Vilhena 1897).

²⁰³ See the French oenologists and agronomists that were influential in Portugal as can be attested from the reading of the works on agriculture published by the Academia Real das Ciências de Lisboa; the most interesting authors in that regard are Francisco Pereira Rebelo da Fonseca, José Verissimo Alvares da Silva, Vicente Coelho Seabra Silva e Telles. There was no systematic knowledge of the diseases affecting the vine and the wine. This is true not just for the period from the 17th to the 18th century but also for the first half of the 19th century that will cope with the challenge of the oidium, phylloxera, downy mildew, black rot and other diseases with the ensuing answers of the Pasteurian paradigm. From the second half of the 19th century a technological revolution is under way that will transform the wine sector in general and the Port wine as well.

The references of these late 18th century authors are Silva, Fonseca, and Telles (da Silva 1788, Fonseca 1789, Telles 1790, Fonseca 1790/1991b, 1790/1991a).

successfully used against the oidium, were repeatedly applied to other vine problems, but proved to be inefficient against the phylloxera blight.

In other words, what lay behind the difficulty to find an efficient solution to the disease is a weak (scientific) knowledge base. The first, more or less, satisfactory explanations for the diseases appeared at the same time as chemistry built its foundations, around figures such as Lavoisier, Berthollet, and his protégé, Gay-Lussac; the latter was the inventor of a device for measuring the alcohol content of the must in order to decide the best time for interrupting the fermentation process of the vinification (which is called *de a prova* or simply *prova*). His invention, like many others, would spread in the second half of the 19th century and still served as a basic reference in the production of must in the *lagar* (wine press) in stone or stainless steel and its ensuing conservation in vats.

Phylloxera destroyed cultures of vine and ruined most of the small winegrowers and even many medium sized and important winegrowers (Pereira 1989a, 1990, 1998a). The invasion of phylloxera and the attack of oidium marked the work of the winegrowers. The treatments of the vine and the wine that would appear after 1876 and the devastation of the phylloxera went through a radical change, similar to a radical innovation. The planting of the vine was, after this period, thoroughly different from what it had previously been. The same applied to the vine-stock, with the introduction of grafting of European stock on American rootstock. Consequently, the wine produced according to this renewed process was probably different from the one of the 19th century, thus acquiring new kinds of ageing properties. But this was difficult to assess with precision because no one held well preserved samples that were available for a chemical comparison and even if this were possible, chemical analysis had proved inadequate to distinguish the elements of a specific vine species when the sample was too small or of poor quality (Ribéreau-Gayon 1999).

With the eradication of the traditional vine stocks, the wine blight imposed higher costs of production in the vine because of the need to graft the European vine on American rootstock. Following the oidium outbreak and with the appearance of other vine diseases (mildew), the vigneron had to acquire chemicals for effective treatment of the plantation (e.g., sulphur). Consequently, with the emergence of new diseases, such as phylloxera, the role of science had considerably increased. For a good treatment of the transformation of the Portuguese agronomy in the 19th century, see the study of Maria Radich Baptista (1987).

This evolution was also a result of the transformation of science as well as the intervention of the State in the economic sector. The State played an important role in the regulation of the production, the market and the trading business of the Port wine. Again, it played a central role in the response given to the phylloxera and oidium, by lowering the costs of acquisitions of chemicals and the techniques in use, intervening at the level of the transmission of technological knowledge and new practices adopted by winegrowers.²⁰⁴

With regard to the winemaking process, from the control of the must and the treatment and conservation of the wine, the Pasteurian paradigm was essential to understand the technological transformations of that time. Science was directly called for in order to solve the problems of the diseases and the spoiling of the wine.

The combination of the Pasteurian paradigm and the new agronomy led to new responses to the problems of production. The science of oenology appeared as the discipline that linked the problems of the vine (the cultivation) with the problems of the wine (the work from the wine press, fermentation process to the ageing and blending of vintages) and integrated a substantial scientific knowledge base. From then on, the oenology was construed as a scientific discipline and, with some similarities with medicine; it keeps working with an important component of "art", the art of making wine, whose knowledge was much more difficult to define with precision.

Art and science were combined in a revolutionary way; this meant that science modified substantially and irreversibly the system of beliefs that underpinned the traditional art of wine-making. A good example of this was the evolution of the decision of stopping the fermentation, the *prova*,²⁰⁵ a crucial decision that influenced the quality of the wine, its basic components such as alcohol content, sugar, color and astringency.

In the 18th century and still in the first half of the 19th century, the technique of evaluating the maturity of the must, in terms of taste, smell and concentration of alcohol was based on experience alone, or almost.²⁰⁶ In the second half of the 19th century, the

²⁰⁴ The documents of the ANTT AHMOPCI, section of agriculture, mç. 948 and mç. 1008 contain useful information about the action of the state in the backing of the replanting of the vine after the phylloxera crisis.

²⁰⁵ The usual expression in the Douro was "dar a prova" when the must reached the maturity for being transferred to the vats. See Vila Maior (1866: 8 *et seq.*)

²⁰⁶ It consists of controlling the fermentation and deciding when to stop it and fill the vats with the newly made wine. The description of the process of "dar a prova" that is still used in the 1850s 1860s is well characterized in documents such as the report of Vila Maior (1866: 8): "D'este ponto em diante os homens [que pisaram as uvas] deixam o lagar, mas presta-se assidua atenção à marcha da fermentação.

instruments of measurement were well diffused, the knowledge of how the fermentation process occurred was better known, especially through the contributions of Pasteur and his followers. After the phylloxera outbreak, the basis of knowledge on the fermentation process changed very much. From then on, much more was known about how and why things happened the way they did.

In Portugal, oenologists and wine specialists like Ferreira Lapa, the visconde de Vila Maior, Afonso Cabral, Francisco Vilhena, and many others were examples of such a major transformation in the knowledge base and the practice of viticulture and vinification together with the spread of oidium, phylloxera, and mildew in the Douro and other wine-producing regions of the country (Vila Maior 1875, Vila Maior 1876, Lapa 1879, Lapa 1885, Vilarinho de São Romão 1889, 1891, Cabral 1894, 1895, Vilhena 1895, Coruche 1896).

Throughout the country in the wine producing regions, several experimental stations (*Estações de viticultura*) were either created or rented for making experiments on vines in order to find a solution to the disease. The solution found was the use of American rootstock onto which the local varieties were grafted. However, the solution in France and Portugal encountered resistance and erroneous processes persisted, like the use of sulphur.

The State rented first some properties for the breeding of American rootstocks and later on more systematic investment were made in helping the transmission of techniques and knowledge.²⁰⁷ In 1914, this was the case with the creation of the Quinta de Santa Bárbara where experimentations started on a much more systematic basis.

If the Portuguese memorialists on agriculture and winemaking were sometimes critical with regard to the French oenologists, they did in fact tend to favor a greater role for science and experiments in the management of the vinification process. The *Traité*

Observa-se se a temperatura diminui, se a espuma se torna menos volumosa, e se o cango começa a destacar-se dos tampos do lagar. Quando aparece o cheiro vinoso bem declarado, quando a doçura do mosto tem diminuído, e que a adstringência se manifesta bem sensível, tira-se a prova, vertendo um pouco de mosto vinificado n'um prato de porcelana branco e limpo para ver se está bom do corpo e cor, se forma lagrimas escorrendo pela porcelana, e finalmente se o cheiro e gosto vinosos e a adstringência fornecida pelo engaço estão bem patentes. É então que se envasilha, adicionando-lhe logo ao entrar para o tonel a aguardente fina na proporção de 4 a 8 por cento do volume do vinho".

In a note the author refers to the use of the pesamosto or glucometro, instrument that was used increasingly in combination with the other criteria employed and described above. "Alguns colheiteiros empregam o pesamosto ou glucometro, não só para verificar o estado de maturação das uvas, mas até para reconhecer quando a fermentação chega ao ponto conveniente para envasilhar o vinho. Uns tiram o mosto quando elle marca no glucometro zero para ter os vinhos seccos. Outros envasilham o mosto ainda com 4 ou 5 graus de assucar para que a fermentação continue na vasilha." (Vila Maior 1866: 8, n1)

²⁰⁷ ANTT, MOPCI, Agricultura mç. 1008.

de viticulture by Jules Guyot, first published in 1860, is a good example of the type of oenology that was spreading throughout Europe.²⁰⁸

Of course, the spreading of innovation and new technological knowledge has been unequal. Those winegrowers closer to the exporting business were better informed and had more demanding customers who asked for a wine of a certain style, the style of the shipping company and favored by its customers. Some of the winemakers were not very receptive to the new agronomy and oenology which worried the agronomists (Baptista 1987).

Several changes in the technology of vine culture are worth mentioning, namely the classification method of Moreira da Fonseca or the method of "punctuation" (*método da pontuação*) that was an innovative and well-balanced method of classification of vineyards (Fonseca 1944, 1949b, 1952, Fonseca, *et al.* 1987). The applications started in the 1940s and changed the way the management of the production of Port wine was organized and the quotas of production distributed. It also defined discretionary prices for the different quality of grapes that were planted in the different types of soils classified.

One aspect that defines not just the landscape but the whole culture of vines in the Douro is the system of terraces (*socalcos*) and the management of the slope of the land. There are now at least three systems in use: the old system before the phylloxera crisis, which is based on shorter width of each *socalco* or terrace, often with two rows of vines and small separating walls between each terrace; the post-phylloxera terraces, wider, with higher walls and often with 5 or more rows of vines, with a higher density of vines; and the so-called *vinha ao alto* (vertical planting) with a still higher density of plants.²⁰⁹

The combinations of these different types of "terraces" has shown an important element of path dependence; the old methods were adapted or preserved in many properties so that the organization of the work in the vineyards and the introduction of new techniques and the mechanization of the harvest and the treatment of the vines was conditioned by what was already there (the existing separating walls and the irrigation system). The resistance, at first, against the American root-stock can also be understood in terms of path dependence.

²⁰⁸ The book is widely diffused in the wine producing regions such as Portugal and Spain; there is a Spanish translation of the first part of the treaty treating the culture of the vine and the treatment of the grapes.

²⁰⁹ There is one more category, more recent, the banked-up terraces that is better fitted for mechanization.

4. The third wave of technological change: 1960-2005

After the big change caused by the phylloxera and other wine diseases, the wine industry was preparing for another wave of technological innovations, leading to new types of wines: less acidic, less astringent, with a stronger chemical analysis and manipulation. This was the modern oenology revolution with names such as Louis Genevois, Jean Ribéreau-Gayon, Émile Peynaud and many others,²¹⁰ following the seminal works of Ulysse Gayon, Alexis Millardet, and Louis Pasteur in the second half of the 19th century.²¹¹ I could describe the process as the use of science and technology for the personalization of wines, adapting them to the evolving tastes dominating the market or responding to market niches. There was a vast literature on the creation of wines with character, with *style*.

In this new wave of technological change, scientific knowledge increased substantially its place in the sector and shaped what a wine looks like today, through the diffusions of the results of basic applied research, often related to the existence of agronomy faculty or institutes. Moreover, experimentation was more systematic after the spread of the oidium and the phylloxera. There were profound changes in the field of agronomy in Portugal, namely in the field of viticulture and winemaking (Baptista 1987, Radich 1996).

In the Port wine sector, this period was characterized by the professionalization of the wine specialist or oenologist in the wineries and the port wine lodges in Vila Nova de Gaia. Their job was new and their scientific training thorough, mastering the knowledge of the underlying processes of maturation, ageing, blending, organic chemistry and tasting.

At the same time, in the early 1930s, the institution of the *Instituto do Vinho do Porto* and the Casa do Douro, two regulatory entities, the former for the Port wine trade and the second for the Douro wine-growers, had an important impact on the stabilization of the Port wine system, including the (legal) definition of the product.

²¹⁰ Most of the names are from France, the dominating country in the wine production and winemaking techniques. Other members of the French oenologists are: Laure Gatet and Ribéreau-Gayon.

²¹¹ Gayon, a student of Pasteur, together with A. Millardet, further the understanding of the mildew and the way it can be efficiently fought. They contributed to the discovery of the mixture of cooper sulphate, called "bouillie bordelaise", for treating the vine and protecting them from mildew.

This definition was also a technical definition, giving lower and upper boundaries for the alcohol content that the qualifying wines must satisfy. There was also a classification of the vineyards dedicated to the production of Port wine, the so-called *método da pontuação* of Moreira da Fonseca, which was further perfected in the following years.

In this case there were strong interaction between the regulatory bodies and the shipping firms and the winegrowers, both being actors of change in the technological transformation of the sector. From the 1960s and 1970s, the sector was going into another important transformation that pre-figures the rise of the biotechnologies of the 1990s.

5. Analysis of the transformation of the Port wine sector

If one looked, some two decades ago, at the literature on the Douro and the Port wine, the striking feature was one of non-integrated and dispersed elements of scholarship of very variable quality.²¹² Much of the research work was descriptive and when we found some theoretical studies, they were or are generally fashionable theses like the theory of dependence, the theory of product cycles, the studies of mercantilism, etc.; following a theoretical framework that did not take the complexity of the case seriously.

More recently, two developments are worth emphasizing. First, some theoretical works on the port wine are based on such paradigms as the theory of transaction costs or the theory of network. This shift was mostly welcome, although some of the narratives and results were highly questionable. Secondly, the historiography of the Douro and the wine production and trade reached a scholarship of high quality that allowed the

²¹² Since the 1940s, new interpretations of the Douro history and new documents have appeared, firstly in the 1950s and then, more recently, in the late 1980s, and 1990s. The work in the 1940s and 1950s are done by some academic and erudite scholars, lacking theoretical contents and systematic research of the data available. Examples of theses studies are given by Guerra Tenreiro and Moreira da Fonseca. See the following note for references

Later in the 1970s, other academic works on the wine trade between Portugal and England have appeared and did not bring much more facts but were following the trend of the theory of dependence, often lacking a good theoretical background (see the references of Sideri and Schneider, in the following note). Here my contribution is to increase the theoretical content and correct the interpretation of first the process of technological change and two the importance of the institutional analysis.

Recently, much more interesting research has been published, mainly in the GEHVID, a group of historians and other scholars specialized in the history of the Douro and the Port wine at the Universidade do Porto (Faculdade de Letras).

deepening of our understanding of historical processes such as the technological and institutional change.

Nevertheless, before proceeding to the treatment of these descriptions, there were a few rare, traditional, though at the same time somewhat dated historical works of valuable scholarship which provide a very useful starting point, despite some shortcomings. I think about Guerra Tenreiro and Álvaro Moreira da Fonseca, and, for the latter, Lúcio de Azevedo.²¹³ Other authors were worth being consulted and presented good scholarly works helped us to understand better the sector today.²¹⁴

The first case was the one on the issue of beneficial or detrimental trade between Portugal and England from the eighteenth century onwards. Sideri defended the thesis that Portugal got trapped in an economically dependent relationship with Great Britain and was "increasingly incapable of developing a balanced economy" (Dauril 1971) and this incapacity was based on the various Anglo-Portuguese treaties from the mid 17th century onwards, until the Methuen treaty of 1703. Fisher was more balanced in defending that the period (1700-1770) was beneficial to both countries (Fisher 1963, 1984). However, if, in some respect, the latter author might be closer to the truth, both did not tackle the internal problems of Portugal, at the level of the country itself, or even its colonial empire. They did not treat carefully the very dynamics of the Portuguese economy and the factors behind the phenomenon of backwardness. There was no serious treatment of the relations between the Monarchy, the landed aristocracy, the public finance problem, and the British and Portuguese merchants. All these factors were part and parcel of the story of the Port wine and no matter how important was the trade with England was, they could not be neglected or just referred to *en passant*. The context of the Port trade is much more important than apparently is thought by Sideri, but the very narrative of the production and trade of Porto is complex. Entities involved in the sector were evolving; there were no fixed social classes and political rulers, such as the nationalistic leaning of Pombal, a controversial and multifarious figure of the Portuguese history, as documented by Borges de Macedo, one of the main references cited by Sideri (Macedo 1982b).

Another aspect which was much neglected was the economies of scale and agglomeration. The Portuguese firms were relatively small in the production industry

²¹³ All the relevant works, with the exception of Borges de Macedo, are: (Azevedo 1922, 1929, Fonseca 1940, 1941, Tenreiro 1942a, 1942b, 1943, 1944, Fonseca 1955, 1957, 1962, Fisher 1963, Sideri 1970, Schneider 1980, Fisher 1984).

²¹⁴ See the studies published in the various issues of the review *Douro - Estudos e documentos*.

and as were the national merchants in the Port trade. The British industrial revolution was already gaining momentum and already at the beginning of the 18th century and its manufactured goods were on a larger scale than the Portuguese. This was also the case of the British traders of the Port wine or the English shippers, who were controlling almost sixty per cent of the ships that Portugal had in the ports and who were doing business with the outside as well as the colonial empire.

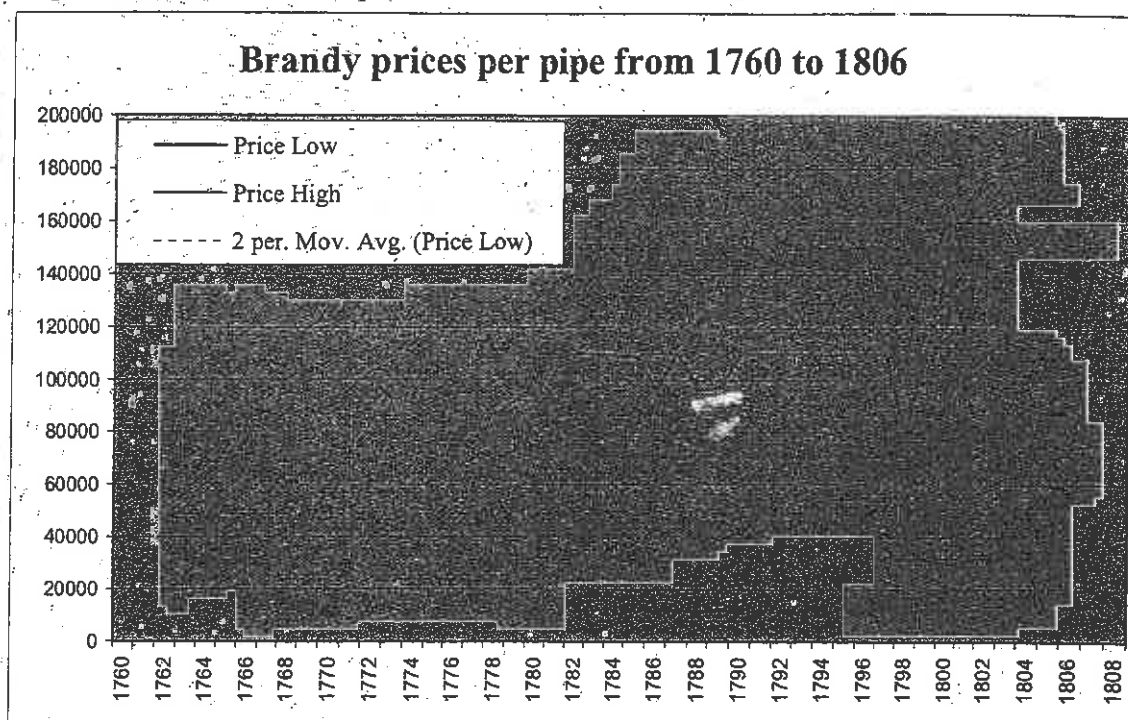
6. Costs and prices

In order to deal with the economic problems of technological change and the production system, I surveyed here the issue of production costs and the production prices. The data available from official publications or from Conceição Andrade Martins (1990) and Norman Bennett have been very useful but unfortunately incomplete. It was almost impossible to obtain from available archives simple price lists of economic transactions such as the price paid by the British merchant in the Douro or the cost of labor for the work in the vineyards. No systematic information was available, so I had to rely on either some punctual documents on costs and on the price of one of the principal inputs for making Port, which was brandy or wine spirit.

I used in the following pages prices of inputs or directly related to the wine-making activity. I leave for the next chapter the export prices. It must be clear that the prices for brandy are important for both the wine-maker in the Upper Douro and the wine merchant in Porto. The two were using brandy for making and conserving wine and for blending and ageing, respectively.

The prices that I have used are once again subject to caution. Sometimes they are official prices (such as during the time of the Companhia Geral and the regulatory period of the Casa do Douro and the Instituto do Vinho do Porto). At other times, the prices were either average prices or estimates from the administration or just the low and high prices (extreme prices) of accounting books from shipping firms.

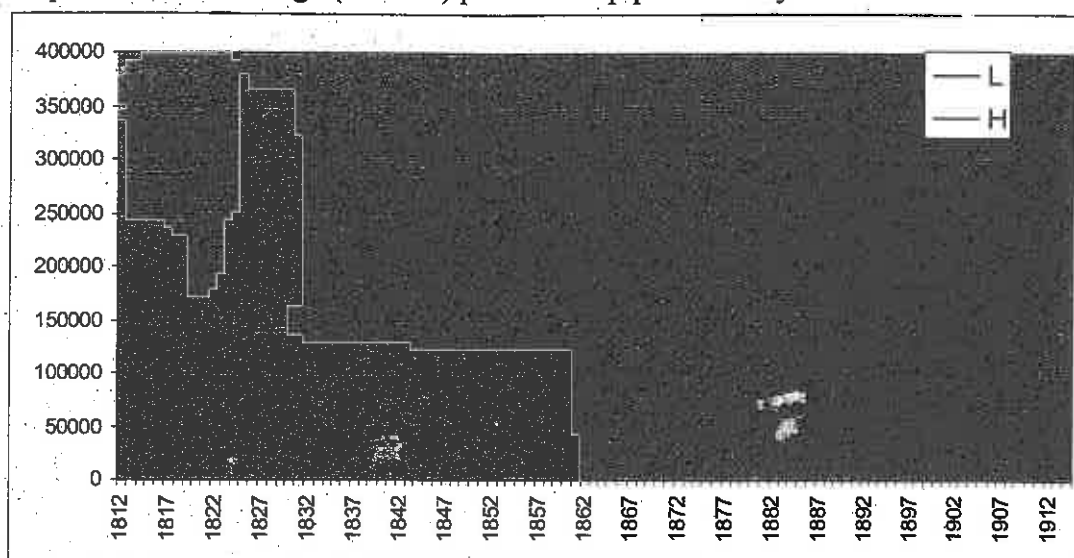
Graph n° 7: Prices of wine spirit



Source: Norman Bennett (2005: 115–116).

One central aspect of the technological system of Port was the addition of wine-spirit or brandy. According to Norman Bennett, if the quantities used varied, the evidence from the late 18th century to the early 20th century indicated an upward trend that often fluctuated above the 10 or 15 %. Given that proportion of wine-spirit used in the Port wine and the higher prices paid for brandy relatively to wine, this aspect was central to the understanding the cost structure and the evolution of the technology. During the time of the Companhia, the price of brandy rose in the end of the 18th century (graph 7). The cost also had to be associated with the incapacity of the Companhia of supplying the brandy the Port shippers needed. This was well documented by Bennett (2005) and in archives (ANTT, JC 70 and AHMOP MR35).

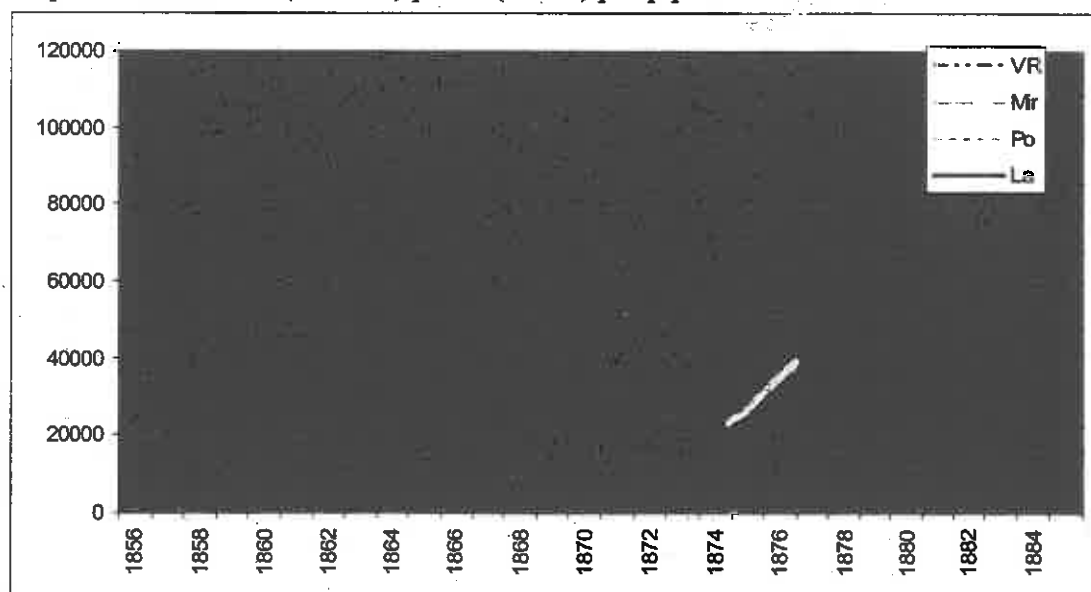
Graph nº 8: Low and high (nominal) prices for a pipe of brandy from 1812 to 1914



Source: Bennett (2005: 115–118); Table V. Brandy prices for the years 1812 to 1907. From 1908 to 1914, *O Comércio do Porto*, various issues.

By the end of the first regulatory period (graph 8) the prices dropped at the end of the French invasions and the relaxation of the regulation of the brandy market. Much later, in the 1850s, prices of brandy were high but wine prices were low, indicating a difficult period for the wine-growers (compare graph 8 and graph 9).

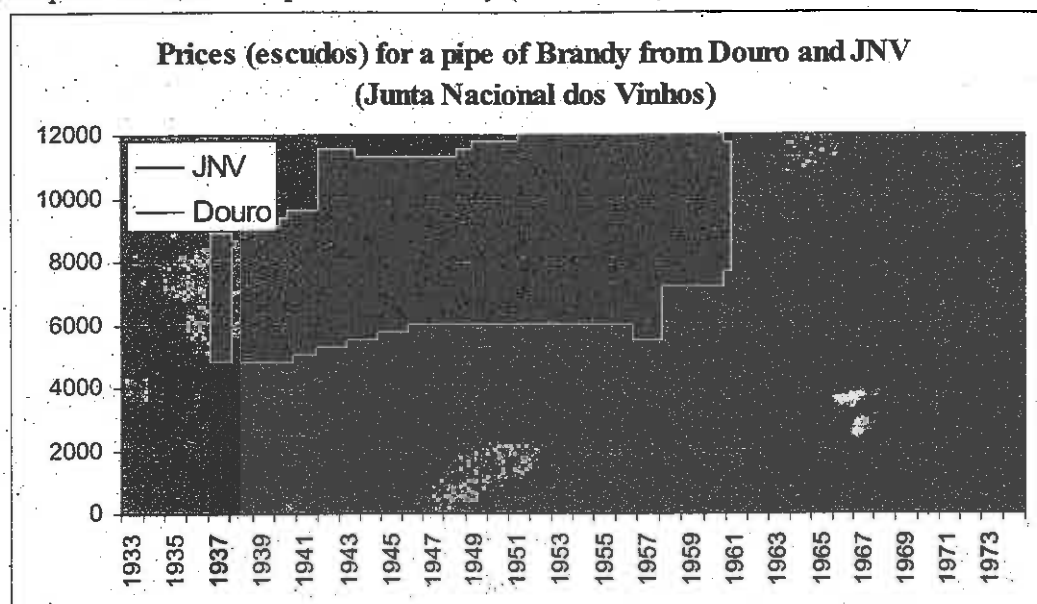
Graph 9: Evolution of (nominal) prices (in reis) per pipe of wine from 1856 to 1885²¹⁵



Legend: VR for Vila Real (bottom line); Mir for Miranda; Po for Porto (tope line) and La for Lamego (thick line). Source: David Justino (1988, Vol. I: 326).

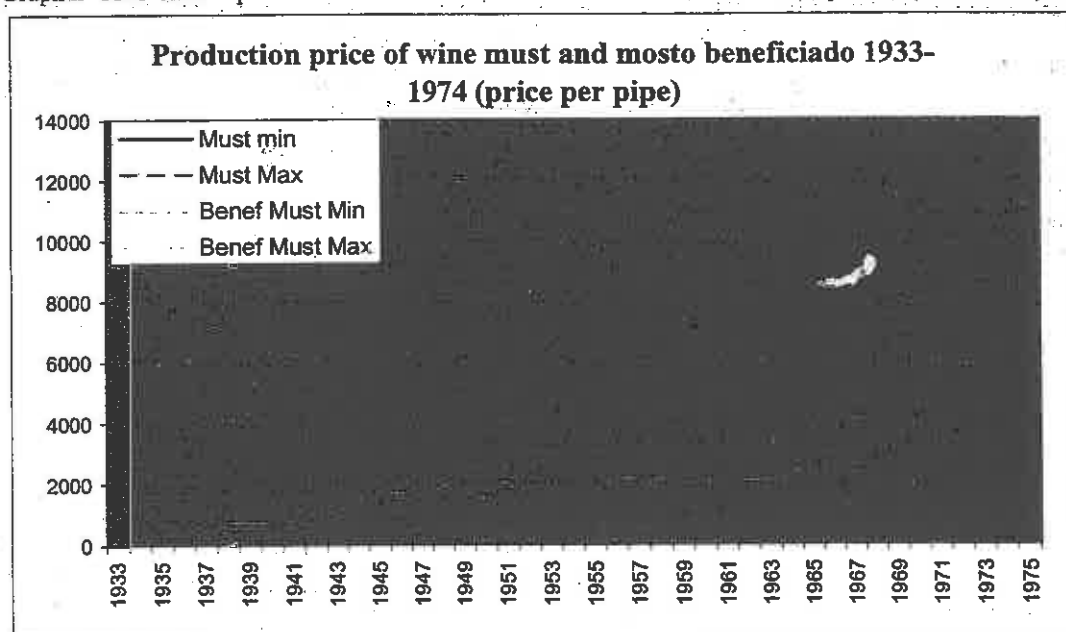
²¹⁵ From David Justino (Justino 1988). Data transformed in price in reis per pipe; my own calculations.

Graph nº 10: Nominal prices for Brandy (1933–1974)



Source: Conceição Andrade Martins (1990: 278-279); my own calculations.

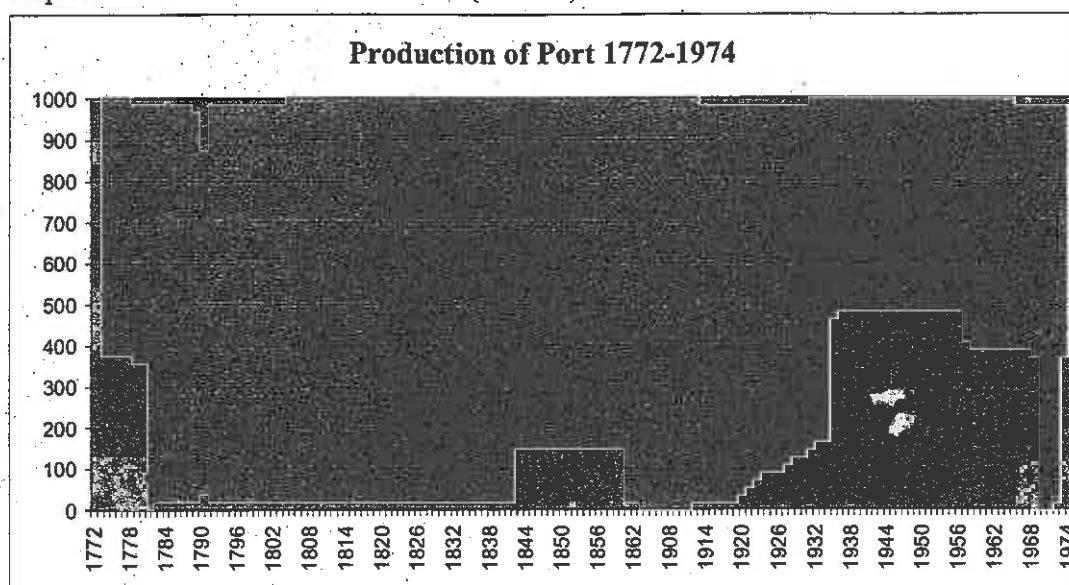
Graph nº 11: Nominal prices for wine must and beneficiated must or *mosto beneficiado* (1933–1974)



Source: Conceição Andrade Martins (1990: 276-277), my own calculations.

Comparing the evolution of the prices (graph nº 11) in the late 1960s up to 1974 with the change in production (graph nº 12), there was an upward trend in both time series and an acceleration in the 1970s. The case of the inflation was part of the explanation in the changes in prices of either input (brandy or wine spirit) or output (wine must and benefited must). Another factor was the increase of the international demand for Port.

Graph nº 12: Production of Port wine (100hls.)



Source: Conceição Andrade Martins (1990: 201–203; 229–230)

The previous graphs nº 10 and 11 support the idea of a relative stabilization of the Port wine systems with controls of prices and quantities. As shown in graph nº 12, the production of Port was decreasing in the 1940s and stabilized in the 1950s before the rapid growth of the 1960s.

The research on costs was frustrating and few quantitative data was found. Usually in the 18th century the cost of transport and the taxes doubled the cost of the wine bought in the Douro and transported to Porto.²¹⁶ Cost improved with the train at the end of the 19th century. But anyway, a great part of the cost was made of commissions and taxes that changed much through time and once more reveal the importance of the regulatory and institutional aspects of the Port wine.²¹⁷

The ratio of average prices paid to the producers in the Douro and the export prices was estimated by Martins (1990: 160) was 1 to 2 for the 19th and 20th centuries and the difference was then aggravated to the detriment of the producer in 1883 and in the 1940s and 1950s, periods of excessive production. In the 1950s the relation is frequently 1 to 3 (Martins 1990 165).

²¹⁶ In 1759 the export wine (vinho de embarque) and the cost of transport and the taxes amounted to 64657 reis per pipe (ANTT JC 70). In 1786, the wine for export was 30000 reis and the taxes and transport costs about 17379 reis (ANTT MR 641). Was this difference due to efficiency improvement or the differences of the type or sources used.

²¹⁷ The importance of taxes and regulation are highlighted by several authors, and, among them Martins (1990: 160–163; 1998)

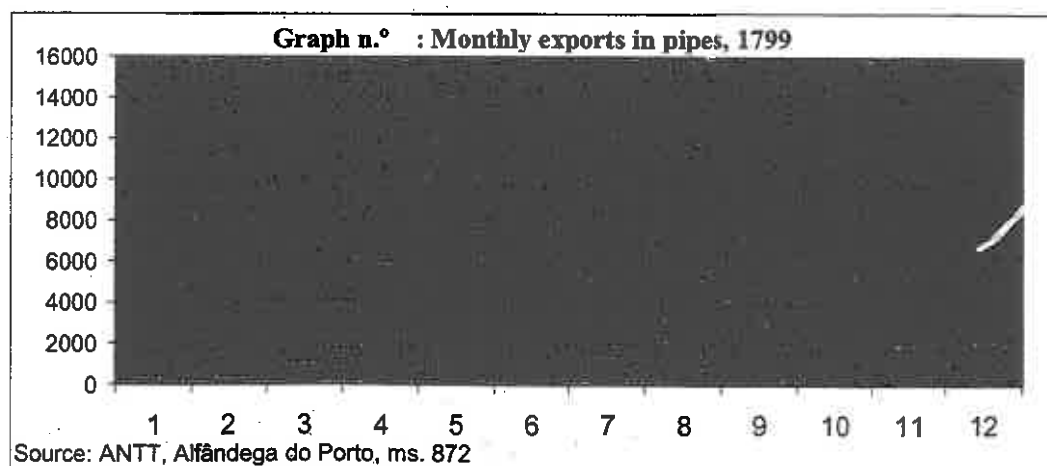
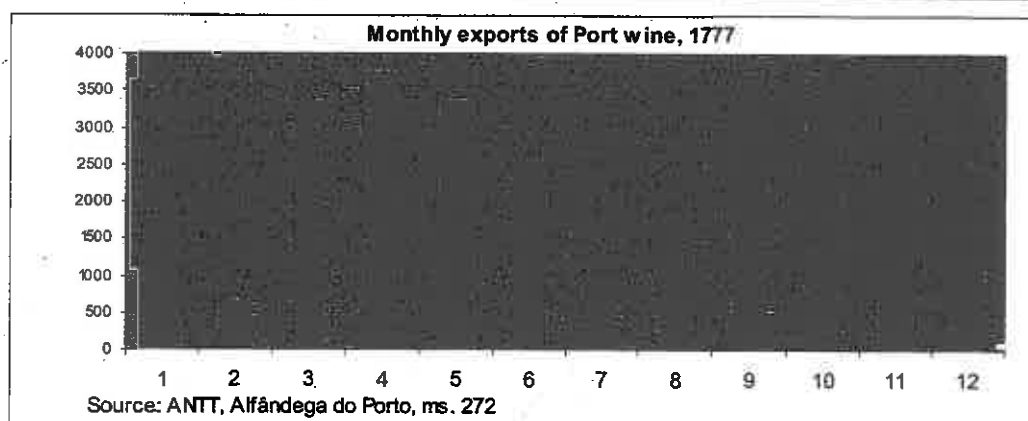
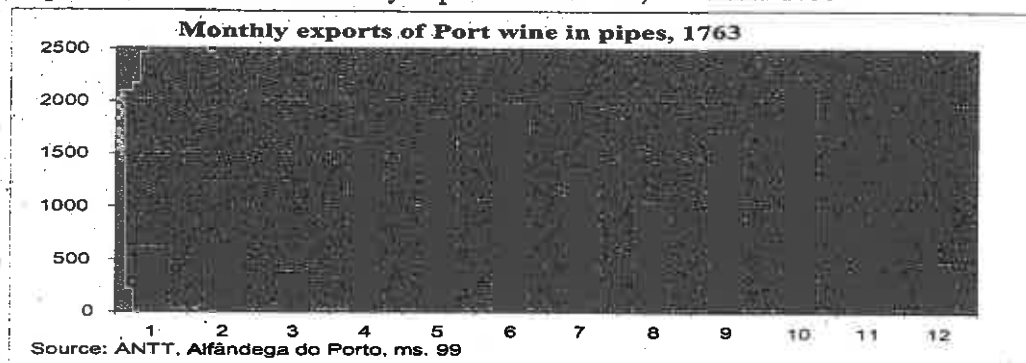
Finally, the prices of Port wine from 1807 increase in relation to the normal or consume wine of the Douro or other regions.²¹⁸ This could be related to the evolution of the price practiced by the shippers with the widening of the difference between the high quality wine and the low quality wine (see the graph 25 of the last chapter) and the data of Norman Bennett on which my comments are made (Bennett 2006).

²¹⁸ ANTT CLNH mc. 9; BACL Série Vermelha, 25, doc 20.

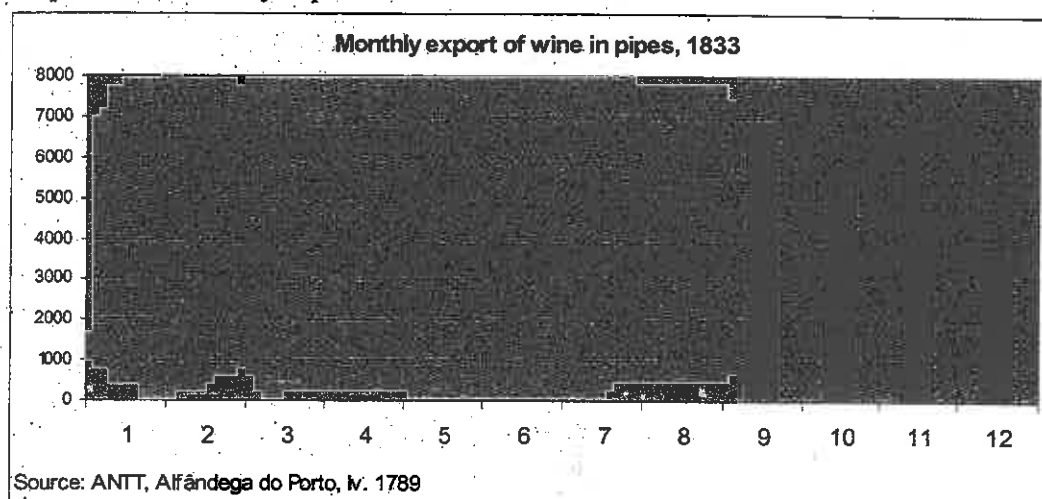
7. Some regularities in the production and trade of Port wine

Before starting the analysis of the port wine shippers, let me consider a last point of the technological side of my analysis: the monthly timing of the exports of port wine during some of the years I have studied so far.

Graphs 13, 14 and 15 – Monthly exports from 1763, 1777 and 1799



Graph nº 16: Monthly exports for 1833



The four graphs I selected correspond to the four years for which I have daily data of export transactions. Unfortunately, for the end of the 19th and early 20th centuries these data from the Porto customs are not available.²¹⁹

In February 1763, the Treaty of Paris ended the Seven Years War between France and England. While 1762 was a good year for Port wine exports, 1763 revealed to be a bad year with a drop of the exports to England from 27.085 pipes to 12.242. The total figures amounted to 14.695,48 pipes of wine, wine spirit and vinegar. The total of Port wine is 12.242,98 pipes, a figure that includes all the exports to the United Kingdom, Northern Europe and Brazil.

In 1762, the combined effect of high stock levels and the exceptional quantities exported led to a drop in demand from the British merchants. As a consequence of the excess of the stocks, and in order to prevent a collapse of the market for Douro wines, the *Companhia Geral* intervened in the market and bought 10.000 pipes of Port wine, especially from the poor winegrowers.²²⁰ The situation for the Port wine industry had

²¹⁹ For lack of time and because the construction of the time series are different than those of the Alfândega do Porto, I was not able to treat the more recent figures of the Instituto do Vinho do Porto.

²²⁰ See the legal document, Avizo de 2 de Março de 1763 (ANTT, MR mç. Xxx 632). The first injunction of the royal fiat to give to the administration of the *Companhia Geral* is the obligation to buy by borrowing between nine to ten thousands pipes of wine ("Primeiramente he indispensavelmente necessario que a Companhia compre a Credito as nove ou dez mil Pipas de Vinho que Vossas Mercês referem: Porque he o unico modo que ha de se evitar a ruina da Companhia, e o barateamento excessivo que os Ingleses ameação debaixo do pretexto de que não necessitaõ de Vinho, mas de que lhes sobeja, ..."). The third point suggest to buy wine to the poorest vigneron ("...se mandem logo comprar antes que os Ingleses se possam precaver: E que assim se comprem as das gentes mais pobres, e das Adeegas mais pequenas, de cuja necessidade os mesmos Ingleses podem fazer o abuso que Vossas Mercês justamente receyão, e se verificaria certamente se não se obviasse.

worsened since the late 1750s also because of the war with Spain and the invasion of the Spanish troops in Northern Portugal, the uncertainty of the wine shippers brought about other problems and led the government to take some action.

This action of regulation of the *Companhia Geral* was not an act of auto-regulation of the very sector, but, to the contrary, exactly consisted of an injunction given by the Marquis of Pombal, through the statute of March 2 1763, to regulate the market at fixed prices and conditions defined by the government. Thence, the intervention of the *Companhia Geral* was also to buy in this case ten thousands pipes of wine at discriminated and fixed prices: between 20 to 25 thousands *reis* per pipe for four thousands pipes and 15 thousands *reis* per pipe for the last six thousands ones.²²¹

In the graph for 1763, what was noteworthy was the timing of the wine exports and the very pattern that the aggregated data suggested. Interestingly enough, this pattern survived the decades of the 18th and 19th centuries, at least until the 1830s. From year to year, after March, the first peak of exports began around April and died off by the end of June and the second peak was centered on October and November. In 1763, the exports were concentrated in the months of April to June and then September and October. In 1777, the peaks were from March to June and September through November. In 1799, the case was similar for the first peaks (from April to June) whereas the second started earlier, in August and lasts until October with a decline in September. For 1833, because of the civil war in Porto and the almost complete stop of the trade business, the first peak was non-existent and the second started a little earlier in September and maintained its level in October while declining in November it stood at a level of export higher than normal for the last two months of the year.

The existence of two peaks was explained by the combination of two increases in the stocks of Port wine. The first increase followed the vintage time in September and October which triggered the need for "free space", empty vats, casks, and pipes in the Douro and in the Porto area. At that time, the quantities and qualities of the grape harvest were known and the winegrowers and shippers could act in consequence, selling the wine of the previous vintage. There was also a financial need for the shipper to

²²¹ Aviso de 2 de Março de 1763, ANTT, MR, mç. 632: "Em quarto lugar, para facilitar as referidas compras: Há Sua Magestade por bem dispensar sem exemplo por esta vez somente a Ley da Instituição, dando Liença à Companhia para comprar quatro mil pipas de Vinho pelos preços de vinte e vinte e cinco mil reis; e as seis mil que restão pelos preços de quinze mil reis, em lugar dos dezanove mil e duzentos reis, em que estão Lotados os Vinhos de refugo: Fazendo-se as ditas compras com a prudencia, e circunspeção que sua Magestade confia dessa Junta".

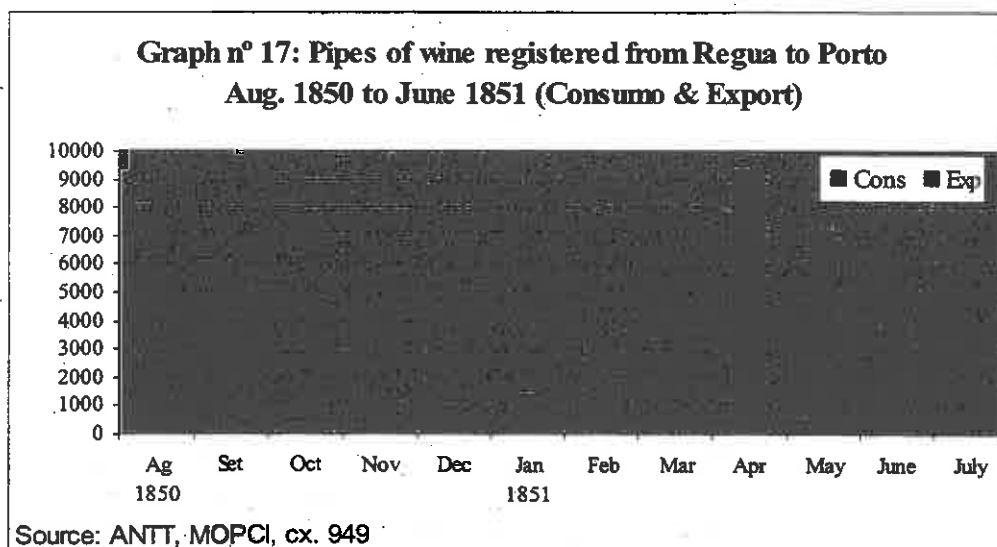
prepare their resources for the buying of wine and wine spirit for the period from February to June.

The second was the transport of the wine from the Douro to Oporto after March when the last year vintage was stabilized and in a good state for traveling. This second transfer required free space in the lodges at Vila Nova de Gaia but also there was again a financial need for accumulating cash for buying the wine novelties from September to November.

These two peaks were interrelated: the selling of the first wave of exports, after March, gives the financial resources for the acquisition of the new wine (novelties) during vintage time and right after it.²²² The second wave, around October, had to do with the preparation of the buying of wine in February and the ensuing months.

In this system for the timing of shipping, the merchants had better financial resources than the winegrowers, who were usually not able to sell other products than wine while some of the shippers were also exporting other staples such as sumac, cork, onions, etc.²²³

With this last example, the interrelations between the shippers and the winegrowers were obvious as well as the impact of the political factors (the civil war of 1833) and the institutional factors (with the legislation of March 1764) regulating the sector and influencing the prices and quantities sold by the winegrowers.



²²² As a matter of fact the Portuguese word for vintage, used until the beginning of the 20th century, was "novidade" or novelty. This word has been substituted by the English word "vintage" for the wine of a specific year that is declared as especially good. Vintage has two meanings: grape harvest and novelty.

²²³ See the numerous cases in the different manuscripts of the Alfândega do Porto. See ms. ANTT, AP, *Consulado e Fragatas: Livros de Sidas*, lvs. n.º 99, 272, 444, 872, 903, and 1600-1610 & 1642.

In the above picture (figure nº 14), I collected the data for the wine shipments from Régua down to Porto or Vila Nova de Gaia that were either proper for exports (Exp.) or for local consumption in Porto (*Consumo*). This information was complementary to the one about the shipments from Porto.²²⁴

Three remarks could be made. First, even if the months of March and July were missing, there was a clear increase of transport activity in the months between, from April to June. A normal situation that corresponded to what was known about the navigation on the Douro river (Oliveira 1960, Pereira and Barros 2001) and its connection to the activity and shipments in Vila Nova de Gaia.

Second, the quantities transported varied during the year and the types of wines that compose the monthly figures are changing through the different seasons. Two types of wines were referred to in each shipment: new wine from the present vintage versus the old wine of earlier periods. From September to January, the shipments were low and composed mostly from old wine (*vinho velho*), that was wine at least from the previous vintage. After March, the new wine (*vinho novo*) dominated the shipments.

Third, the records showed the importance of the wine for exports that dominated all the period, with the exception of August.²²⁵ This was one indication of the prominent role played by the export trade in the Douro wine economy.

I now pass to the study of the shipping industry and the characteristics of the trading firms and the evolution of the population of merchants, from the 18th century until the 1970s.

²²⁴ All the information here comes from the documents of the Direction of agriculture of the *Ministério das Obras Públicas, Comércio e Indústria*, ANTT, MOPCI, cx.949, documents 41 to 71. They are unfortunately incomplete, two months are missing (March and July), but a good idea of the overall volume can be traced down.

²²⁵ Again in August, the wine is mostly old wine (*vinho velho*) as if the winemakers were making their last decisions about shipping the extra wine they have before the next vintage time (September or October).

Chapter III – The evolution of Port wine firms: Selection and survival²²⁶

The present chapter analyses the Modern origins (approximately from the second half of the 17th century) and the subsequent transformations of the Port wine sector, focusing on the population of shippers and evidencing the role of the big players or dominating firms that control the market for Port wine in the Upper Douro and the city of Porto.²²⁷ The available data do not permit us to go beyond the late 17th century, though the profound changes in the wine trade date back well into the beginning of the 16th century, with an accelerating pace, above all, from the middle of the seventeenth century with a diversification and internationalization of the commercial routes (Ferreira 1983).

The expansion of the wine trade and its first major technological transformations were closely related, first, to the expansion of the Dutch and, subsequently, the British, commercial empires, and, second, to the broadening of the consumer market for alcohol beverages at both ends: the low priced drinks (such as beer) and the top quality wines, such as Port wine. This dichotomy that is still fundamental today in the strategy of Port shippers and wine or alcoholic beverage conglomerates.²²⁸

²²⁶ The data in this chapter/section comes from a number of sources. First, the historical archives and records of the Port wine firms, including the *Companhia Geral da Agricultura das Vinhas do Alto Douro* (CGAVAD, or, for references to specific documents: CG or ARCV, the latter for manuscripts of the Arquivo da Real Companhia Velha, the historical archive of the CG).

Second, the historical records of the institutional setting like the Instituto do Vinho do Porto (IVP, now Instituto do Vinho do Douro e do Porto - IVDP), the Casa do Douro (CD), the Instituto da Vinha e do Vinho (IVV, formerly the Junta Nacional do Vinho, JNV), and the Ministry of Agriculture (MA, including different institutes and organizations dealing with the regulation of backing of winemakers and winegrowers).

Third, other public archives were of much interest: the Arquivo Nacional da Torre do Tombo (ANTT), the Historical Archives of the Ministerio das Obras Publicas (AHMOP), the Arquivo Distrital do Porto (ADP), Arquivo da Alfândega do Porto (AAP), Arquivo da Alfândega de Lisboa (AAL), Arquivo Histórico do Ministério dos Negócios Estrangeiros (AHMNE).

Finally, I consulted a wide range of publications: the *Anais do IVP*, *O Vinho*, *Arquivo Rural*, *Boletim da Direcção Geral da Agricultura*, etc.; consulted at the following libraries: IVP, BNL, EAN, MNE, FLUP, FLUL, and ISEG-UTL.

²²⁷ I introduce the concept of repeat player as used in the sociology of law for characterizing the people that repeatedly go to court for forcing the other part of the contract to comply with the clauses. Here a repeat player is a rather big shipper or one that because of the high frequency of its trading acts, including export transactions, and because he can learn better and strive better for survival than a small or (almost) one-shot player. The routines of those repeat players get better ingrained in their business and augment their fitness potential.

²²⁸ See the role of urbanization to the expansion of wine markets (Lachiver 1988, Unwin 1991).

Nevertheless, while it was usual to encounter both low and high quality wines, for most of our period there was still a lack of a genuine mass market for wine, *i. e.*, a market for reasonable wines at a low price. In all probability, what approximated the mass market in the 18th century was, with due wariness, the local Porto wine market, in the taverns of the city and its outer limits.²²⁹ At the international level, the revolution of the 20th century was under way: the creation of a mass market for wine on a scale that never existed before. The British and the French markets were the first to be part of that transformation. Before that period, low quality wine was prevalent in many markets with a rather low level of wine consumption (Simpson 2004). The creation of the mass market for wine was a rather complicated issue, which had been understudied. However, probably part of the answer lay in the evolution of the low quality wine, and, namely in the fact that by the end of the 19th century the technological factors were ready for a better conservation of cheap wines through the widening of what Paul had called the Pasteurian paradigm to almost all types of wines (Paul 1996). That was the time of the rise of microbiology in winemaking processes.

Therefore, the starting point at about 1680 gave us a partial view of the origins of the sector and its transformations under way around the end of the 17th and the beginning 18th centuries. From 1700 to 1756, the domination of the British merchant was clear, as could be seen in the following table.

Table 1 - Distribution of pipes exported from Porto

	Portuguese	English	Dutch	French	German (Hamburg)
1700	9663	7186	337	—	—
1710	7645	10803	483	—	—
1730	8871,5	16349	174	74	39 *
1740	9883,5	14114	—	—	—
1750	12643	24335	—	—	127
1756	17448	13465	—	—	121,5

Source: *Manifesto de vinhos na Imposição do Porto (1700-1756)*

Data from Barros. Cardoso. (2004: p. 910-911) in pipes of wine.

²²⁹ The market of the city (*cidade do Porto e o seu termo*) is flooded by wines of a lower quality (*vinho de ramo*) than the wines for the British market (Factory wine).

At the beginning of the 18th century, some influence of the Dutch merchants could be noticed but this disappeared by the middle of same century. At that time, the market was divided basically between Portuguese and English merchants. Of course, the English dominated the Portuguese wine trade with the United Kingdom while the Portuguese dominated the local Porto market and the Brazilian market. These figures revealed the rise of the British merchant empire and the decline of the Dutch. At the same time, the Portuguese kept an important market share, even though for lower quality wines that reflected partly the privileged relationship between Portugal and its colony.

I relied on the distinction of the two main groups in the Port wine sector: the traders, on the one hand, and the cultivators and winemakers, on the other.²³⁰ This distinction was quite old but has been increasingly blurred from the late 1860s onwards, following the phylloxera crisis and the transformation of the wine trade, especially around the changing patterns of capital investments and technological needs in the sector. Later, the new wave of internationalization of the sector, namely after World War II, triggered new investments from merchants and international corporations for alcoholic beverages in the vineyards and the wineries. The movement of globalization for all beverages had been increasing since the mid 1960s and paralleled by a pervasive technological change in the wine industry both on the production side and on the trade business.

1. Structure of the market and characteristics of the population of shipping firms

1.1. A fundamental distinction²³¹

Two groups of actors dominate the wine business. On the one hand, the wine growers, cultivating the vineyards and very often making wine. Those making wines proper for exports were the ones that have reached a critical size. The big landowners

²³⁰ Of course, another distinction should be made between the vine cultivator (*vigneron*) and the winemaker, the latter dedicated to the vinification and conservation of wine. See chapter II of the second part.

²³¹ Part of this section and the following one are based on the article "Transformations technologiques du vin de Porto et interactions institutionnelles: Une perspective de longue durée (1680-1995)" » [to appear in the Journal : *Douro – Estudos e Documentos*, vol. 10, n°. 19, 2005, Journal of the Faculdade de Letras da Universidade do Porto (FLUP)].

and some medium-sized production units, were often well integrated with the trading business, dominate the first group. On the other hand, the shipping industry consisted of the traditional merchants, both national and foreign, and the speculators and capitalist investors. This group passed through several important transformations.

This distinction was analytical and both sides of the picture were necessary to understand the dynamics and transformation of the wine sector. This very argument was not new: Henri Pirenne once said that “wine trade cannot be conceived without the viticulture” (Pirenne 1969: 26). The two sides of the production process – viticulture and vinification – did not receive the same attention during the last three centuries. This situation further complicated the study of the historical sources. The relation between the two groups (vignerons and winemakers, on the one hand, and Port shippers, on the other hand) had been, occasionally one of give and take, but, more often than not, one of conflict and opposing interests. The overall relation was one of relative harmony, with a combination of conflicts of interests and mutual benefits according to the distribution of the benefits and costs in the periods of expansion and crisis.

TRADERS AND SHIPPERS	CULTIVATORS, WINEMAKERS AND OTHERS
- FOREIGN MERCHANTS (EXCEPT BRITISH); - BRITISH MERCHANTS; - PORTUGUESE MERCHANTS;	- VINE-GROWERS OR VIGNERONS; ²³² - WINE-MAKERS; - OTHERS; ²³³

Table n.º 2: The categories of wine merchants, winegrowers and other professionals.

Through the ages, the Port shippers evolved quite considerably. I distinguish two historical ideal-types: the merchant that corresponded to the trader of the first capitalist expansion, and the firm that was the transformation of the individual traders into corporations with distinct structure of ownership.

The merchant was the figure that dominates the wine trade until the early 18th century and was by then slowly but steadily substituted by the other figure: the shipping firm, which was a transformation of the individual merchant into a capitalist firm. The landmark of the merchant was his personality and his personal or family assets and

²³² The word « winegrowers » is ambiguous because it does not distinguish the work in the vineyard (the treatment of the vine) by the vine-cultivators (*lavradores*) from the winemaking process in the winery and cellars (*adega*) which includes the work in the *lagar* (the wine press), the vinification proper and the treatment in the casks after that the process of fermentation has ended.

²³³ This include the professions that historically had their importance in the wine industry: the cask makers or coopers (*tanoeiros*), the Douro transporters with or without the rabelo boat (*barco rabelo*), etc. For references on coopers, see Lacerda (2003) and Veiga (1954).

relationships, whereas the firm was an association of investors (associates) that share some common purpose. Firms appeared toward the end of the 17th century and had a profound effect on the development of the trade business. The 18th century corresponded to the first clear expansion of trading firms beyond individual endeavors. The necessity of disposing important financial capita for the trade of wine and the simultaneous affirmation of the commercial companies in the Pombal era transformed the population of traders. Most of the shippers that survived from 1763 to 1799 or even 1825 were associations of individuals referred to in the Portuguese customs' manuscripts as "*e cpa.*", "*C^a*" for *Companhia*, corporation or company.

Finally, I was able to distinguish a third case, beyond the merchant and the firm, namely the corporation where the ownership was not in the hand of associates but was owned by other firms or important investors.

1.2. A typology of Port shippers, 1678-1995

	Merchants	Firms ²³⁴	Corporations
Ownership	Individual	Associates	Investors and other corporations
Typical period	17 th -18 th	19 th	20 th
Foundations of business	Individuality	Contract or convention of association (of merchants)	Capitalization
Capital distinction entity/owner	Not always clearly separated from the individual's private ownership	Limited liability	Limited and structured liability ²³⁵

Table n.º3: Three types of shippers.

²³⁴ The shipping firm during the period 1933-1974 is symptomatically called *firma (exportadora)* in the documents of the IVP, the regulating body of the Ministry of Agriculture. So, in a way when we talk about *firms* in the sector it has usually the meaning of a joint stock company that corresponds either to the two types of business endeavors I have distinguished: the firm and the corporation.

Between the firm and the corporation, there is an important difference. While the firm can frequently have a close relationship with the family that established the business some generations ago, e. g., the Ferreira, the Ramos Pinto, etc, the corporation, as a rule, does not maintain such a close relationship. The administration is not traditionally given to a member of the founding family. This does not mean that the family is not active in the corporation, quite the contrary. But its form is less pervasive and within stricter bounds of action and decision.

²³⁵ By structured liability I mean the structure of the portfolio of investments of a corporation in different business activities and the existence of cross-investments between related firms. The logic of this organization of investments goes beyond the logic of the Port wine sector, including global strategies of multinationals in alcoholic beverages or corporations that invest in the sector as a consequence of the strategy of diversification and search for prestige and distinctive units of production like a traditional wine producer or a quinta.

The figure of the merchant is still relevant in the early 19th century but disappeared by the turn of the century with the rise of the shipping firms, some already gaining momentum in the late 18th century. The 20th century is the century of the transformation of the shipping firms into corporations, a movement that was accentuated after World War II.

Although both sides are important, for reasons of lack of time and space, and also because the information on the production of wine is more dispersed and limited, I will focus on the shippers rather than the winemakers, except for the technological side of the story presented in the previous chapter. Accordingly, the previous chapter dealt both with a brief description of the winegrowers as well as a typology of their population. With regard to the shippers, I will rely on information from several archives.

In order to avoid a cumbersome explanation of the data, the annex of the thesis describes, archive by archive, the documents I have consulted.

1.3. A proposal for an evolutionary analysis

First, I consider each export as an action that positively influences the probability of survival. Second, this probability is not just influenced by the frequency of exports but also by the very level of exports. A firm with a higher quantity of pipes of wine per export increases its chances of success. The frequency and volume positively influence the probability of survival; and the firms that are still around today, albeit of a different type and structure, are those that became big and repeat players, frequently exporting large quantities of wine. Behind this mechanism there is a process of learning through repetition of a series of actions leading to export, mainly to the United Kingdom until well into the 20th century.

The Port wine is a rather well delimited sector, which, on the trade side is composed of a population of shippers, varying between 40 to 200 firms in the periods going roughly from the 1750s to the 1970s. This allows me to adopt an evolutionary analysis of the sector based on the population perspective of the shippers. I have gathered information about the companies from 1769 to 1970 which includes the list of

firms and the quantities exported in a particular year. Moreover, for the interpretation of the data I have relied on different archive documents.

1.4. The structure of the market (general discussion and Herfindahl index)

One of the central aspects of the sector is its relative concentration, with the trade being dominated by some five to twenty firms or merchants, at least the trade that matters in terms of mark-up or market share. I use the working hypothesis that the larger the market share the more difficult it gets to keep on going not just because of the competition of others but because of the erosion of the internal structure of the firms, the continuous change in the technological frontier and knowledge base. I will, in what follows, rely on some traditional measures of concentration like the market share, the concentration ratio (CR) and the Herfindahl index (HI), while making some adaptation to these statistics for the sake of clarity.

If we take the usual measures of concentration for the sector –the concentration ratio (CR, here in the table C_k) and the Herfindahl index (HI); it is easily verifiable that the sector is far from the perfect competition paradigm. It is neither a perfect competition case nor a very high concentration sector such as electricity in some countries of the current European Union.

In general, the study of the concentration cannot be limited to the indicators presented here; some qualitative aspects must also be taken into account that can give a better interpretation and understanding of the structure of the sector and its level of concentration in particular.

Years	Number of firms	C1 %	C5 %	C10 %	C15 %	C20 %	H1 %	H5 %	H10 %	H15 %	H20 %	HI %
1763	64											
1777	75 (69) ²³⁶	20,8	53,8	73,3	84,9	91,3	4,33	7,90	8,67	8,96	9,04	9,08
1786	88 (79)	25,7	54,1	78,5	88,6	94,4	6,60	8,81	10,01	10,23	10,29	10,32
1799	64	9,6	37,6	58,6	74,3	82,9	0,91	2,94	3,84	4,26	4,46	4,63
1833	91	12	39	57	69	77	1,36	3,37	4,05	4,23	4,39	4,62
1866	43 ^{*237}	15	40,1	58	67,9	75	2,24	3,88	4,59	4,78	4,89	5,00
1875	91 ^{*71}	9,6	30,5	46,9	55,4	61,5	0,91	2,04	2,60	2,74	2,82	2,97
1948	80	8	25	39	49	59	0,65	1,38	1,76	2,00	2,19	2,62
1960	75	16	36	49	57	67	2,30	3,40	3,68	3,92	4,07	4,38
1972	59	13	40	55	66	76	1,60	3,97	4,41	4,68	4,88	5,12
1974	56	18	47	61	71	79	3,19	5,78	6,20	6,39	6,52	6,71

C_k – or concentration ratio – is the aggregated market share of all the firms from 1 to k , when all firms are ranked by size of quantities sold, C_1 is the market share of the biggest firm, C_{20} is the market share of the 20 biggest firms;

H is the measure for concentration that is based on the calculations necessary for obtaining the Herfindahl index and adapted for the distribution of some selected groups of the 20 first firms. The HI is the Herfindahl index for measuring the concentration in the wine sector.

Table n.º 4 – Measures of concentration through the years 1777-1974. ²³⁸

The case of perfect competition gives us a market share of s_i for the firm i . The aggregation of the market shares of the firms ranked by size (measured by volume of sales, here the number of pipes or hectoliters exported and sold in Portugal) gives us the concentration ratio that is defined as the following:

$$C_k = \sum_{i=1}^k s_i, \text{ where } s_i \text{ is the market share of firm } i, s_i \in [0, 1] \text{ and } k \text{ the}$$

number of firms that are included in the ratio. The market share varies between 0 and 1; the extreme cases of perfect competition and monopoly. Other ways to express it, in

²³⁶ The total population from the ledger books of the Alfândega do Porto is 75 exporters. However, some of them are just captains of ships or just appear once with less than a pipe. So, if those are excluded from the total, the population is reduced to 69 Port shippers.

²³⁷ The data, available at the Arquivo Histórico do Ministério dos Negócios Estrangeiros (AHMNE), are not complete. The small producers are aggregated into “others” and there is no way to know exactly how many they were. Therefore, I had to guess. So I added one third of the figures available in order to estimate the small shippers.

²³⁸ The data come from the ANTT for the years 1763-1833, the AHMNE for the years 1866-1875, and, finally, for the years 1748-1974, from the series of the archives of the IVP at the Museu do Douro (physically located temporarily at the Arquivo Distrital do Porto). See the annex for the precise references about the different manuscripts and other primary sources.

percentage points, are possible but I will ignore them here given that the interpretation is the same. I proceed this way because of the facility of constructing the next indicator of concentration.

In the table, I have chosen the concentration ratio for the following five cases: the first firm, the fifth, the tenth, the fifteenth, and the twentieth.

An alternative to the concentration ratio is the Herfindahl-Hirschman index (HHI) that measures the overall concentration in a sector and can be expressed as follows:

$$H = \sum_{i=1}^n s_i^2$$
, where s_i is again the market share, $s_i \in [0, 1]$ and n is the total number of firms.

One caution I have to stress with this index is the definition of the relevant market. In our case, the Port wine is a good example of a correct definition of a market: the product is almost unique and defines a product coming from a demarcated area. Even if there is some fraud, for example when the brand name Port is used by other companies from other countries, this problem is secondary for understanding the change in the internal structure of the sector. These considerations on the imitations of the product are of some value but discarded here for several reasons: feasibility, available data, and a rather good approximation with no other better substitute.

Because of the lack of data, I had to adapt or approximate the HI by doing the following: take the idea behind the concentration ratio and transpose it to the Herfindahl-Hirschman index. I define an index, which is expressed as the sum of the square of the market shares up to the last firm k that enters in the summation, but does not necessarily go to the last and smallest firm. I obtain the following:

$$H_k \equiv \sum_{i=1}^k s_i^2$$
, where k is the k^{th} firm that enters into the index and this measure corresponds to the C_k , but expressed in different terms. In the table for the Port shipper I give the H_k for $k=1, 5, 10, 15$ and n , the last one is the true Herfindahl index as we can find in the last column of the table (HI).²³⁹

²³⁹ Another interesting statistic is the instability index, I , that measures the sum of the absolute value of the variation of the market shares. I will not use it here because the periods I have taken are not sufficient and this measure is sensitive to the interval of years between the observations and the intervals are

The Herfindahl index can reach a maximum value of 1, which is a case of monopoly, and often encountered in the energy sector in small and highly regulated economies like the Portuguese of the Greek cases. Of course, the values I obtain are far from this extreme case, but it is still a case of high concentration especially for the years 1777, 1866, 1972 and 1974. It is probably the case today, given that the acquisitions of firms like Sandeman by Sogrape, which also owns Ferreira, Hunt & Roope, among others, acquired in the last two decades, or even with a higher overall index.

First of all, the size of the market does not go over one hundred firms, a rather small number given the level of production in the sector. Except for the last 50 years, the British merchants or firms dominated the export market throughout the period, controlling between one-third and one-half of the total population of shippers. Nevertheless, their concentration was also relevant for the group of the biggest firms: Warre, Croft and others in the 18th and 19th centuries; Cockburn and Sandeman, during the last past two centuries. C1, for example, corresponds to the market share of Sandeman from 1833 to 1974, a rather good score if compared to other big firms that entered the market much before George Sandeman in the 1810s.

Second, the concentration ratio, the adapted H_k indexes and the Herfindahl index are measures of the intensity of the concentration in a given market of economic sector. But this does not take into account the total market size, in terms of volume, and the type of evolution the same market is undergoing, e. g., either expansion or recession. If I compare 1777 and 1786, the HI rises from 9,08 to circa 10,32, revealing a higher concentration, and indeed the biggest firm rises from 21 to almost 26 percent of market share; but this happens in a period of stagnation in the market. If we compare the two years, a decrease of total exports is evident from about 30190 pipes in 1777 to 27234 pipes in 1786. Several firms and merchants disappeared completely, even if the total number of traders increased by 13. What made the difference was the fusion or disappearance of some of the most important Portuguese and British merchants. If Manuel Portugal Calhorda, that exported 205 pipes in 1777, ended its export activities in the meanwhile, this loss was compensated by some new or more dynamic traders such as Manuel Francisco Guimarães, José Euletério Barbosa de Lima, Pedro Marinho

irregular because of the non-availability of most of the years between 1800 and 1975.

$$I \equiv \frac{1}{2} \sum_{i=1}^n |s_{i2} - s_{i1}|$$

da Costa and the firm Rocha Ribeiro & C^a. The firm Thomas Lambert & C^a disappears and is substituted by another firm: the Lambert Kingston but the quantities exported by the new firm dropped from 2144,5 to 1328 pipes. The same happens to William Campion, who is associated with Offley and Hesketh in a new company. However, the new company of the associates exports just 2960 pipes in 1786 while William Campion exported 4926 pipes and Hesketh 938 pipes in 1777.

Another factor has to do with the fact that 1785 was a bad harvest year in quality even though in terms of quantity it was reasonable (Henrique David 1997).

Third, the HI index is not just a measure of concentration but also one of diversity, as currently used in biology, genetics and agronomy. If it is very close to one, it indicates the existence of just a few species, at the lowest level just one, indicating that there is low or even no diversity at all. The interpretation is nevertheless not straightforward for most of the values of HI. In industrial organization studies, if the Herfindahl index is close to 1, we have just one firm and no diversity and if the HI index is zero, we have perfect competition. Although this is straightforward, in practice and except for the cases of very high concentration and monopoly, the index has values that oscillate between the two extremes.

Close to zero, we find an infinite possibility of more or less diversity, but in our case we are not close to zero. So, does this mean that the diversity is low? On the basis of the number of firms, maybe this is arguable. And this is exactly what we have here, an index that fluctuates between 2,62 and 10,316.

In biology the index is usually expressed in decimals and when the index is close to one, there is very low or no diversity whereas if the index is close to zero, there are many different species.

1.5. The structure of the market: the evolution of the top 20 firms form 1762 to 1974

I will proceed now to a more detailed analysis of the evolution of the market structure of Port wine export based on a varied array of sources that I have already used for constructing the Herfindahl index in the previous section.

First of all, the that data I was able to find begins in 1762. I used also information from António Barros Cardoso's thesis in order to define the context of the

wine trade and the main characteristics of the market structure, namely who were the most important merchants.²⁴⁰

Table nº 5: Pipes bought and shipped from the Upper Douro by British merchants - 1762				
Rank	Port Shippers	Pipes	Share	Ci
1	Warre & Calvaerts	1957	0,16	0,16
2	Etty & Offley	1140	0,09	0,25
3	Swarbreck & Lambert	1053	0,08	0,33
4	R & S Thompson	1053	0,08	0,41
5	Adam Standart	911	0,07	0,49
6	Bearsley Webb & Stanfort	906	0,07	0,56
7	Bowman & Francklin	743	0,06	0,62
8	H. Haughton	589	0,05	0,66
9	H. Berne	485	0,04	0,70
10	Claes Babington	405	0,03	0,73
11	Hitchcock & Wood	328	0,03	0,76
12	Vincent, Harris Johnson	311	0,02	0,78
13	Charles Page	296	0,02	0,81
14	Tidswell	287	0,02	0,83
15	James Stewart	221	0,02	0,85
16	Thompson Croft	213	0,02	0,87
17	Henry Wells	204	0,02	0,88
18	Thomas Dawson	183	0,01	0,90
19	T. Wettenhal	179	0,01	0,91
20	J. Perry	157	0,01	0,92
	Total of British Transport	12592	1	
	Total of Exports of 1762	27085		
	Total of Exports of 1763	12242		

Source: ANTT, JC, mc70, cx. 224.²⁴¹

This list is only made of British merchants that bought wines in the Douro and sent it to the city of Porto for exporting them. Among that sub-population, the concentration is high. Five or six shippers have fetched 50 % of the market. Several of the wine merchants were active before that date, such as Warre, Babington, Bearsley, Standard, Etty and Offley. The survival of the big firms is much higher than the small one if compared to the rest of the list of small shippers not included here. May shippers had an activity of less than 20 or 10 pipes a year.

²⁴⁰ For any survey of the Port wine trade from 1700 to 1756, the most comprehensive study has been done by António Barros Cardoso (2003: 295–559).

²⁴¹ There exists a similar, but less complete, list of wine shipments from the Douro (carregações do Douro) by the British merchants, at ANTT, MR 641 and published by Moreira da Fonseca (1969).

Table nº 6: Pipes bought in the Douro and transported by British merchants - 1762-1771				
Rank	Port Shippers	Pipes	Share	Ci
1	Etty Offley	15959	0,11	0,11
2	Warre & Calvaerts	12018	0,08	0,19
3	Olive Beckett	11506	0,08	0,26
4	R & S Thompson	10650	0,07	0,33
5	Bearsley Webb & Stanfort	8724	0,06	0,39
6	Claes Babington	8511	0,06	0,45
7	Swarbreck & Lambert	7744	0,05	0,50
8	H. Haughton	6383	0,04	0,54
9	J. Perry	5615	0,04	0,58
10	Adam Standart	4370	0,03	0,61
11	Bowman & Francklin	4282	0,03	0,64
12	James Stewart	4232	0,03	0,67
13	Thompson Croft	4146	0,03	0,69
14	Tidswell	3895	0,03	0,72
15	Vincent, Harris Johnson	3282	0,02	0,74
16	T. Wettenthal	3231	0,02	0,76
17	Hitchcock & Wood	3082	0,02	0,78
18	Sampson	2795	0,02	0,80
19	H. Berne	2530	0,02	0,82
20	Charles Page	2442	0,02	0,84
	Total of British Transport	150010	1	
	Total exports 1762-1771	201786		

The table nº 6, coming from the same source as the preceding one, was the aggregation of a decade of Port wine shipment from the Upper Douro to Porto. Several of the names were either active in their own firm during the preceding decades or member of some recent partnership. Sampson was the partner of Peter Dowker that continued a once thriving business (Barros Cardoso 2003). If many firms disappeared, especially the small one, part of them are absorbed by others. Several families of merchants had more than one inter-marriage, such as the Croft and Thompson families (more than five) or Page and Wye, Sanford and Bearsley, Croft and Dawson and Wettenthal and Newell. My hypothesis is that the businesses were passed on and the names and partners change in the small community of British merchants in Porto.²⁴²

²⁴² I have used the book by Sellers on the British families in Porto (Sellers 1899). I have also consulted archives from firms but the results were not what I was expecting. I obtained some information from the Archive of AA Ferreira on firms such as Hunt Roope and Constantino. Those two firms were associated and then bought from the late 1950s to the early 1960s, a period of regression and stagnation for the Port wine shippers

Table nº 7: Ranking of Port shippers - 1777				
Rank	Port Shippers	Pipes	Share	Ci
1	Companhia Geral (CGAVAD)	6374	0,21	0,21
2	Campion	4927	0,16	0,37
3	Lambert	2145	0,07	0,44
4	Warre	1577	0,05	0,49
5	Bearsley	1451	0,05	0,54
6	Searle	1350	0,04	0,58
7	Arcediago (Archdeacon)	1268	0,04	0,62
8	Croft	1255	0,04	0,66
9	Brett	1173	0,04	0,70
10	Heskett	938	0,03	0,73
11	Stafford	879	0,03	0,76
12	Babington	847	0,03	0,79
13	Wye	815	0,03	0,82
14	Young	563	0,02	0,83
15	J Perry	442	0,01	0,85
16	Claes Bailey	431	0,01	0,86
17	Thomas Newman	366	0,01	0,87
18	William Wharton	341	0,01	0,89
19	Samuel Weaver	287	0,01	0,90
20	John Nevill	242	0,01	0,90
	Total	30630	1	

Source: ANTT, AP Saldas 1777 and Paul Duguid (2000)

This is the list of the main exporters at the end of the period of the Marquis of Pombal. The Companhia Geral fetched first position but the British merchants were still dominating the trade. No Portuguese merchant enters in the top 20 firms. The evidence supported the point of view that the Companhia was not as much a direct competitor of the British shippers as the main competitor of the small Portuguese shippers who were excluded from the bulk of the Brazilian trade and had to compete with the British and the Companhia on the English market. Indeed, in that year, the exports of the Companhia to Brazil were 3210 pipes or half of her export trade.²⁴³ If the trade with Brazil was excluded, the Companhia was not the first shipper.

After 20 years of regulation and activity of the *Companhia*, there was no new Portuguese or foreign shippers (British excluded) that have emerged. This was one more indication of the effects of the restrictive action of the Companhia on the renewal of the population of Port shippers.

²⁴³ AHMOP MR 35, fl 372. The shipment for Rio de Janeiro alone were 2730 pipes.

Table nº 8: Ranking of Port shippers - 1786				
Rank	Port Shippers	Pipes	Share	Ci
1	Companhia Geral (CGAVAD)	6995	0,26	0,26
2	Offley Campion Hesketh & Cia	2960	0,11	0,37
3	William Warre & Cia	1713	0,06	0,43
4	John Searle & Cia	1593	0,06	0,49
5	Thomas Stafford & Cia	1478	0,05	0,54
6	Thompson Croft & Cia	1474	0,05	0,60
7	Francisco Bearsley & Cia	1412	0,05	0,65
8	Lambert Kingston	1328	0,05	0,70
9	James Brett & Cia (Diogo Brete)	1297	0,05	0,75
10	Joseph Perry	1127	0,04	0,79
11	John Nevill & Cia	727	0,03	0,81
12	William Babington & Cia	611	0,02	0,84
13	George Wye & Cia	513	0,02	0,86
14	José Eleutério Barbosa de Lima	482	0,02	0,87
15	Thomas Newman	413	0,02	0,89
16	Charles Page & Ca	395	0,01	0,90
17	Smith Penell	384	0,01	0,92
18	Manuel Francisco Guimarães	283	0,01	0,93
19	Edward Molloy	261	0,01	0,94
20	Thomas Snow	250	0,01	0,95
	Total	27234		

Source: ANTT, AP Saídas 1786 and Paul Duiguid (1997)

The Companhia in 1786 exported 2923 pipes of Port to Brazil, which was still a considerable portion of its trade. Only two Portuguese names emerged in the list (J. E. Barbosa de Lima and Manuel Guimarães, number 14 and 18 respectively).

It is interesting to note that the success of the Companhia was in sectors which were much protected from competition: the Brazilian market, the market for Douro wines in Porto, and the market for wine-spirit in the Douro region and vicinity.

This is a typical listing of what Norman Bennett called (1990) the *golden period* for Port shipping (for the British shippers of course) with the traditional firms like Warre, Offley, Bearsley (the predecessor of Taylor's group) and Croft dominating the trade.

This is also a period of high concentration in the sector with the 20 first firms reaching 95 % of the total market for exports. It has slightly increased since 1777.

Table nº 9: Ranking of Port shippers - 1799				
Rank	Port Shippers	Pipes	Share	Ci
1	Companhia Geral (CGAVAD)	4912	0,10	0,10
2	Perry	4517	0,09	0,18
3	Campion Offley	3807	0,07	0,26
4	Warre	3207	0,06	0,32
5	Lambert	2875	0,06	0,38
6	Croft	2719	0,05	0,43
7	J Monteiro de Almeida	2151	0,04	0,47
8	Bearsley	1990	0,04	0,51
9	Harris	1970	0,04	0,55
10	Newman Land	1941	0,04	0,59
11	Penell Smith	1842	0,04	0,62
12	Searle	1781	0,03	0,66
13	Ferreira Cunha	1558	0,03	0,69
14	Burmester Nash	1485	0,03	0,72
15	Stafford	1397	0,03	0,74
16	Ferreira S Payo	1062	0,02	0,76
17	João da Cruz	979	0,02	0,78
18	John Henrique (Henry)	914	0,02	0,80
19	Oliveira Lopo	745	0,02	0,82
20	Babington	706	0,02	0,84
	Total	51358		

Source: ANTT, AP Saidas 1799

In this year, the Companhia was still first and new Portuguese shippers appeared (Monteiro de Almeida, Ferreira Cunha, Ferreira Sampaio and Oliveira Lopo). Others merchants, like Lambert emerged as important shippers such as Offley, Croft and Warre.

I had to underline the fact that according to the book of the Alfândega do Porto of 1799 the Companhia had a total of pipes exported of 51358, much lower than one of the two quantities given by Conceição Andrade Martins. This was an important result for correcting the

The sector was still concentrated but a little less than in 1786. There seemed to have more entry in the trading activity.

Table nº 10: Ranking of Port shippers - 1825				
Rank	Port Shippers	Pipes	Share	Ci
1	Quarles Harris	2917	0,06	0,06
2	Offley Forrester Webber	2408	0,05	0,12
3	Lambert Kingston	1814	0,04	0,16
4	Dixon Allen	1784	0,04	0,20
5	Croft	1580	0,03	0,23
6	Geo. Sandman	1316	0,03	0,26
7	Van Zeller	1254	0,03	0,29
8	João Filho Guillman	1216	0,03	0,32
9	Smith Woodhouse	1216	0,03	0,34
10	Knowsley e Nassau	942	0,02	0,36
11	Butler Nephew	834	0,02	0,38
12	Cockburns Grey e C ^a	806	0,02	0,40
13	Nogueira e Fructuozo	760	0,02	0,42
14	Nicolau Copque	757	0,02	0,43
15	Burmester	753	0,02	0,45
16	José Diogo de Bastos	750	0,02	0,47
17	Da Mathews. Feuerheerd	722	0,02	0,48
18	Ormerod Irmãos	662	0,01	0,50
19	Joaquim Ferreira Duarte	650	0,01	0,51
20	T J smith	634	0,01	0,52
	Total			

Source: ANTT, AP Saídas 1825 and AHRCV, Book, Lista de exportadores, 1825.

A decade after the French invasions, the British firms were once again dominating the trade and hold the six first positions. Compared to the previous list of 1799, important changes occurred. First, new shippers entered the Port wine market such as Sandeman, Cockburns, Burmester, Ormerod and Smith. Some new Portuguese shippers appeared also in the list.

This period seemed to be a period of important renewal also with the almost disappearance of the Companhia that lost the exclusivity on the Brazilian market and some of its prerogatives. So, any lost of privileges for the Companhia turned it a much weaker organization and its importance in the international trade is lower than the medium-sized shippers.

Table nº 11: Ranking of Port shippers - 1833				
Rank	Port Shippers	Pipas	Share	Ci
1	Sandeman	2414	0,12	0,12
2	Quarles Harris Senior	1956	0,09	0,21
3	Offley Forrester & Weaver	1550	0,07	0,29
4	Lambert Kingstons & Egan	1240	0,06	0,35
5	Croft	916	0,04	0,39
6	Fonseca Monteiro & cia	887	0,04	0,43
7	Knowles Procter & Bold	844	0,04	0,47
8	Allen Morgan Cia	772	0,04	0,51
9	J. I. Smith	670	0,03	0,54
10	Cockburn Greig & cia	612	0,03	0,57
11	Smith Woodhouse & Cia	544	0,03	0,60
12	Joseph Taylor & Cia	505	0,02	0,62
13	Rocher Alvarenga Tunn & Cia	459	0,02	0,65
14	Butler Nephew & Cia	435	0,02	0,67
15	Burmester & Cia	394	0,02	0,69
16	José Alves Pinto Vilar e filho	377	0,02	0,70
17	Manuel de Clamouse Brown	353	0,02	0,72
18	Page & Cia	335	0,02	0,74
19	António Bernardo Ferreira	320	0,02	0,75
20	Guerreiros & Ribeiro	312	0,02	0,77
	Total	20710	1	

Source: ANTT, AP Saídas 1833 and AHRCV, Book, Lista de exportadores, 1833.

This year has seen the export of Port wine disorganized by the civil war and affected the volume trade. Sandeman has risen to leader of the market. If the Bearsley family was not in the trade, their business continued with Joseph Taylor.

Some Portuguese shippers are entering in the trade, but as in the other periods, the Portuguese name come and go much faster than the British names such as Page, Taylor, Woodhouse and Cockburn.

In the Portuguese names, António Bernardo Ferreira has to be emphasized for being a predecessor of the company Ferreira.

Table nº 12: Ranking of Port shippers - 1854				
Rank	Port Shippers	Pipes	Share	Ci
1	Sandeman & C ^a	4050	0,10	0,10
2	Cockburn Smithes & C ^a	2395	0,06	0,16
3	Martinez Gassiot & C ^a	2392	0,06	0,23
4	J D Harris	2329	0,06	0,28
5	Guilherme e J Graham & C ^a	1804	0,05	0,33
6	Offley Webber & Cramp	1768	0,05	0,38
7	Hunt Roop Teage & C ^a	1582	0,04	0,42
8	Morgan Junior & Ridge	1148	0,03	0,45
9	G A Redpath & Rosas	1056	0,03	0,47
10	Bruno S ^a & I ^o	1006	0,03	0,50
11	Butler Nephew & C ^a	865	0,02	0,52
12	Manoel de C Browne	831	0,02	0,54
13	Taylor Fladgate & Yeatman	805	0,02	0,56
14	H Donaldson & C ^a	793	0,02	0,58
15	Direcção Companhia dos vinhos	781	0,02	0,60
16	C N Kopke & C ^a	758	0,02	0,62
17	Croft & C ^a	692	0,02	0,64
18	José J. Forrester	659	0,02	0,66
19	W. G. Roughton	652	0,02	0,67
20	Kingston & Sons	632	0,02	0,69
	Total	39252	1	

Source: *O Comércio do Porto*, October 4 1854

This list is from the Journal *O Comércio do Porto* because of the original documents of the Alfândega do Porto were missing and after many investigations, nothing better was found. The only problem with that data is that they give the main shippers 30 or 40 but do not tell us who are the small shippers and how many they are.

From now on, the companies Sandeman, Cockburns and Martinez are dominating the trade. It is interesting to note that these are rather recent shippers.

The concentration in the sector is still lower than in the previous year and corresponds to a much weaker regulation system with a Companhia almost reduced to a trading firm.

Table nº 13: Ranking of Port shippers - 1866				
Rank	Port Shippers	Pipes	Share	Ci
1	Sandeman & Filhos	5411	0,15	0,15
2	Cockburn Smiths & cia	3023	0,08	0,23
3	Hooper Irmãos	2208	0,06	0,29
4	Martinez Gassiot & cia	2042	0,06	0,35
5	Offley, Cramp & Forrester	1800	0,05	0,40
6	W. e I. Graham & Cia	1738	0,05	0,45
7	Clode & Baker	1577	0,04	0,49
8	Hunt Roop Leage & Cia	1437	0,04	0,53
9	D. M. Fueuerheer Junior & Cia	910	0,03	0,56
10	R. I. Teixeira de Carvalho & Cia	874	0,02	0,58
11	I. H. Andersen	853	0,02	0,61
12	W. G. Roughton	780	0,02	0,63
13	Dow & Cia	696	0,02	0,65
14	Companhia de Vinhos	619	0,02	0,66
15	Croft & Cia	578	0,02	0,68
16	Silva & Cosens	574	0,02	0,70
17	Taylor Fladgate & Yeatman	520	0,01	0,71
18	Morgan Irmãos	518	0,01	0,72
19	Smith Woodhouse & Cia	513	0,01	0,74
20	A. F. Menezes	492	0,01	0,75
	Total	36133		

Source: *O Comércio do Porto*, January 4 1866

Now the Companhia is abolished and the liberalization of the trade continue. Some new firms are entering the market (Morgans, Menezes, Silva & Cosens) but at the same time the most important shippers, Sandeman, Cockburns and Martinez, already well established, are almost unaffected by this change.

For the years to come, it seems that the volume of trade is expanding and the number of shippers also. Many small Portuguese shippers will enter the Port trade between 1854 and 1871, the extreme for which I was able to gather the data.

Sandeman in 1866 and 1871 was divided between two companies because of some disagreement between the partners. After the years and the quarrel would die down and T. G. Sandeman and Sandeman would be back together under the name Sandeman.

In the next tables (table 14 and 15), I have distinguished between the two cases, the two Sandeman firms counting for just one or being separated and the index of concentration is affected. This is just to make it clear that some of the situations with the historical data are not as easy to treat as cases of today.

Table nº 14: Ranking of Port shippers - 1871				
Rank	Port Shippers	Pipes	Share	Ci
1	Cockburn Smithes & C ^a	3250	0,08	0,08
2	Martinez Gassiot & C ^a	1839	0,04	0,12
3	Hooper Brothers	1757	0,04	0,16
4	Offley Webber & Cramp	1725	0,04	0,20
5	D M Feuerheerd Junior & C ^a	1522	0,04	0,23
6	Silva & Cosens	1511	0,04	0,27
7	Clode & Baker	1401	0,03	0,30
8	T. G. Sandeman & Sons	1186	0,03	0,33
9	Sandeman & C ^a	1165	0,03	0,36
10	Dow & C ^a	1080	0,03	0,38
11	Hunt Roop Teage & C ^a	790	0,02	0,40
12	W. G. Roughton	706	0,02	0,42
13	Croft & C ^a	705	0,02	0,43
14	Taylor Fladgate & Yeatman	682	0,02	0,45
15	Direcção Companhia dos vinhos	668	0,02	0,46
16	Manoel Pereira Guimarães e Silva	660	0,02	0,48
17	Carlos Brandão	625	0,01	0,49
18	Rodrigo José Teixeira de Carvalho	609	0,01	0,51
19	Morgan Brothers	562	0,01	0,52
20	C N Kopke & C ^a	502	0,01	0,53
	Total	43171	1,00	

Source: *O Comércio do Porto*, February 3 1871.

Table nº 15: Ranking of Port shippers - 1871				
Rank	Port Shippers	Pipes	Share	Ci
1	Cockburn	3250	0,08	0,08
2	Sandeman & TG Sandeman	2351	0,05	0,13
3	Martinez	1839	0,04	0,17
4	Hooper Brothers	1757	0,04	0,21
5	Offley	1725	0,04	0,25
6	Feuerheerd	1522	0,04	0,29
7	Silva Cosens	1511	0,04	0,32
8	Clode & Baker	1401	0,03	0,36
9	Dow	1080	0,03	0,38
10	Hunt Roope	790	0,02	0,40
11	Smith Woodhouse & C ^a	705	0,02	0,42
	Total de 43171	43171		

Source: Idem, ibidem.

Table nº 16: Ranking of Port shippers - 1907				
Rank	Port Shippers	Pipes	Share	Ci
1	Silva & Cosens	2711	0,06	0,06
2	Cockburn Smithes & C ^a	2705	0,06	0,12
3	Sandeman & C ^a	2660	0,06	0,18
4	Augusto C. d'Almeida & C ^a	2345	0,05	0,23
5	Guilherme & João Graham & C ^a	1523	0,03	0,27
6	Martinez Gassiot & C ^a	1422	0,03	0,30
7	Antonio José da Silva & C ^a	1419	0,03	0,33
8	Robertson Brothers & C ^a	1365	0,03	0,36
9	Real C ^a Vinícola do Norte de Portugal	1326	0,03	0,39
10	Guimarães & C ^a	1187	0,03	0,42
11	Tait & Ramsey - Tait & C ^a	1095	0,02	0,44
12	Taylor Fladgate & Yeatman	1092	0,02	0,47
13	Hunt, Roope Teage & C ^a	1012	0,02	0,49
14	C ^a Vinicola Portuguesa	987	0,02	0,51
15	Ferreira CACVP	962	0,02	0,53
16	Velloso & Tait	897	0,02	0,55
17	Miguel de Souza Guedes	889	0,02	0,57
18	A. Pinto dos Santos Junior & C ^a	888	0,02	0,59
19	Clode & Baker	870	0,02	0,61
20	Dch Mathias Feuerheerd Junior & C ^a	863	0,02	0,63
	Total	44566		

Alfândega do Porto/Museu do Transporte e Comunicações, Livro de contas correntes dos exportadores de vinho do Porto, 1907.

Once again, the data for 1907 and 1926 come from the Custom House of Porto (Alfândega do Porto) and are of rather good quality, especially if compared with the years 1854 or 1871. I was able to check for each shipper the quantities exported notice that while the sector was in crisis, there were more than 93 shippers and that by 1926 it was over 130.

The market structure seemed to be more competitive in that period with a stronger pressure for individuals and firms to enter the Port wine market. In the analysis of biological or organizational populations this corresponds to a higher density, i.e. a higher absolute numbers of the members of a determinate population (Hannan and Freeman 1977, Hannan 1988, Hannan and Carroll 1992).

Most of the firms that enter the market are small ones and disappear within a short period of time (five to six years according to what I was able to verify in the books of the Custom House).²⁴⁴

²⁴⁴ AHAP/MTC, Porto; Contas Correntes dos exportadores do vinho do Porto, 1907-1933.

Table nº 17: Ranking of Port shippers - 1926				
Rank	Port Shippers	Pipes	Share	Ci
1	Croft & C ^a	7173	0,08	0,08
2	Monteiro & Mesquita	6017	0,06	0,14
3	Sandeman & C ^a	5676	0,06	0,20
4	Cockburn Smithes & C ^a	4221	0,04	0,24
5	Ferreira (CACVP)	4165	0,04	0,29
6	Martinez Gassiot & C ^a	4017	0,04	0,33
7	A. A. Calem & Filho	3482	0,04	0,36
8	Guimarães & C ^a	2983	0,03	0,40
9	Guilherme & João Graham & C ^a	2820	0,03	0,43
10	Hans Kolitzus	2643	0,03	0,45
11	Adriano Ramos Pinto e Irmão	2574	0,03	0,48
12	Silva & Cosens	2541	0,03	0,51
13	Taylor-Fladgate & Yeatman	2062	0,02	0,53
14	Antonio Antunes de Freitas	2024	0,02	0,55
15	Delaforce Sons & C ^a	1967	0,02	0,57
16	Reis & Sá	1881	0,02	0,59
17	Almeida & Commandita	1789	0,02	0,61
18	Maria da Gloria Sampaio Arião	1763	0,02	0,63
19	Antonio José da Silva & C ^a	1757	0,02	0,65
20	Robertson Brothers & C ^a	1740	0,02	0,66
	Total Exports	95238		

Alfândega do Porto/Museu do Transporte e Comunicações, Livro de contas correntes dos exportadores de vinho do Porto, 1926.

The year 1926 is characterized by a high volume of exports and an important renewal of shipping firms. Many firms in the period will be absorbed in the 1950s and 1960s by some of the stronger ones like the Ferreira.

At the same time, if the trade is in expansion, the entrance and exit movement are important. According to the listings of shipping firms, in the years 1907 to 1926 the number of entrants exceed largely the number of firms that went out of business. Most of the selection will occur between the 1930s and 1940s with the stagnation of the trade and the weaker situation of the small and medium-sized firms with regard to the new regulations (lei do terço and quality control). Later still, the firms that were not eliminated were often absorbed like the company Rodrigues Pinho, G-. H. Sellers & Ferro, J Gouveia, J. H Andersen that were integrated in the Ferreira group (consórcio).²⁴⁵ I will continue this point for the year 1960.

²⁴⁵ A H AA Ferreira, documentos de Valor, Hunt Roope, Caixa 1144.

Table nº 18: Ranking of Port shippers - 1948				
Rank	Port Shippers	Pipes	Share	Ci
1	Sandeman & Cia	2893	0,08	0,08
2	Ferreira - CACVP	1795	0,05	0,13
3	Adriano Ramos Pinto & Cia	1581	0,04	0,18
4	Croft & Cia	1572	0,04	0,22
5	Cockburn Smithies & Cia, Ltda	1163	0,03	0,25
6	C. N. Knopke & C.o	1083	0,03	0,29
7	A. A. Calém	951	0,03	0,31
8	Real Companhia Vinícola do Norte de Portugal	949	0,03	0,34
9	J. W. Burmester & Cia, Ltda	889	0,03	0,36
10	G. & J. Graham & Cia ou W. & J. Graham & C.o	832	0,02	0,39
11	Martinez Gassiot & C.o, ltd	822	0,02	0,41
12	Robertson Bros & Cia, Ltda	805	0,02	0,43
13	Hunt, roope & Cia	786	0,02	0,46
14	Silva & Cosens	770	0,02	0,48
15	Delaforce Sons, Ltda	762	0,02	0,50
16	António José da Silva, Ltda	746	0,02	0,52
17	Soc. dos Vinhos do Porto Constantino, Ltda	708	0,02	0,54
18	Offley Forrester, Ltda	695	0,02	0,56
19	Guimaraens & C.o	640	0,02	0,58
20	Pinto Ferreira & Filhos, Ltda	624	0,02	0,60
	Total	35347		

Source: ADP, IVP, Listagem de contas correntes; IVP, Relatório das contas correntes de 1948.

With this list of shippers, a new period of regulation is already stabilized and the main firms are much more stable. The number of firms, or density is lower (80 firms) than 1926 and the competitive pressure has probably decreased. At least the cost of entering the Port trade is much higher. As in the time of the Companhia, there is a list of registered shippers. The creation of the Port wine institute (IVP) and the Casa do Douro regulate the market and limit the possibility of entering the market.

These measures were reinforced in subsequent years with the creation of the compulsory stock holding for Port shippers (*lei do terço*). In the graphs that follow the number of firms diminished and the concentration augmented.

This is one important interaction with the institutional setting where the population of shipping firms is influenced by the legal arrangements and the costs that the newcomers have to support in order to enter the business.

At the same time, the market until the 1960s is stagnant and accumulation of stocks is an important financial burden for the shipping firms.

Table nº 19: Ranking of Port shippers - 1960				
Rank	Port Shippers	Pipes	Share	Ci
1	Sandeman & Cia	6918	0,16	0,16
2	Cockburn Smithies & Cia, Ltda	3179	0,07	0,23
3	Croft & Cia	2224	0,05	0,29
4	Miguel de Sousa Guedes & Irmão, Ltda.	2063	0,05	0,33
5	Martinez Gassiot & C.o, ltd	1958	0,05	0,38
6	Ferreira CVPCN	1232	0,03	0,41
7	Warre & Cia	1144	0,03	0,43
8	G. & J. Graham & Cia ou W. & J. Graham & C.o	1142	0,03	0,46
9	Silva & Cosens	1024	0,02	0,48
10	Antônio José da Silva, Ltda	1023	0,02	0,51
11	CGAVAD	968	0,02	0,53
12	Delaforce Sons, Ltda	959	0,02	0,55
13	A. A. calém	810	0,02	0,57
14	Amândio Silva & Filhos, Lda	800	0,02	0,59
15	Barros, Almeida & Cia	786	0,02	0,61
16	Wiese & Krohn, Scrs.	764	0,02	0,63
17	Offley Forrester, Ltda	750	0,02	0,64
18	C. N. Knopke & C.o	695	0,02	0,66
19	Diez Hermanos, Ltda	680	0,02	0,68
20	Adriano Ramos Pinto & Cia	664	0,02	0,69
	Total	43139		

Source: Idem, ibidem; IVP, Relatório das contas correntes de 1960.

In this period, the concentration of the sector increased and a new wave of acquisitions occurred after 1963. The firm Ferreira made the acquisition of Marques de Merito, Hannappier and Morgado & Silva. The Real Companhia Velha (CGAVAD) was also approximating itself to such firms as Hooper Brothers that were acquired later.

The market is in regression, exports, expressed in quantities, are about half those of 1926. The sector show signs of crisis and several firms will be out of business in the context of a strong regulatory system that seems to benefit the big firms.

In the last two graphs, the trend to concentration continues, as attested by the higher value of the concentration index that can be compared to the previous results of the table with the Herfindahl index.

Table nº 20: Ranking of Port shippers - 1972				
Rank	Port Shippers	Pipes	Share	Ci
1	Sandeman & Cia	11136,02	0,14	0,14
2	CGAVAD	10785	0,13	0,27
3	Cockburn Smithies & Cia, Ltda	6244	0,08	0,35
4	Martinez Gassiot & C.o, ltd	3475	0,04	0,39
5	Warre & Cia	3051	0,04	0,43
6	Croft & Cia	2717	0,03	0,46
7	C. da Silva	2614	0,03	0,49
8	Offley Forrester, Ltda	2506	0,03	0,52
9	Silva & Cosens	2407	0,03	0,55
10	Delaforce Sons, Ltda	2268	0,03	0,58
11	Adriano Ramos Pinto & Cia	1799	0,02	0,60
12	Amândio Silva & Filhos, Lda	1758	0,02	0,62
13	Sociedade Agrícola e C.a dos Vinhos Messias, SARL	1754	0,02	0,64
14	Manuel D. Poças Junior, Ltda	1706	0,02	0,67
15	Real Companhia Vinícola do Norte de Portugal	1702	0,02	0,69
16	Ferreira - CACVP	1698	0,02	0,71
17	António José da Silva, Ltda	1691	0,02	0,73
18	Wiese & Krohn, Scrs.	1676	0,02	0,75
19	Taylor Fladgate & Yeatman	1637	0,02	0,77
20	G. & J. Graham & Cia ou W. & J. Graham & C.o	1461	0,02	0,79
	Total	81451		

Source: Idem, ibidem; IVP, Relatório das contas correntes de 1972.

Table n° 21: Ranking of Port shippers - 1974				
Rank	Port Shippers	Pipes	Share	Ci
1	CGAVAD	15348	0,19	0,19
2	Sandeman & Cia	10620	0,13	0,32
3	Cockburn Smithies & Cia, ltda	7446	0,09	0,41
4	Warre & Cia	3618	0,04	0,45
5	Croft & Cia	3596	0,04	0,50
6	Offley Forrester, ltda	3066	0,04	0,53
7	Silva & Cosens	2557	0,03	0,57
8	Real Companhia Vinicola do norte de Portugal	2088	0,03	0,59
9	C. da Silva	1969	0,02	0,61
10	Delaforce Sons, ltda	1948	0,02	0,64
11	Ferreira -CACVP	1785	0,02	0,66
12	Serafim Cabral	1727	0,02	0,68
13	Amândio Silva & Filhos, Lda	1637	0,02	0,70
14	G. & J. Graham & Cia ou W. & J. Graham & C.o	1485	0,02	0,72
15	Martinez Gassiot & C.o, ltd	1434	0,02	0,74
16	Sociedade Agrícola e C.a dos Vinhos Messias, SARL	1410	0,02	0,75
17	Quinta do Noval - Vinhos, SARL	1285	0,02	0,77
18	Rozès, lda	1192	0,01	0,78
19	Taylor Fladgate & Yeatman	1190	0,01	0,80
20	Guimaraens & C.o	1125	0,01	0,81
	Total	81851		

Source: Idem, *ibidem*; IVP, Relatório das contas correntes de 1974.

1.6. Conclusions

Over the whole period under study, the merchants are basically the rising side of the sector and the cultivators, treating the vine and making wine, are lagging behind because of the lack of organization, political support and general lack of resources due to their economic, political, institutional and social isolation.

A first conclusion that results from the study of the various documents – from the Porto fiscal administration to the *Companhia Geral* – is the importance of the central players, i. e., those that can define and influence the rules of the game, such as the big port shippers. There is a clear concentration in the sector and it has been continuously renewed through the centuries.²⁴⁶ As I have tried to show, the Herfindahl

²⁴⁶ See the documents of the AHMOP, MR 35, mf. 28, *Mappa dos vinhos legaes de embarque ...*; mf. 29, *Mappa de exportadores ... 1792*; mf. 30, *vinho de ramo ... da Companhia Geral ... (1756-1788)*; and mf. 31, 1784. I have also used several years of the Books of registry of the Alfândega do Porto (ANTT,

index has fluctuated as time went by, but not it has not much decreased substantially over the period, quite to the contrary.²⁴⁷

A second conclusion has to do with the high degree of renewal of the business. Most of the firms or individuals disappear or die, and even the absorption of one firm by another gives us firms that still bear the same name but are quite different from the time preceding the fusion or acquisition. In other words, there is a high instability of the sector, typical of a product like wine, influenced by many factors: climate, vine blights, wine diseases, war, political alliances, competition, state and regional regulation, etc. We see also the emergence of new firms and the growth of some, while others decline, almost inexorably, not to mention those very small traders that are a very high proportion of the total population, but that do not survive much time in the business, especially with exclusive dedication to wine trade. This is clear when we compare the list of exporters from generation to generation. This second point is of high relevance for our study.

Finally, the type of shipping firms has evolved historically from individual merchants, a characteristic of the 17th and 18th centuries; to trading firms still centered on family ties and the rising role of the partners, from the late 18th and the whole 19th centuries, and to the trading corporations of the 20th centuries, appearing in the Port wine sector after World War II.

2. The case of the *Companhia Geral*

The case of the *Companhia Geral do Alto Douro* is one of the most interesting regulatory and productive organizations in the history of Modern Portugal. It is related to the general economic context, the political changes in the country and the modifications of the economic policy. The *Companhia* has been instituted as a privileged company, and became a very common legal organization by the end of the *Ancien Régime*, was characterized by strong state control over key economic sectors. This company with all its privileges lasted over half a century, and, in the 1830s, it transformed into a trading firm with the endowment of some control mechanisms that

Alfândega do Porto, from 1769 to 1833. The documents of the IVP show a rather high concentration and an ever-increasing one throughout the 20th century.

²⁴⁷ Although I have no precise quantitative data of the current market share in the sector, with the recent buyouts and absorptions in the last decade, the index could only have increased substantially.

will be suppressed with the dissolution of the *Companhia Geral* in 1852, the year of its final transformation into a commercial firm (*sociedade comercial*). The last transformations, from 1830 to 1852 correspond to the rise of liberalism in Portuguese economic policy.²⁴⁸

A prominent aspect of the Port wine sector is the creation in 1756 and the subsequent evolution and transformation, if not transmutation, of the *Companhia Geral da Agricultura das Vinhas do Alto Douro* (CGAVAD) or, in brief, *Companhia Geral*, which later on was often called *Real Companhia Velha*, and this is the current name for a commercial firm still existing today while assuming a tiny part of its legacy.

From a theoretical point of view, the Company can be studied from diverse paradigms and narrower perspectives. In economic history, the dominant focus comes from the transaction costs theory, mainly in the interpretation of Williamson. As I have discussed it briefly but insufficiently in the previous chapter, I will here distinguish my position from that of Williamson. I will not enter the debate over the inefficiency of trade monopolies. I prefer first to understand better the workings of those companies and how they relate with the various elements of the system in which they are embedded: the regulatory scheme, the central state, the Douro region, the city of Porto, and the wine shippers and the foreign markets.

2.1. The *Companhia Geral*: a charter or privileged company?

The trading companies of the 18th century, with the attribution of a monopoly or privilege by the monarch, are not new, not even in the early eighteenth century. The first cases, which were reasonably successful, appear in the Netherlands and in England for the trade with India, and, throughout the 17th century onwards, are followed by other countries: Spain, France, Sweden and Portugal.

In the case of Portugal, the fascination with the Companies has dropped at the dawn of the next century. It is only during the Pombal administration that the Companies were reintegrated on a different and substantial basis, with a stronger focus

²⁴⁸ From 1834 to 1838, the *Companhia* has become a commercial firm (*sociedade comercial*), but its transformation and the decline of its regulatory power starts in the 1780s and continues irregularly until the upheavals in Porto in the early 1830s. The year 1838 marks the beginning of the *Companhia Geral* as a control entity after the first liberal interlude between 1834 and 1838. The control function of the *Companhia* will last a little more than a decade (1852), with much fewer prerogatives than in the past. Then again the firm is transformed in a private commercial firm, as one shipper equal to the others.

on the capital and its division of shares. An example of this consists of the emergence of the capitalist or share companies (*sociedades de capitais*) in Portugal during a phase of expansion of the capitalist economies (Marcos 1997).

The *Companhia Geral da Agricultura das Vinhas do Alto Douro*, like the other privileged companies, was created by the state, through specific legislation (alvarás of 1756 and 1761) and owned by private shareholders: civil servants, members of the aristocracy or religious orders, and individuals from the bourgeoisie. In the case of the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, the Condessa de Oeiras, wife of Pombal, is among the shareholders together with Diogo Archibold (unique British wine merchant), Vicente Noronha Leme Cernache (from Porto and future *provedor*, i.e., chairperson, of the *Companhia*).

Out of the 194 shareholders at the time of the foundation of the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, eighty-nine are from the city of Porto, twelve from Lisbon, six from Coimbra and six from Viana, four from Vila Nova de Gaia compared to seven from Vila Real, four from Lamego and four from Lobjos in the Upper Douro. The shareholders of the city of Porto dominated the *Companhia* right from the beginning and this is one further argument against the self-organization of the sector. More than half of the shareholders are from either Porto or Lisbon and Vila Nova de Gaia, the major trading centers of the Portuguese wines. In fact, the owners coming from outside the Douro are over two thirds of the total.²⁴⁹ And, out of thirty three shareholders holding ten or more shares, twenty six are from Porto, three from Vila Real, two from Provezende, one from Vila Nova de Gaia and one from Santa Marta; this shows the clear dominance of the most important shareholders that are the only ones that can occupy the seat of the chair or the Administration of the *Companhia* (called *Provedor* and *Junta*, respectively). The Junta was the supreme authority in the whole organization of the *Companhia*, depending directly from the Crown.²⁵⁰

²⁴⁹ See the original list of shareholders at the Biblioteca Geral da Universidade de Coimbra (BGUC), ms. 673, fl. 369. The list is reproduced in Borges de Macedo (1982: 135-139). From now on the reference will be made to BGUC, ms. 637.

²⁵⁰ If the shareholders owing less than three shares (a situation not giving the right to vote for the election of the Junta (Administration)) are 60, with a total probably lower than 120, their influence in the election of the chair and the management of the *Companhia* is limited. The second group of shareholders, with three shares at least and nine at the most, is important, reaching probably half of the shares (600 or a little more?) and with a right to vote in the election of the direction of the Company. The last group, composed by the shareholders possessing ten shares or more, is 33 and their aggregate voting power should be close to half, with a minimum of 330 shares. In the latter group we could advance the figure of 500 shares (BGUC, ms. 637).

I have already given a brief sketch of the historical setting before the creation of the *Companhia Geral*, and to do this I have relied partly on (Cardoso, Antonio Barros 2003).²⁵¹ At the time of the creation of the Company, the Port wine sector had already been consolidated its business over seventy years, exporting mainly to the United Kingdom. In the 1740s and the early 1750s, there was a crisis characterized by excessive production and a lowering of the quality through adulteration, as well as the widespread use of improper land, quite unsuitable for vine growing and the introduction of wines from other adjacent regions. It is in this context that the central State legislated for the creation of the *Companhia Geral* as a means to control one key economic sector, central for the reorganization of the Portuguese fiscal incomes.

In relation to the creation of the Company, the initiative was not just a proposition from the Douro vigneron but rather it was a convergence between the absolutist state needs and policy objectives and landed aristocracy, the Porto and Douro bourgeoisies and some important winegrowers. Probably the vast majority of the winegrowers, and especially the small ones did not take part in the scheme and decision process. This structure of the shareholders, as I have just shown, had to be seen in its historical context and in the theoretical perspective of a regulation centered on the state, with the clear domination of the city of Porto over the productive region of the Douro. Porto was an intermediary between the local production and the central state as much as between the winegrowers and the traders. If I looked at the list of shareholders, I could notice that the Porto residents were the most important group in number but also each shareholder from the city has, on average, more shares than those originating from the Upper Douro.²⁵²

I must give a word of caution with regard to the notion of monopoly. The concept of monopoly, found today in the textbooks or generally understood by lawyers

What is clear from the data is the domination of the Porto shareholders, in general and in each category, a dominance more accentuated in the last group of the important shareholders. On the other hand, the voting power of the Porto shareholder is accentuated as much as their ability to access to the ten members of the administration (one *provedor*, the chair, one *vice-provedor*, vice-chair; seven *deputados*, administrators; and one *secretário*, secretary).

This structure has been substantially modified in the 19th century, especially between 1834 and 1843, before its extinction in 1852 as a regulatory body. See Sousa (2003) for some details on the formal evolution of the *Companhia Geral*.

²⁵¹ See the introduction of the second part of the thesis.

²⁵² See BGUC, ms. 673; where the shareowners owning more than one piece of stock are marked by * or **. This reinforces what I said before on the domination of the Porto residents in the organization of the *Companhia*. This is a recurrent problem in the *Companhia Geral*, with its headquarters in Porto and most of the management coming from Porto members and not from people from the Douro. See Gaspar Martins Pereira 2004 and the AHMOP, MR 35, mf 29-31.

or economists does not correspond to the historical case of monopolies provided by monarch during the Modern times or the Medieval Europe. This argument has been defended for medieval guilds in Europe (Richardson 2004). Here I defend the position of monopoly as a dynamic situation and distinguish monopoly power at different levels. For instance, the *Companhia Geral* had the monopoly of trade with Brazil and the selling of wine in the city of Porto during the second half of the eighteenth century. It was a legal monopoly, which was not always respected in practice because of smuggling and the existence of competition with other products (other wines and alcoholic beverages in this case).

The Company created was a privileged company composed of private capital stocks but under the aegis of the state. The shareholders are members of the aristocracy, the public administration, and merchants or important landowners (usually of vineyards) residing in Porto or the Douro. The entity has privileges and exclusive rights over the control of the transport of the Port wine, the qualification of the wine produced (proper or not for export), exclusivity of sales to the Porto taverns, exclusivity of exports to four major Brazilian destinations (*Capitanias* of Rio de Janeiro, São Paulo, Pernambuco and Bahia),²⁵³ judicial privileges for its public servants, etc. On top of that, the Company defines the *arrolamento*, authorization of production, the price system and the market conditions for the selling of wines after the vintage time (grape-harvest).

2.2. The origins of the Companhia Geral

The origin of *Companhia Geral* is partly controversial. It is not just the idea of the Marquis of Pombal, even if he had some knowledge about the trading companies; it is not just the result of the interest of the Douro landowners, it is not just the creation of a company for securing revenues for the Royal Treasury.

However, without any of these good reasons, the Company would not have been created and taken the form it took for the organization and control of the Port wine market. The question of the origins of the *Companhia Geral* matters for our purpose of explaining the creation of the first regulatory regime (1756-1808) of the whole period chosen.

²⁵³ AHMOP, MR 35, mf. 30 for the quantities of wine (*vinho de ramo*) exported from 1756 to 1788 by the *Companhia Geral* to the main Brazilian ports: Rio de Janeiro, Bahia and Pernambuco. The other ports are not important at all.

It is the result of a context deeply influenced by (1) the mercantilist doctrines, especially with regard to the counselors of the king, a legacy that goes back at least to Luis da Cunha and the ministers of King João V; (2) the modification of the Portuguese State which is in need of additional income after the loss of the prominent Asian trade, the wars with Spain and the maintenance of a military navy; (3) the colonial transformation with the increased importance of Brazil; (4) the rivalry between the Portuguese producers and the English merchants, the latter dominating the Douro wine trade; and (5) the political leaning of the Marquis of Pombal and the King and his Court and counselors.

The creation of the company was indeed the consequence of the confluence of several factors. The central one is not just the crisis of the early 1750s, at least in the framework adopted here, as it is traditionally presented in the literature with the subsequent recognition by the Marquis of Pombal of the project presented by some influential Douro wine-growers (Fonseca 1955, 1957, 1962, Fonseca, *et al.* 1987, Moreira 1998).

The creation of the *Companhia Geral* was not just a premature self-regulation entity but also a typical company with regulatory power, typical of the administration of the economy by the absolutist state. It is one case among several others in which the state shapes the productive setting through new legislation by establishing privileges and new practices; an absolutist government orienting investment in such a way that it can motivate individuals and increase the income of the central State.

The creation of the Company is often presented as a response of the Marquis of Pombal to the domination of the British merchants in the Douro wine trade. This is what we find in the work of Moreira da Fonseca (1941, 1955, 1957, 1962), Schneider (1980), and, more recently, Sousa (2003). This last author described the objective of the Company (2003b: 9): "the *Companhia Geral* [...] was created for guaranteeing and promote in an articulated manner the production and trade of the wines of the Upper Douro and to limit the predominance and even the control of this activity by the English". If the first part is according to me unambiguous, the second part is open to discussion, at least if we take into account what really happened with the *Companhia Geral* and its relation with the British merchants. They were not just competitors as they also had combined interests, namely against the emergence of other (*i.e.*, Portuguese) prominent wine merchants that would be in direct competition with both of them.

Most probably, the creation of the privileged companies, such as the Brazilian companies and the *Companhia Geral da Agricultura das Vinhas do Alto Douro*, responded to a general objective to control the economic sector and enjoy balance of power in society and trade. Moreover, the increasing influence of the British merchants is another determining factor as well. In this sense, the *Companhia Geral* was a competitor for the British merchants. Nevertheless, it was above all a competitor for the Portuguese merchants, who were much smaller in size than the British. This objective behind the creation of the company was not solely to take the business from the British, but rather to control their activity as part of a general policy of control of an economic sector in which the British were just one group of players, the most important ones. This point is substantiated by Kenneth Maxwell for the policy of Pombal in relation to the trading companies in Brazil (Maxwell 1995).

Nevertheless, the discussion of the genuine objective cannot avoid the study of the very role of the *Companhia Geral* and its effects on the Port wine sector and the economy in general.

2.3. Evolution of the *Companhia Geral*

The *Companhia Geral* was created, among other things, in order to control a promising economic sector, the Port wine, and a region, the Douro, as much as it has been one of the instruments of the state to accrue financial resources by way of taxes and duties.

The statutes of the *Companhia Geral*, published in 1756, gave it exclusivity in some areas of the Port wine sector, defined its structure, its organization, its administration and the role it had to play.

The legislation was further extended by new statutes and legal norms in almost every aspect of the production and trade of the Port and Douro wines as well as wine spirit. This extension and strengthening of the role of the Company has profoundly marked the sector and created a new regulatory tradition. It also consolidated the commercial function of the *Companhia Geral*, exporting wine to Brazil and to Northern Europe, including the United Kingdom while at the same time

extending its activities in tax collection and other socio-economic tasks such as education, and public roads.²⁵⁴

From 1777, the Company lost some of its attributes after the fall of the Marquis of Pombal; but its role in the regulation of the sector was still considerable. I would say that until the French invasions (1807) the *Companhia Geral da Agricultura das Vinhas do Alto Douro* was the central regulatory entity much in the way outlined by the Marquis of Pombal. It was after the French invasions, the rise of liberalism, and the loss of Brazil that the situation changed substantially and erratically until its abolishment in 1865. The regulation in the period posterior to the 1800s and then the 1820s was completely transformed, leaving to the shippers, winegrowers and local authorities most of the mechanisms for the organization of the production and trade.

The crisis in the sector was recurrent, and after a protracted agony, the Companhia was finally transformed in 1865 into a private trading company, the *Real Companhia Velha* (Royal Oporto Company), losing all attributes of its regulatory role played in the past. The absence of a real center of regulation will continue until the 1900s when the CVRD and then the IVP and CD were created in the early 1930s.

During the second half of the 19th century the disappearance of the *Companhia Geral* is consumed and the size of Portuguese shippers is slowly increased, in comparison to the British merchants that maintained their position as leaders in the sector. The emergence of Portuguese shippers is rather slow and barely compensated for the disappearance of the *Companhia* in the 19th century. Probably in the late 20th century this is not true and Portuguese shippers have contested the British leadership of the sector, as can be exemplified by the case of the Sogrape company, acquiring shipping firms such as Ferreira and Sandeman in the 1990s. The British Association (or British Factory), once a numerous association of English shippers, is now limited to four full members.

At least two fundamental periods can be distinguished for the *Companhia Geral da Agricultura das Vinhas do Alto Douro*: the first one, from its inception, in 1756, to the end of the regulatory role of the Companhia in 1852, is characterized by a strong control of the economic activity, on almost any aspect of production and trade, at least in the Portuguese territories, and the second one, from then on (1852) the Companhia has become a mere trading firm, devoid of privileges.

²⁵⁴ See ANTT, MR, 632, 640; AHMOP, MR 35; and AHRCV 1 [1.001, 1.011]; 8 [8.1-8.31], 9 [9.1-9.4] and special sections (*subfundos*): A, C, D and F.

Of course, this division is open to discussion, as I have shown it in the first chapter of the present part of the thesis. First, the end of the strong regulatory regime starts in the late 1770s and the privileges will be irregularly decreasing until 1834 and, from then on, its path is leading almost inexorably to the dissolution of the regulatory role of the *Companhia Geral*. The regulatory order, still stable between 1777 and 1805 is starting to decay right from the French invasions, the so-called liberal revolution of the 1820s and the civil wars of 1833 and 1834.

The first period is a phase of rising regulation (1755-1777), a normalization process with some suppression of the most salient features of the previous period (1778-1806) and a clear decay from 1807 to 1834. The last regain of regulation – from 1838 to 1852 – is short lived and will not change much the path of change in the regulation regimes. From that time, the *Companhia Geral* had become a simple trading firm that still exists today.

2.4. Evolution of the Port wine firms and the *Companhia Geral*

In this section, I will study the evolution of the relation between the producers of wine in the Douro, on the one hand, and the merchants and trading firms, on the other hand. The first group is related to the traditional view on technological change, the second, with more recent theoretical development, like rent-seeking (Medema 1991), and the focus on institutional change.

The perspective I take is essentially evolutionary. I will identify the firms from the end of the 17th century and see their evolution through time as well as the emergence of the new ones during the last three centuries.

Here, I try briefly to compare the evolution of the population and the role played by the *Companhia Geral*. The situation of the wine-growers, with the exception of the years following the legislation of 1907-1908, has not been favorable, and, compared to the wine shipper, their relative strength has diminished whereas during the period under study, it was not strong for any substantial period of time.

The shippers, to the contrary, have dominated the industry almost constantly, and with the crises of the 1740s, 1750s, the 1800s, the 1840s, and the second half of the 19th century, their position has strengthened. In the following century, the position of the shipper has been relatively strong before World War II and after the years of

depression, the situation returned to normal in the late 1960s with a new expansion that has not finished with a recent trend in the 1990s and the years 2000-2004.

Beyond the claims of the British merchants against the company, the Companhia Geral was an important regulatory entity that helped to stabilize the productive system much in line with what the English firms and customers desired, but less in line with what the winegrowers needed. The privilege of acquiring wines on a compulsory basis was exactly a mechanism favoring the Companhia Geral and its business to the detriment of the winegrowers, being subject to the following hard choice: either rapidly selling the wine to a British merchant but at a low price or waiting for better opportunities (higher prices) but risking that a commissioner of the company could oblige him to sell production at a fixed (and usually low) price. This was a rather frequent situation in the years of middle and good quality wines, i.e., above average or middle quality vintages (Bennett, 1990, 1992, 1992-93).

The division between winegrowers and wine shipper can be clearly seen on the basis of three criteria. First, the wine producers, in their vast majority, lack technological knowledge and a good network location to endeavor technological change whereas the wine merchants are better integrated in network of merchants and people knowledgeable of trends in tastes and technologies.

Second, the organization of the wine merchants is more articulated than that of the winegrowers. The British merchants, for example, have their English Factory for meeting and taking collective positions against adversaries and threats of any kind. The winegrowers are rather badly organized, especially to defend their interests against the merchants, namely in periods of crisis like the phylloxera blight.

Third, the relation to the regulatory entities is different. Wine merchants and prominent landowners were either closer to the regulatory body, such as the Companhia Geral, or not so much controlled as the smaller merchants and the winegrowers in general. The control of the production of wine spirit, the qualification of the wine quality, and the authorizations for transportation are good examples of this.

3. The issue of prices in the Port wine industry

The research about the evolution of prices in the production of port is a delicate one. Several reasons can be highlighted. First, there are few data available and, when

the data exist, they are very often of poor quality (e.g., official or average prices); this is problem 1. Second, there is very little information about the distribution of the prices at any time (problem 2). Moreover, several prices and costs are to be distinguished (problem 3). Finally, although the study of the price system is crucial for any meaningful economic analysis, such a study is still lacking (problem 4), with the exception of the study by Norman Bennett on Brandy used in the process of making port, or the study of António Barros Cardoso on the retail prices in the city of Porto (2004).

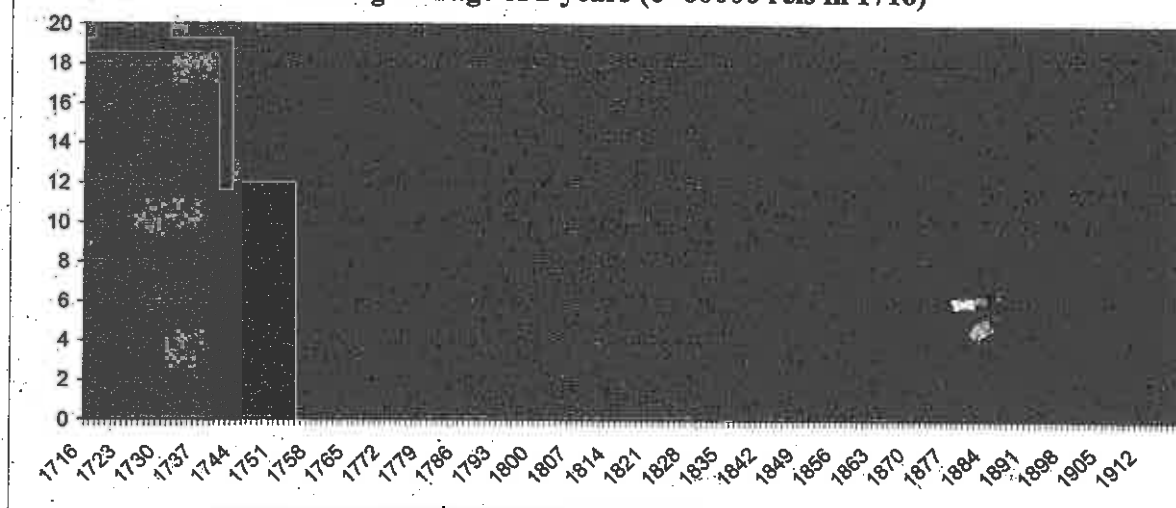
The first problem is the lack of complete series of prices and the quality of the data available. To appraise the difficulty, it is necessary to distinguish the different categories of prices and costs relevant or available to the researcher (problem 3). With the exception of the price of brandy and the costs of production, three types of prices can be distinguished: the selling price of the wine-grower in the Upper Douro to the wine merchant, the price in the Porto market (price to the retailer) or the export prices (either in local or foreign currency), and, finally, the price paid by the consumer (either in Portugal, namely Porto; or abroad; both are retail prices to the consumer).

The prices available are often average market prices or official prices that differ from the effective prices at which exchanges are made. This is particularly the case for the selling prices in the Douro during the existence of the *Companhia Geral* and its tight regulatory scheme and ambiguous action.

The prices in the Upper Douro were regulated from 1757 to 1865 with some interruptions. This regulation fixed reference prices for the selling of wine in the Douro for different kinds of qualities. Unfortunately, the series are very scanty and the only time series that can be used are those of the export prices (current prices from 1716 to 1974) and international, deflated prices from 1890; both series can be found in Martins (1990). I will use them and present the major trend in price fluctuations (see graphs 18 and following).

Graph n° 18: Evolution current export price index of pipes of port wine (1716-1908)

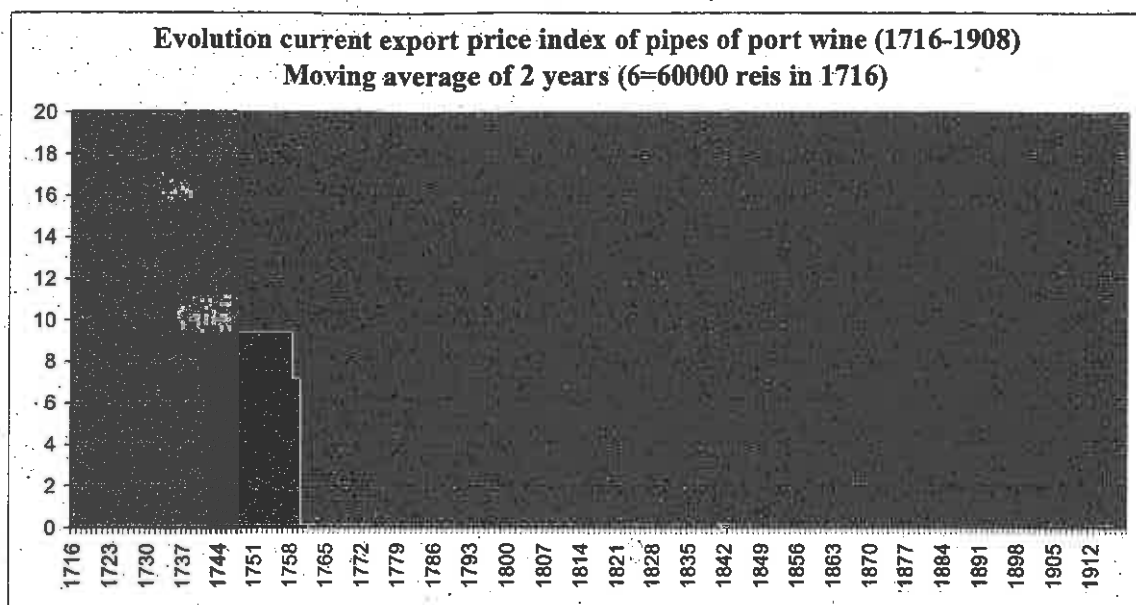
Moving average of 2 years (6=60000 reis in 1716)



The evolution of the price in this graph (two years moving average) is relatively clear. After a decrease in price from 1716 and 1750 (the only years available for the period 1680-1750) show a decrease in current price. For this period under review, the inflation can be considered moderate (this is not true for the following period that follow World War I and above all the period of the 1970s). There is a first cycle of price increase from 1750 to 1811. The increase from 1808 to 1811 is due to the French invasions and the perturbation in supply and trade. Then the increase in prices in the period 1852-1860 and 1860-1868 are related to the decrease in production due to the oidium and the phylloxera outbreaks respectively. Prices decrease from 1870 to 1886, with one more crisis in the Douro and the recuperation is slow, but above prices of the beginning of the century.

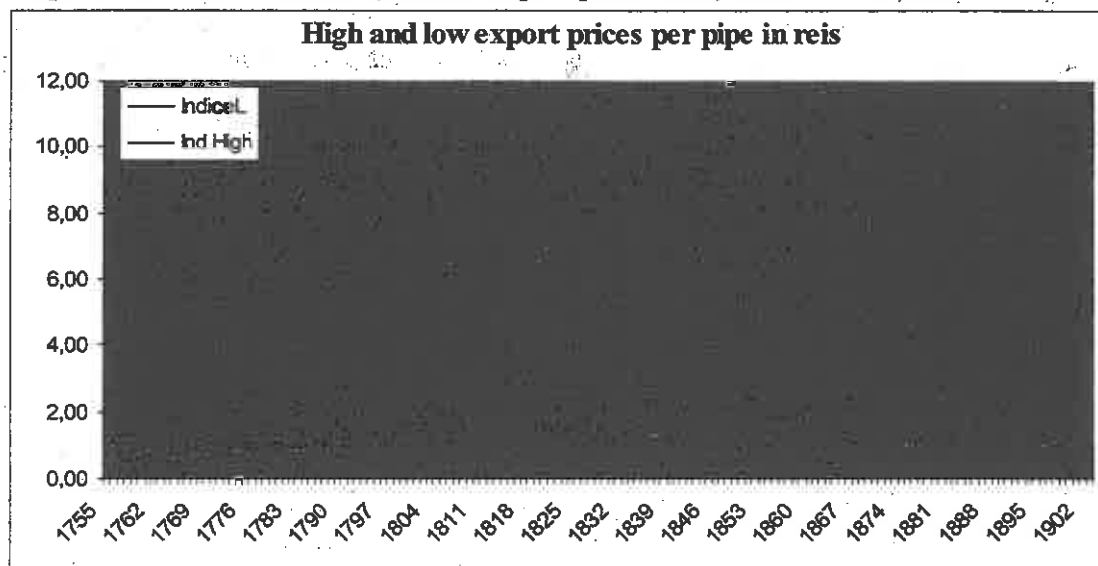
Prices from 1919 are a reflection of inflationary pressure in the Portuguese economy while production is getting back to normal. After World War I the Port wine begins a new price cycle, with two periods of inflation 1919-1928 and 1969-1974. The price increase also translate a valorization of the Port wine in the first two decades of the 20th century and from the period from 1939 to 1965, a period of stagnation in production and trade (in terms of quantities) but beneficiary for the export prices. These trends are clear on the following graph.

Graph n° 19: Price evolution (nominal export price index) from 1716 to 1908



Source: Conceição Andrade Martins (1990: 243-244)

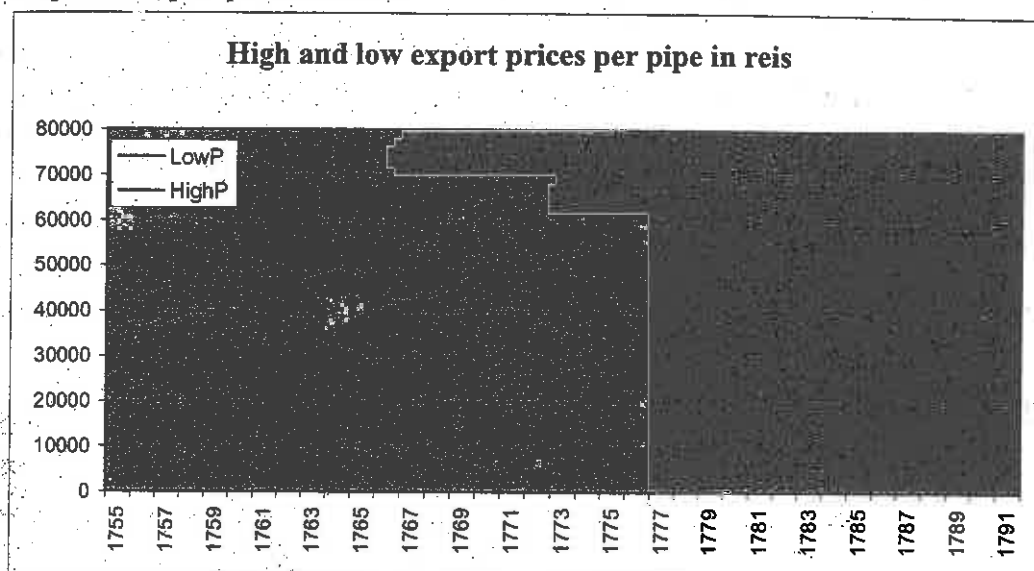
Graph n° 20: Price evolution (nominal export price index) from 1716 to 1908



Source: Bennett (2006)

An interesting observation can be made on the Graph n° 20. After the French invasions, the low and high price for the Port shipper is widening and it seems that since that time the market for cheap wines is increasing with another important change after the 1860s. These data show that the process of creating a mass market for Port wine is quite old. However, the information available does not permit to infer the importance of the cheap wine in relation to the expansive one.

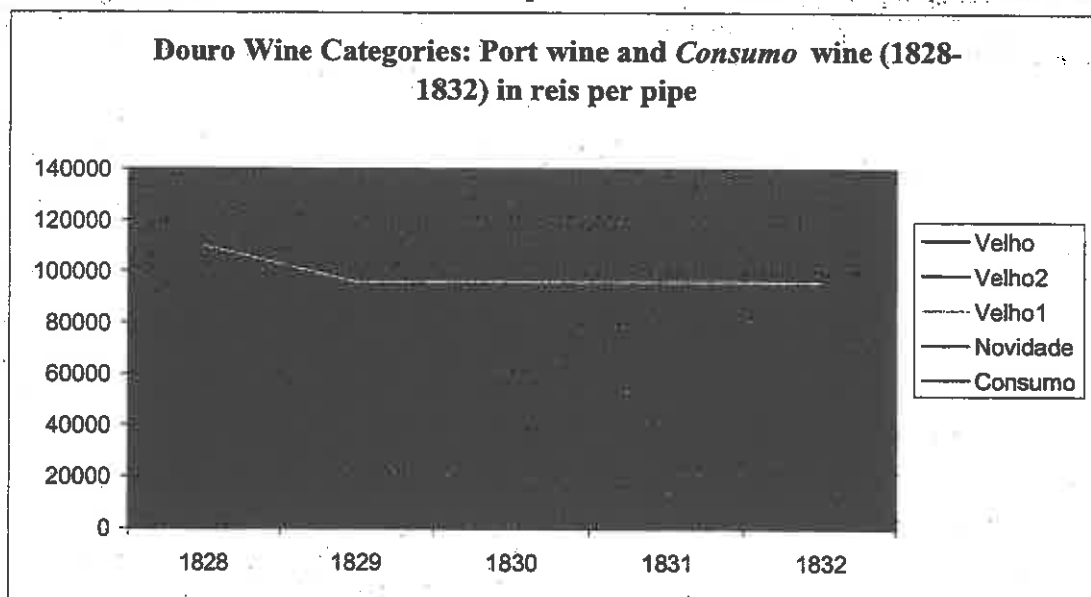
Graph 21. Export prices for wine



Source: Bennet (2006)

I would suggest that the wine merchants are adapting themselves in the 18th century to a different business after the Golden age (see graph 20 and 21) of the 18th century and entering the market for cheap wines.

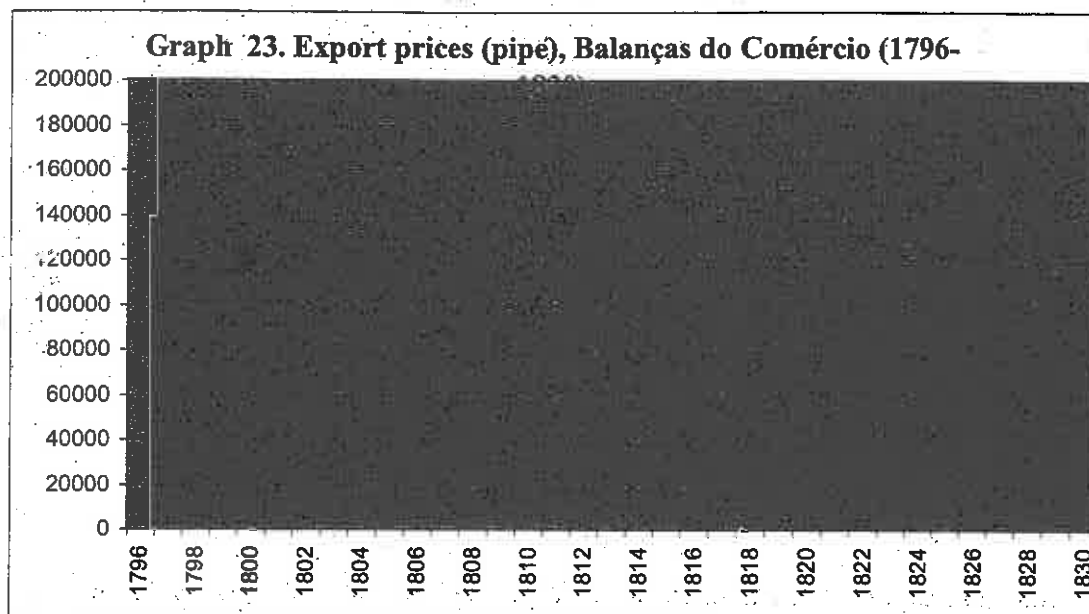
Graph n° 22: Price evolution of different qualities of Port wine



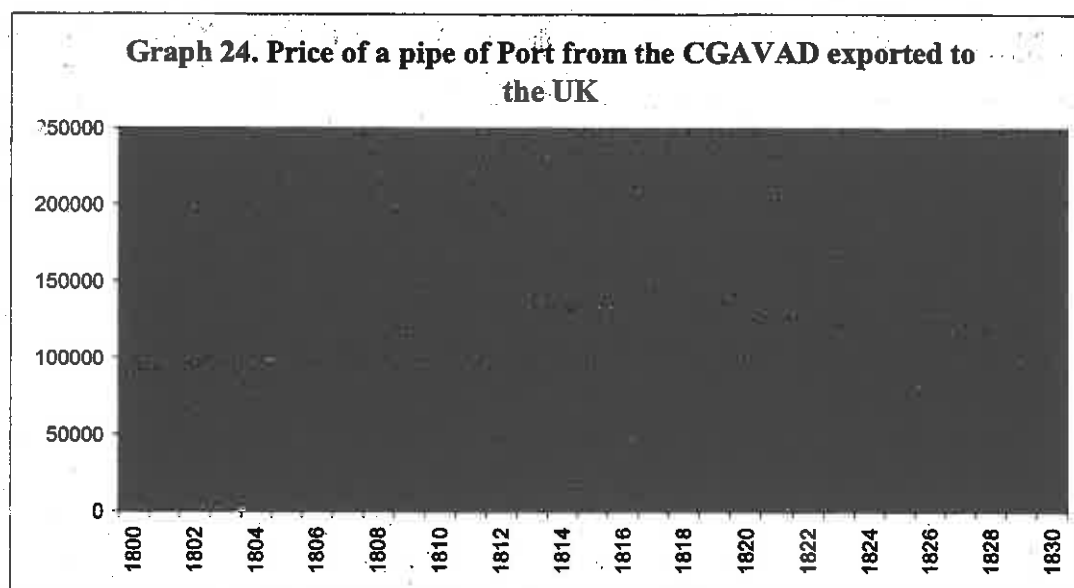
Source: *Folha Mercantil do Porto* (1828-1832), various issues.

Consumo means wine for local consumption in the city, *Novidade* is the last vintage and the *Velho* wines from 1 to 3 are respectively the wines one year, two years

or three years older than the vintage. This graph illustrates the variety of Port qualities and related prices.

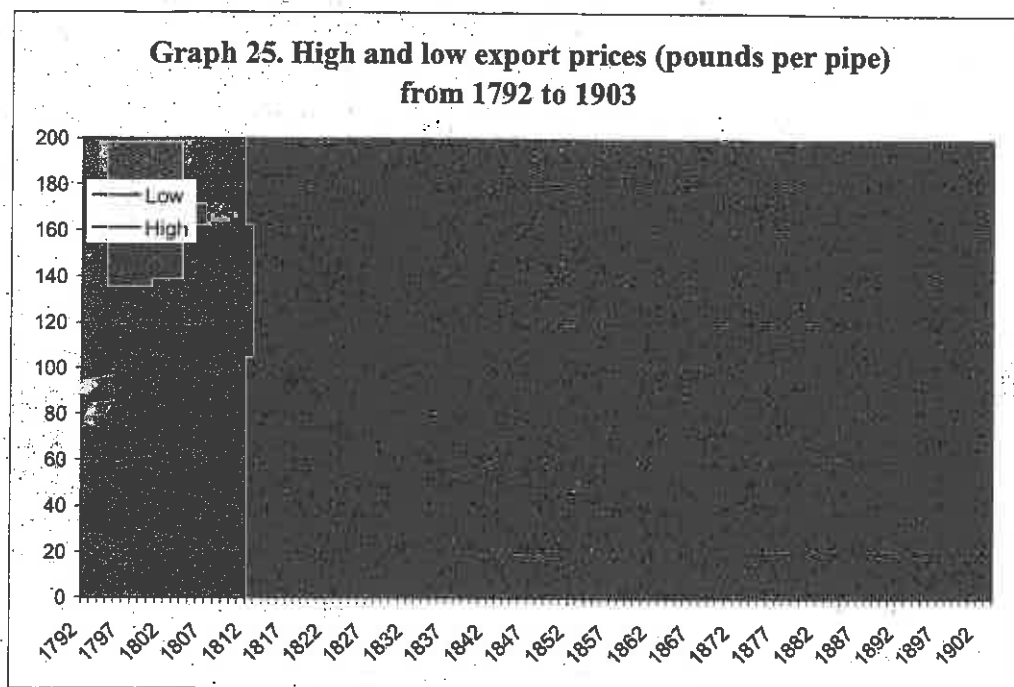


Source : BINE, Balanças do Comércio and AHMOP, Balanças do Comércio

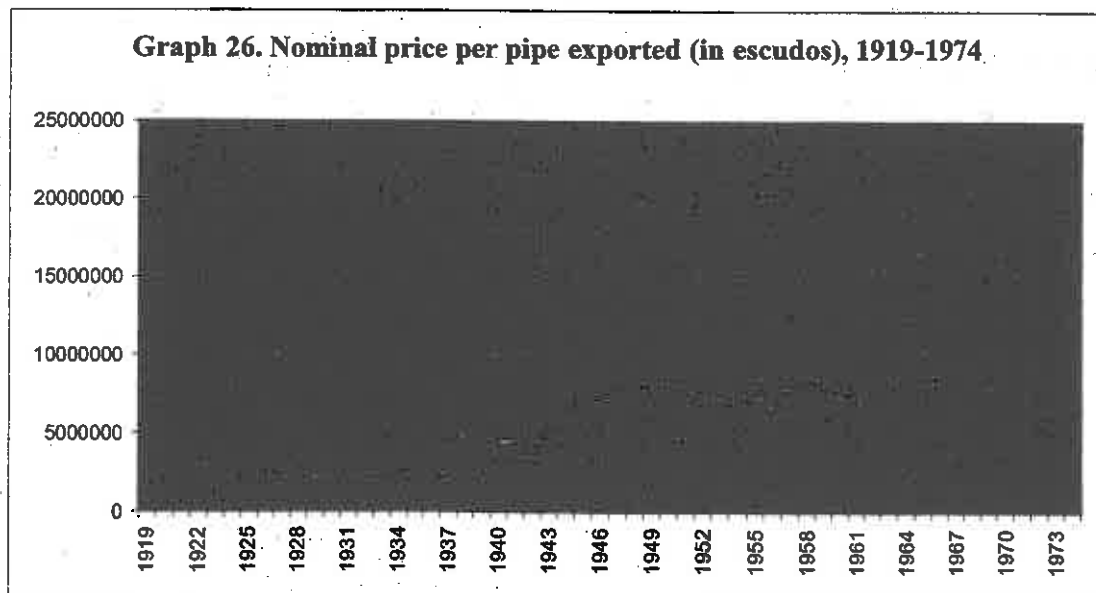


Source: Tenreiro (1944: 88–89)

The graphs 23 and 24 illustrate the rise in prices during the French invasions and the new higher level of prices the Port wine reached.

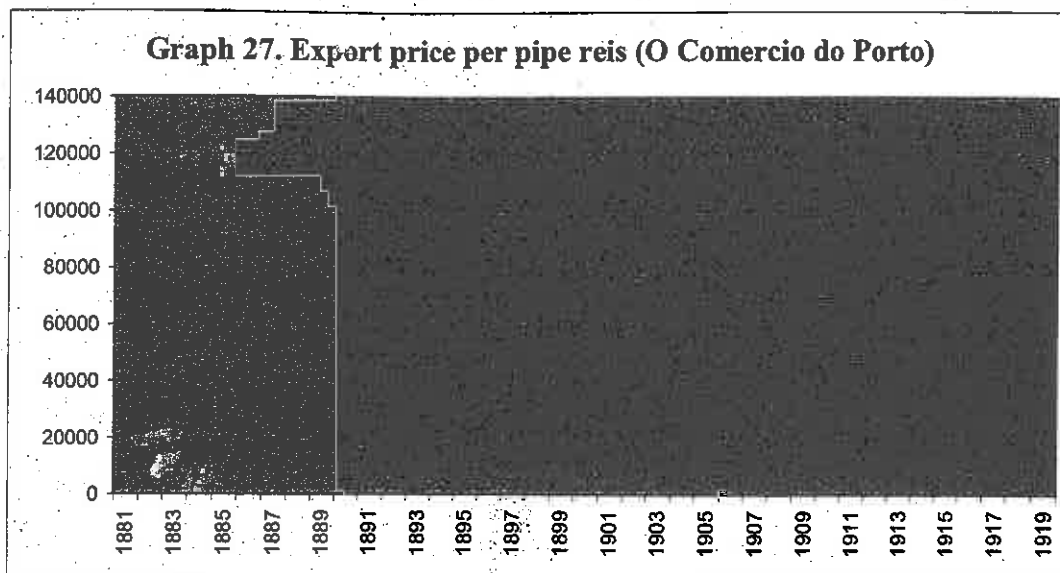


Source: Bennett (2006)



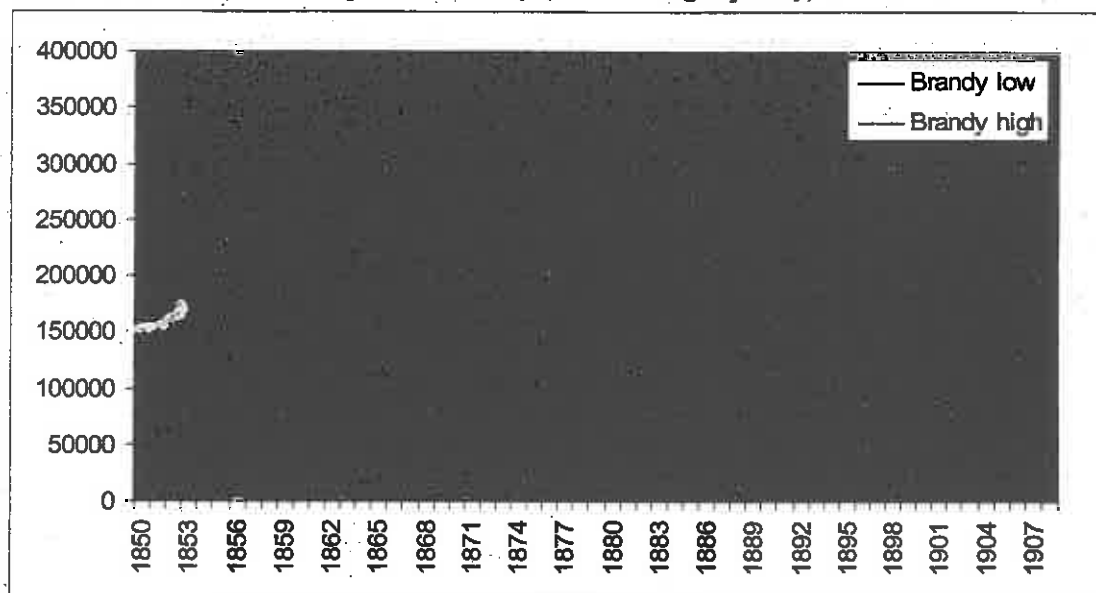
Source: Conceição Andrade Martins (1990: 244-245)

In the graph 25, expressed in pound sterling, the prices rise in real terms. But in the 20th century, see graph 26, the nominal prices rise at three distinct periods: 1918–1924, 1940s and the 1970s which correspond to periods of higher inflation.

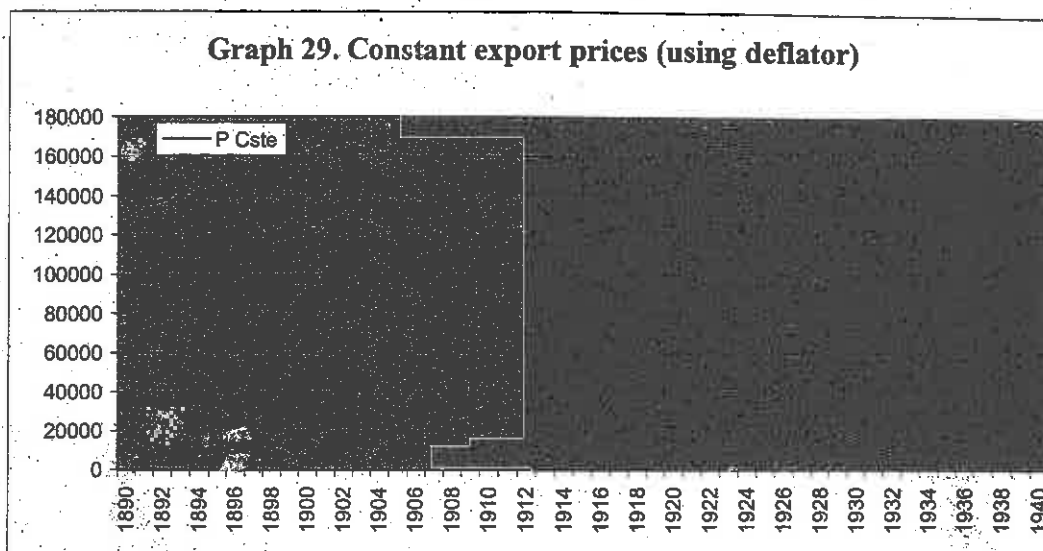


Source: O Comércio do Porto, Various issues from 1881 to 1920

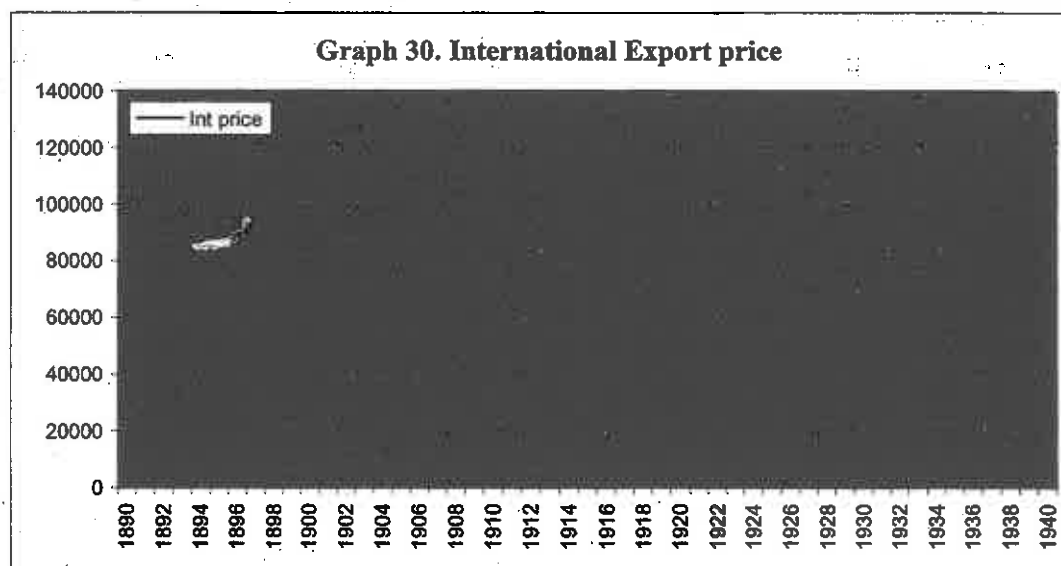
Graph 28. Evolution of the price of brandy (low and high quality)



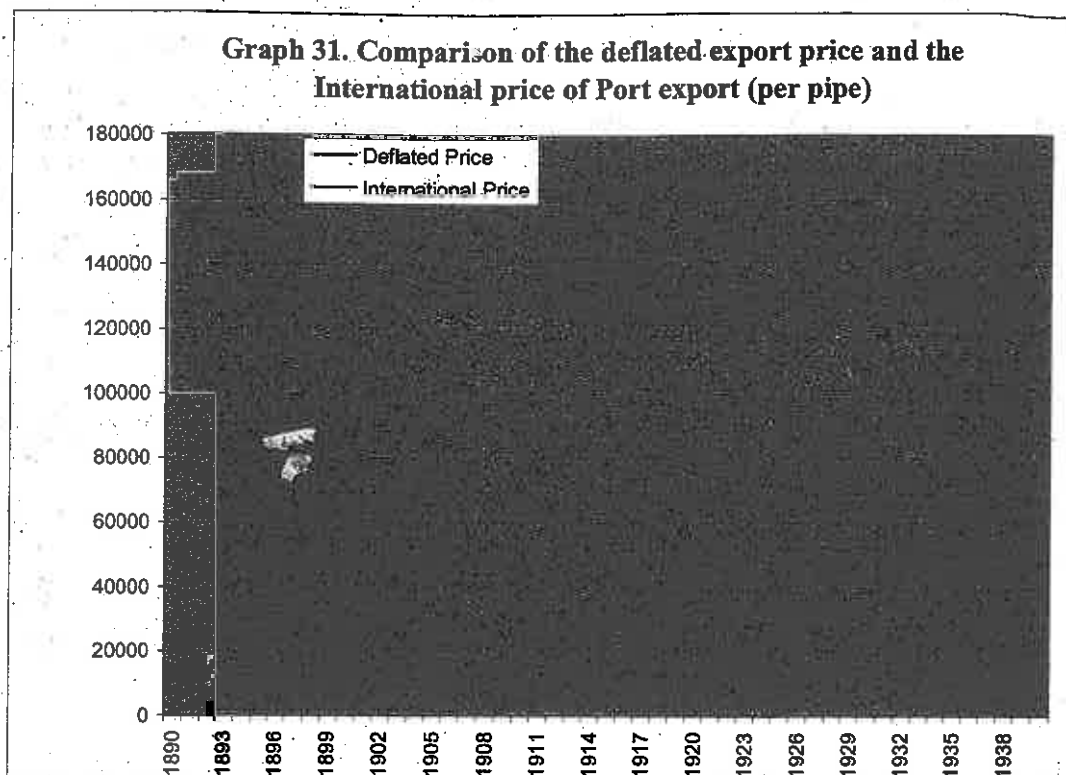
Source: Bennett (2005)



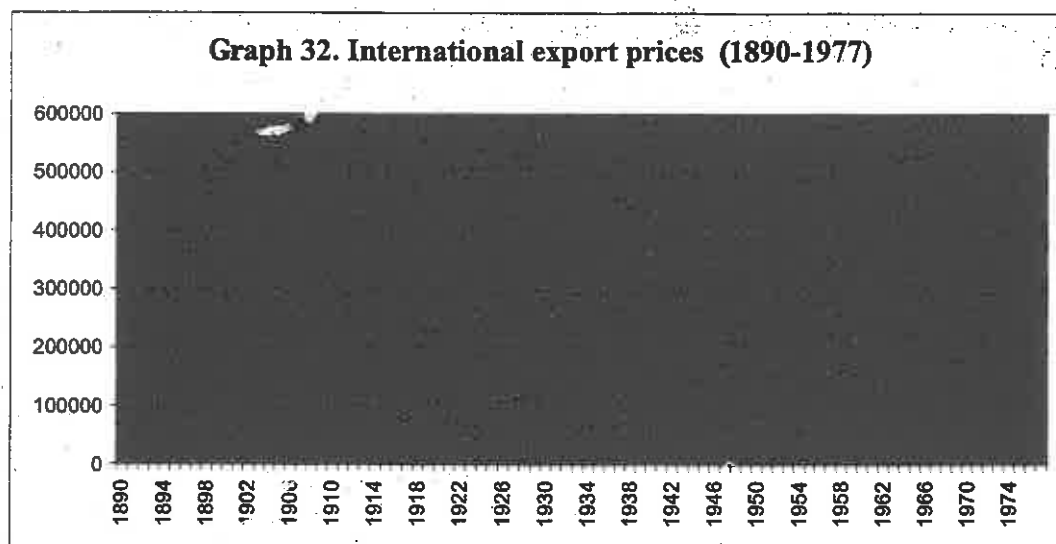
Source: Conceição Andrade Martins (1990), for the prices and Bastien (2001) for the price index.



Source: Conceição Andrade Martins (1990)



Source: Conceição Andrade Martins (1990), for the prices and Bastien (2001) for the price index.



Source: Conceição Andrade Martins (1990).

Conclusions

The main results based on the period of the research can be divided under five headings for a systematic presentation. First, at the theoretical level, the thesis has tried to illustrate the relevance of a precise set of tools for analyzing the three processes of change that were retained here: technology, regulation and market structure and population of shipping firms.

This theoretical part of the thesis is the basis for the contribution made to the understanding of the Port wine sector in the three questions I have included as my main object of study. Before proceeding to this assessment, I will consider the importance of the data used in the previous chapters.

Second, data mining amounted to a large part of the work done, throughout the various research phases. Given the focus on the issue of regulation and the importance of institutional aspects in the Port wine sector, I have reviewed documents held by the ministries and entities that directly supervised or controlled the activities of production and trade of Douro wines.

This work in public and private records was systematic for the documents in the collections of the *Instituto dos Arquivos Nacionais – Torre do Tombo*; *Alfândega do Porto*, *Casa dos Condes de Linhares*, *Junta do Comércio*, *Ministério da Agricultura*, *Ministério da Fazenda/Finanças*, *Ministério das Obras Publicas (Secção Agricultura)*; the *Alfândega de Lisboa*, containing with documents of the *Alfândega do Porto*; the *Alfândega do Porto*, containing a detailed record of Port wine exporters from 1900 to 1933; the *Instituto do Vinho do Porto*, contained in the records of the *Museu do Douro*, with lists of Port wine exporters.

Unfortunately, the research identified other sources that I was not able to consult either for lack of time or due to disorganization of the institutions or for bad access management of the documents or even as a result of highly restricted or forbidden access. The latter refer to the listings of producers, shippers and correspondence of the *Companhia Geral (Arquivo Histórico da Real Companhia Velha)*, the process of bankruptcy (*Tribunal do Comércio do Porto*) and several valuable records of Port wine shippers in private companies.

Third, the results of the research concern three further aspects: the technological change, the transformation of the regulation of the sector and the evolution of the shipping firms. These are the most important results of the present research, which has

been developed all through the second part of the thesis when studying the Port wine sector as an exemplary and heuristic case for historical economics, evolutionary economics and institutional analysis. I will proceed now with the presentation of conclusions on the three research questions I have tried to investigate in the three chapters of part II.

1. The issue of technological change

The first question has to do with the technological change in the Port wine sector. I have studied essentially the technology of cultivating vineyards and making and storing wine, ageing it and blending it for commercialization. There are several conclusions that can be adduced from this study. First, the long run perspective reveals profound exogenous (or approximately so) changes for the vine and wine blights as well as endogenous change in the case of mechanization.

My study has shown the important role of the State in promoting new technologies and practices (such as the use of American rootstocks and the grafting of European stocks on these). The state and the regulatory authorities produced norms that modified the production process such as the incentives for red (and not white) wine, the importance of grape varieties and the use of chemicals in treating the vine blights. This is one of the important connections between the technological change and the institutional and regulatory framework.

Several cases can be characterized as *path dependent* in the sense that when a technological path is taken, the subsequent decisions are influenced by the norms of this very path created. This was the case of the response given to the oidium blight that destroyed part of the vineyards, reduced the production and ruined some winegrowers. The response was in terms of chemicals and norms based on the scientific knowledge and practice of the time. It created faith and confidence in these solutions. Later, when phylloxera appeared, the effective response to the new plague was slow to come because of the faith in the past response to oidium (a fungus) while the phylloxera was a tiny aphid that destroyed the leaves and roots of the vines leaving nothing but devastation. The use of chemicals was ineffective and the solution – grafting European species on American rootstocks revealed to be the best solution for saving the vineyards

from the mysterious and unknown scourge. The path dependent nature of pest controls and use of chemicals in agriculture is rather well known (Cowan 1996).

Of course what is meant by path dependence is not an absolute and once for all transformation that leads to a solution to the detriment of another one. The merit of the grafting solution was unknown at the time of the appearance of the phylloxera.

However, given the importance of exogenous shocks, the study of technological change is difficult in terms of identification of a clear pattern of change and business cycles in the production and trade.

These paths have been influenced by institutional elements such as the Companhia Geral, the government, the Ministry of Agriculture, the *Instituto do Vinho do Porto* and the *Casa do Douro*. All exerted some influence on the technological path.

2. The regulation of the Port wine sector

The second research question is about the characterization and importance of the regulation of the Port wine sector. This is a complex issue and not just, in the Port wine sector, a problem of self organization, but one of interaction and coordination between interested parties or groups that do not always hold similar preferences (wine-growers, merchants, intermediaries and shipping firms, the central government and the state in general and a limited number of relevant actors: Porto's capitalists, local municipalities in the Douro and the municipalities of Vila Nova de Gaia and Porto).

The State has defined, either by its strong involvement or by a weak intervention at different periods of the sector history, the legal and formal context of regulation that influenced practices and the effective regulation of the sector.

The study of the institutional framework, to the contrary, brings some new materials and revises the thesis of self-regulation in the Port wine sector. This thesis is today the dominant one in the literature on legal, historical, and economic matters. If today this thesis seems plausible for characterizing the current Port system, this cannot be sustained for the past, at least for the period between 1750 and 1933. The regulation of the Port wine sector is much related to the role of the state and the liberal periods did probably reveal the necessity of some (State) regulation instead of self-regulation.

The regulation of the sector has substantially influenced the system of production and the type of wine selected. There is an important interaction between the

technological system and the institutional system. The institutional framework did facilitate the transition of the production in conformity with the taste and requirement of the consumers of the first and foremost market: the British Isles. The case of the *Companhia Geral* is in this respect interesting. On the one hand, this company was created to guarantee (political and economic) order over a geographic area and an important area of production for Portugal; at the same time, the Company was also an important source of tax revenue for the Crown. On the other hand, however, the Company reinforced the bargaining power of the British wine merchants whilst weakening the position of both the winegrowers and the Portuguese wine merchants. During the existence of the *Companhia Geral*, there is fundamentally no major Portuguese merchant. The company and the institutional framework acted as barriers to entry for Portuguese firms but not so much for British firms.

If the regulation of the sector was strong, many aspects of the productions were defined and controlled by the regulatory entity, creating new norms that were intended to solve in a particular way the *problem of order* (Spengler 1948) and stability to the sector and the state revenues. If the regulation was weak, many features of the production and trade of Port wine were left to the judgment and interaction between producers and merchants, each one following their interest and routines. In periods of liberty of trade and production, chronic problems of overproduction and falsification of the wine traded were frequent.

The regulation of the sector was one of the pillars of success or failure (for lack of it or for typical excesses) of the Port wine shippers. In periods of strong regulation (1756–1780 and 1933–1974), the norms on quality of wine exportable, the clear distinction between consumption (local wine) and export wine, the tasting practices and the influence on the wine stocks policy of the firms was favorable to the existing (incumbent) dominant shippers and detrimental to new comers and small (less than 50 pipes) or very small shippers (less than 10 pipes). During these periods the contestable market threshold was much higher. Correspondingly, in periods of lower regulation by the state (like 1860–1906), the possibility of entrance of new firms is increased given the decrease of the costs of setting up an export trade for the Douro sweet wines.

3. The evolution of Port wine firms

The third and last research question is about the evolution of Port wine shippers. The first conclusion is about the transformation of the wine merchant from individual trader to partnerships, commercial firms and modern corporations. I have identified three ideal-types: the individual merchant and the partnership based on the qualities of a limited number of associates, the Port wine firm (a trading firm with more anonymous ownership based not on crucial partners but on shares and shareholders) and the modern firm or corporation that is characterized by a stronger distinction between ownership and management and the integration of these firms in more complex financial structure.

Of course these three types are not just sequential and at the end of the period under study and still today some of the wine-exporters hold the characteristics of individual merchants rather than those of corporations. There is some juxtaposition of these types of Port wine shippers. There is also a variety of forms between these three types firms and each category cannot be considered as a clearly bounded set.

Another conclusion has to do with the dominance of the wine-trade by a limited number of firms. The first ten firms in most of the years represent 80% of the volume of exported wine. The dominance of the British firms among that group is very clear and remained unchallenged until well into the 20th century.

There are three periods of increased competition with an upsurge in the number of firms: 1812–1833, 1856–1877 and 1900–1930. These years correspond to a rather weak regulation of the sector that did not hinder the entrance of new firms as did previous decades of strong regulation. Also, compared to the decades of strong regulation, the requirement for stock holding was much lower in times of weaker regulation and control. The period between 1933 and 1974 is the only protracted period that shows a clear decrease in the number of shipping firms, from 242 in 1932 to 84 in 1947 and down to 56 in 1974.

For the other periods, two classes are evident. First, for the periods 1700–1762 and 1833–1855, no data, in the later case, and no reliable data, in the former case, are available, which does not permit me to get a clear idea of what happened in between. From 1700 to 1756, the number of British merchants has increased and, probably, with the creation of the *Companhia Geral*, the number of Portuguese merchants has decreased, especially those that were exporting Port wine to Brazil given the exclusivity of the wine trade for the *Companhia* with the three most important Brazilian markets

(Rio de Janeiro, Pernambuco and Bahia). For the other period, 1833–1864, the data available for the period 1864–1876 are only about shippers above 50 pipes of wine, excluding the numerous small exporters in a time of free exports to Brazil and Great Britain. Thus, there is no clear conclusion for this period.

The other class of periods is composed by those of decreasing or stagnating population, when referring to the number of exporters. During these periods, 1763–1800 and 1877–1900, the exported quantities have steadily increased but the number of shippers has fluctuated without a clear upward or downward trend. The years 1780–1800 are usually referred to as the Golden Age of the Port wine trade, in particular for the exports to Great Britain (Bennett 1990 and 1994), dominated by the British merchants. However, the number of British firms did not increase, being 31 firms in 1762, 29 the following year, 28 in 1765 and 29 in 1799. On the other side, the total population from the extreme dates has not changed: being 62 in 1762 and 1765 and 64 in 1799. But in between some changes occurred and the number of shippers has fluctuated (being more than 79 in 1786). This fluctuation can be explained by the entrance, fusion and exit of port shipper affecting a population that was not constant over time.

From 1877 to 1900 or 1910, the Port wine trade has not increased in volume, compared to the other period 1762–1800. Moreover, the British market has lost part of its relative importance between 1864 and 1900, with an accentuated change between 1870 and 1883. This period is one of crisis in the sector – both at the level of production and trade, with the Brazilian market offsetting some of the decrease of the British market. The Brazilian market has been the opportunity for many small or medium sized Portuguese shippers.

I have studied the transformation of the shipping firms in an evolutionary perspective, looking at what happened to the firms from generation to generation. These conclusions have to be read with due caution. The data obtained might at some time reflect specific years that were not easily characterized because of the numerous years lacking the most basic information: the total exports of each firm.

The overall evolution of the port-shippers is characterized by a constant renewal of the firms. Usually, the small firms rapidly disappear, they either went under or they were acquired by stronger ones. Some have simply gone bankrupt, especially in the 1760s, 1806–1840, 1870–1900, 1933–1966. This is the case of Bull in the 18th century. Others were bought or hand over by major partners, such as Thompson to Croft, Hunt

Roope to Ferreira, etc. There is a long transformation period in the second half of the 18th century because of the financial exhaustion of some shippers. Several medium British shippers disappeared from the lists of exporters because of the high competition maintained by the big shippers that were able to hold the necessary stocks of wine for making different lots and better adapting themselves to the customer demands and changes in preferences.

The changes in the entrance to and exit from the population of firms are influenced by the regulatory context of the time. Before the strong regulation of 1932-33, there is an increase of the number of entrants from 1908 to the early 1930s. At that time, the regulation of the port-shippers was more relaxed and international trade more open.

As time goes by, in periods of stability, the degree of contestability of the market decreases because of the accumulation of stocks and the increased necessity of having sufficient wine and brandy reserves in order to enter the market.

After the French invasions and the 1830s, due to the wars (the French war and the civil wars) but also to the stagnation of the British market (in regression) and the difficulties in the Douro, another wave of change in shipping firms has renewed three quarters of the British shippers. The English merchants had to flee the city of Porto because of the French invasion. Once the war over, several British firms will not come back and some that did so will not survive the stiff competition of the years 1812-1850. Another wave of changes is between the years 1875 to 1900, with another renewal of the population of shipping firms. A considerable number of Portuguese firms managed to survive and expand. Between 1900 and 1932-33, the number of firms is clearly increasing before the halt of the 1930s and the crisis that will last about three decades. This new crisis implied the disappearance of many firms (Hunt Roope, Constantino, among others) and an increase in the concentration of the sector. From the 1960s to 1974, some big firms will emerge and consolidate (Ferreira, Taylor Faldgate, the Symmington family and Cockburn).

Moreover, the study of the evolution of the shipping firms identified three distinctive periods of financial structure and behavior of stocks, capital and financial assets. Two are labeled according to the conservative financial policies of the exporting firms and correspond to the years 1700-1800 and 1930-1974. One is rather innovative and characterized by financial strain for the firms and frequent financial crisis in

Portugal and abroad. This period corresponds to the years following the French invasions and the advent of liberalism up to the end of the 1920s.

The 18th century is characterized by the dominance of the British shippers and their financial structure based on the steady accumulation of stocks of wine and the reluctance to contract debt. The financial needs of the firm are usually satisfied by the capital advanced by the partners and the debts that the shipping firms owe to either the individual partners in Porto or their partners and associates in London and other markets. The British shippers and the Companhia Geral accumulate cash-flow and stocks of wine during most of the years covering the second half of the 18th century.

The French invasions (especially hitting the British merchants) and the civil war (destroying the wine stock of the Companhia Geral) constituted a serious blow to the financial structure of the sector and the firms that are specialized, exclusively or almost so, in the wine business.

The following period consisted of regulatory uncertainty and major changes in the political and economic context (1806-1834) as well as the vine culture (1845-1888). The traditional British market was receding in relative terms and even in absolute figures (measured by the number of pipes exported). The wine trade has become less of a routine and financial risks have increased through the increased indebtedness of the firms and the uncertain economic and political environment. Moreover, either the good grape harvest or the bad one can add strain to the financial problems. In quantitative terms, the abundant production devalue the existing stocks that are the guarantee of most of the (short and medium term) debt. The bad years, in quantitative terms, increase the cost of purchasing wine, making brandy and blending wines. The years of bad quality increase the costs of making wine and brandy for keeping up the level of quality that the British consumers are used to. If the quality is good, the effect on the value of the existing stocks can be disastrous and lead to bankruptcy if several difficult years add up.

During this period, the incumbent firms are continuously dealing with new entrants, adding pressure on their difficult financial situation. Sandeman was one of them around 1816 and Cockburn, Gassiot, Martinez followed suit.

The third period, following the stagnation of the market in the 1930s and the accumulation of wine stocks during three decades, has been characterized by a conservative move of most of the companies. First, the concentration increased, permitting a diversification of markets. Second, the Portuguese, Brazilian and other

European markets acted as offsetting mechanisms, allowing the selling of stocks that lost part of their value. Third, the risky indebtedness decreased in the sector with a process of financial consolidation (often related to fusions and acquisitions). Fourth, the regulatory mechanisms limited productions quantitatively and avoided the major losses of value of existing stocks.

Finally, in the third chapter of the second part of the thesis, I have used new materials from archives, including some that was never studied before. In this respect, the first conclusion is that the data on wine export and on wine shippers that is usually used (compiled in the work of Conceição Andrade Martins (1990)) can be revised for the period from 1780 to 1833. For 1799, for example, one of the series by Martins seems more plausible than the other one when comparing the figures with the books of the Alfândega do Porto. For lack of documents, I cannot extend this first conclusion to subsequent periods. The second conclusion, still in the third chapter of the second part, is that the concentration of firms through history has been relatively high, dominated by less than twelve British firms, with a renovation of both the whole population and the dominating firms, as these latter firms survive from one period to the other mostly by merger and acquisition.

Finally, this research highlights the interaction between the technological system, the regulation regimes and the evolution of the population of Port wine shippers. At the center of the interaction process and at the center of the coordination between the producers with their technology of production and the wine merchants and their relations with the foreign markets, lies the role of the regulatory system with varying responses to the needs of different epochs.

References from Archives and Newspapers

In the following, I have listed all the consulted archives with the respective sections and localization of documents in books (*livros*, lv.), boxes (*caixas*, cx.) or files and bundles of documents (*maços*, mç.) and manuscripts (*manuscrito* or *códice*, abbreviated as ms. or cod.).

I have adopted the notation and norms that are usually in use among Portuguese historians or historians specialized in Ibero-American or Portuguese history.

In the text, I have adopted a condensed notation identifying first the Archive (e.g., ANTT), then the section (italicized in the list of archives as in *Ministério do Reino*, are abbreviated in the text simply as MR) and finally the number of the file, book or box. For books, such as ledgers, the sheet (*folha*, fl.) is indicated followed by v. (verso) when the information is on the verso of the sheet. Often documents in boxes are not classified, so no further indication is given except the one identifying the very document (letter, date, sender, receiver, title, and the like). My preoccupation was to give as much accurate information as possible to the reader so she or he could identify the document right away.

Cross references are made for documents in deposit in one institution while being either legally deposited in another one or legally owned by another organization.

I have consulted two newspapers at the Biblioteca Nacional: *O Comércio do Porto* and *A Folha Mercantil do Porto*.

Arquivo Distrital do Porto [ADP]

Alfândega do Porto

Miscellaneous correspondence;

Instituto do Vinho do Porto [IVP]

Unidades de Instalação: 1679, 1681, 1685, 2093, 2326, 3693-3698, 4578, 4792, 4900, 4908;

Arquivo Histórico A. A. Ferreira [AHAAF]

Documentos de Valor: Hunt Roope: cx. 1144;

Sociedade António Ferreira Meneses, Sucessor;

Arquivo Histórico Adriano Ramos Pinto [AHARP]

Correspondência – Quintas, volume 2;

Correspondência – miscellaneous documents (pastas);

Arquivo Histórico da Alfândega de Lisboa [AHAL]

Livros da Alfândega do Porto

Livros 220, 221, 222;

Arquivo Histórico da Alfândega do Porto [AHAP]²⁵⁵

Livros de registo dos exportadores de vinho do Porto, various books from 1907 to 1934;

Arquivo Histórico da Assembleia da República [AHAR]

Section I and II

cx. 9, cx. 12, cx. 16, cx. 34, cx. 37, cx. 38, cx. 44, cx. 45, cx. 54, cx. 59, cx. 73, cx. 75, cx. 80, cx. 81, cx. 143, cx. 207, cx. 209, cx. 250;
lv. 1791, lv. 1817-1848, lv. 2084, lv. 2792-2795;

Section VI

cx. 2;

Arquivo Histórico da Associação Britânica, Porto [BA]²⁵⁶

Books of the Proceedings of the Meetings of the British Association (3 volumes)

Arquivo Histórico da Croft/Taylor Faldgate [AHC/TF]

Miscellaneous manuscripts and ledger books (unclassified documents)

Arquivo Histórico Municipal do Porto [AHMP]

Imposição do Vinho

Arquivo Histórico do Ministério dos Negócios Estrangeiros [AHMNE]

Legação de Londres

Relatórios de cônsules em Londres;

Arquivo Histórico do Museu do Douro [AHMD/ADP]²⁵⁷

Instituto do Vinho do Porto [IVP]

Lists of shipping firms

²⁵⁵ This archive is physically located at the library of the Transport and Communication Museum (Museu dos Transportes e Comunicação, MTC) of the city of Porto.

²⁵⁶ This is the *Library of the British Association* at Porto, assuming the legacy of the former British Factory of the earlier centuries and extinguished in 1810.

²⁵⁷ This archive is presently located at the Arquivo Distrital do Porto. See above and the text for a description of the documents consulted.

Arquivo Histórico do Ministério das Obras Publicas [AHMOP]

Superintendência Geral dos Contrabandos

Balança do Comércio das Praças do Reino de Portugal... 1776 e 1777 [BC],

5-1, 5-2

Balanças Gerais do Comércio [BGC]

5-3 (1783); 5-6 (1798); 5-8 (1822)

Ministério do Reino [MR]

Lvs. 5 (5.1 & 5.2), 35, 36, 68;

Arquivo Histórico da Offley [AHO]

Miscellaneous documents;

Arquivo Histórico da Real Companhia Velha [AHRCV/AHCGAVAD]

Section 1 (Legislação/Legislation); Section 7 (Fiscalização/Inspection);

Section 8 (Impostos/Taxes);

Arquivo Histórico do Tribunal de Contas [AHTC]

Cartórios Avulsos

cx. 11, cx. 13, cx. 16, cx. 17, cx. 18, cx. 82, cx. 83, cx. 86;

Erário Régio

ER3489–ER3497 (*Alfândega do Porto*);

ER5446 (*Conta Corrente da Companhia Geral da Agricultura das Vinhas do Alto Douro*, 1804–1830);

ER3727–3737, ER3752–3759, ER3763–3799, ER3816–3820, 3914–3938, 3948–3951
(*Subsídio Literário*);

Miscellaneous book: ER2461, ER2464; ER3443; ER3503, ER3505; ER3727–3737,
ER3752–3759, ER3763–3799, ER3810, ER3910, ER5381–ER5386;

Arquivo Histórico Ultramarino [AHU]

[Ministério do] Reino

mç. 33;

Arquivos Nacionais da Torre do Tombo (Instituto dos) [IAN/TT or ANTT]

Alfândega do Porto [AP]

Lv. 62, lv. 64, lv. 72, lv. 79, lv. 80, lv. 81, lv. 99, lv. 127, lv. 134, lv. ;

Casa dos Condes de Linhares [CLNH]

mç. 9, mç. 10, mç. 27, mç. 37;
lv. 28 (1 & 2);

Feitos Findos [FF]

Conservatória da Companhia Geral da Agricultura das Vinhas do Alto Douro

mç. 1, mç. 2 (provisory classification);

Diversos, mç. 15, n° 1, mç. 38;

Feitos da Coroa, mç. 38, n° 2;

Conservatória Inglesa: mç. VI, mç. VII;

Junta do Comércio [JC]

mç. 70: cx. 224, cx. 225; mç. 71, cx. 226;

Ministério da Agricultura [MA]

Ministério da Fazenda/Finanças [MFF]

Conselho da Fazenda: lv. 125, lv. 126;

mç. 305;

lv. 3878;

Ministério dos Negócios Estrangeiros [MNE]

cx. 39, cx. 64; lv. 760;

mç. IV, mç. VI, mç. VII;

Ministério das Obras Publicas, Comércio e Indústria /Direcção Geral da Agricultura [MOPCI]

mç. 892, mç. 915, mç. 946, mç. 949, mç. 970, mç. 997, mç. 998, mç. 1008, mç. 1038, 1141;

Ministério do Reino [MR]

mç. 352, mç. 356, mç. 357, mç. 431, mç. 623, mç. 641;

Biblioteca da Academia de Ciências de Lisboa [BACL]

Série Vermelha

ms. 25, 31, 35, 702;

Série Azul

ms. 17, 373, 375, 376, 916, 1487;

Biblioteca da Ajuda [BA]

Manuscritos: 50-V-35, 50-V-36, 50-V-37, 51-XII-11, 52-IX-26, 54-V-14, 54-VIII-46, 77-B-XI-11;



Biblioteca da Assembleia da República [BAR]

Miscellaneous documents, printed material;
Diário das Cortes, various issues;

Biblioteca do Instituto Nacional de Estatística [BINE]

Balanças Gerais do Comércio [BGC], 1796-1831 (the years 1798, 1808 and 1821 are missing and can be found in the *Arquivo Histórico do Ministério das Obras Públicas*, same series: SGC or BGC)

Biblioteca do Ministério da Agricultura [BMA]

Miscellaneous legislation and reports on agriculture;

Biblioteca Nacional, Lisboa [BNL]

Colecção Pombalina [PBA]

cód. 122, cód. 255, cód. 453, cód. 454, cód. 455, cód. 456, cód. 457, cód. 459, cód. 462, cód. 464, cód. 473, cód. 490, cód. 610, cód. 611, cód. 612, cód. 613, cód. 634, cód. 635, cód. 636, cód. 638, cód. 649, cód. 651-655, cód. 658, cód. 677, cód. 686, cód. 692;

Fundo Geral (Manuscripts)

Cx. 189, cx. 245, cx. 252;
cód. 598, cód. 600, cód. 805, cód. 6400, cód. 6936, cód. 8048, cód. 8773, cód. 11463;
mss. 35, mss. 226;

Newspapers

A Folha Mercantil do Porto - 1828-1832
O Comércio do Porto - 1854-1974

Biblioteca Pública Municipal do Porto [BPMP]

Cód. 994, cód. 1089;

British Library [BL]

Additional Manuscripts (add. ms.): 15592, 20802, 20803, 20804 (mf. 523694), 20815, 20951;

Casa do Douro [CD]

Miscellaneous documents and statistics;

Estação Agronómica Nacional [EAN-MA]

Rare books and academic journals on agronomy and oenology;
Master theses;

Instituto do Vinho do Porto [IVP]

See *Arquivo Histórico do Museu do Douro*

Instituto da Vinha e do Vinho [IVV]

Miscellaneous documents and newspapers;

Ministério da Agricultura [MA]

See *Biblioteca do Ministério da Agricultura*

Public Record Office, Kew, UK [PRO]

Customs [CUST]

Cust-3, microfilms, 1697-1780;

Foreign Office [FO]

State Papers [SP]

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Bibliography

- Abbott, Andrew (1988): "Transcending General Linear Reality," *Sociological Theory*, 6 (2), Autumn, pp. 169-86.
- Abbott, Andrew (1995): "Sequence Analysis: New Methods for Old Ideas," *Annual Review of Sociology*, 21, pp. 93.
- Abbott, Andrew (2001): *Time Matters. On Theory and Method*. Chicago: Chicago University Press.
- Adorno, Theodor (1972/1980): "Zur Logik der Sozialwissenschaften," in *Gesammelte Schriften*, 8 - *Soziologische Schriften 1*, ed. by T. Adorno. Frankfurt am Mainz: Suhrkamp.
- Alarte, Vicêncio (1712): *Agricultura das vinhas, e tudo o que pertence a ellas até perfeito recolhimento do vinho, & relação das suas virtude, & da cepa, vides, folhas, & borras*. Lisboa: Off. Real Deslandesiana
- Alchian, A. A. (1950): "Uncertainty, Evolution and Economic Theory," *Journal of Political Economy*, 58 (2), pp. 211-21.
- Aldrich, Howard (1979): *Organizations and Environments*. Englewood Cliffs, NJ: Prentice-Hall
- Aldrich, Howard (1999): *Organizations Evolving*. London: Sage Publications.
- Aldrich, Howard (2001): "Who Wants to Be an Evolutionary Theorist? Remarks on the Occasion of the Year 2000 OMT Distinguished Scholarly Career Award Presentation," *Journal of Management Inquiry*, 12 (1), June, pp. 1-12.
- Aldrich, Howard and Martha Martinez (2001): "Entrepreneurship as Social Construction: A Multi-level Evolutionary Approach," *Working Paper*, Chapel Hill: University of North Carolina, Department of Sociology
- Alexander, Jeffrey C. (1984): "Positivism," in *The Social Science Encyclopedia*, ed. by A. Keuper and J. Keuper. London & New York: Routledge, 631-33.
- Almeida, Alberto Ribeiro de (1999): *Denominação de origem e marca*. Coimbra: Faculdade de Direito da Universidade de Coimbra & Coimbra Editora
- Almeida, Alberto Ribeiro de (2001): "Indicação geográfica, indicação de proveniência e denominação de origem," in *Direito industrial, Vol. I*, ed. by APDI. Coimbra: Almedina.
- Almeida, Alberto Ribeiro de (2002): "Denominações geográficas e marcas," in *Direito industrial, Vol. II*, ed. by APDI. Coimbra: Almedina.
- Almeida, Alexandre Magno de Couto de (1884): *Cultura da vinha perante a filoxera*. Lisboa: Typ. Mattos Moreira
- Alter, Norbert (1996): *Sociologie de l'entreprise et de l'innovation*. Paris: Presses Universitaires de France
- Alter, Norbert (2000): *L'innovation ordinaire*. Paris: Presses Universitaires de France
- Amin, Ash and Patrick Cohendet (2000): "Organisational Learning and Governance Through Embedded Practices," *Journal of Management and Governance*, 4 (1), pp. 93-116.
- Araújo, Henrique Gomes de (2001): *A Casa Ferreira: A construção antropológica do sucessor*. Lisboa: Quetzal Editores
- Araujo, Luis and Carlos Brito (1997): "Agency and constitutional ordering in networks: A case study of the port wine industry," *International Studies of Management & Organization*, 27 (4), Winter, pp. 22.

- Argyrous, George (2001): "Setterfield on Cumulative Causation and Interrelatedness: A Comment," *Cambridge Journal of Economics*, 25 (1), Jan, pp. 103-06.
- Arnaud, André-Jean (1973): *Essai d'analyse structurale du code civil français: La règle du jeu dans la paix bourgeoise*. Paris: Librairie Générale de Droit et de Jurisprudence
- Arnaud, André-Jean (1988). *Dictionnaire encyclopédique de théorie et de sociologie du droit*. Paris, Librairie Générale de Droit et de jurisprudence: pp. 897.
- Arnaud, André-Jean (1998a): *Entre modernité et mondialisation: Cinq leçons d'histoire du droit et de l'État*. Paris: LGDJ
- Arnaud, André-Jean (1998b): *Le droit trahi par la sociologie*. Paris: LGDJ
- Aron, Raymond (1986): *Introduction à la philosophie de l'histoire*. Paris: Gallimard
- Arostegui, Julio (1995): *Metodologia de investigación histórica*. Barcelona: Critica
- Arthur, Brian W. (1989): "Competing Technologies, Increasing Returns, and Lock-in by Historical Events," *Economic Journal*, 99 (394), pp. 116-31.
- Arthur, Brian W. (1990): "Positive Feedbacks in the Economy," *Scientific American*, 262, pp. 92-99.
- Arthur, Brian W. (1994): *Increasing Returns and Path Dependence in the Economy*. Ann Arbor, MI: University of Michigan Press
- Arthur, Brian W. (1999): "Complexity and the Economy," *Science*, 284, 2 April, pp. 107-09.
- Arthur, Brian W. (2000): "Cognition: The Black Box of Economics," in *The Complexity Vision and the Teaching of Economics*, ed. by D. Colander. Northampton, Mass. & Cheltenham: Edward Elgar.
- Ashton, T. S. (1977): *An Economic History of England: The 18th Century*. London: Methuen
- Atlan, Henri (1979): *Entre le cristal et la fumée: Essai sur l'organisation du vivant*. Paris: Seuil
- Axelrod, Robert and Michael D. Cohen (2000): *Harnessing Complexity: Organizational Implications of a Scientific Frontier*. New York: Basic Books
- Aydalot, Philippe (1986): *Les milieux innovateurs en Europe*. Paris: GREMI
- Ayres, Clarence E. (1951): "The Co-Ordinates of Institutionalism," *The American Economic Review*, 41 (2, Papers and Proceedings of the Sixty-third Annual Meeting of the American Economic Association), May, pp. 47-55.
- Ayres, Clarence E. (1953): "The Role of Technology in Economic Theory," *The American Economic Review*, 43 (2, Papers and Proceedings of the Sixty-fifth Annual Meeting of the American Economic Association), May, pp. 279-87.
- Azevedo, J. Lúcio de (1922): *O Marquês de Pombal e a sua época*. Lisboa: Seara Nova
- Azevedo, J. Lúcio de (1929): *Épocas de Portugal económico*. Lisboa: Clássica Editora
- Baccini, Alberto and Renato Giannetti (1997): *Cliometria*. Barcelona: Critica Grijalbo Mondadori
- Backhouse, Roger E. (1988): *Economists and the Economy: The Evolution of Economic Ideas 1600 to the Present Day*. Oxford: Basil Blackwell
- Backhouse, Roger E. (1994). *New Directions in Economic Methodology. Economics as social theory*. T. Lawson. London, Routledge: pp.
- Backhouse, Roger E. (1997): *Truth and Progress in Economic Knowledge*. Cheltenham (UK): Edward Elgar
- Baechler, Jean (1995a): *Le capitalisme: 1. Les origines*. Paris: Gallimard
- Baechler, Jean (1995b): *Le capitalisme: 2. L'économie capitaliste*. Paris: Gallimard
- Bagnasco, A. (1977): *Tre Italie. La problematica territoriale dello sviluppo italiano*. Bologna: Il Mulino

- Bagwell, L. S. and B. D. Bernheim (1997): "Veblen Effects in a Theory of Conspicuous Consumption," *American Economic Review*, 86 (3), June, pp. 349-73.
- Bairoch, Paul (1997): *Victoires et déboires. Histoire économique et sociale du monde du XVII^e siècle à nos jours*. Paris: Gallimard
- Bairoch, Paul (1999): *Mythes et paradoxes de l'histoire économique*. Paris: La Découverte
- Baptista, Maria Carlos Correia Mendes Radich de Oliveira (1987): "A agronomia portuguesa no século XIX: A imagem da natureza nas propostas técnicas," Lisboa: Universidade Técnica de Lisboa, Instituto Superior de Agronomia [Ph.D. thesis]
- Barbiroli, Giancarlo (1997): *The Dynamics of Technology. The Methodological Framework for Techno-Economic Analyses*. Dordrecht: Kluwer
- Baron, James N. (2004): "Employing Identities in Organizational Ecology," *Ind Corp Change*, 13 (1), February 1, 2004, pp. 3-32.
- Baron, James N. and Michael T. Hannan (1994): "The Impact of Economics on Contemporary Sociology," *Journal of Economic Literature*, 32, Sept., pp. 1111-46.
- Baron, JN, et al. (1996): "The Road Taken: Origins and Evolution of Employment Systems in Emerging Companies," *Ind Corp Change*, 5 (2), June 1, 1996, pp. 239-76.
- Barreto, José (1986): "Introdução," in *Pombal, Escritos económicos de Londres: 1741-1742*, ed. by J. Barreto. Lisboa: Biblioteca Nacional.
- Basalla, George (1988): *The Evolution of Technology*. Cambridge: Cambridge University Press
- Bastien, Carlos and José Luís Cardoso (2004): "Corporatism and The Theory of The Firm: Lessons from the Portuguese Experience," *Journal of the History of Economic Thought*, 26 (2), pp. 197-219.
- Becattini, G. (1987): *Mercato e forze locali - Il distretto industriale*. Bologna: Il Mulino
- Becattini, G. (2000): *Distretti industriali e sviluppo locale*. Torino: Bollati Boringhieri
- Benko, Georges (1998): *La science régionale*. Paris: Presses Universitaires de France
- Benko, Georges and Alain Lipietz (1992). *Les régions qui gagnent*. Paris, Presses Universitaires de France: pp.
- Bennett, Norman (2005): *Esse artigo indispensável: Aguardente e vinho do Porto - That Indispensable Article: Brandy and Port Wine*. Porto: GEHVID
- Bennett, Norman (2006): "The Struggle to Keep Port "the Englishman's wine": The Shipping Price of Port Wine, 1750s to 1908," *O Douro contemporâneo*, Porto: GEHVID.
- Bennett, Norman R. (1990): "The Golden Age of the Port Wine System, 1781-1807," *The International History Review*, 12, pp. 221-48.
- Bennett, Norman R. (1992): "The Vignerons of the Douro and the Peninsular War," *The Journal of European Economic History*, 21 (1), Spring, pp. 7-29.
- Bennett, Norman R. (1992-93): "The Wine Growers of the Upper Douro, 1780-1800," *Portuguese Studies Review*, 2 (1), pp. 28-45.
- Bennett, Norman R. (1994): "The Port Wine System in the 1890s," *The International History Review*, 16, pp. 251-66.
- Bennett, Norman R. (2001): "That Indispensable Article: Brandy and Port Wine, c. 1750-1908," *Douro - Estudos & Documentos*, 6 (11), pp. 149-60.
- Berg, Maxine and Kristine Bruland (1998). *Technological Revolutions in Europe, Historical Perspectives*. K. Bruland. Cheltenham (UK), Edward Elgar: pp.

- Berg, Maxine and Pat Hudson (1992): "Rehabilitating the Industrial Revolution," *Economic History Review*, 45 (1), Feb., pp. 24-50.
- Bhaskar, Roy (1975): *A Realist Theory of Science*. Leeds: Leeds Books
- Black, M. (1962): *Models and Metaphors: Studies in Language and Philosophy*. Ithaca: Cornell University Press
- Black, Max (1937): "Vagueness. An Exercise in Logical Analysis," *Philosophy of Science*, 4 (4), Oct., pp. 427-55.
- Blaug, Mark (1990): *Historia do pensamento económico*. Lisboa: Dom Quixote
- Bloch, Marc (1940/1990): *L'étrange défaite*. Paris: Gallimard
- Boland, Lawrence A. (2001): "Towards a useful methodology discipline," *Journal of Economic Methodology*, 8 (1), pp. 3-10.
- Bonabeau, Éric, et al. (1999): *Swarm Intelligence. From Natural to Artificial Systems*. New York & London: Oxford University Press
- Bonifácio, Fátima (2002): *O século XIX português*. Lisboa: ICS
- Boudon, Raymond (1993): *Effets pervers et ordre social*. Paris: Presses Universitaires de France
- Boudon, Raymond and François Bourricaud (2000): *Dictionnaire critique de la sociologie*. Paris: Presses Universitaires de France
- Boulding, Kenneth E. (1981): *Evolutionary Economics*. London: Sage
- Boulding, Kenneth E. (1991): "What is Evolutionary Economics?," *Journal of Evolutionary Economics*, 1 (1), pp. 9-17.
- Bourdieu, Pierre (1979): *La distinction*. Paris: Éditions de Minuit
- Bourdon, Albert-Alain (1970): *Histoire du Portugal*. Paris: Presses Universitaires de France
- Boyer, Robert (2003): "Les institutions dans la théorie de la régulation," *Document de travail*, n° 2003 - 08, pp.
- Braudel, Fernand (1958/1972): "História e ciências sociais. A longa duração," in *História e ciências sociais*, ed. by F. Braudel. Lisboa: Presença.
- Braudel, Fernand (1968): "Histoire et sociologie," in *Traité de sociologie, T. I*, ed. by G. Gurwitsch. Paris: Presses Universitaires de France.
- Braudel, Fernand (1972): *História e ciências sociais*. Lisboa: Editorial Presença
- Braudel, Fernand (1979a): *Civilisation matérielle, économie et capitalisme, XV^e-XVIII^e siècle - 1. Les structures du quotidien*. Paris: Armand Colin
- Braudel, Fernand (1979b): *Civilisation matérielle, économie et capitalisme, XV^e-XVIII^e siècle - 2. Les jeux de l'échange*. Paris: Armand Colin
- Braudel, Fernand (1979c): *Civilisation matérielle, économie et capitalisme, XV^e-XVIII^e siècle - 3. Le temps du monde*. Paris: Armand Colin
- Bréhier, Émile (1930-1938): *Histoire de la philosophie II - XVII^e-XVIII^e siècles*. Paris: Presses Universitaires de France
- Bréhier, Émile (1932): *Histoire de la philosophie III - XIX^e-XX^e siècles*. Paris: Presses Universitaires de France
- Brito, Carlos Melo (1991): *Cooperation in the Port Wine Industry*. Lancaster: The Management School of Lancaster University
- Brito, Carlos Melo (1997): *Estrutura e dinâmica do sector do Vinho do Porto*. Porto: Instituto do Vinho do Porto & GEHVID (Faculdade de Letras da Universidade do Porto)
- Brouwer, L.E.J. (1910): "Über Abbildung von Mannigfaltigkeiten," *Mathematische Annalen*, 71 (1), pp. 97-115.
- Bruhns, Hinnerk (2002): *Max Weber: Ökonomische Theorie und Wirtschaftsgeschichte*. Erfurt: Universität Erfurt

- Byrne, David (1997) "Complexity Theory and Social Research", Department of Sociology - University of Surrey (UK), [10-7 / 2002]
www.soc.surrey.ac.uk/sru/SRU18.html
- Cabral, Afonso do Vale Coelho Pereira (1894): *Fabrico e preparação dos vinhos generosos*. Lisboa: Imp. Nacional
- Cabral, Afonso do Vale Coelho Pereira (1895): "A região vinhateira do Alto Douro desde Barca de Alva até ao Cachão da Valeira," *Boletim da Direcção Geral da Agricultura*, 6º ano (n.º 3), pp.
- Callon, Michel (1993): "Variety and Irreversibility in Networks of Technique Conception and Adoption," in *Technology and the wealth of nations*, ed. by D. Foray and C. Freeman. London: Pinter.
- Camagni, Roberto (1991): *Innovation Networks: Spatial Perspectives*. London: Belhaven Press
- Camic, Charles (1986): "The Return of the Functionalists," *Contemporary Sociology: A Journal of Reviews*, 15 (5), Sep., pp. 692-95.
- Camic, Charles (1987): "The Making of a Method: A Historical Reinterpretation of the Early Parsons," *American Sociological Review*, 52 (4), pp. 421-39.
- Camic, Charles (1991). *Talcott Parsons: The Early Eessays*. Chicago, Chicago University Press: pp.
- Camic, Charles (1996): "Alexander's Antisociology," *Sociological Theory*, 14 (2), Jul., pp. 172-86.
- Camic, Charles (1998): "Reconstructing the Theory of Action," *Sociological Theory*, 16 (3), Nov., pp. 283-91.
- Campbell, Christy (2004): *Phylloxera - How Wine was Saved for the World*. London: Harper-Collins
- Canguilhem, Georges (1966): *Le normal et le pathologique*. Paris: Presses Universitaires de France
- Cardoso, Antonio Barros (1996): "O alvará de instituição da companhia e os motins do Porto de 1757," *Douro - Estudos & Documentos*, 1 (1), Primavera, pp. 57-78.
- Cardoso, Antonio Barros (1997): "Vinho e fiscalidade na Época Moderna," *Douro - Estudos & Documentos*, 2 (3), Primavera, pp. 71-83.
- Cardoso, Antonio Barros (2003): *Baco & Hermes - O Porto e o comércio interno e externo dos vinhos do Douro (1700-1756)*. Porto: GEHVID-FLUP
- Cardoso, António Barros (2003): "Portugal e a Inglaterra nos tempos modernos," *História - Revista da Faculdade de Letras da Universidade do Porto*, III Série (4), pp. 37-58.
- Cardoso, Jose Luis (2003): "Leitura e interpretação do Tratado de Methuen: balanço histórico e historiográfico," in *O Tratado de Methuen: diplomacia, guerra, política e economia*, ed. by J. L. Cardoso, et al. Lisboa: Livros Horizonte, 11-29.
- Cardoso, José Luis (2004): "Política económica," in *Nova História económica de Portugal*, ed. by P. Lains and Á. P. da Silva. Lisboa: ICS.
- Cardoso, José Luís (1997): *Pensar a economia em Portugal: Digressões históricas*. Lisboa: Difel
- Cardoso, José Luís (2001): *História do pensamento económico português: Temas e debates*. Lisboa: Livros Horizonte
- Carreira, António (1969): *As companhias pombalinas de navegação, comércio e tráfico de escravos entre a costa africana e o nordeste brasileiro*.
- Carreira, António (1983). *As companhias pombalinas: de Grão-Pará e Maranhão e Pernambuco e Paraíba*. Lisboa, Presença: pp.

- Casti, John L. (1994): *Complexification: Explaining a Paradoxical World Through the Science of Surprise*. New York: Harper & Collins
- Cazenave, Michel and Basarab Nicolescu (1994). *L'homme, la science et la nature - Regards transdisciplinaires*, Le Mail,: pp.
- Chandler, Alfred D. (1978): "Presidential Address: Business History - A Personal Experience," *Business and Economic History*, Second Series, Volume 7, pp. 1-8.
- Chanteau, Jean-Pierre (2003): "La dimension socio-cognitive des institutions et de la rationalité : éléments pour une approche holindividualiste," *L'Année de la Régulation*, 7 (Economie, Institutions, Pouvoirs), pp.
- Charles (1996): "The Importance of Innovation and the Conditions Under which Processes of Innovation Occur," *Ciencia, Tecnologia y cambio social en Euskal Hierra*, Donostia: Eusko Ikaskuntza
- Charles, David (1996): "The Importance of Innovation and the Conditions Under which Processes of Innovation Occur," *Ciencia, Tecnologia y cambio social en Euskal Hierra*, Donostia: Eusko Ikaskuntza D. Charles.
- Charleton, Walter (1669): *Two discourses. I. Concerning the different wits of men: II. Of the mysterie of vintners*. London: R. W. for William Whitwood,
- Charleton, Walter (1734): *The art and mystery of vintners and wine-coopers. Containing approved directions for the preserving and curing all manner and sorts of wines. By E.T. a wine-cooper of long experience*. London: J. Roberts, 1734.
- Clément, Pierre (1846): *Histoire de la vie et de l'administration de Colbert*. Paris: Guillaumin
- Coase, R H (1984): "The New Institutional Economics," *Journal of Institutional and Theoretical Economics*, 140, pp. 229-31.
- Coase, R H (1988): *The Firm, the Market and the Law*. Chicago: University of Chicago Press
- Coase, Ronald (1998): "The New Institutional Economics," *The American Economic Review*, 88 (2), May, pp. 72.
- Coase, Ronald H. (1937): "The Nature of the Firm," *Economica*, New Series 4, pp. 385-405.
- Coase, Ronald H. (1960): "The problem of social cost," *Journal of Law and Economics*, 3, October, pp. 1-44.
- Coase, Ronald H. (1993): "Coase on Posner on Coase," *Journal of Institutional and Theoretical Economics*, 149 (1), pp. 96-98.
- Coe, David T., et al. (1997): "North-South R & D Spillovers," *The Economic Journal*, 107 (440), Jan., pp. 134-49.
- Colander, David (2000a). *Complexity and the History of Economic Thought. Perspectives on the History of Economic Thought*. London, Routledge: pp. 249.
- Colander, David (2000b). *The Complexity Vision and the Teaching of Economics*, Edward Elgar: pp. 307.
- Commons, John R. (1924): *Legal Foundations of Capitalism*. New York: Macmillan
- Commons, John R. (1934): *Institutional Economics - its place in political economy*. New York: Macmillan
- Constant, Edward W. (1999): "Reliable Knowledge and Unreliable Stuff: On the Practical Role of Rational Beliefs," *Technology and Culture*, 40 (2), April, pp. 324-57.
- Constant, II, Edward W. (2002): "Why Evolution is a Theory About Stability: Constraint, Causation, and Ecology in Technological Change," *Research Policy*, 31 (8-9), 2002/12, pp. 1241-56.

- Correia, Francisco António (1929): *História económica de Portugal*. Lisboa: Empresa Nac. Publicidade
- Correia, Francisco António (1931): *A administração do Marquês de Pombal: O comércio e as companhias privilegiadas*. Lisboa: Of. do Inst. Sup. de Ciências Económicas e Financeiras
- Coruche (1896): *A questão do álcool e dos vinhos*. Lisboa: Comp. Nac. Ed.
- Cowan, Robin (1990): "Nuclear Power Reactors: A Study in Technological Lock-in," *Journal of Economic History*, 50 (3), Sep., pp. 541-67.
- Cowan, Robin (1991): "Tortoises and Hares: Choice Among Technologies of Unknown Merit," *Economic Journal*, 101, July, pp. 801-14.
- Cowan, Robin, et al. (2000): "The Explicit Economics of Knowledge Codification and Tacitness," *Industrial and Corporate Change*, 9 (2), pp. 211-53.
- Cowan, Robin and Gundy (1996): "Sprayed to Death: Path Dependence, Lock-in and Pest Control Strategies," *Economic Journal*, 106 (May), pp. 521-42.
- Crutchfield, James (1994a): "The Calculi of Emergence: Computation, Dynamics, and Induction," *Physica D*, 75 (1), pp. 11-54.
- Crutchfield, James (1994b): "J. P. Crutchfield, 'Is Anything Ever New? Considering Emergence,'" in *Complexity: Metaphors, Models, and Reality*, ed. by G. Cowan, et al. Redwood City: Addison-Wesley, 479-97.
- Cziko, Gary (2000): *The Things We Do: Using the Lessons of Bernard and Darwin to Understand the What, How, and Why of Our Behaviour*. Cambridge, MA: The MIT Press
- da Silva, José Veríssimo Alvares (1788): "Memória sobre a cultura das vinhas, e sobre os vinhos," in *Memórias de agricultura (premiadas pela Acad. Real das Sciencias de Lisboa)*, ed. by Academia Real das Sciencias de Lisboa. Lisboa: Academia Real das Sciencias de Lisboa, 1-101.
- Dales, J. H. (1955): "The Discoveries and Mercantilism: An Essay in History and Theory," *Canadian Journal of Economics and Political Science*, 21 (2), May, pp. 141-53.
- Daumas, Maurice (1996/1962). *Histoire générale des techniques: 1 - Des origines aux XV^e siècle*. Paris, Presses Universitaires de France: pp.
- Daumas, Maurice (1996/1964): *Histoire générale des techniques: 2 - Les premières étapes du machinisme: XV^e-XVIII^e siècle*. Paris: Presses Universitaires de France
- Dauril, Alden (1971): "Trade and Power: Informal colonialism in Anglo-Portuguese relations; The Portugal Trade: A study of Anglo-Portuguese commerce 1700-1770," *Journal of Economic History*, 31 (4), Dec., pp. 990-93.
- David, Henrique (1997): "Cor, corpo e gosto. O juízo do ano na viragem do século XVIII para o século XIX," *Douro - Estudos & Documentos*, 2 (3), pp. 87-93.
- David, Paul A (1985): "Clio and the Economics of QWERTY," *American Economic Review*, 75 (2), May, pp.
- David, Paul A (1993a): "Path-dependence and Predictability in Dynamic Systems with Local Network Externalities: A Paradigm for Historical Economics," in *Technology and the Wealth of Nations*, ed. by D. Foray and C. Freeman. London: Pinter.
- David, Paul A. (1975): *Technical Choice, Innovation and Economic Growth: Essays on American and British Experience in the Nineteenth Century*. Cambridge: Cambridge University Press
- David, Paul A. (1994): "Why are Institutions the Carriers of History? Path Dependence and the Evolution of Conventions, Organizations and Institutions," *Structural Change and Economic Dynamics*, 5 (2), pp.

- David, Paul A. (2001): "Path Dependence, its Critics, and the Quest for 'Historical Economics'," in *Evolution and Path Dependence in Economic Ideas: Past and Present*, ed. by P. Garrouste and S. Ioannides. Cheltenham: Edward Elgar.
- David, Paul A. and Dominique Foray (2001): "An Introduction to the Economy of the Knowledge Society," *MERIT Research Memoranda*, 2001 (41), pp.
- de Vries, Jan (1976): *The Economy of Europe in an Age of Crisis, 1600-1750*. Cambridge: Cambridge University Press
- DeBresson, Christian (1999): "An Entrepreneur Cannot Innovate Alone; Networks of Entreprises are Required," *DRUID's Innovation Systems Conference, June 1999*.
- Delorme, Robert (2001): "Theorizing complexity," in *Frontiers of evolutionary economics*, ed. by J. Foster and J. S. Metcalfe. Cheltenham: Edward Elgar, 80-108.
- Denis, Henri (2000): *História do pensamento económico*. Lisboa: Livros Horizonte
- Dolfsma, Wilfried (2001): "Metaphors of Knowledge in Economics," *Review of Social Economy*, 59 ((1)), March, pp.
- Dopfer, Kurt (1986): "Causality and Consciousness in Economics: Concepts of Change in Orthodox and Heterodox Economics," *Journal of Economic Issues*, 20 (2), Jun, pp. 509.
- Dosi, G. (2000): *Innovation, Organization and Economic Dynamics*. Cheltenham: Edward Elgar
- Dosi, G. and et al. (1988). *Technical Change and Economic Theory*. London, Pinter: pp.
- Dosi, G., et al. (1992). *Technology and Enterprise in a Historical Perspective*. Oxford, Clarendon Press: pp.
- Dosi, Giovanni (1982a): "Technological Paradigms and Technological Trajectories," *Research Policy*, 11 (3), pp. 147-208.
- Dosi, Giovanni (1982b): "Technological paradigms and technological trajectories : A suggested interpretation of the determinants and directions of technical change," *Research Policy*, 11 (3), July, pp. 147-62.
- Dosi, Giovanni (1988): "Sources, Procedures, and Microeconomic Effects of Innovation," *Journal of Economic Literature*, Vol. 26, September, pp. pp. 1120-71.
- Dowrick, Steve (1995). *Economic Approaches to Innovation*. Aldershot, Edward Elgar: pp.
- Dubois, Didier and Henri Prade (1988): *Possibility theory*. New York: Plenum Press
- Dubois, Didier and Henri Prade (2001): "Vérité incertaine - Vérité approximative," *Rue Descartes*, 31 (Rationalités de la science), juin, pp. 105-26.
- Dugger, William M (1990): "The New Institutionalism: New but Not Institutionalism," *Journal of Economic Issues*, 24 (2), Jun, pp. 423.
- Duguid, Paul (1996): "Lavradores, exportadores, intermediários e capitalistas: Componentes da Região do vinho do Porto," *Douro - Estudos & Documentos*, 1 (2), pp. 201-24.
- Duguid, Paul (2000): "Tudo em detalhes: instantâneos sobre o comércio de vinho do Porto em 1777 e 1786," *Douro - Estudos & Documentos*, 10 (2), pp. 45-72.
- Duguid, Paul (2003): "The Making of Methuen: The Commercial Treaty in the English Imagination," *História - Revista da Faculdade de Letras da Universidade do Porto*, III Série (4), pp. 9-36.
- Duguid, Paul and Teresa Silva Lopes (1999): "Ambiguous Company: Institutions and Organizations in the Port Wine Trade, 1814-1834," *Scandinavian Economic History Review*, 47 (1 - Special issue on Institutional Theory and Business History), pp. 83-102.

- Duguid, Paul and Teresa Silva Lopes (2001): "Divide and Rule: Regulation in the Port Wine Trade, 1812-1840," in *Business History Year Book 3*, ed. by T. Gourvish. Aldershot, UK: European Society for Business History, 1-24.
- Ekelund Jr., Robert B. and Gordon Tollison (1997): "On neoinstitutional theory and preclassical economies: mercantilism revisited," *European Journal of the History of Economic Thought*, 4 (3), pp. 375-99.
- Ekelund Jr., Robert B. and Robert D. Tollison (1997): *Politicized Economies: Monarchy, Monopoly and Mercantilism*. College Station: Texas A&M University Press
- Ekelund, Robert B. Jr. and Robert F. Hébert (1997): *A History of Economic Theory and Method*. New York: McGraw-Hill
- Ekelund, Robert B., Jr. and Robert D. Tollison (1980): "Mercantilist Origins of the Corporation," *The Bell Journal of Economics*, 11 (2), Autumn, pp. 715-20.
- Elias, Norbert (1997a): "La société des individus,"
- Elias, Norbert (1997b): "Towards a Theory of Social Processes," *British Journal of Sociology*, 48 (3), pp. 355-83.
- Ellul, Jacques (1990): *La technique ou l'enjeu du siècle*. Paris: Economica
- Elster, Jon (1989): *Nuts and Bolts About the Social Sciences*. Cambridge: Cambridge University Press
- Enjalbert, Henri (1953): "Comment naissent les grans crus: Bordeaux, Porto, Cognac," *Annales: Economies, Sociétés, Civilisations*, 8, pp. 322-23.
- Enjalbert, Henri (1975): *Histoire de la vigne et du vin: L'avènement de la qualité*. Paris:
- Ferreira, J. A. Pinto (1983): *A economia do vinho e o crescimento do Porto, nos séculos XVII ao XIX*. Porto: Fund. Eng. António de Almeida
- Fikentscher, Wolfgang (1998): "Cultural Complexity," *Santa Fe Institute Working Paper*, 1998 (87), Sept., pp. 70.
- Fine, Ben (2002): *The World of Consumption*. London: Routledge
- Fisher, H. E. S. (1963): "Anglo-Portuguese trade, 1700-1770," *Economic History Review*, 16 (2), pp. 219-33.
- Fisher, H. E. S. (1984): *De Methuen a Pombal: O comércio anglo-português de 1700 a 1770*. Lisboa: Gradiva
- Fleck, James (2000): "Artefacts versus Activity: The Coevolution of Artefacts, Knowledge and Organization in Technological Innovation," in *Technological Innovation as an Evolutionary Process*, ed. by J. Ziman. Cambridge: Cambridge University Press.
- Flichy, Patrice (1995): *L'innovation technique: Récents développements en sciences sociales vers une nouvelle théorie de l'innovation*. Paris: La Découverte
- Fonseca, Álvaro Moreira da (1940): "Práticas culturais nos vinhedos durienses antes e depois da invasão filoxérica," *Anais do Instituto do Vinho do Porto*, 1940 (1), 31-63, pp.
- Fonseca, Álvaro Moreira da (1941): "Apontamentos históricos sobre o Douro e sobre a preparação do vinho do Porto," *Anais do Instituto do Vinho do Porto*, pp. 5-81.
- Fonseca, Álvaro Moreira da (1944): *O A B C da vinificação*. Porto: IVP (Instituto do Vinho do Porto)
- Fonseca, Álvaro Moreira da (1949a): *As demarcações pombalinas no Douro vinhateiro (I)*. Porto: Instituto do Vinho do Porto
- Fonseca, Álvaro Moreira da (1949b): *O benefício e a sua distribuição*. Régua: Fed. dos Vinicultores da Região do Douro/Casa do Douro
- Fonseca, Álvaro Moreira da (1950): *As demarcações pombalinas no Douro vinhateiro (II)*. Porto: Instituto do Vinho do Porto

- Fonseca, Álvaro Moreira da (1951): *As demarcações pombalinas no Douro vinhateiro (III)*. Porto: Inst. do Vinho do Porto
- Fonseca, Álvaro Moreira da (1952). *O método da pontuação: algumas considerações sobre a distribuição de benefício*. Régua, Casa do Douro,: pp. 17.
- Fonseca, Álvaro Moreira da (1955): "A ideiação da Companhia da Agricultura das Vinhas do Alto Douro: D. Bartholomeu Pancorbo, Dr. Luís Beleza de Andrade e Frei João de Mansilha," *Anais do Instituto do Vinho do Porto*, 1955-1956, pp. 1-243.
- Fonseca, Álvaro Moreira da (1956): "O vinho do Porto. Um valor, uma marca, uma organização," *Boletim da Casa do Douro*(123-124), Novembro-Dezembro, pp.
- Fonseca, Álvaro Moreira da (1957): "O vinho do Porto na época dos Almadas," *Suplemento ao Caderno do Instituto do Vinho do Porto*, n.º 212, Agosto, pp. 1-57.
- Fonseca, Álvaro Moreira da (1962): "Genese de um alvará pombalino," *Anais do Instituto do Vinho do Porto*, 1961-1962, pp. 1-129.
- Fonseca, Álvaro Moreira da (1996): *As demarcações marianas*. Porto: Instituto do Vinho do Porto
- Fonseca, Álvaro Moreira da, et al. (1987): *O Vinho do Porto: Notas sobre a sua história, produção e tecnologia*. Porto: IVP
- Fonseca, Francisco Pereira Rebelo da (1789): "Descrição económica do território vulgarmente chamado Alto Douro," in *Memórias económicas*, ed. by Academia Real das Sciencias de Lisboa. Lisboa: Academia Real das Sciencias de Lisboa.
- Fonseca, Francisco Pereira Rebelo da (1790/1991a): "Memória sobre o estado da agricultura, e comércio do Alto-Douro," in *Memórias económicas das Academia Real das Ciências de Lisboa (1789-1815)*, Tomo III, ed. by J. L. Cardoso. Lisboa: Banco de Portugal.
- Fonseca, Francisco Pereira Rebelo da (1790/1991b): "Qual he o methodo mais conveniente, e cautellas necessarias para a clutura das vinhas em Portugal: para a vindima; extracção, e fermentação do mosto; conservação, e bondade do vinho, e para a melhor reputação, e vantagem d'este importante ramo do nosso commercio?," in *Memórias de agricultura premiadas pela Academia Real das Sciências de Lisboa em 1787 e 1788*, ed. by Academia Real das Sciencias de Lisboa. Lisboa: Academia Real das Sciencias de Lisboa [Oeiras: Estação Agronómica Nacional, edição facsimile].
- Fontana, Josep (1976): "Acenso y decadencia de la escuela de los 'Annales'," in *Hacia una nueva historia*, ed. by Parain and e. al. Madrid: Akal.
- Fontana, Josep (1982): *Historia: Análisis del pasado y proyecto social*. Barcelona: Editorial Crítica
- Fontana, Josep (1992): "La historia despues del fin de la historia,"
- Fontana, Josep (1999a): *Historia: análisis del pasado y proyecto social*. Barcelona: Crítica
- Fontana, Josep (1999b): *Introducción al estudio de la historia*. Barcelona: Crítica
- Fontana, Josep (2001): *La historia de los hombres*. Barcelona: Crítica
- Fontana, Josep (2002): *La historia de los hombres: el siglo XX*. Barcelona: Crítica
- Foray, Dominique (2000): *L'économie de la connaissance*. Paris: La Découverte
- Forrester, Joseph James (1854): *The prize-essay on Portugal: being the essay for which the Oliveira Prize and Medal were awarded*. London: John Weale
- Foster, John and J. S. Metcalfe (2001). *Frontiers of Evolutionary Economics*. Cheltenham, Edward Elgar: pp.
- Foucault, Michel (1975): *Surveiller et punir*. Paris: Gallimard

- Fox, Robert (1998): *Technological Change*. London: Harwood Academic Publishers
- Freedman, David A. (1999): "From Association to Causation: Some Remarks on the History of Statistics," *Statistical Science*, 14 (1), pp. 243-58.
- Freeman, Chris (1994): "The Economics of Technical Change," *Cambridge Journal of Economics*, 18, pp. 463-515.
- Freeman, Chris (1996). *Long Wave Theory. The International Library of Critical Writings in Economics*. Cheltenham, Edward Elgar: pp.
- Freeman, Chris and Francisco Louçã (2001): *As Time Goes By: From the Industrial Revolutions to the Information Revolution*. Oxford: Oxford University Press
- Freeman, Chris and Carlota Pérez (1983): "Structural Change and Assimilation of New Technologies in the Economic and Social Systems," *Futures*, 15 (4), October, pp. 357-75.
- Freeman, Chris and Luc Soete (1997): *The Economics of innovation*. London: Pinter
- Freeman, Christopher (1992a). *The Economics of Hope. Essays on Technological Change, Economic Growth and the Environment*. London, Pinter: pp.
- Freeman, Christopher and Francisco Louçã (1999): "Kondratiev and the Dynamics of Economic Development: Long Cycles and Industrial Growth in Historical Context," *The Economic Journal*, 109 (459), Nov, pp. F776.
- Fulbrook, Mary (2002): *Historical Theory*. London & New York: Routledge
- Fuller, Wayne A. (1976): *Introduction to Statistical Time Series*. New York: John Wiley and Sons
- Gambs, John S. (1973): *Beyond Supply and Demand*. Westport, Connecticut: Greenwood Press
- Gibbons, Michael, et al. (1994): *The New Production of Knowledge*. London: Sage
- Gille, Bertrand (1978). *Histoire des techniques. Encyclopédie de la Pléiade*. Paris, Gallimard: pp.
- Gille, Bertrand (1978a): "Prolégomènes à une histoire des techniques," in *Histoire des techniques*, ed. by B. Gille. Paris: Gallimard.
- Gimpel, Jean (1976): *The Medieval Machine: The Economic Revolution of the Middle Ages*. New York: Holdt, Reinhart & Winston
- Giner, Salvador and et al. (1998): *Diccionario de sociologia*. Madrid: Alianza
- Göcke, M. (2002): "Various Concepts of Hysteresis Applied in Economics," *Journal of economic surveys*, 16 (2), pp. 167.
- Godinho, Vitorino Magalhães (1955): *Prix et monnaies au Portugal: 1750-1850*. Paris: Librairie Armand Colin
- Godinho, Vitorino Magalhães (1968): *Ensaio I - Sobre história universal*. Lisboa: Sá da Costa
- Goldstone, Jack A. (1998): "Initial Conditions, General Laws, Path Dependence, and Explanation in Historical Sociology," *American Journal of Sociology*, 104 (3), Nov 1998, pp. 829-45.
- Gordon, Richard (1989): "Les entrepreneurs, l'entreprise et les fondements sociaux de l'innovation," *Sociologie du Travail*, 89 (1), pp.
- Gordon, Richard (1991): "Innovation, Industrial Networks and High Technology Regions," in *Innovation Networks: Spatial Perspectives*, ed. by R. Camagni. London: Belhaven Press.
- Grande, João Maior (1855): "Memória sobre a molestia dos vinhos," in *Memórias da Academia Real das Sciencias de Lisboa, Classe de sciencias mathematicas, physicas e naturaes.*, ed. by Academia Real das Sciencias de Lisboa. Lisboa: Academia Real das Sciencias de Lisboa.

- Grande, José Maria (1849): *Guia e manual do Cultivador ou elementos de agricultura*. Lisboa: Imprensa da Epoca
- Gurvitch, Georges (1968/1986): *A vocação actual da sociologia*, vo. II. Lisboa: Cosmos
- Haack, Susan (1996): *Deviant Logic, Fuzzy Logic: Beyond the Formalism*. Chicago/London: University of Chicago Press
- Hacking, Ian (1992): "'Style' for Historians and Philosophers," *Studies In History and Philosophy of Science Part A*, 23 (1 SU -), 1992/3, pp. 1-20.
- Hacking, Ian (1997): "Searle, Reality and the Social," *History of the Human Sciences*, 10 (4), Nov, pp. 83.
- Hacking, Ian (1998): "Canguilhem and the Cyborgs," *Economy and Society*, 27, pp. 202-16.
- Hacking, Ian (1999): "The Time Frame Problem: The Law, Social Construction, and the Sciences," *The Social Science Journal*, 36 (4 SU -), pp. 563-73.
- Hacking, Ian (2001): *An Introduction to Probability and Inductive Logic*. Cambridge: Cambridge University Press
- Hacking, Ian (2002): *Historical Ontology*. Cambridge MA: Harvard University Press
- Halévy, Daniel (2001 [1948]): *Essai sur l'accélération de l'histoire*. Paris: Ed. de Fallois
- Hamilton, David B. (1970 [1953]): *Evolutionary Economics: A Study of Change in Economic Thought. Revision of Newtonian classicism and Darwinian institutionalism*. Albuquerque: University of New Mexico
- Hancock, David (2004): *War, Wine and Trade, 1750-1815. Working Paper*. Ann Arbor, University of Michigan, History Department: pp.
- Hannan, Michael T. (1988): "Organizational Population Dynamics and Social Change," *European Sociological Review*, 4 (2), Sep., pp. 95-109.
- Hannan, Michael T. (1997): "Comment: On Logical Formalization of Theories from Organizational Ecology," *Sociological Methodology*, 27, pp. 145-49.
- Hannan, Michael T. and Glenn R. Carroll (1992): *Dynamics of Organizational Populations: Density, Legitimation, and Competition*. New York & Oxford: Oxford University Press
- Hannan, Michael T. and John Freeman (1977): "The Population Ecology of Organizations," *American Journal of Sociology*, 82 (5), Mar., pp. 929-64.
- Hannan, Michael T. and John Freeman (1984): "Structural Inertia and Organizational Change," *American Sociological Review*, 49 (2), Apr., pp. 149-64.
- Hannan, Michael T. and John Freeman (1986): "Where Do Organizational Forms Come from?," *Sociological Forum*, 1 (1), Winter, pp. 50-72.
- Hannan, Michael T., et al. (2004): "The Evolution of Inertia," *Ind Corp Change*, 13 (1), February 1, 2004, pp. 213-42.
- Hart, Oliver (2001): "The Usefulness of Rules in Economics," *mimeo*, Cambridge MA: Harvard University, Department of economics
- Harvey, Charles, et al. (1999): "Continuity, change, and specialization within metropolitan London: the economy of Westminster, 1750-1820," *The Economic History Review*, 52 (3), Aug, pp. 469.
- Hathaway, Oona A. (2001): "Path Dependence in the Law: The Course and Pattern of Legal Change in a Common Law System," *The Iowa Law Review*, 86 (2), January 2001, pp. 601-61.
- Heaton, Herbert (1937): "Heckscher on Mercantilism," *The Journal of Political Economy*, 45 (3), Jun., pp. 370-93.
- Heckscher, Eli F. (1936): "Revisions in Economic History: V. Mercantilism," *Economic History Review*, 7 (1), Nov., pp. 44-54.

- Hempel, Carl G. (1942): "The Function of General Laws in History," *Journal of Philosophy*, 39 (2), January, pp. 35-38.
- Henriques, Júlio Augusto (1880): *Phylloxera - Apontamentos*.
- Herrera, Alonso de (1620): *Agricultura general que trata de la labranza del campo, y sus particularidades*. Madrid: por la Viuda de Alonso Martin
- Hodgson, Geoffrey M (1993): *Economia e evolução*. Oeiras: Celta
- Hodgson, Geoffrey M (1997b): "Economics and Evolution and the Evolution of Economics," in *Economics and evolution*, ed. by J. Reijnders. Cheltenham: Edward Elgar.
- Hodgson, Geoffrey M (1998a): "The Approach of Institutional Economics," *Journal of Economic Literature*, 36 (March), March, pp.
- Hodgson, Geoffrey M (1999a): *Evolution and Institutions. On Evolutionary Economics and the Evolution of Economics*. Cheltenham (UK): Edward Elgar
- Hodgson, Geoffrey M (1999b): *Economics and Utopia: Why the Learning Economy is not the End of History*. London: Routledge
- Hodgson, Geoffrey M (2000): "What is the Essence of Institutional Economics?," *Journal of Economic Issues*, 34 (2), Jun, pp. 317.
- Hodgson, Geoffrey M (2001): *How Economics Forgot History: The Problem of Historical Specificity in Social Science*. London: Routledge
- Hodgson, Geoffrey M (2002a): "Darwinism in Economics: From Analogy to Ontology," *Journal of Evolutionary Economics*, 12, pp. 259-81.
- Hodgson, Geoffrey M (2004a): *The Evolution of Institutional Economics*. London: Routledge
- Hodgson, Geoffrey M (2004b): "What Are Institutions?," *EAEPE 2004 Conference*, Crete, University of Rethymno:
- Holland, John (1997): *A Ordem Oculta*. Lisboa: Gradiva
- Holland, John (1998): *Emergence from Chaos to Order*. Oxford: Oxford University Press
- Hossiasson, Janina (1931): "Why Do We Prefer Probabilities Relative to Many Data?," *Mind*, New Series, 40 (157), Jan., pp. 23.-36.
- Hossiasson, Janina (1940): "On Confirmation," *Journal of Symbolic Logic*, 5 (4), Dec., pp. 133-48.
- Hossiasson, Janina (1941): "Induction et analogie: Comparaison de leur fondement," *Mind*, New Series, 50 (200), Oct., pp. 351-65.
- Hughes, Thomas P. (1987): "The Evolution of Large Technological Systems," in *The Social Construction of Technological Systems*, ed. by W. E. Bijker, et al. Cambridge MA: MIT Press, 51-82.
- Hughes, Thomas Parke (1969): "Technological Momentum in History: Hydrogenation in Germany 1898-1933," *Past and Present*(44), Aug., pp. 106-32.
- Iggers, Georg G. (1995): "Historicism: The History and Meaning of the Term," *Journal of the History of Ideas*, 56 (1), pp. 129-52.
- Iggers, Georg G. (1997): *Historiography in the twentieth century: From scientific objectivity to the postmodern challenge*. Middletown: Connecticut: Wesleyan University Press
- Jacquinet, Marc (2000): "Métaphore et rationalité des sciences sociales ou la question du regard ou du statut de la théorie au travers des paradigmes de l'individualisme, du holisme et de la transdisciplinarité," *Discursos*, Número especial à memória do Professor Luís Sá, Dezembro, pp. 247-67.
- Jacquinet, Marc (2006b): "Evolução dos regimes de regulação no sector do vinho do Porto, 1755-1948," *O Douro Contemporâneo*, Porto: GHEVID.

- Janne, Henri (1968): *Le système social: Essai de théorie générale*. Bruxelles: Institut de Sociologie de l'Université Libre de Bruxelles
- Johnson, Steven (2001): *Emergence. The Connected Lives of ants, Brains, Cities and Software*. London: Penguin
- Júnior, Oliveira (1872): *Novo flagelo das vinhas: Filoxera Vastatrix*. Pôrto: Tip. de Freitas Fortuna
- Justino, David (1988): *A formação do espaço económico nacional. Portugal 1810-1913*. Lisboa: Vega
- Kaldor, N. (1972): "The irrelevance of equilibrium economics," *Economic Journal*, 82 (6?), December, pp. 1237-55.
- Kaldor, Nicholas (1977): "Equilibrium Theory and Growth Theory," *Cambridge Journal of Economics*, pp.
- Kaldor, Nicholas (1981): "The Role of Increasing Returns, Technical Progress and Cumulative Causation," *Economie Appliquée*, pp.
- Katzner, Donald W. (1993): "Some Notes on the Role of History and the Definition of Hysteresis and Related Concepts in Economic Analysis," *Journal of Post Keynesian Economics*, 15 (3), Spring, pp. 323-45.
- Katzner, Donald W. (1999): "Hysteresis and the Modeling of Economic Phenomena," *Review of Political Economy*, 11 (2), pp. 171-81.
- Keynes, John Maynard (1920): *A Treatise on Probability*. London: MacMillan
- Kingston, William (1984): *The Political economy of innovation*. Den Hage: Martinus Nijhoff Publishers
- Kirman (1993): "Ants, Rationality and Recruitment," *Quarterly Journal of Economics*, 108 (1), pp. 137-56.
- Kirman, Alan P. (1983): "Communication in Markets: A Suggested Approach," *Economic Letters*, 12, pp. 101-08.
- Kirman, Alan P. (1997): "The Economy as an Evolving Network," *Journal of Evolutionary Economics*, 7, pp. 339-53.
- Kirzner, Israel (1997): "Entrepreneurial Discovery and the Competitive Market Process: An Austrian Approach," *Journal of Economic Literature*, 35 (1), March, pp. 60-85.
- Kirzner, Israel M. (1985): *Discovery and the Capitalist Process*. Chicago: Chicago University Press
- Klein, Lawrence R. (1983): "Identifying the Effects of Structural Change," *Industrial Change and Policy*, Kansas City: Federal Reserve Bank of Kansas City F. R. B. o. K. City.
- Knight, Frank H (1921): *Risk, Uncertainty, and Profit*. Boston: Houghton Mifflin Company
- Koselleck, Reinhart (1979): *Le règne de la critique*. Paris: Les Editions de Minuit
- Koselleck, Reinhart (1990): *Le futur passé: Contribution à la sémantique des temps historiques*. Paris: EHESS
- Koselleck, Reinhart (1997): *L'expérience de l'histoire*. Paris: Le Seuil, EHESS and Gallimard
- Koselleck, Reinhart (2000): *Zeitschichten: Studien zur Historik*. Frankfurt am Main: Suhrkamp
- Kyburg Jr., Henry E. (1974): *The logical foundations of statistical inference*. Dordrecht: D. Reidel
- Lachiver, Marcel (1988): *Vins, vignes et vignerons - Histoire du vignoble français*. Paris: Fayard

- Ladrière, Jean (1977): *Les enjeux de la rationalité. Le défi de la science et de la technologie aux cultures*. Paris: Aubier-Montaigne/Unesco.
- Lains, Pedro (1995): *A economia portuguesa no século XIX: Crescimento económico e comércio externo - 1851-1913*. Lisboa: INCM
- Lalande, André (1930): *Les illusions évolutionnistes*. Paris: Alcan
- Lalande, André (1991/1926). *Vocabulaire technique et critique de la philosophie*. Paris, Presses Universitaires de France: pp.
- Landes, David S (1968): "The Unbound Prometheus,"
- Landes, David S (1994): "What Room for Accident in History? Explaining Big Changes by Small Events," *Economic History Review*, November, pp. 637-56.
- Landes, David S (1995): "Some Further Thoughts on Accident in History: A Reply to Professor Crafts," *Economic History Review*, 48 (3), pp. 599-601.
- Landes, David S and Charles Tilly (1971). *History as Social Science. The Behavioral and Social Sciences Survey*. Englewood Cliffs NJ, Prentice-Hall: pp.
- Lane, David (2002): "Complexity and Local Interactions: Towards a Theory of Industrial Districts," in *Complexity and industrial clusters: Dynamics and models in theory and practice*, ed. by A. Quadrio Curzio and M. Fortis. Berlin: Physica-Verlag. 65-82.
- Lapa, João Ignacio Ferreira (1879): *Revista da agricultura na Exposição Universal de Paris de 1878*. Lisboa: Imprensa Nacional
- Lapa, João Inácio Ferreira (1885): *Tecnologia rural ou artes químicas, agrícola-florestais*. Lisboa: Typ. da Academia Real dos Sciencias
- Laszlo, Ervin (1994): *Evolução: A grande síntese*. Lisboa: Instituto Piaget
- Law, John and John Urry (1999) "Enacting the Social", Centre for Science Studies and Sociology Department, Lancaster University, [23/06 / 2003]
<http://www.comp.lancs.ac.uk/sociology/soc099jlju.html>
- Lawson, Tony (1985): "Uncertainty and Economic Analysis," *Economic Journal*, 95 (380), Dec., pp. 909-27.
- Lawson, Tony (1997): *Economics and Reality*. London: Routledge.
- Lawson, Tony (2003): *Reorienting Economics*. London: Routledge
- Le Moigne, Jean-Louis (1990): *La théorie du système général: Théorie de la modélisation*. Paris: Presses Universitaires de France
- Le Moigne, Jean-Louis (1999a): *O construtivismo I: Dos fundamentos*. Lisboa: Instituto Piaget
- Le Roy, Étienne (1999): *Le jeu des lois. Une anthropologie "dynamique" du Droit*. Paris: LGDJ
- Lefebvre, Henri (2000): *La production de l'espace*. Paris: Anthropos (Economica)
- Lemonier, Pierre (1993): "Introduction," in *Technological Choices: Transformations in material cultures since the Neolithic*, ed. by P. Lemonier. London: Routledge.
- Leroi-Gourhan, André (1964/1985): *O gesto e a palavra: 1 - Técnica e linguagem*. Lisboa: Edições 70
- Leroi-Gourhan, André (1965/2002): *O gesto e a palavra 2 - Memória e ritmos*. Lisboa: Edições 70
- Leroi-Gourhan, André (1971/1984a): *Evolução e técnicas: I - O homem e a matéria*. Lisboa: Edições 70
- Leroi-Gourhan, André (1971/1984b): *Evolução e técnicas: II - O Meio e as técnicas*. Lisboa: Edições 70
- Lewontin, R. C. (1998): *Biologia como ideologia: A doutrina do ADN*. Lisboa: Relógio d'Água

- Leydesdorff, Loet (2000): "Complexity and Technology," Amsterdam: University of Amsterdam, Communication Science
- Loasby, Brian (1976): *Choice, Complexity and Ignorance: An Inquiry into Economic Theory and The Practice of Decision-making*. Cambridge: Cambridge University Press
- Loasby, Brian (1999): *Knowledge, Institutions and Evolution in Economics*. London: Routledge
- Loasby, Brian (2001a): "Cognition, Imagination and Institutions in Demand Creation," *Journal of Evolutionary Economics*, 11 (1), pp. 7-21.
- Loasby, Brian (2001b): "Time, Knowledge and Evolutionary Dynamics: Why Connections Matter," *Journal of Evolutionary Economics*, 11, pp. 393-412.
- Loasby, Brian J. (2000): "Market Institutions and Economic Evolution," *Journal of Evolutionary Economics*, 10, pp. 297-309.
- Loasby, Brian J. (2002a): "Content and Method: An Epistemic Perspective on Some Historical Episodes," *European Journal of the History of Economic Thought*, 9 (1), March, pp. 72 - 95.
- Loasby, Brian J. (2002b): "The Evolution of Knowledge: Beyond the Biological Model," *Research Policy*, 31 (8-9), 2002/12, pp. 1227-39.
- Loasby, Brian J. (2003): "Closed Models and Open Systems," *Journal of Economic Methodology*, 10 (3), September, pp. 285-306.
- Lopes, Teresa da Silva (2002): "Brands and the Evolution of Multinationals in Alcoholic Beverages," *Business History*, July, pp.
- Lopes, Teresa Silva (1998): *Internacionalização e concentração do Vinho do Porto, 1945-1995*. Porto: GEHVID
- Louçã, F. (1997): "Turbulência na economia,"
- Louçã, F. (1997b): *Turbulence in Economics: An Evolutionary Appraisal of Cycles and Complexity in Historical Processes*. Cheltenham: Edward Elgar
- Louçã, F. and Mark Perlman (2000): *Is Economics an Evolutionary Science? The Legacy of Thorstein Veblen*. Cheltenham: Edward Elgar
- Lupasco, Stéphane (1947): *Logique et contradiction*. Paris: Presses Universitaires de France
- Lupasco, Stéphane (1987a): "Le principe d'antagonisme et la logique de l'énergie,"
- Lupasco, Stéphane (1987b): "L'énergie et la matière vivante,"
- Macedo, Jorge Borges de (1966a): "Companhias comerciais," in *Dicionário de história de Portugal*, ed. by J. V. Serrão. Lisboa: ???
- Macedo, Jorge Borges de (1966b): *O tratado de Methuen*. Lisboa: Tip. E. N. P.
- Macedo, Jorge Borges de (1982a): *O marquês de Pombal (1699-1782)*. Lisboa: Biblioteca Nacional
- Macedo, Jorge Borges de (1982b): *A situação económica no tempo de Pombal*. Lisboa: Moraes
- Machado, J. T. Montalvão (1983): *A filoxera na região duriense*. Porto: Fund. Eng. António de Almeida
- Magalhães, Nuno P. (1999): "Tending the vineyard," in *Encyclopedia of the Wines of Portugal: Port and Douro wines*, ed. by A. L. Vieira. Lisboa: Chaves Ferreira.
- Magnusson, Lars and Jan Ottosson (1997). *Evolutionary Economics and Path Dependence*. Cheltenham, Edward Elgar: pp.
- Mahoney, James (2000): "Path dependence in historical sociology," *Theory and Society*, 29 (4), 2000/8, pp. 507-48.
- Mahoney, James (2004): "Comparative-historical Methodology," *Annual Review of Sociology*, 30 (1), pp. 81-101.

- Nelson, Richard (2001): "The Coevolution of Technology and Institutions as the Driver of Economic Growth," in *Frontiers of Evolutionary Economics*, ed. by J. Foster and J. S. Metcalfe. Aldershot: Edward Elgar.
- Nelson, Richard R. and Bhaven N. Sampat (2001): "Making Sense of Institutions as a Factor Shaping Economic Performance," *Journal of Economic Behavior & Organization*, 44 (1), pp. 31-54.
- Nelson, Richard and Sidney Winter (1982): *An Evolutionary Theory of Economic Change*. Cambridge MA: Harvard University Press
- Nicolescu, Basarab (1996): "Levels of complexity and levels of Reality : Nature as trans-Nature," *Proceedings of the Plenary Session of the Pontifical Academy of Sciences on The emergence of complexity in mathematics, physics, chemistry and biology*, Roma & Princeton: Pontificia Academia Scientiarum and Princeton University Press Bernard Pullman.
- Nicolescu, Basarab (2000): "Transdisciplinarity and Complexity: Levels of Reality as Source of Indeterminacy," *Bulletin Interactif du Centre International de Recherches et Études transdisciplinaires*, 15, mai, pp.
- Nicolis, Grégoire (1995): *Introduction to Nonlinear Science*. Cambridge: Cambridge University Press
- Nicolis, Grégoire and Ilya Prigogine (1989): *Exploring Complexity: An Introduction*. New York: Freeman
- Nielsen, Klaus and Björn Johnson (1998): *Institutions and Economic Change: New Perspectives on Markets, Firms and Technology*. Cheltenham: Edward Elgar
- Nisbet, Robert A. (1969): *Social Change and History*. Oxford & New York: Oxford University Press
- North, Douglass (1999): *Understanding the process of economic change*. London: The Institute of Economic Affairs
- Nosi, Jorge (1991). *Technology and National Competitiveness: Oligopoly, Technological Innovation, and International Competition*. Montreal, McGill-Queen's University Press: pp.
- Oliveira, António Brás de and maria José Marinho (1983): *Devassa ao território do Alto Douro de 1772*. Lisboa: Biblioteca Nacional
- Oliveira, J. M. Pereira de (1960): "O Douro e as navegações," *Studium Generale*, 7 (1), pp. 147-84.
- Ordish, George (1987): *The Great Wine Blight*. London: Sigwick & Jackson
- Paniccia, Ivana (2002): *Industrial Districts: Evolution and competitiveness in Italian Firms*. Cheltenham: Edward Elgar
- Pasteur, Louis (1872/1924): *Études sur le vin, ses maladies, causes qui les provoquent*. Paris: Masson & Cie
- Paul, Harry W. (1996): *Science, Vine and Wine in Modern France*. Cambridge: Cambridge University Press
- Paulinyi, Akos (1989): *Industrielle Revolution. Vom Ursprung der modernen Technik*. Reibeck bei Hamburg: Rowohlt
- Pavitt, Keith (1984): "Sectoral Patterns of Technical Change: Towards a Taxonomy and Theory," *Research Policy*, 13 (6), pp. 343-73.
- Pavitt, Keith (1998): "The Social Shaping of the National Science Base," *Research Policy*, 27, pp. 793-805.
- Pavitt, Keith (2002): "Innovating Routines in the Business Firm: What Corporate Tasks Should They be Accomplishing?," *Ind Corp Change*, 11 (1), February 1, 2002, pp. 117-33.

- Pedreira, Jorge Miguel (1992): "Os negociantes de Lisboa na segunda metade do século XVIII. Padrões de recrutamento e percursos sociais," *Análise Social*, 27 (116-117), pp.
- Pedreira, Jorge Miguel (1994): *Estrutura industrial e mercado colonial: Portugal e Brasil (1780-1830)*. Linda-a-Velha: Difel
- Pedreira, Jorge Miguel (1995): *Os homens de negócio da praça de Lisboa de Pombal ao vintismo (1755-1822): diferenciação, reprodução e identificação de um grupo social*. Lisboa
- Peixoto, Fernando (1998): "O Triângulo corporativo e os primeiros passos do Instituto do Vinho do Porto," *Douro - Estudos e Documentos*, III (6), pp. 51-99.
- Peixoto, Fernando (2003a): "As instituições reguladoras do Vinho do Porto," in *O Vinho do Porto*, ed. by G. M. Pereira. Porto: Instituto do Vinho do Porto.
- Peixoto, Fernando (2003b): "The regulatory institutions," in *Port Wine*, ed. by G. M. Pereira. Porto: Instituto dos Vinhos do Douro e do Porto, 107-21.
- Peixoto, Fernando (2006a): "Entrepósito de Gaia: Um viveiro de conflitos," *Douro - Estudos e Documentos*, forthcoming, pp.
- Peixoto, Fernando (2006b): "O fim do corporativismo no sector do vinho do Porto," *Douro - Estudos e Documentos*, forthcoming, pp.
- Pereira, Gaspar Martins (1984a): "As quintas do Oratório do Porto no Alto Douro," *Revista de História Económica e Social*, pp.
- Pereira, Gaspar Martins (1984b): "O vinho do Porto, o Alto Douro e a Companhia na época pombalina (1756-1777), segundo Bernardo José de Sousa Guerra," *Estudos Transmontanos*, 2, pp. 81-118.
- Pereira, Gaspar Martins (1986): *Aspectos sociais da viticultura durieuse nos fins do século XVIII*. Porto: Centro de Estudos Norte de Portugal - Aquitânia
- Pereira, Gaspar Martins (1989a): "A produção de um espaço regional: o Alto Douro no tempo da filoxera," *Revista da Faculdade de Letras - História (Universidade do Porto)*, 2ª Serie, vol. 6, pp. 311-53.
- Pereira, Gaspar Martins (1989b): *A produção de um espaço regional: o Alto Douro no tempo da filoxera*. Porto
- Pereira, Gaspar Martins (1990): *O Douro: O vinho, a vinha e a região de Pombal a João Franco*. Porto: Faculdade de Letras da Universidade do Porto,
- Pereira, Gaspar Martins (1991): *O Douro e o vinho do Porto: de Pombal a João Franco*. Porto: Afrontamento
- Pereira, Gaspar Martins (1998a): "Ancient Vines, Universal Wine," in *Port and Douro Wines*, ed. by??? Lisboa: Chaves Ferreira.
- Pereira, Gaspar Martins (1998b): "A evolução das técnicas vitivinícolas no Douro oitocentista," *Os vinhos licorosos e a história*, Funchal: Centro de Estudos de História do Atlântico.
- Pereira, Gaspar Martins (1999): "The Origins and Evolution of a Great Wine," in *Vintage Port*, ed. by G. M. Pereira and J. N. d. Almeida. Porto: IVP & Campo das Letras.
- Pereira, Gaspar Martins (2000): "A Companhia Geral da Agricultura das Vinhas do Alto Douro em 1784, segundo um relatório de Luís Pinto de Sousa Coutinho. II," *Douro - Estudos e Documentos*, 9 (1), pp. 155-74.
- Pereira, Gaspar Martins (2004): "A regulação da região demarcada do Douro: Do absolutismo ao liberalismo," *Encontro da APHES de Novembro de 2004*, ICS, Lisboa:
- Pereira, Gaspar Martins and Amândio Jorge Morais Barros (2001): *Memória do Rio: para uma história da navegação no Douro*. Porto: Afrontamento

- Pereira, Gaspar Martins and Natália Fauvrelle da Costa (1998): "Instruções para a cultura da vinha e para o fabrico do vinho nas quintas de João Pacheco Pereira, antes da instituição da Companhia," *Douro - Estudos & Documentos*, 3 (5), pp. 161-75.
- Pereira, Miriam Halpern (1971): *Livre câmbio e desenvolvimento económico: Portugal na segunda metade do século XIX*. Lisboa: Ed. Cosmos
- Perez, Carlota (1983): "Structural Change and Assimilation of New Technologies in the Economic and Social Systems," *Futures*, 15 (5), October, pp. 357-91.
- Peukert, Helge (2000): "Bridging Old and New Institutional Economics: Gustav Schmoller and Douglass C. North, seen with Oldinstitutionalists' Eyes," pp.
- Peukert, Helge (2001a): "The Schmoller Renaissance," *History of Political Economy*, 33 (1), pp.
- Peukert, Helge (2001b): *Werner Sombart*. Frankfurt/Mainz: J. W. Goethe-Universität
- Pietrobelli, Carlo, et al. (2001): *The Global Challenge to Industrial Districts: SMEs in Italy and Taiwan*. Cheltenham, UK and Lyme, US: Edward Elgar
- Pietrobelli, Carlo and R. Rabellotti (2004): *Upgrading in Clusters and Value Chains in Latin America*. Boston MA: The MIT Press for the Inter-American Development Bank
- Pirenne, H. (1934): "The Rise of Capitalism," *Economic History Review*, 5 (1), Oct., pp. 125.
- Pirenne, H. (1969): *Histoire économique et sociale du Moyen-Âge*. Paris: Presses Universitaires de France
- Pirenne, Henri (1914): *Les périodes de l'histoire sociale du capitalisme*. Brussels: Hayez
- Plotkin, H. (1994): *The Nature of Knowledge*. London: Allan Lane
- Polanyi, Michael (1983): *The Tacit Dimension*. Gloucester, Massachusetts: Peter Smith
- Pombal (1986): *Escritos económicos de Londres: 1741-1742*. Lisboa: Biblioteca Nacional
- Portugal. (1797): *Collecção das leis, decretos, e alvarás, que comprehende o feliz reinado del rey fidelissimo D. José o I*. Lisboa: Na Officina de Antonio Rodrigues Galhardo
- Posner, Eric A. (1993): "The New Institutional Economics Meets Law and Economics," *Journal of Institutional and Theoretical Economics*, 149 (1), pp. 73-87.
- Posner, Richard A (2000): "Path-dependency, Pragmatism, and Critique of History in Adjudication and Legal Scholarship," *The University of Chicago Law Review*, 67 (3), Summer, pp. 573-606.
- Posner, Richard A. (1993): "Nobel Laureate: Ronald Coase and Methodology," *The Journal of Economic Perspectives*, 7 (4), Autumn, pp. 195-210.
- Pospisil, Leopold J. (1974): *Anthropology of Law: A Comparative Theory*. Washington: Human Relations Area Files (HRAF)
- Pospisil, Leopold J. (1978): *The Ethnology of Law*. New Haven, Connecticut: Human Relations Area Files (HRAF)
- Prigogine, Ilya and Grégoire Nicolis (1977): *Self-organization in Nonequilibrium Systems*. New York: Wiley
- Radich, Maria Carlos (1996): *Agronomia no Portugal oitocentista: Uma discreta desordem*. Oeiras: Celta
- Ramsey, Frank P. (1931/1926): "Truth and Probability," in *The foundations of mathematics and other logical essays*, ed. by R. B. Braithwaite. London: Paul Kegan.

- Ramsey, Frank P. (1931/1928): "Further Considerations," in *The foundations of mathematics and other logical essays*, ed. by R. B. Braithwaite. London: Paul Kegan.
- Ramsey, Frank P. (1931/1929): "Last Papers: Probability and Partial Beliefs," in *The foundations of mathematics and other logical essays*, ed. by R. B. Braithwaite. London: Paul Kegan.
- Reijnders, Jan P. G. (1997). *Economics and Evolution. Belgian-Dutch Association for Post-Keynesian Studies*. Cheltenham, Edward Elgar: pp.
- Richardson, Gary (2004): "Guilds, Laws, and Markets for Manufactured Merchandise in Late-Medieval England," *Explorations in Economic History*, 41 (1), 2004/1, pp. 1-25.
- Ricoeur, Paul (1983): *Temps et récit*. Paris: Le Seuil
- Ricoeur, Paul (2000a): *La mémoire, l'histoire, l'oubli*. Paris: Seuil
- Ricoeur, Paul (2000b): "L'écriture de l'histoire et la représentation du passé," *Annales Histoire, Sciences Sociales*(4), juillet-août, pp. 713-47.
- Robbins, Lionel (1932/1935): *An Essay on the Nature and Significance of Economic Science*. London: MacMillan
- Rocher, Guy (1972): *Talcott Parsons et la sociologie américaine*. Paris: Presses universitaires de France
- Rodriguez de las Heras, Antonio (1976): *Historia y crisis*. Valencia: Fernando Torres
- Rosenberg, Nathan (1969): "The Direction of Technological Change: Inducement Mechanisms and Focusing Devices," *Economic Development and Cultural Change*, 18 (1, Part 1), Oct., pp. 1-24.
- Rosenberg, Nathan (1976): *Perspectives on Technology*. Cambridge: Cambridge University Press
- Rosenberg, Nathan (1982): *Inside the Black Box*. Cambridge: Cambridge University Press
- Rosenberg, Nathan (1994): *Exploring the Black Box*. Cambridge: Cambridge University Press
- Rouelle, Guillaume François (1750): *Cours de chimie*. s.l.: s.n.
- Rouland, Norbert (1988): *Anthropologie juridique*. Paris: Presses Universitaires de France
- Rouland, Norbert (1995): *L'anthropologie juridique*. Paris: Presses Universitaires de France
- Rozier, [Abbé] Jean-Baptiste François (1784): *Cours complet d'agriculture théorique, pratique, économique et de médecine rurale et vétérinaire, Tome cinquième ; suivi d'une Méthode pour étudier l'agriculture par principes, ou Dictionnaire universel d'agriculture*. Paris: s.n.
- Russell, Bertrand (1923): "Vagueness," *Australasian Journal of Philosophy and Psychology*, 1 (1), pp. 84-92.
- Samuels, Warren J (1989a): "The Legal-economic Nexus," *George Washington Law Review*, pp.
- Samuels, Warren J (1989b): "Some Fundamentals of the Economic Role of Government," *Journal of Economic Issues*, 23 (2), Jun, pp. 427-34.
- Samuels, Warren J (1992): "The Legal-economic Nexus," in *Essays on the Economic Role of Government: Volume I - Fundamentals*, ed. by W. J. Samuels. New York: New York University Press.
- Samuels, Warren J (2000): "An essay on the unmagic of norms and rules and of markets," *Journal des Economistes et des Etudes Humaines*, 10 (2-3), pp.

- Samuels, Warren J. (1977a): "The Political Economy of Adam Smith," *Ethics*, 87 (3), Apr., pp. 189-207.
- Samuels, Warren J. (1977b): "Technology *Vis-a-Vis* Institutions in the J.E.I.: A Suggested Interpretation," *Journal of Economic Issues*, Vol. 11 (4), December, pp. 871-95.
- Samuelson, Paul A. (1947): *The Foundations of Economic Analysis*. New York: Atheneum
- Samuelson, Paul A. (1963): "Problems of Methodology - Discussion," *American Economic Review*, May, pp. 231-6.
- Santos, Júlio Eduardo dos (1916): *O Vinho do Pôrto: Seu passado, presente e futuro - Produção, comércio, estatística*. Lisboa: Tipografia Nacional
- Saviotti, Pier Paolo and Bart Nooteboom (2000). *Technology and Knowledge: From the Firm to Innovation Systems*. European Association for Evolutionary Political Economy. Cheltenham, Edward Elgar: pp.
- Schneider, Susan (1980): *O Marquês de Pombal e o vinho do Porto: Dependência e subdesenvolvimento em Portugal no século XVIII*. Lisboa: A Regra do Jogo
- Schumpeter, J A (1908): *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*. Berlin: Duncker & Humblot
- Schumpeter, J A (1926): "Gustav v. Schmoller und die Probleme von heute," *Jahrbuch für Gesetzgebung, Verwaltung und Volkswirtschaft im Deutschen Reich*, Bd. 50 (1926), pp. S. 337-88.
- Schumpeter, J A (1934): *The Theory of Economic Development*. New York: Galaxy Book-Oxford University Press
- Schumpeter, Joseph A (1949): "Communist Manifesto," *Journal of Political Economy*, pp. 293.
- Schumpeter, Joseph A (1954): *The History of Economic Analysis*. New York: Oxford University Press
- Schumpeter, Joseph A. (1943/1992): *Capitalism, socialism and democracy*. London & New York: Routledge
- Scieur, Philippe (2001): *Polynomie et désarroi. Contribution à une sociologie des petites et moyennes entreprises familiales*. Louvain-la-neuve: Ciaco
- Scott, Joan Wallach (1989): "History in crisis? The others' side of the story," *American Historical Review*, 94 (3), June, pp. 680-92.
- Screpanti, Ernesto and Stefano Zamagni (1993): *An Outline of the History of Economic Thought*. Oxford: Clarendon Press
- Sellers, Charles (1899): *Oporto, old and new. Being a historical record of the Port wine trade and a tribute to British commercial enterprise in the north of Portugal*. London: Herbert e, Harper
- Sequeira, Carla (2000): *A questão duriense e o movimento dos Paladinos, 1907-1932: Da Comissão de Viticulutra Duriense à Casa do Douro*. Porto: GEHVID
- Serrão, José Vicente (1993): "O quadro económico. Configurações estruturais e tendências de evolução," in *História de Portugal*, ed. by J. Mattoso. Lisboa: Círculo de Leitores, IV, 71-117.
- Serres, Olivier de (1600): *Le théâtre d'agriculture et ménage des champs*. Paris: I. Metayer
- Setterfield, M (1997): "'History versus Equilibrium' and the Theory of Economic Growth," *Camb. J. Econ.*, 21 (3), May 1, 1997, pp. 365-78.
- Setterfield, M (1998): "History versus equilibrium: Nicholas Kaldor on historical time and economic theory," *Camb. J. Econ.*, 22 (5), September 1, 1998, pp. 521-37.

- Setterfield, M (2001a): "Notes and Comments. Cumulative Causation, Interrelatedness and the Theory of Economic Growth: A Reply to Argyrous and Toner," *Camb. J. Econ.*, 25 (1), January, pp. 107-12.
- Setterfield, Mark (1999): "Expectations, Path Dependence and Effective Demand: A Macroeconomic Model Along Keynesian Lines," *Journal of Post Keynesian Economics*, 21 (3), Spring, pp. 479.
- Setterfield, Mark (2001): "Cumulative causation, interrelatedness and the theory of economic growth: A reply to Argyrous and Toner," *Cambridge Journal of Economics*, 25 (1), Jan, pp. 107.
- Shionoya, Yuichi (1997): *Schumpeter and the Idea of Social Science: A Metatheoretical Study*. Cambridge: Cambridge University Press
- Sideri, Sandro (1970): *Trade and Power - Informal Colonialism in Anglo-Portuguese Relations*. Rotterdam: Rotterdam University Press
- Silva, Abílio Diniz (2003): "D. Luís da Cunha e o Tratado de Methuen," *História - Revista da Faculdade de Letras da Universidade do Porto*, III Série (4), pp.
- Silva, Francisco Ribeiro da (1983): *Absolutismo esclarecido e intervenção popular: Os motins do Porto de 1757*. Lisboa: Imprensa Nacional - Casa da Moeda
- Silva, Francisco Ribeiro da (1990a): "A Alfândega do Porto: os diplomas legais que marcaram a sua evolução secular," in *A Alfândega do Porto e o despacho aduaneiro*, ed. by Arquivo Histórico Municipal do Porto. Porto: Arquivo Histórico Municipal do Porto.
- Silva, Francisco Ribeiro da (1990b): "O Despachante oficial: uma profissão moderna e um serviço antigo," in *A Alfândega do Porto e o despacho aduaneiro*, ed. by Arquivo Histórico Municipal do Porto. Porto: Arquivo Histórico Municipal do Porto.
- Silva, Francisco Ribeiro da (1996): "Do douro ao Porto: O protagonismo do vinho na Época Moderna," *Douro - Estudos & Documentos*, 1 (2), pp. 93-118.
- Silva, Francisco Ribeiro da (2001): "Vinhos do Douro: loteamentos clandestinos que desafiaram o Marquês (1771-1775)," *Douro - Estudos & Documentos*, 6 (11), pp. 161-80.
- Simmel, Georg (1981): *Sociologie et épistémologie*. Paris: Presses Universitaires de France
- Simões, Nuno (1932): *Os vinhos do Porto e a defesa internacional da sua marca, (Subsídio para o estudo da questão)*. Coimbra: Imprensa da Universidade
- Simon, H A (1976): "From Substantive to procedural rationality," in *Method and appraisal in economics*, ed. by S. Latsis. Cambridge: Cambridge University Press, 129-48.
- Simon, H A (1978): "Rationality as Process and as Product of Thought," *American Economic Review*, 68 (2), May, pp.
- Simon, H A (1991): "Bounded Rationality and Organizational Learning," *Organization Science*, 2 (1), Feb., pp. 125-134.
- Simon, H A (1992): "De la rationalité substantive à la rationalité procédurale," *Pistes*, 3, Octobre, pp.
- Simon, H A (2001): "Complex Systems: The Interplay of Organizations and Markets in Contemporary Society," *Computational and Mathematical Organization Theory*, 7 (1), pp. 79-85.
- Simon, Herbert A (1983): *Reason in Human Affairs*. Stanford: Stanford University Press
- Simon, Herbert A. (1962): "The Architecture of Complexity," *Proceedings of the American Philosophical Society*, 106 (6), Dec. 12, pp. 467-82.



- Simon, Herbert A. (1976): "How Complex are Complex Systems?," *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 1976 (Volume Two: Symposia and Invited Papers), pp. 507-22.
- Simon, Herbert A. (2002): "Near Decomposability and the Speed of Evolution," *Ind Corp Change*, 11 (3), June 1, 2002, pp. 587-99.
- Simon, Herbert A. and Yumi Iwasaki (1988): "Causal Ordering, Comparative Statics, and Near Decomposability," *Journal of Econometrics*, 39 (1,2), Sep/Oct, pp. 149.
- Simpson, James (2004): "Selling to Reluctant Drinkers: the British Wine Market, 1860-1914," *Economic History Review*, 57 (1), February, pp. 80-108.
- Smith, Keith (2002): "What is the 'Knowledge economy'? Knowledge Intensity and Distributed Knowledge Bases," *Discussion paper*, Maastricht: United Nations University, Intech
- Snooks, G. D. (1993). *Historical Analysis in Economics*. London, Routledge: pp.
- Snooks, Graeme Donald (1993): *Economics without Time. A Science Blind to the Forces of Historical Change*. London: Macmillan
- Snooks, Graeme Donald (1998): *Longrun Dynamics. A General Economic and Political Theory*. London: Macmillan
- Snooks, Graeme Donald (1999): *Global Transition. A General Theory of Economic Development*. London: Macmillan
- Snow, C. P. (1993): *The Two Cultures*. Cambridge: Cambridge University Press (Canto Books)
- Sombart, Werner (1929): "Economic Theory and Economic History," *Economic History Review*, 2 (1), January, pp. 1-19.
- Sousa, Fernando de (2003a): "A Administração da Companhia Geral da Agricultura das Vinhas do Alto Douro (1756-1852)," in *Os arquivos da vinha e do vinho do Douro*, ed. by CEPESE. Porto: CEPESE.
- Sousa, Fernando de (2003b): "A Companhia Geral da Agricultura das Vinhas do Alto Douro (1756-1978)," in *Os arquivos da vinha e do vinho do Douro*, ed. by CEPESE. Porto: CEPESE.
- Spengler, Joseph J. (1968): "Hierarchy vs. Equality: Persisting Conflict," *Kyklos*, 21 (1), pp. 217-36.
- Spengler, Joseph J. (1948): "The Problem of Order in Economic Affairs," *Southern Economic Journal*, 15 (1), Jul., pp. 1-29.
- Spengler, Oswald (1958): *L'homme et la technique*. Paris: Gallimard
- Swedberg, Richard (1991b): *Schumpeter a Biography*. Princeton: Princeton University Press
- Teece, David J., et al. (1997): "Dynamic Capabilities and Strategic Management," *Strategic Management Journal*, 18 (7), Aug., pp. 509-33.
- Telles, Vicente Coelho Seabra Silva e (1790): "Memoria sobre a cultura das videiras, e a manufactura dos vinhos," in *Memorias de Agricultura*, ed. by Academia Real das Sciencias de Lisboa. Lisboa: Academia Real das Sciencias de Lisboa.
- Tenreiro, A. Guerra (1942a): "Douro - Esboços para a sua história económica (I): Geografia económica do Douro nos séculos XVI e XVII," *Anais do Instituto do Vinho do Porto*, 1942 (1), pp. 157-294.
- Tenreiro, A. Guerra (1942b): "Douro - Esboços para a sua história económica (II): Legislação pombalina," *Anais do Instituto do Vinho do Porto*, 1942 (2), pp. 1-176.

- Tenreiro, A. Guerra (1943): "Douro - Esboços para a sua história económica (III): Ainda o tratado de Méthuen," *Anais do Instituto do Vinho do Porto*, 1943 (1), pp. 17-65.
- Tenreiro, A. Guerra (1944): "Douro - Esboços para a sua história económica (IV): Conclusões," *Anais do Instituto do Vinho do Porto*, 1944 (1), pp. 1-115.
- Tidd, Joe, et al. (1997): *Managing Innovation: Integrating Technological, Market and Organizational Change*. New York: John Wiley & Sons
- Tollison, Robert (1982): "Rent-seeking: A survey," *Kyklos*, 35 (4), pp. 575-602.
- Tollison, Robert D. (2001): "The Interest-Group Theory of Government: Problems and Prospects," *Kyklos*, 54 (2), pp. 465.
- Tort, Patrick (1985): *Misère de la sociobiologie*. Paris: Presses Universitaires de France
- Tort, Patrick (1992): *La pensée hiérarchique et l'évolution*. Paris: Aubier Montaigne
- Trachtman, Joel P. (2004): "The Methodology of Law and Economics in International Law," *International Law FORUM du droit international*, 6 (2), pp. 67.
- Trigg, Andrew B (2001): "Veblen, Bourdieu, and conspicuous consumption," *Journal of Economic Issues*, 35 (1), Mar, pp. 99.
- Tull, Jethro (1731/1733): *The New Horse Hoing Husbandry: An Essay on the Principles of Tillage and Vegetation*.
- Tullock, Gordon (1996): "Rent-seeking and the Law," in *Current issues in public choice*, ed. by J. C. Pardo. Cheltenham: Edward Elgar, 179-88.
- Unwin, Tim (1991): *Wine and the Vine*. London: Routledge
- Urry, John (2003): *Global Complexity*. Cambridge: Polity
- Veblen, Thorstein (1898): "Why is Economics not an Evolutionary Science?," *Quarterly Journal of Economics*, 12 (2), pp. 373-426.
- Veblen, Thorstein (1899): *The Theory of the Leisure Class*. New York, N.Y./London: Macmillan: Macmillan
- Veblen, Thorstein (1899/1912): *The Theory of the leisure class. An economic study in the evolution of institutions*. New York, N.Y./London: Macmillan
- Veblen, Thorstein (1904): *The Theory of business enterprise*. New York, N.Y.: Scribner's
- Veblen, Thorstein (1912 [1899]): *The Theory of the leisure class. An economic study in the evolution of institutions*. New York, N.Y./London: Macmillan
- Veblen, Thorstein (1915): *Imperial Germany and the industrial revolution*. New York: Macmillan
- Veblen, Thorstein (1990): *The Place of Science in Modern Civilization and Other Essays*. New Brunswick and London: Transaction [1919]
- Verley, Patrick (1997): *La révolution industrielle*. Paris: Gallimard
- Verney, Luís António (1746): *Verdadeiro metodo de estudar: para ser util à Republica, e à Igreja: proporcionado ao estilo, e necessidade de Portugal*. Valensa [Nápoles]: na oficina de Antonio Balle [Gennaro e Vincenzo Muzio]
- Verney, Luís António (1762): *Essai sur les moyens de rétablir les sciences et les lettres en Portugal*. Lisbonne: Chez P. AL Le Prieur
- Vila Maior (1876): *O Douro ilustrado: album do Rio Douro e paiz vinhateiro: album ce fleuve et de son pays vignoble: an album of the river Douro and adjacent wine country*. Porto: Liv. Universal de Magalhães & Moniz
- Vila Maior, Visconde de (1867): *Memoria sobre os processos de vinificação empregados nos principaes centros vinhateiros do continente do reino - 1ª divisão, districtos do Norte*. Lisboa: Imprensa Nacional
- Vila Maior, Visconde de (1875): *Manual de viticultura pratica*. Coimbra: Imprensa da Universidade

- Vilar, Sergio (1997): *La nueva racionalidad: Comprender la complejidad con métodos transdisciplinarios*. Barcelona: Kairós
- Vilarinho de São Romão (1889): *Videiras americanas*. Porto: Lugan & Genelioux
- Vilarinho de São Romão (1891): *Flagelos da videira*. Porto: Magalhães e Moniz
- Vilhena, Francisco A. Palma de (1895): "Relatório dos serviços oficiais da estação ampelo-filoxérica do Norte em 1895," *Boletim da Direcção Geral da Agricultura*, 6º ano (n.º 4), pp.
- Vizetelly, Henry (1880): *Facts about Port and Madeira with notices of the wines vintaged abound Lisbon and the wines of Tenerife*. London: Ward, Lock and Co.
- Vromen, Jack J (1995): *Economic Evolution: An Enquiry into the Foundations of New Institutional Economics*. London: Routledge
- Vromen, Jack J (1997): "Evolutionary economics: Precursors, paradigmatic propositions, puzzles and prospects," in *Economics and Evolution*, ed. by J. Reijnders. Cheltenham: Edward Elgar
- Wallerstein, Immanuel (1974): *The Modern world system I: Capitalist agriculture and the origins of the European world-economy in the sixteenth century*. San Diego: Academic Press
- Wallerstein, Immanuel (1980): *The Modern world-system, II: Mercantilism and the consolidation of the European world-economy, 1600-1750*. New York: Academic Press
- Wallerstein, Immanuel (1985): *Capitalisme historique*. Paris: La Découverte
- Walley, Peter (1991): *Statistical Reasoning with Imprecise Probabilities*. London: Chapman and Hall
- Walley, Peter (2000) "Imprecise Probabilities", Imprecise Probability Project, [04-01-2003 / 2003] <http://ippserv.rug.ac.be>
- Weatherston, Brian (2002): "Keynes, Uncertainty and Interest Rates," *Cambridge Journal of Economics*, 26 (1), February, pp. 47-62.
- Williamson, Oliver E. (1993): "Transaction Cost Economics Meets Posnerian Law and Economics," *Journal of Institutional and Theoretical Economics*, 149 (1), pp. 99-118.
- Williamson, Oliver E. (1996): "Review of Jack Vromen *Economic evolution*," *Economic Journal*, 106 (6), November, pp. 1791-3.
- Williamson, Oliver E. (2000): "The New Institutional Economics: Taking Stock, Looking Ahead," *Journal of Economic Literature*, 38 (3), Sep., pp. 595-613.
- Williamson, Samuel H. (1991): "The History of Cliometrics," in *Research in Economic History*, ed. by JAI, 15-31.
- Wilson, Bee (1999): "Conspicuous Consumption," *New Statesman*, 12 (551), Apr 19,, pp. 42.
- Wilson, Charles (1957): "'Mercantilism': Some Vicissitudes of an Idea," *Economic History Review*, 10 (2), pp. 181-88.
- Witt, U. (2003): *The Evolving Economy: Essays on the Evolutionary Approach to Economics*. Cheltenham: Edward Elgar
- Witt, Ulrich (2001): "Learning to Consume - A Theory of Wants and Demand Growth," *Journal of Evolutionary Economics*, 11 (1), pp.
- Wunenburger, Jean-Jacques (1990): *La raison contradictoire. Science et philosophies modernes: la pensée du complexe*. Paris: Albin Michel
- Young, A. (1928): "Increasing Returns and Economic Progress," *Economic Journal*, 38, pp. 527-42.
- Zadeh, Lofti A. (1968): "Probability Measures of Fuzzy Events," *Journal of Mathematical Analysis and Applications*, 23, pp. 421-27.

Zadeh, Lofti A. (1978): "Fuzzy Sets as a Basis for a Theory of Possibility," *Fuzzy Sets System*, 1 (1), pp. 3-28.

Ziman, John (2000). *Technological Innovation as an Evolutionary Process*. Cambridge, Cambridge University Press: pp.