UNIVERSIDADE DE LISBOA

Instituto Superior de Economia e Gestão

Essays on Consumer Behaviour:

A Marketing Approach to Lottery Gambling

José Bernardo Fonseca Pólvora Trindade Chagas

Orientador: Prof. Doutor Jorge Filipe da Silva Gomes

Tese especialmente elaborada para obtenção do grau de Doutor em Gestão

2022

UNIVERSIDADE DE LISBOA

Instituto Superior de Economia e Gestão

Essays on Consumer Behaviour:

A Marketing Approach to Lottery Gambling

José Bernardo Fonseca Pólvora Trindade Chagas

Orientador: Prof. Doutor Jorge Filipe da Silva Gomes

Tese especialmente elaborada para obtenção do grau de Doutor em Gestão

Júri:

Presidente: Doutor Nuno João de Oliveira Valério
Professor Catedrático e Presidente do Conselho Científico
Instituto Superior de Economia e Gestão da Universidade de Lisboa

Vogais: Doutor Rui Manuel Vinhas da Silva
Professor Catedrático
ISCTE Business School do ISCTE – Instituto Universitário de Lisboa

Doutor Jorge Filipe da Silva Gomes
Professor Catedrático
Instituto Superior de Economia e Gestão da Universidade de Lisboa

Doutora Helena do Carmo Milagre Martins Gonçalves
Professora Catedrática
Instituto Superior de Economia e Gestão da Universidade de Lisboa

Doutor Henrique Jorge Cristo Lopes
Professor Auxiliar Convidado
Católica Lisbon School of Business & Economics da Universidade Católica Portuguesa

2022

ABSTRACT

The present dissertation presents three essays on marketing, focused on consumer behaviour. The first essay approaches the state of the art on gambling consumer behaviour, with a special emphasis on the use of big data. Results show that most of the studies found were carried out by a small group of researchers and databases from a very restricted number of operators. Therefore, this essay found a researcher gap that is a steppingstone in this dissertation, which complements the gap found in the study of consumer behaviour, of gambling studies, including on lottery gambling. The second essay (Chapter 4 – Essay 2) had as a main objective, the identification of segments of players through their levels of involvement (high, neutral, low) and the evaluation of the preferences of product categories, through the creation and use of segmentation models. Results indicate the existence of a hierarchy in the relevance of sociodemographic variables to determine players profiles and segments. The models generated various segments of players who engage in different games. The results support the identification of different segments and the possibility of creating a more effective marketing effort in identifying segments and defining and elaborating targeting and responsible gaming strategies. The second essay (Chapter 4 – Essay 2) is the first study to use real game data from the Portuguese national lottery, which were made available exclusively for this study, and has never been analysed before, a situation similar to one of the longitudinal databases used in the third essay. The third essay (Chapter 5 – Essay 3) analyses the effect of cannibalization on the product portfolio of the Portuguese national lottery. Cannibalization is a marketing phenomenon that occurs when sales of a product decrease in volume or market share, due to the introduction of a new product on the market, launched by the same or another company. The new product absorbs the demand for the current product, reducing its sales. When considering institutions that operate in monopolistic, oligopolistic, or highly regulated markets, as is the case of state lotteries, it is expected that the gambling activity grows by the expansion of total demand. So far, very few studies have focused on the impact of the introduction of new games on pre-existing games in this specific sector. This study is the first to assess the impact of cannibalization on the Portuguese national lottery portfolio, and it is also the first to

include games such as passive lotteries. The results demonstrate the existence of cannibalization between product categories and between single products. Scratchcards are the product that most cannibalizes other games. The results also demonstrate the existence of complementarity between games, both in terms of product category and individual products. The results obtained advance the knowledge in the field and on cannibalization of lottery products.

Key Words: marketing; consumer behaviour; gambling; segmentation models; product cannibalization.

JEL classification: D12; D18; M31; H71; C31; C32

RESUMO

Na presente dissertação são apresentados três ensaios, numa abordagem de marketing, focada no comportamento do consumidor. No primeiro ensaio é analisado o estado da arte de estudos sobre comportamento de consumidor, nomeadamente com uso de dados reais de rastreamento comportamental e *big data*, dado que, com o surgimento da internet, passou a ser possível estudar, remotamente, o comportamento real de consumidores e jogadores, em diversas condições e contextos. Os resultados obtidos revelam que a maioria dos estudos encontrados, neste contexto, foram realizados por um número reduzido de investigadores, os quais utilizaram bases de dados de um grupo muito restrito de operadores, o que, apesar dos contributos existentes para o conhecimento existente, se revelam ainda bastante delimitados. Observa-se assim uma lacuna investigacional que se propõe preencher nesta dissertação, a qual complementa a abordagem de estudo ao comportamento do consumidor, de jogo a dinheiro, nomeadamente lotarias, até aqui desenvolvido.

O segundo ensaio tem como primeiro e maior objectivo, a identificação de grupos, ou segmentos, de jogadores através dos seus níveis de envolvimento (alto, neutro, baixo) e a avaliação das preferências de categorias de produto, através da criação e utilização de modelos de segmentação. Os resultados encontrados indicam a existência de uma hierarquização na relevância das variáveis sociodemográficas para a determinação dos segmentos e perfis de jogadores. Os modelos geraram vários segmentos de jogadores que se envolvem em diferentes jogos. Os resultados suportam a identificação de diferentes segmentos e a possibilidade de criação de um esforço de marketing mais eficaz na identificação de segmentos e na definição e elaboração de estratégicas de *targeting* e de jogo responsável. O segundo ensaio é o primeiro estudo a utilizar dados reais de jogo da entidade que explora os jogos de lotaria em Portugal, os quais foram disponibilizados exclusivamente para este estudo, e nunca foram analisados anteriormente, situação semelhante a uma das bases de dados longitudinais utilizada na elaboração do terceiro ensaio.

No terceiro ensaio é analisado o efeito da canibalização no portefólio de produtos dos jogos sociais do estado. A canibalização é um fenómeno de marketing que ocorre

quando as vendas de um produto diminuem em volume ou participação de mercado, devido à introdução de um novo produto no mercado, lançado pela mesma empresa. O novo produto absorve a procura pelo produto atual, reduzindo suas vendas. Ao considerar instituições que operam em mercados monopolistas, oligopolistas ou altamente regulados, como é o caso dos jogos sociais do estado, comumente designados como "lotarias", é expectável que a atividade de jogo cresça pela expansão da procura total. Até ao momento, muito poucos estudos se concentraram no impacto da introdução de novos jogos em jogos preexistentes, neste sector em específico. Este estudo é o primeiro a avaliar o impacto da canibalização no portefólio dos jogos sociais do estado e é também o primeiro a incluir jogos como as lotarias passivas (Lotaria Clássica e Popular). Os resultados demostram a existência de canibalização entre categorias de produto e entre produtos individuais. As raspadinhas são o produto que mais canibaliza outros jogos. Os resultados demonstram também a existência de complementaridade entre jogos, tanto ao nível de categoria de produto como de produtos individuais. Os resultados obtidos avançam o conhecimento produzido por investigações anteriores sobre canibalização em jogos de "lotarias".

Palavras-chave: marketing; comportamento do consumidor; jogo a dinheiro; modelos de segmentação; canibalização de produto.

Classificação JEL: D12; D18; M31; H71; C31; C32

ACKNOWLEDGEMENTS

First, I would like to thank my family who have always supported and encouraged me to pursue my goals. Thank you for understanding all the late nights and days away from family activities to develop and complete this work. Without you, none of this would have been possible. A special word to my mother who has inspired so many, including myself, for her kindness, and for always being there with her eternal positivity. To my friends and colleagues who have supported me throughout this journey.

I would like to thank and respect my thesis supervisor, Professor Jorge F. Gomes, for his guidance and assistance throughout the thesis research.

To Professor Margarida Duarte my gratitude for her friendship, support, and guidance. To Professor Helena Gonçalves and Professor Cristina Baptista for their friendship and encouragement. To Professor Rui Brites and Professor Isabel Proença for their friendship and support.

I would also like to give my most special gratitude to Eng. Vidal de Oliveira for his friendship, support, and for sharing his wisdom and knowledge with me. Another special acknowledgment to Professor Mark D. Griffiths for allowing me to learn from his vast experience in the gambling studies field.

Finally, I would also like to thank Santa Casa da Misericordia de Lisboa for providing the conditions, including the data, that enabled the possibility of developing some of the studies integrated in this dissertation.

…the things you think about determine the quality of your mind.
Your soul takes on the colour of your thoughts.

…the mind is that which is roused and directed by itself.
It makes of itself what it chooses. It makes what it
chooses of its own experience.

Marcus Aurelius, *in Meditations*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDIXES

ABBREVIATIONS, UNITS AND ACRONYMS

CAGR – Compound annual growth rate

EGBA - European Gaming and Betting Association

EU – European Union

EL - European State Lotteries and Toto Association, generally referred to as “European Lotteries”

DJ/SCML - Departamento de Jogos da Santa Casa da Misericórdia de Lisboa

DSM - Diagnostic & statistical manual of mental disorders

IEJO - Imposto especial sobre jogo online (special tax on online gambling)

GGR - Gross gaming revenue

JSC – Jogos Santa Casa

OGGR – Online gross gaming revenue

RJO - Regime jurídico dos jogos e apostas online (legal regime for online gambling and betting)

SARS-CoV-2 - Severe acute respiratory syndrome coronavirus 2

SCML – Santa Casa da Misericórdia de Lisboa

SMS - Short messaging service

SRIJ – Serviço de Regulação e Inspeção de Jogos e Comissão de Jogos do Instituto do Turismo de Portugal, I. P. - (Gambling Inspection and Regulation Service)

US – United States of America

VLT – Video lottery terminal

WLA - World Lottery Association

PART I

INTRODUCTION AND RESEARCH OVERVIEW: A GENERAL PERSPECTIVE OF ONLINE AND OFFLINE GAMBLING, AND CONSUMER BEHAVIOUR

Chapter 1

Approaching the Theme, Bounding the Research, and Options

1.1 General introduction and historical background on gambling

1.1.1 Gambling historical background

Playing is an activity that is so old that can be considered older than culture and human society, as animals have not waited for man to teach them their playing (Huizinga, 1949). Early studies have distinguished games of chance from games of skill as most gambling involves a bet or stake where gamblers have no way to influence the outcome (Culin, 1992a; 1992b; Kerr, O'Brennan, & Vazquez, 2021).

Gambling and gaming activities have played a significant role in human entertainment and interaction throughout history. According to Thompson (2010), the first lottery was created in Florence, Italy, in 1530. Clark (1987) defines lottery as a scheme for raising money by selling lots or chances, to share in the distribution of prizes, now usually money, through numbered tickets selected as winners.

Gambling began to diversify with “coursing” events for greyhounds in 1576 and horse racing with private wagering became a regular activity for the settlers of Virginia colony which, was the first enduring English colony in North America (Thompson, 2010). In 1621, the first restrictions on gambling were established in the Plymouth Colony and 1638 is the year when the first casino (the first government-authorized gaming house in Europe) was established in Venice. Gambling as a source for governmental taxes was

first created in 1765 when the British Parliament passed the Stamp Act, which provided for the taxation of playing cards (Thompson, 2010). Between the 1780s and the 1830s Lotteries became an economic source of governmental revenue in the United stated of America (US). In Portugal, an annual class lottery was created by royal decree of Queen Mary I in 1783 (Santa Casa da Misericórdia de Lisboa, 2021). Its profits were to be distributed between the Royal Hospital, an orphanage, and the Royal Academy of Science. The initial objective is still reflected today, as it was intended to support the activity of other institutions dedicated to providing care for the needy and to support science (Santa Casa da Misericórdia de Lisboa, 2021). Despite being one of the oldest lotteries in the world, the body of published literature and research on the subject, in Portugal, is still very limited today.

Advertising on gambling is something that has raised attention from public officials for almost 150 years. In 1876 the first ban on lottery advertising was approved by the US Congress (Thompson, 2010). The first slot machine was built in San Francisco by car mechanic, in 1895 (Huizinga, 1949). In the second quarter of the 20th century, in 1931, the state of Nevada, in the US, legalizes wide-open casino gambling and in the next 1940's the Las Vegas strip is settled as the world's primary casino gambling location, being heavily associated with organized crime in its early days. In 1934 Macau, at the time a Portuguese enclave, also starts having its place as the centre for casino gambling in Asia (Thompson, 2010).

The first steps towards the digitalization of gambling, regards the registration of wagers through digital communication networks, which started to emerge in the 1960's/1970's (Kerr, 2006; Kerr, O'Brennan, & Vazquez Mendoza, 2021). In 1975 New Jersey installed an online system for tracking numbers from wagering. In 1976 Puerto

Rico creates a network of more than 600 off-track outlets for online television betting and in 1979, the province of Ontario, Canada, initiates the world's first lotto game where all play was entered into an online computer network.

In the 1980's and 1990's the US congress passes its first legislation on money laundering, a topic that today is still a key element in the deterrence of the use of gambling activities for laundering money coming from illegal activities (Thompson, 2010). The 1990's was also the decade where the widespread availability of the Internet made sports wagering available to most residents in the US, which created a substantial increase in the amount of sports betting by Americans, most of which illegal (Thompson, 2010). In 1996 the first responsible gambling efforts were reflected in the creation of the US National Center for Responsible Gaming (International Center for Responsible Gaming, 2021) and there years later the first National Education Campaign on Responsible Gaming took place. In the 1990's, US, European and Australian lottery operators began to increasingly use digital communication networks for lotto games operations activities (Thompson, 2010).

Significant changes due to technological advances have enabled new ways of players to engage in gambling activities in the In the XXI century. Some of these changes include the development of new online and internet channels and new ways players interact with each other and gambling providers such as social media networks. These electronic channels have opened a pandora's box regarding gambling. Although today's gambling actives are just one click away, organized playing activities have been around for quite some time. All have in common the intention of people to engage in leisure and social activities and also the intent to have financial returns. Since gambling is a

controversial activity, states have decided to regulate such activities, in many countries (Thompson, 2010).

The early 2000's saw quite significant changes in the awareness of the activities of the gambling sector as the first blueprint for responsible gambling was laid (Shaffer et al., 2003). In 2004 the Portuguese National Lottery (*Jogos Santa Casa*) joined the Responsible Gambling Working Group of the World Lottery Association (WLA) (DJ/SCML, 2004) and began to develop research on responsible gambling policies (Lopes, 2009). The 2000's was the decade were online gambling started to have a greater relevance within the legalized gambling market. By 2010 the global gambling market (land-based and online) generated EUR 275 billion in Gross Gaming Revenue (GGR), of which EUR 80 billion in the EU, with a market share of 29% of the world market (European Commission, 2012). Global internet gambling (all products) was worth EUR 23.28 billion in 2010, 8.5% of the total gambling market. The European Union represented, in 2010, 45% of the world online gambling market (European Comission, 2012).

In 2019 the global online gambling market was valued at EUR 44.31 billion and expected to grow at a 11.5% CAGR until to 2027 (Grand View Research, 2020). This forecasted growth raises concerns among researchers who focus on problem gambling and youth gambling , including by the increase in social gambling via online social media platforms (Griffiths, 2013, 2018a) and the increase usage of randomized mechanics in free-to-play games in what is best known as "loot boxes" (Kerr, 2017; Kerr, O'Brennan, & Vazquez , 2021; Kristia, Nielsen, & Grabarczyk, 2019; Macey & Hamari, 2019). Loot boxes are potentially blurring the boundaries between games of skill and games of chance (Close, et al., 2021; Drummond & Sauer, 2018; Griffiths, 2018; Macey et al., 2019; Kerr, 2017, 2021). Recent research on loot boxes have linked these gaming features to

problem gambling (Brooks & Clark, 2019; Kristiansen & Severin, 2020; Li, Mills, & Nower, 2019; Zendle & Cairns, 2018, 2019; Zendle, Cairns, Barnett, & McCall, 2020) Including by adolescents (Griffiths, 2019; Zendle, Meyer, & Over, 2019). These concerns extend to consumers and legislators who are calling for the regulation of these revenue models on the grounds that they are unfair, predatory, or could be considered gambling (Derevensky & Griffiths, 2019; McCaffrey, 2019).

Gambling itself is a controversial activity due to its potential impact on public health. Some individuals can develop problems associated with the gambling activity. The Royal College of Psychiatrists (2021) define problem gambling as gambling that disrupts or damages personal, family, or recreational pursuits. The National Council on Problem Gambling a (2021) considers that "problem gambling or gambling addiction includes all gambling behaviour patterns that compromise, disrupt or damage personal, family or vocational pursuits". The National Council on Problem Gambling (2021) mentions that the "symptoms include increasing preoccupation with gambling, a need to bet more money more frequently, restlessness or irritability when attempting to stop, "chasing" losses, and loss of control manifested by continuation of the gambling behaviour despite mounting, serious, negative consequences". The impacts of problem gambling can result in financial ruin, legal problems, loss of career and family, or even suicide (The National Council on Problem Gambling, 2021).

Problem gambling can be related to many different forms of gambling, including lottery gambling. Studies on the subject are not consensual as one relevant issue in comparing results from studies on lottery playing that have used many different problem gambling screening instruments (Calado & Griffiths, 2016). In what regards the most involved players, examination of the European past-year problem gambling

prevalence rates showed that they varied between 0.12% and 3.4%, the highest rate in the German and French speaking part of Switzerland (Calado & Griffiths, 2016). Calado & Griffiths (2016) also state that problem gambling tend to occur on people with the following characteristics: being male, single, or divorced individuals, of a younger age, with a lower level of education and/or income, unemployed, and being an ethnic minority or a foreigner. These are all characteristics that contribute to the uprooting of an individual and that may lead to or reflect increased risk in gambling (Clotfelter & Cook, 1990; Gray, Jonsson, LaPlante, & Shaffer, 2015; Hubert & Griffiths, 2017; Thompson, 2010).

1.1.2 Definition and different forms of gambling

Gambling can be considered an activity which involves the participation in games of chance for money (Fulton, 2015). It is described as "betting or staking of something of value, with consciousness of risk and hope of gain, on the outcome of a game, a contest, or an uncertain event whose result may be determined by chance or accident or have an unexpected result by reason of the bettor's miscalculation." (Britannica, n.d.).

These players "miscalculations" involve the participants subjective perceptions on the possible outcomes of the games in which they place wagers or bets. Such subjectivity regards concepts such as luck, superstition thinking, illusion of control and susceptibility to prize sizes and rollovers[1], among other forms of internal and external

[1] The Portuguese terminology for this concept is adapted from the Anglo-Saxon term and has taken a different meaning in Portuguese. In Portugal, a rollover is designated by the word *jackpot*. A rollover (*jackpot*) occurs when a draw has no winners, and the amount of the prize adds up to the next draw.

causalities that condition many players (Chagas, 2007). Some researchers point out that most individuals behave and think irrationally when gambling, due to cognitive bias, that may play an important role in the development and maintenance of gambling behaviour (Benhsain, Taillefer, & Ladouceur, 2004; Gadboury & Ladouceur, 1989).

Gambling can take several forms. Kerr, O'Brennan, and Vazquez Mendoza (2021) approached the differences between commercial and other forms of gambling. They explain that, in commercial forms of gambling, the amounts lost go to the commercial operator, whereas in non-commercial recreational gambling, money amounts are usually redistributed between participants. Today, commercial gambling refers to a diversity of gambling types from land-based or offline betting, lotteries, and casino games to new online forms (Kerr et al., 2021).

Table 1.1

Forms of Gambling

Category	Definition
Commercial Gambling	This term refers to a formalised, regulated style of gambling that includes a variety of gambling types such as casinos, video lottery terminals, lottery tickets, horse racing, and legal sports betting, amongst others. The relationship between gambling provider and gamblers is unequal as the gambler usually loses money to the provider (Abbot et al., 2018).
Recreational Gambling	This term refers to gambling as a recreational, leisure and social entertainment activity usually occurring in low-risk settings and/or controlled situations and involves the redistribution of money between participants (Abbot et al., 2018). Some researchers discuss positive aspects of recreational gambling (Per, 2013; Hilbrecht & Mock, 2019).
Private Gambling	This term includes betting with friends. This type of gambling takes place in informal social settings, and the group members redistribute the money among all of them (Abbott et al., 2018).
Illegal Gambling	This refers to gambling activities not constrained by laws or relation to pay winners or to collect debts through legitimate avenues. The relationship between illegal operators' gamblers is unequal (Abbott et al., 2018).
Gaming	The term is sometimes used in the literature to refer to gambling activities, but they are not the same thing. Gaming refers to videogames only. Though gamblers achieve gambling outcomes by chance, gaming outcomes usually require skills and strategy. The development of games on social media platforms on social media platforms has blurred the line between gambling and gaming. Some games include elements of gambling and gaming. Some games include elements of gambling (e.g., "skin gambling", "loot boxes" and gambling simulations), while some forms of gambling have adopted game-like elements (e.g., skill-based slot machines and arcade casino games) (Abbott et al., 2018).

Source: Kerr, Aphra; O'Brennan, John and Vazquez Mendoza, Lucia (2021).

When exploring the several forms of gambling, states or other public bodies can choose to explore gambling activities directly or grant concessions to other public, state, or private entities or non-governmental organizations (Table 1.2).

Table 1.2

Gambling Regulation

Direct State Exploitation	**Indirect Exploitation Granted by the State in Monopoly Regime**			
	Public Entities	Non-Governmental Organizations	State companies	Private operator, Licensed and regulated by the state
The operator is directly owned by the State or government agency	Game business is operated by public entities, for example, public banks	Licenses granted to non-governmental organizations	In which all or most of shares belong to the State.	- Private companies regulated by government bodies
Examples: most of the federal lotteries of the USA; Swedish Svenska Spel, Bavaria lottery	Examples: Lottery Irish National; German WestLotto	Examples: PMU French and ONCE Spa	Examples: Ontario Lottery and Gaming Corporat	Examples: Camelot in the United Kingdom, Uthingo, South Africa

Note: adapted from Gaast e Pinotti (2005); Gomes (2007, p.24)

There are several forms of legalized gambling, from casino-based games, to betting games and number games (Table 1.3).

Table 1.3

Forms of Commercial Gambling

Land-based Gambling	Internet Gambling
Casino Games - Slot Machines - Blackjack Games - Poker Games - Roulette - Keno - Craps - Baccarat - Other Casino Games	Online Casino Games - Online Casino Games* - Online Blackjack Games - Online Poker - Online Roulette - Online Casino Style Games**
Traditional Betting - Sport Betting using bookmaker shops - Horse or dog betting on racecourses - Any other type of betting in betting shops	Online Betting*** - Online sport betting using traditional bookmaker's websites or other websites - Online betting on horse or dog racing via internet - Fantasy sports betting - Spread betting (including on sports and financial markets)
Number Games - Lotteries - Instant Lotteries or "scratch-off" games - Raffles - Bingo - The lotto	Online Number Games - Lotteries - Instant Lotteries - Raffles - Bingo - The lotto

Note: Adapted from Kerr, O'Brennan and Vazquez-Mendoza (2021).

* Casino games on social media platforms, also known as social casino games, are not necessarily a form of gambling, and thus, not included in this category.

** The range of online casino games is wider than land-based casino games

*** Online betting takes place on the internet, and it is characterized by several popular features such as "in-play" gambling (which allow a client to bet while the event is in progress) and "cash-out" (which enable users to get their money back before the event is over).

When choosing to explore gambling activities directly, this choice includes lottery games. The public debate on lotteries is one that covers several aspects that range from

public order to taxes and revenue generation or the causes it supports with the money raised from such activity (Table 1.4)

Table 1.4

Summary of reasons for both sides of the State Lotteries debate

	Against	In Favour
Game Promotion by the State	The State should not promote an activity considered to disturb the normal functioning of the economy.	Gambling is an inevitability. The State should intervene, acting as a regulator, and in order to guarantee the maintenance of public order.
Impact on the Economy	Lottery revenues are withdrawn from the economy and are not used for goods or services that implement employment and other important activities.	Lotteries have a positive impact on the economy by creating jobs and motivating direct and indirect employment.
Revenue Generation	When compared to the tax system, lotteries are inefficient and inequitable.	Lotteries cannot be compared with the system, as it is a for-profit activity and with different assumptions.
Regressivity	Lottery products are regressive.	Any product with a fixed price is regressive.
Philanthropy	The action of the State is replaced by the resources obtained by the lottery.	Lottery revenues bring benefits to society as a whole, as they increase the State's resources for social causes.
Advertising	The game is incited due to the coercive publicity of the State Lotteries.	Advertising for state lotteries is informative for consumers.
Probabilities	The odds of the prize are very low.	Only wins those who play the lottery.
Amusement	Uselessness and waste of money in lotteries.	Lotteries are considered a product with entertainment capacity, like any other.
Replacement	Lottery is an easy way to play and encourages other types of play.	On the contrary, the Lottery encourages a way of playing that replaces much more problematic ones.

Note: Adapted from Gomes (2007, p.19).

State lotteries typically have low prize payouts when compared to other forms of gambling (lottery is typically 50%, compared to 74% in bingo, 81% in horseracing, 89% in slot machine, and 98% in blackjack played according to the basic rules). Ariyabuddhiphongs (2011) consider that due to its low prize payouts it is rather a

phenomenon on why people play the lottery. To some researchers (Clotfelter & Cook, 1990) advertising helps players gain a sense of availability of winnings. These researchers (Clotfelter & Cook, 1990) also highlight other motives for playing lottery such as playing for amusement or altruistic reasons related to the application of the proceedings from lottery revenue, but mostly in the hopes of private gain. Although lotteries are considered a very particular form of gambling due to its low payout ratios and low probability of winning (Clotfelter & Cook, 1990) people still engage in this form of gambling. In fact, its popularity is even increasing in some countries such as in Portugal.

Traditionally, lotteries were only offered to players via land-based retailers. More recently with the advent of the internet, they are also available remotely. Today it is possible for researchers to study such behaviours from different angles as more internet and online operators are making their databases available to researchers. Some operators have established partnerships with universities and research centres. To some researchers, this form of gambling behaviour research is considered highly accurate (Shaffer et al., 2010). In their view, the study of internet and online gambling requires the examination of actual behaviour. As in any other pattern of human behaviour, measuring players' behaviour has always been challenging for researchers for several methodological and sociological reasons (limitations of self-reporting and social inhibitions associated to gambling). Additionally, and despite the existence of specific tools that have helped standardize gambling measures, many approaches led to different conclusions, not always entirely comparable across gambling products, channels or even jurisdictions. Albeit these limitations, it is generally accepted that traditional lottery games are highly distinguishable from forms of "hard" gambling such

as VLT's, casinos and bingos. Typically, empirical research on lottery gambling has been divided into studies that use psychological variables such as attitudes, norms, motivations, and those that use demographic variables such as gender, age, education, and SES (Ariyabuddhiphongs, 2011). In the case of studies on lottery playing using demographic variables, different jurisdictions have showed different patterns and gambling preferences (Clotfelter & Cook, 1990; Gray, Jonsson, LaPlante, & Shaffer, 2015; Hubert & Griffiths, 2018; Thompson, 2010).

1.2 Research Subject

The purpose of this dissertation is to analyse to lottery gambling, including its online and offline formats from a consumer behaviour perspective, applied specifically to gambling. This section (1.2) describes the subject upon which the research was grounded. The next section (1.3) describes the Theoretical and Methodological Relevance (1.3.1) and the Business Practice Relevance (1.3.2).

In the history of gambling, lotteries may be considered a somewhat "recent" activity even though in some jurisdictions, such as in Portugal, these games have been run by the state since the 1780's. Although they have traditionally been sold via land based offline channels, especially with more traditional products, new games and new distribution channels have emerged in recent years. As a result, lottery sales have been growing for the past decade. According to LaFleur's 2008 World Lottery Almanac, worldwide lottery sales amounted to USD 224.3 billion in 2007. In 2015 total sales rose

to USD 279.9 billion, according to the World Lottery Association. This increase shows that despite being a mature market, sales have grown consistently.

In Portugal, the lottery is operated under an exclusive concession from the state to *Santa Casa da Misericórdia de Lisboa* (SCML), who runs the national lottery via its *Departamento de Jogos* (Games Department), under the brand name "*Jogos Santa Casa*". Portugal has an area of 92 212km2 and population of around 10.3 million (Pordata, 2017) with a 65% of people in active working age (15 to 64 years of age). During the period of observation (2013/2014) Portugal was still under a bailout program, started in 2011, because of the sovereign debt crisis that hit the country. During this period, unemployment rate skyrocketed to more than 16% in 2013, more than double the rate of just 5 years before. In 2016, the unemployment rate had lowered to 11%.

The Portuguese lottery's proceedings are used for charitable purposes and good causes, directly by SCML and number of other direct and indirect beneficiaries. In Portugal, the gambling market includes also offline casinos and bingos. Since 2015, the online market has been liberalized to several online games such as sports betting, horse betting, bingo, casino games and poker.

The Portuguese lottery brand portfolio includes several product categories within that include lotto games (*Totoloto* and *Euromilhões*), class / passive lotteries (*Lotaria Clássica* and *Lotaria Popular*), scratchcards/instant lottery (*Raspadinhas/Lotaria Instantânea*), toto (*Totobola* and Totogolo), land-based sports betting (*Placard*) and addon games to lotto and toto games (*Joker* and *Milhão*) which are offered together with the other products. Some of the games in the portfolio are currently inactive (*Joker* and *Totogolo*). The active games are offered via a traditional land-based retailer network

and digitally through the *Jogos Santa Casa* website, an app for smartphones, and players can also place their bets via Short Messaging Service (SMS).

Lotaria Nacional are class/passive lottery products, also known as raffles in some jurisdictions, which comprise two complementary products: *Lotaria Clássica*, the oldest product in the portfolio, and *Lotaria Popular*, created in 1987 (Santa Casa da Misericórdia de Lisboa, 2018). These two games have different pricing points and positioning. *Lotaria Nacional* was instated in 1783 by Queen D. Maria I by authorizing *Santa Casa da Misericórdia de Lisboa* to explore an annual lottery. *Lotaria Nacional* began as a class lottery and is today a passive lottery game.

The first draw was held in the first of September 1784. In 1955 passive lottery products officially assumed the *Lotaria Nacional* brand name and in 1987 a *Popular Lottery* was launched, with more accessible prices for players. According to *Santa Casa da Misericódia de Lisboa* (SCML), the objective of the release of *Lotaria Popular* was to face off illegal gambling, to channel such demand to state lottery gamers whilst reaching a market segment with less purchasing power. Passive Lotteries, which include "*Lotaria Clássica*" and "*Lotaria Popular*" are games with a fixed and pre-determined prize plan. In each draw there is an emission of numbered tickets, from which the prized tickets are drawn. "*Lotaria Clássica's*" tickets are composed of 5 fifths (individual tickets) with different price points and draws depending on special seasons (e.g. Christmas, Easter, etc.) or festivities and events. According to *Santa Casa da Misericórdia de Lisboa*, "*Lotaria Clássica's*" individual tickets are sold under three price points (*Ordinária*: 5 Eur *Especial*: 10 Eur and *Extraordinária:* 15 Eur). The price of each individual ticket is 1/5 of the total ticket price and it is the product of the portfolio with the highest probability of winning the first prize and, on average, one in every three individual tickets is prized.

Lotaria Popular is the second game in their portfolio with the highest probability of winning the first prize. Like *Lotaria Clássica* it is also comprised of three different prize points and draws, although prices are lower than the other comparable product (*Ordinária:* 2 Eur, *Especial:* 3 Eur and *Extraordinária*: 5 Eur). Other products in the portfolio include lotto type games (*Totoloto, Loto 2* and *Euromilhões*), Scratch-cards (*Lotaria Instantânea* also known by its brand name *Raspadinhas*), Mutual Betts and Sports Betting. Some of these games have also add on games associated to them (lottos and mutual bets games).

Totoloto is a lotto game and was the second mutual bets' game to become available in Portugal (the first was the toto game, *Totobola*). It was launched in 1985 and in 1997 a second weekly draw was added, dubbed *Loto 2*, which was later extinguished. Today, *Totoloto* still has 2 weekly draws butt under the same product name and branding. A lotto type game is based in a draw of a set of numbers from a larger pool of numbers. *Totoloto* has seen over time some changes to its odds and probabilities. Initially was based in a 6/45 system and in 1990 it was changed to 6/49. Currently it considers a combined game mechanism of 5/49 numbers with a 1/13 "lucky number". *Totoloto* has a minimum first prize of 1 million Eur with no jackpot or rollover limit and has an average odd of winning of 1:7 with a price per bet of 0,90 Eur.

Euromilhões (*EuroMillions*) is also lotto type game with a 5/50 number choice in a "Numbers" combined with a 2/12 numbers choice in the "Stars" grid. It currently considers two weekly draws. *Euromilhões* is a game that is organized together with several other European countries. The first *Euromilhões* draw was held in 2004 in Paris. The initial group of organizing countries included Spain, France and the United Kingdom. Other European countries joined later and include Portugal, Austria, Belgium, Ireland,

Luxembourg and Switzerland. The first in which these 9 countries were included was held in October 2004. Although the international coordination is carried out among the nine countries, the management of the game is done individually by each country. This country level management included the betting slips image and the destination of the revenue obtained in that country. Each country is also responsible for the bets registered in its territory and for the payment of the respective prizes.

1.3 Research Relevance

Adam Smith (2012), the father of modern economics, considered that that the best economic benefit for all can usually be accomplished when individuals act in their own self-interest. This is based on a Rational Choice Theory which states that individuals use rational calculations to make rational choices and achieve outcomes that are aligned with their own personal objectives. These results are also associated with maximizing an individual's self-interest. Using rational choice theory is expected to result in outcomes that provide people with the greatest benefit and satisfaction, given the limited options they have available. These economic theories assume that each person acts in its own best interest, given the information at its disposal in that moment. This idea clashes with some psychology theories (West, 2001) where decisions made are not always rational nor do they protect self-interest. This is the case, for instance, with addictions, and gambling addiction is not an exception. Gamblers appear to switch off their rational belief during gambling and switch it on again after gambling (Ladouceur & Sevigny,

2003). Some researchers (Griffiths & Wood, 2001) theorize that this also happens with lotteries although, lottery is somewhat different as most lottery games are not considered a form of “hard” gambling. The cognitive theory of gambling, for instance, emphasizes the gamblers’ irrational beliefs at the different stages of their activities (Griffiths & Wood, 2001). The main irrational beliefs are gamblers’ fallacy, entrapment, belief in hot and cold numbers, unrealistic optimism or perceived luckiness, superstitious belief, illusion of control, near miss, and roll over effect. Another lottery gambling theory (Theory of Demand for Gambles) assumes that individuals gamble to obtain “something in return for nothing’’ and that, to obtain something, it is necessary to give up something else (Nyman 2004). In that sense, this theory suggests that disadvantaged people are more likely to engage in recreational lottery gambling and are the greatest group of contributors to the lottery companies’ revenues. Kaizeler and Faustino (2011) found that lower income-class countries spend more than the higher income-class countries on lotteries.

Gambling is a widespread activity and, in that sense, to no surprise, most individuals gamble at some point during their lives, and there are more gamblers than non-gamblers (Calado & Griffiths, 2016). Gambling is an activity that has been widely studied and much has been written about these leisure activities with prize money. Gambling takes many forms, and it is researched in several areas such as public policy, public health, compulsive, and addictive behaviours. Since the advent of the internet, gambling has diversified into many new forms. The transformation enabled by remote gambling has also led to new research approaches and methods that help to better identify players and to understand their behaviours. One of these new approaches is the use of real internet playing data. Research in this area increased over the past decade although

many of the studies relied on the same databases from a few operators to characterize and evaluate such behaviour. The analysis of real internet gambling behaviour has so far been limited to a small number of databases, although more recently we are seeing more gambling operators making their databases available for researchers to study gambling behaviour.

As in other businesses, one of the issues in customer interaction is the point of contact between the customer and companies regarding channels, platforms, or devices as a part of the consumer journey (Court, Elzinga, Mulder, & Vetvik, 2009; Edelman & Singer, 2015). This is closely related to how the information collected from these touch points should be used to produce more entertaining and safe products that are at the same time profitable for operators. Remote gambling technology has led to new research approaches and methods that help to better identify players and to understand their behaviours. This considers the relevance of the research and its contribution. Most of the studies on gambling, including lottery gambling, resort to self-reporting methods to analyse gambling behaviour. In this study we analysed a novel dataset from the Portuguese national lottery to assess lottery playing behaviour and draw the profiles of the internet lottery players. Additionally, the sample is representative of all active online lottery players, which is also a novelty in lottery gambling research, including in Portugal. There is a considerable amount of literature on lottery gambling behaviour but most resort to non-representative samples of player's activity. In that sense, the body of published literature with nationally representative data is considerably narrower. To reinforce this, it is important to highlight that no previous studies were found, that used a marketing approach to study lottery gambling. Additionally, no previous studies have been conducted with a marketing segmentation approach to study the online

Portuguese lottery players, which is accomplished in the present research, including by identifying lottery players segments on the Portuguese national lottery. To extend this research on lottery gambling, a marketing cannibalization approach was also developed to understand whether those players segments overlap and if the different games of the Portuguese national lottery portfolio appeal to the same segments of players or to mutually exclusive segments.

In the development of this dissertation and, especially for the second essay (Chapter 4 – Essay 2), nationally representative studies were searched and analysed, including from European countries where cultural settings are closer to those of the country where this study was carried out. The analysis was narrowed down to studies that were representative of the entire population as some other studies focused on demographic segments of the population or even in particular regions or states of a certain country. Different approaches have been followed when conducting such studies. From the studies found, the economists and sociologists' approach has focused mostly on macro and microeconomic trends and social phenomenon's that affect and reflect consumer behaviour whilst others, such as psychiatrists, phycologists and public health officials have covered at-risk, abusive, or compulsive behaviours. Some studies are not necessarily binary in categorization, as we found more "hybrid" approaches, but this helps to categorize the field or research. This thesis covered both angles as it deemed to analyse studies that emphasize players' profiles and behaviour, independently of their nature.

Despite an extensive search of the academic literature and other Internet databases, there is almost nothing known empirically about gambling and problem gambling in Portugal. Furthermore, the Portuguese General Directorate for Intervention

on Addictive Behaviours and Dependencies (SICAD, 2020) stated in their latest report that the annual reports on gambling have not been carried out so far. This lack of knowledge on the consumer habits of Portuguese lottery players is of extreme relevance due to the nature of the activity of the national lottery, which aim is to promote public order, combat illegal gambling and generate money to support good causes. In that sense it is relevant, from a research stand point, as there are no studies conducted so far that enable the segmentation of players and the assessment of cannibalization between games, in order to promote information that provides researcher and public officials information for the decision making on designing a balanced game portfolio that promotes optimum revenue results whilst reducing problem gambling.

Country reports on gambling typically highlight the number of gaming machine outlets and opportunities (e.g., 7,500-10,000 gaming machines down from 35,000 in the 1990s) rather than any information on gambling participation (Portugal Report for Euromat, 2007). Conversely, most of these studies do not focus solely on gambling behaviour but also problem gambling and possible implications for public health and policy. In that sense, and even though some researchers consider that the "typical" (median) consumer is of little relevance (Clotfelter & Cook, 1990) in the study of gambling, we have a supplementary approach, as we believe that it is also relevant to address the playing characteristics and preferences of the vast majority healthy players. This approach was covered in the second essay (Chapter 4 – Essay 2), with the segmentation and engagement determination approach. Gray, Jonsson, LaPlante, & Shaffer (2015) defined player engagement in a particular game as having at least one active gambling day during the period of observation. In their study, they used this

information to calculate the total number of games played for each subscriber across a 2-year window of observation.

The third and final essay (Chapter 5 – Essay 3) focused on a marketing approach to cannibalization on product portfolio, as in the outputs of the second essay (Chapter 4 – Essay 2) we found that players engaged in the several forms of lottery gambling and players in several games, according to their specific profiles which could create situations of substitution between games.

1.3.1 Theoretical and Methodological Relevance

According to the National Academy of Sciences (NAS), a scientific theory is a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences, and tested hypotheses. When it comes to gambling research, some specific approaches in this field have been used in studying players' behaviour as it differs from other forms of consumer behaviour. Gamblers appear to lose rational belief during gambling and regain it again after gambling. Some researchers (Griffiths & Wood, 2001; Rogers, 1998) theorize that this also happens when playing lotteries although lottery gambling is somewhat different as it is not considered a form of 'hard' gambling, except for rapid draw lottery games such as keno. Most studies on gambling behaviour are performed by mental health professionals and the approach usually focuses on harm prevention or abusive or compulsive behaviours. Although such research is of the upmost importance to assure safe levels of gambling, not much research is done with a focus on the insights of most players, especially from a marketing

perspective. Such research is relevant for supporting the regulated gambling activities that provide a revenue for supporting social causes. As an example, very few studies approach gambling from a consumer behaviour perspective (Kearney, 2005), including with the use of multivariable analysis. The focus of this dissertation is centred on a marketing research approach to lottery gambling, which is quite scarce in the literature. The approach taken includes a lottery player behavioural analysis from a customer segmentation perspective, addressing some of the shortcomings found in other studies.

Studies on gambling have traditionally used self-report methods to identify profiles and determine behaviour (LaPlante, Gray, Bosworth, & Shaffer, 2010). These studies present methodological limitations when compared to studies using electronic records of gambling behaviour, as the first might implicate erroneous accounts of such behaviour, namely by excess (Gray, Jonsson, LaPlante, & Shaffer, 2015). Over the past decade, several studies have resorted to this approach to study gambling behaviour by using real gambling data to analyse player behaviour. In that sense, our study is novel as it analyses for the first time, Portuguese internet/online lottery players' gambling activity, using actual playing data. Research on real internet playing data has relied on the same databases from a few operators to characterize and evaluate such behaviour. To further contribute to understanding internet/online lottery gambling, different player profiles and segments were identified based on their level of gambling engagement. The national lottery remote channels data comprises a full year aggregated gambling activity and is representative of all active internet lottery players.

Kotler & Armstrong (2017, p.671) describe a market segment as a "group of consumers who respond in a similar way to a given set of marketing efforts" and market segmentation as "dividing a market into distinct groups of buyers who have different

needs, characteristics, or behaviours and who might require separate marketing strategies or mixes." To develop this dissertation, we used multiple segmentation approaches in the identification of player/consumer segments. The approach taken combined behavioural segmentation with demographic segmentation. Kotler & Armstrong (2017, p.216) define behavioural segmentation as "dividing a market into segments based on consumer knowledge, attitudes, uses of a product, or responses to a product" and demographic segmentation as "dividing the market into segments based on variables such as age, life-cycle stage, gender, income, occupation, education, religion, ethnicity, and generation" (Kotler & Armstrong 2017, p.669). This multiple segmentation approach enabled the creation of several player/consumer profiles and segments which had never been attempted in lottery gambling, especially for online lottery gambling and with the use of real playing data.

Considering that the player profiles and segments identified showed that different player groups engage in more than one game and more than one product category (game family), we set out to understand whether this engagement would imply a product or product category cannibalization or product substitution. No previous studies exist where cannibalization is assessed for lottery gambling products that includes games such as passive/class lotteries which is a type of game that exists in a very limited number of countries, including Portugal.

There are several definitions of product cannibalization and there is not a consensus on the subject. Heskett's (1976, p.581) definition states that cannibalization is "the process by which a new product gains sales by diverting them from an existing product". This definition is shared by Kerin, Harvey, and Rothe (1978). Kotler & Armstrong (2017, p.651) explain that cannibalization is "the situation in which one

product sold by a company takes a portion of its sales from other company products". This explanation fails to address situations in which cannibalization happens from within the company and between products in their product line or product range. For such situations, they explain that a "company can expand its product line in two ways: by line filling or line stretching. Product line filling involves adding more items within the present range of the line. There are several reasons for product line filling: reaching for extra profits, satisfying dealers, using excess capacity, being the leading full-line company, and plugging holes to keep out competitors. However, line filling is overdone if it results in cannibalization (eating up sales of the company's own existing products) and customer confusion. The company should ensure that new items are noticeably different from existing ones" (Kotler & Armstrong, 2017, p.256). The risk of cannibalization is a very real threat for many new product launches and that risk becomes even more significant if the new product is launched under the same brand name as an existing product. Since line extension is a common branding strategy for new products, it is important that managers develop their understanding of the effect.

1.3.2 Business Practice Relevance

The European online gambling scene has seen many changes for the past 10 years. The European Commission published a Green Paper on online gambling in the Internal Market (European Comission, 2012). In this Paper, the Commission acknowledged that there were, at that time, two models of national regulatory framework applied to online gambling: one based on licensed operators which must act

within a strict regulatory framework, and another based on a government monopoly controlled by the state. This legal obstacle to online gambling in the European Union created what the Commission calls "grey" and illegal online markets; these are markets where gambling services are offered in other member states without obtaining the appropriate licenses in those states, or gambling services offered within a black market. According to the European Commission's (2012) Green Paper on online gambling in the internal market, "online gambling was the fastest growing segment of the overall gambling market". Annual revenues in 2008 were estimated in excess of 6,16 billion Euros. Today this is still the case. Thus, the purpose of the green paper was to launch a public consultation about the regulatory framework of online gambling services in the internal market; particularly how these services could co-exist among different regulatory frameworks. The paper also sought information about the specific issues arising from the development of legal and unauthorized online gambling services; information about the risks associated with online gambling; contributions on the regulatory and technical means member states use or should use to ensure consumer protection and the preservation of public order. The consultation also sought to compile the current rules applicable to online gambling services at the EU level.

The Green Paper (European Commission, 2012) provided a description of the situation of online gambling in the EU. The main categories of online gambling services offered, then and now, are sports betting, casino games, poker, state lottery and bingo games. The European Commission Green Paper (2012) was the first step in an effort for the harmonization of gambling laws. Today there are still several rulings that make online gambling services to be regulated specifically in each of the EU member states. In countries such Portugal, the government allowed the possibility to issue licenses to

private operators to explore such activities (Regime Jurídico Dos Jogos e Apostas Online, DL n.º 66/2015, de 29 de Abril, 2015) to eradicate any grey market practices.

According to data from *Bareme* Internet 2020, released by *Marktest*, In Portugal, 76% of the population uses the internet, an increase of 1% compared to the 75% registered in 2019 (Marktest Grupo, 2021). The slight global growth of Portuguese with regular use of the Internet (+2%) the smartphone is the most used (66%), which increases the distance to the personal computer (61%) (Marktest Grupo, 2021). In 2013 and 2014, the average number of registered online players at the Portuguese national lottery internet platform (*Jogos Santa Casa*) was 639,574.

The incorporation of online business with traditional ones, by using the internet has changed many businesses and gambling is no exception. But this shift brings about new challenges for managers, including in the lottery industry, which has a more traditional business setting due, perhaps to the causes that their proceedings are used for and perhaps also due to the regulation models followed in many countries and jurisdictions where lotteries are operated as state monopolies. In that sense the balance between profitability and public health and responsible gaming needs to be perfect, which requires constant monitorisation and new ways to look at business practices and policies.

Apart from the scientific and academic contribution, this dissertation intends also to contribute to help lottery business managers better understand how consumers are segmented and which profiles do lottery players have. Also, how on a monopolistic lottery market, cannibalization can come from within the portfolio and understand how to manage such situations to maximize the lottery's sales whilst minimizing cannibalizing and gambling harm.

This dissertation focuses on two important marketing topics, namely market segmentation and product cannibalization, that cover both online and offline lottery gambling. The market segmentation concept, which aims at meeting the specific needs of different customer groups, has been part of marketing science for many years. Primarily the literature focuses on the different ways of creating segments. On the one hand, it becomes apparent that segmentation activities may differ considerably, depending on issues like sector, industry, and company size (Kesting & Rennhak, 2011). On the other hand, the field also identifies some remarkable trans-sectoral similarities concerning segmentation issues (Kesting & Rennhak, 2011).

The present study analysed a novel behavioural tracking dataset comprising a nationally representative cohort of Portuguese online lottery players. In this study we identify their profile(s) and describe the main characteristics that contribute to their playing habits using a novel segmentation approach in the study of real gambling. The segmentation allowed the determination of several relevant profiles and helped to better identify how the sociodemographic profile of players is relevant in their gambling expenditures and engagements.

The Portuguese national lottery has seen some changes since 2011, namely with the induction of new games/products. Although its overall revenue has increased, some cannibalization has occurred, as we demonstrate on the third essay (Chapter 5 – Essay 3). This might not have been obvious for the lottery as Leitão (2016) states that between 2012 and 2014, *Jogos Santa Casa's* revenue growth was manly supported by scratch-cards' revenue which resulted from an enlargement of the number of players from 63% to 76% of the adult population. He further ascertains that Jogos Santa Casa's 2015 market research found that most players play EUR 1 or EUR 2 tickets and reinvest low

value prizes (under EUR 5), mainly on other scratchcards. Also, 6% of players (2,5% of the adult population) play every day of the week – individually and spend an average of EUR 1,185 per year (Leitão, 2016). To analyse this phenomenon in a broader way, we covered product category and individual products cannibalization as the main topic of the third essay (Chapter 5 – Essay 3) in order to shed some new light into the subject and help lottery managers better understand the sales behaviour of its products.

Studies on the Portuguese national lottery are very scarce. In that sense, we further contribute to the enlighten of the subject. Kaizaler, Faustino, & Marques (2014) analysis, for instance, only includes lotto's and pari-mutuel sports betting (*Totobola*, *Totogolo, Totoloto*, *Lotto 2, Joker*, and *EuroMillions*) sales. They do not analyse passive lotteries sales and scratchcards sales. Passive lotteries include two different separate weekly draws and are operationalized as two different, but complementary products (*Lotaria Clássica* and *Lotaria Popular*), each with its own positioning, and price point. Scratch-cards (*Raspadinhas*) are today the most salient product in the *Jogos Santa Casa*'s (JSC) product portfolio and accounted in 2019 for more than 51% of the Lottery's total revenue (*Santa Casa da Misericórdia de Lisboa,* 2020*)*. It is noteworthy that not including these other products, which were in the period they analysed a significant part of the Portuguese national sales revenue stream, does not allow a full picture of the demand determinants for the lottery business itself. Although they mentioned that their study assesses the determinants of lottery sales in Portugal, they did not consider the entire product portfolio, which is an approach taken in this dissertation.

1.4 Research Objectives

The research objectives for this dissertation are broken down into three main aspects. First, we set out to identify and understand the state of the art of online and internet gambling consumer behaviour, and the major trends in science that cover this topic. This part is covered in the first essay (Chapter 3 - Essay 1) which entails a thorough critical literature review of internet and online gambling behavioural tracking research. In this essay we analyse and compare empirical analysis approaches on Internet and online gambling, which were the focus of previous studies. This comparison is limited to studies of internet or online lottery gambling that use tracking data to analyse gambling behaviour. The literature published on internet lottery with real data is still very scarce, and in that sense, comparability is somewhat limited. Additionally, comparison with other types of games would possibly prove to be unfruitful as lottery products have very distinctive structural characteristic which differ from games such as sports betting, casino games, bingo, and poker, for example.

The development of the first study led to the central topic and objectives of the second essay (Chapter 4 – Essay 2) which was to identify and determine player/consumer segments in online lottery gambling, with the use of behavioural tracking data. This was never achieved in Portugal, nor has it been developed before with the approach taken in this dissertation, namely with the use of segmentation models. Considering the identification of several different player profiles, which engaged in different online lottery products, the purpose was to understand if this segmentation would translate in mutually exclusive consumption patterns or, on the other contrary, cannibalization is also a reality within a lottery product portfolio, both

for its online and offline sales channels. This was the central objective for the third and final essay.

1.5 Research Design

This section describes the research strategy followed which impacted the choices in the development of this research project. This dissertation focuses on key marketing issues such as market/consumer segmentation and in product portfolio cannibalization and uses multiple statistical approaches to assess such constructs.

The initial focus was to identify and analyse the state of the art in consumer research of online and offline lottery gambling and to understand its limitations. This made evident the major shift that digitalization brought to the gambling industry and gambling and consumer research by these new data sources and collection processes. Real behavioural digital records enabled, for the first time, the possibility for a researcher to analyse real behaviour without the caveats of the traditional forms of observational research, as the researcher is not present and hence does not influence the subjects' demeanour. The empirical analysis of real playing records allows researchers greater opportunities for cohort and case control observational studies, without the limitations found in traditional observational studies. This approach also overcomes some limitations which typically characterize primary data surveys, namely recall and self-representation biases. The research conducted is detailed on the first essay (Chapter 3 -

Essay 1), which can be found on Part II and is dubbed “Internet Gambling: A critical review of behavioural tracking research".

Following this approach, the research problem developed into several relevant topics. The first was to analyse online lottery paying behaviour and determine players´ profiles and segments. To address this research problem the first empirical analysis conducted was based on the analysis of real playing records from the Portuguese national lottery. This analysis of a full year of playing records considers all internet lottery players and is the first nationally representative study of Portuguese internet lottery players, including with the use of real playing data. The data analysed was provided by the Portuguese national lottery and is fully anonymized for player identity protection. The database contains sociodemographic variables and playing records which enabled the development of a player profile and segmentation. The second essay (Chapter 4 – Essay 2), “Consumer profile segmentation in online lottery gambling utilizing behavioural tracking data from the Portuguese national lottery” uses a segmentation-based approach to examine account-based tracking data of the Portuguese online lottery players and covers a full year gambling activity of all active players. The main research goal was the identification of players’ profiles and segments by engagement levels (high, neutral, low). This main research goal was seconded by the aim to assess preferences in product category with the use of segmentation models, built purposely for this study, based on expenditure and sociodemographic variables. Findings can be found in Part II, Chapter 4, and help support more effective segmentation and responsible gambling approaches.

The second essay (Chapter 4 – Essay 2) utilized a cross-sectional dataset of a full year aggregate real online lottery playing activity. This dataset was provided exclusively for

the development of this essay, by Santa Casa da Misericordia de Lisboa, and has never been analysed or studied before. Cross-sectional data analysis is considered the study of a particular phenomenon (or phenomena) at a particular time, i.e. a 'snapshot (Saunders, 2007, p. 623). A cross-sectional design study involves the collection of information from any given sample of population elements only once and provides a snapshot of the variables of interest at that point in time (Moutinho & Hutchenson, 2011), as contrasted to the longitudinal study that provides a series of pictures, which, when pieced together, provide a movie of the situation and the changes that are occurring (Shukla, 2008). Saunders (2007, p.176) considers that the main strength of longitudinal research is the capacity that it has to study change and development. Saunders (2007, p.176) highlights that in longitudinal research the researcher can exercise a measure of control over variables being studied, provided that they are not affected by the research process itself. The primary objective of longitudinal design is to monitor change over a period of time and involves a fixed sample that is measured repeatedly (Shukla, 2008).

The third Essay (Chapter 5 – Essay 3) focuses on product portfolio cannibalization by analysing two longitudinal datasets of online and offline lottery sales. The first comprises annual sales figures of all lottery products for a period of 10 years. The second considers a two-year period of weekly/draw lottery sales, which includes all products.

Considering the absence of specific theoretical models that apply to the object of study, the approach was based more extensively on a descriptive design, both the segmentation approach and the identification of the players profiles, in the second essay (Chapter 4 – Essay 2), as well as the cannibalization and longitudinal analysis which grounded the approach of the third essay (Chapter 5 – Essay 3).

The reasons for adopting multiple methods in the conduction of the research for this dissertation are related to the ability to embrace several key important aspects of marketing strategy, namely market segmentation and cannibalization and to complement both methods which allowed this research to be multiple angled and overcoming the limitations of each method when used individually and considering that these two approaches are not mutually exclusive.

1.6 Research thesis outline

This dissertation is divided in three main parts. Part I presents a general introduction of the field in which the research in centred (legalized online and offline gambling) and highlights its relevance in the field of gambling studies, consumer behavioural research and marketing. In this section research relevance is discussed both in terms of its impact in science as well as its contribution to the industry and practical applications. This first part also includes an analysis of the current trends of the market, its areas of business, how it is composed, and its current situation. The first part also details the research objectives and describes how the research was designed to be carried out in a way that those objectives could be achieved.

The second part of this thesis presents the essays on online and offline gambling from a consumer behaviour perspective. Each essay focuses on a particular topic that complements the others by creating a stringline narrative. Each essay picks up on the findings and further research suggestions of the previous one. The first essay (Chapter 3

- Essay 1) is an in-depth critical literature review of the state of the art of internet gambling behavioural tracking research. This thorough review allowed the identification of relevant subjects for the second and third part of this chapter. The second essay (Chapter 4 – Essay 2) focuses on drawing the profile of the Portuguese internet lottery players. This is approached from a consumer profile segmentation perspective though an empirical investigation of real playing data from the Portuguese national lottery. The third essay (Chapter 5 – Essay 3) focuses on a longitudinal analysis of lottery sales to address potential individual product cannibalization, product category cannibalization and other important marketing assessment of lottery gambling and consumer behaviour.

The third part of this dissertation covers a general discussion on the subject and dwells on the conclusions drawn from the research performed and the literature revied. This final part wraps up the dissertation and presents a connection of the several chapters of the research conducted. It also highlighted the contribution of this work both for the fields of consumer research in marketing and gambling research.

Chapter 2

Gambling: A Contextual View

2.1 Main Topics on Gambling Research and Player Consumer Behaviour Research

In the 21st century there are numerous types of games and related entertainment activities. However, due to its nature, some arouse more attention from several sectors of society which is reflected in public opinion and government policies. Gambling is one of such activities and relates to games that are characterized by placing bets and wagers, with the intent of wining prize money or other forms of compensation.

Research in the areas of gambling, and the relations of several sectors of society with this industry can be found in many countries, regions, and jurisdictions. Although there are numerous studies focusing on gambling, not many address this industry from a consumer behaviour research perspective. Most of the research reviewed focuses on addictive behaviours and the impact of gambling in the economy of a certain region. Some possible motivations for this trend may be associated to the fact that gambling is a very sensitive area due to some of its specificities (e.g., source of public funding and potential addictiveness). Another important aspect about the literature reviewed is that most researchers tend to focus on one form of gambling. Not covering the full spectrum of games available may limit the possibility of creating a wider interpretation of the gambling phenomenon. Stehmann (2020) argues that several disciplines have

influenced gambling studies on online and internet gambling, which implies that academics and practitioners must deal with fragmented knowledge. In turn, this fragmentation makes it harder to obtain an effective overview and an accurate understanding of the roots and recent advancements of the field (Stehmann, 2020). Stevens (2006) and Williams and Wood (2007) also reinforce this notion that internet gambling is an inherently interdisciplinary research topic which results in challenges in literature review and in the dissemination of research findings through scholarly publications.

To identify the major areas of research and academic interest in gambling research, we set out to address and examine several in-depth reviews and analysis of the published literature in the field. Shaffer, Stanton, and Nelson (2006) examined 2,246 citations between 1903 and 2003. In that period, these authors conclude that gambling-related research grown at an exponential rate and that the prevalent topics were based on pathology, risk-taking, decision-making and addiction. Shaffer, Stanton, and Nelson (2006) also observed an increase in the prevalence of studies focusing on epidemiology, drug abuse, comorbidity, and neuroscience in the latter part of the analysed period, between 1999 and 2003. Other researchers also analysed gambling industry study trends. Moon, Yang, Kim, and Park (2017) assessed 9,128 studies covering a time span from 1960 to 2016. They highlight an increase in the role of technology in gambling related studies within the last two decades, attributing this to the Internet as it has become a popular mode in accessing gambling activities. One of the trends they identified is cantered on gambling addiction and treatment. Another trend is focused on public policy in gambling and the final one regards the role of technology and internet in lottery, casino, and other forms of remote gambling. A recent bibliometric analysis

argues that online gambling and online gaming research can be broken down into six major research topics and most topics have in common being connected by the Diagnostic and Statistical Manual of Mental Disorders (DSM–5) and Internet gaming disorder (Stehmann, 2020). Stehmann (2020) also state that research looking at Internet gambling and problem gambling is largely separated from other research streams. The first and largest topic presented by Stehmann (2020) regards the assessment of internet gaming disorders. The second topic is aimed at understanding the neurobiological processes of addiction to the Internet and online games. The third encompasses different approaches to understand how online gaming and internet gambling is related to problem gambling (mostly from 2000–2002). The fourth research topic is focused on understanding what may make people become addicted to online gambling by looking at their psychological characteristics (most common between 2003–2005). The fifth subject regards multiplayer online gaming and how these games enable new social interactions (popular between 2006–2014). Finally, the last research issue deals with the reasons for people to play online. Since 2015 research has been more concerned with the challenges associated with addiction and Internet gaming disorder. This author approaches online gaming and online gambling in a perspective that these activities are becoming closer and increasingly resemble each other on situations of potential addictiveness.

Bonello and Griffiths (2019) highlight the role that technology has had over the past decade in gambling and acknowledge that the growth in online gambling is related to the availability and convenience of the internet. The impact of technology on gambling offerings is also reflected on gambling research. Traditionally, gambling research has relied on self-reported methods or case study research for assessing

gambling behaviour. With the Internet, however, it has become possible for researchers to remotely study the real behaviour of gamblers. Interestingly, there is still a concise body of research on gambling behaviour with the use of Internet gambling tracking data. Most studies are based on the same databases, meaning that a few companies and websites were the basis for most of the research produced so far. Considering that Internet gambling behavioural tracking research is still a recent phenomenon, much can still be done to further develop this field of research. This dissertation is centred in the analysis on the most popular form of legalized gambling, lotteries, and includes a study on online tracking lottery gambling behaviour but also approaches in section 2.4, all the legal gambling activities existing in the region where the study was conducted (Portugal).

Regulation on online gambling is still very recent. It was only in 2011 that the European Commission first started to address this activity and published a Green Paper on online gambling in the internal market (European Union, 2011). This paper was the kick starter of a public consultation on what the regulation of online gambling services in the European Union (EU) should be, to potentially develop a harmonization of gambling laws. In 2011 the different legal and regulatory frameworks for online gambling services that were in place in the EU back then made it very difficult to have a harmonized legal framework in the internal market that would ensure public order and players' protection. The Green Paper on online gambling in the internal market (European Union, 2011) also intended to collect inputs on the potential consequences of unauthorized online gambling services in the EU, as this is a very particular form of e-commerce. Legalized gambling is frequently used by states as a social control over illegal gambling activities. In some jurisdictions the state manages these games directly whilst in others, the state grants concessions to private organizations. In general, part of the

proceedings of these activities are returned to society as social benefits. The Green Paper on online gambling in the internal market (European Union, 2011) was also intended to identify and compile information on the different rules of online gambling services in the different countries and jurisdictions of the EU. In Europe, there are essentially two co-existing national regulatory frameworks in the internal market for online gambling. One of such frameworks is based on licensing private operators which must act within a strict regulatory framework, and the other is based on a state monopoly controlled by the government. In Portugal, these two models currently coexist. Since 2015, the online gambling market has been opened to licensed operations on a number of online games such as sports betting, horse betting, bingo, casino games and poker (*Regime Jurídico dos Jogos e Apostas Online,* 2015). The Portuguese market also includes land-based casinos and bingos and the lottery is operated by SCML under the brand name "*Jogos Santa Casa*".

2.2 General trends in lottery consumption

Lotteries have traditionally been sold via land based offline channels, especially with more traditional games but new games and new "distribution channels" have emerged in recent years, due to the internet. As a result, lottery sales have been growing for the past two decades. According to LaFleur's 2000 World Lottery Almanac the lottery industry global revenue was USD 135 billion in that year (LaFleur, 2000). By 2007 worldwide lottery sales amounted to USD 224.3 billion (LaFleur, 2007). In 2015 total

sales rose to USD 279.9 billion, according to the World Lottery Association (2016). In 2020 global lottery industry revenue surpassed USD 310 billion (LaFleur, 2020). This increase shows that despite being a mature market, sales have grown 130% in the last 20 years. The US accounted for over 28.9% of global lottery market in 2020 (LaFleur, 2020). Europe also has a considerable share of the global lottery market as the total revenue in 2019 amounted to EUR 84.6 billion (The European Lotteries and Toto Association, 2020). European online gross gaming revenue (GGR) in 2019, calculated by subtracting prizes from sales, amounted to EUR 2.8 billion, which is 8% of the EUR 35 billion Euro European GGR. Online lottery sales are still a small part of total revenue, but this form of lottery gambling is likely to gain more popularity. The current COVID-19 pandemic has contributed to this as the global market for online lottery was initially estimated at USD 7.1 Billion in the year 2020, and its reached USD 11 Billion. Online mobile lottery accounted for USD 3.1 Billion in 2020 and is expected to reach USD 5.8 billion by 2027 (Report Linker, 2020). Online draw-based lottery games are projected to grow at a 6.6% CAGR to reach USD 5.3 billion by 2027 (Report Linker, 2020), even with the impact of the COVID-19 pandemic, caused by the SARS-CoV-2 virus. Growth in the online sports lotteries segment is expected to stand at 7.4% CAGR until 2027. This segment accounted for a 23.2% share of the global Online Lottery market in 2020 (Report Linker, 2020).

The analysis of consumer behaviour on gambling is very particular and requires specific approaches due to the risk of potential addictiveness for some individuals. The continuous increase in sales on gambling products can raise concerns regarding problem gambling and abusive behaviours. Most state lottery games are, to some extent, different from other forms of gambling as they usually have lower prize payouts when

compared to other forms of gambling. Lottery is typically 50%, compared to 74% in bingo, 81% in horseracing, 89% in slot machine, and 98% in blackjack (Clotfelter & Cook, 1990; Ariyabuddhiphongs, 2011). Considering such differences in prize payouts lottery gambling pose a lesser risk but is also becomes rather interesting to understand why people play the lottery. Clotfelter & Cook (1990) found that major drivers for turning inactive players into active ones and increasing player activity of current players was related to product innovation, more so than advertising. This issue is increasingly relevant as the tools available today for designing and providing games and related content to consumers, move at a much faster pace. This is what is happening currently with online gambling as the internet allows for a much faster development and availability of new gambling concepts and products.

Lottery players typically show biases and irrational thinking patterns regarding their playing activity (Rogers, 1998). These include the misunderstanding of playing odds, gambler's fallacy, which reflects a misunderstanding of chance and randomness, cognitive entrapment, irrational beliefs such as the belief in hot and cold numbers, unrealistic optimism, belief in personal luck, superstitious thinking, illusion of control, erroneous perception of near misses, susceptibility to prize size and rollover effects, framing of gambling outcomes and finally the influence of social factors on lottery play (Rogers, 1998). This shows that players do not always exercise logic and rational behaviour when playing lottery. Some reasons that may help explain such choices also be laid on advertising as it helps players gain a sense of availability of winnings (Clotfelter & Cook, 1990). Other motives for playing lottery include playing for amusement or altruistic reasons related to the application of the proceeding of lottery revenue, but mostly in the hopes of private gain (Clotfelter & Cook, 1990). Auer and Griffiths (2013)

noted that lottery games tend to have a very low frequency of play as draws and playing occurs once or twice a week. One of the most popular lottery games is lotto. Clotfelter and Cook (1990) consider that lotto is a game with peculiar economies of scale namely due to rollovers effects. The structural characteristics (particularly event frequency) of bi-weekly lotteries is unlikely for these types of games to cause problems for players as compared to other games such as slot machines where event frequency can be very high.

2.3 Sales channels in the gambling industry: Land-based, online lottery gambling and other gambling offerings

Traditionally lotteries and other forms of gambling have been offered through land-based retailers and other bricks and mortar venues. More recently and with the advent of the internet, most games are also available remotely. Remote gambling occurs when a person participates in gambling activities with the use of remote communication including the internet, telephone, television, radio, and any other kind of electronic or other technology for facilitating communication (Gambling Act, 2005).

In the gambling landscape, lotteries are considered a very particular form of gambling due to its low payout ratios and low probabilities of winning (Clotfelter & Cook, 1990), but people still engage in this form of gambling. In fact, its popularity is increasing in recent years in some markets. In Portugal, this increase has been observed both on the internet and land-based channels, except for 2020, probably due to the COVID-19

pandemic, where sales increase on the remote channels but decreased in the land-based one, most likely because of the several lockdowns and restrictions to circulation. The Portuguese National Lottery makes its games available to players via land-based and internet (website and smartphone app) and other remote channels, namely short messaging service.

Although most lottery games have traditionally been labelled as a “soft” form of gambling, when compared to other types of legalized gambling (i.e. VLT’s, casinos and bingos), some structural and situational characteristics of lottery games are sometimes confused with indicators of “hard” gambling. Such characteristics are more likely influencers in the acquisition of gambling behaviour, rather than factors involved in the maintenance of gambling behaviour (Griffiths & Wood, 2001). Some of such factors are applicable to both online lottery gambling and land-based offline channels (accessibility, “opening hours”, membership rules, stake size, prize structure, probability of winning, size of jackpot, advertising, and the rules of the game) whilst others are specifically considered for traditional land-based retailers (number of outlets, location, and type of gambling establishment).

Remote lottery gambling is most commonly designated in the literature as online lottery gambling. As in many other businesses, remote lottery gambling, and other forms of online gambling have changed the way people engage in this specific form of e-commerce. Online and internet gambling have generated many concerns due to the changes it has made to the entire gambling experience. Some of these concerns include accessibility to gambling; fast action play; potential inability to protect underage and problem gamblers; potential inability to restrict unprincipled marketing techniques, such as embedding and serial pop-ups; capacity to prevent gambling while players are

intoxicated or at work (Griffiths, 1999; Griffiths & Parke, 2002). Such concerns led to an increase in interest by academia to better understand and describe this form of consumer behaviour and come up with proposals and solutions for more responsible gambling policies and practices.

Online gaming and online gambling have been raising research interest for far longer than could be expected as it began in 1965, having a significant increase from the 1990's onwards (Stehmann, 2020). The first studies on online and internet gambling behaviour used self-reported data from surveys and questionnaires to analyse player behaviour. Today it is possible for researchers to study such behaviours from different angles as more internet and online gambling operators are making their databases available to researchers. Some operators have even established partnerships with universities and research centres.

As in any other pattern of human behaviour, measuring gambling behaviour has been challenging for researchers due to methodological and sociological reasons (limitations of self-reporting and social inhibitions associated to gambling). Additionally, and despite the existence of specific tools that have helped in coming closer to a potential standardization of gambling measurement, there is still not a consensus in academia on the subject. There have been many approaches to the study of gambling, not always entirely comparable across gambling products, channels or even jurisdictions. Gray, Jonsson, LaPlante, and Shaffer (2015) conducted the first study on lottery gambling with the use of tracking data. They used data from the Icelandic Internet betting service provider *Í slensk Getspa* and studied the behaviour of 520 people who opened an account during January 2010. Still, online lottery gambling behaviour, with the use of tracking data, has not been extensively studied as it could

have if more lottery providers and similar operators made its data available and worked closely with academia. The second essay included in this dissertation (Chapter 4 – Essay 2) analysed real playing data and is a positive contribution in this direction as the data used in the essay was made available exclusively for this dissertation and has never been analysed before. This essay helps to enhance the understanding of lottery consumer behaviour, including with the use of real playing tracking data.

Despite the increasing research attention on online lottery gambling, especially with the use of tracking data, it is important to highlight that most lottery players still play in land-based venues. Many lottery jurisdictions around the globe that already offer their games through digital channels, have very differed percentage of their revenues coming from digital and interactive channels, but all are inferior to the revenue coming from land-based venues. Leading nations in online gaming, based on the percentage of interactive gambling revenue are: 1 Finland 35.9%; 2 Ireland 34.0% and 3 Denmark 33.4% (World Lottery Association, 2014). It should be noted that the world average is 8.2% and Portugal ranks in 30th with just 7.6% (World Lottery Association, 2014). Although the numbers refer to a pre-pandemic setting, and the balance may have changed in the past two years, in most jurisdictions land-based lottery sales still outperform digital channels sales. This is still the case in Portugal, even after the COVID-19 pandemic hit and despite lockdowns and the considerable growth in online channels sales according to SCML's 2021 annual report (*Santa Casa da Misericórdia de Lisboa*, 2021). In 2020, sales for the digital sales channels grew by 26.4%, when compared to 2019, to EUR 110 million, but still only represented 4.0% of total sales, which surmounted EUR 2.7 billion in 2020 (Santa Casa da Misericórdia de Lisboa, 2021). Like in Portugal, the COVID-19 pandemic has increased the interest of digital sales channels in

lottery gambling, in many other countries. According to Barkho (2021), the pandemic helped accelerate the growth of online lottery sales. Some reports (Report Linker, 2021) estimate that the global online lottery market will reach US$ 14.5 billion s by 2026. This is still a fraction of the total global lottery market as it is estimated that it will reach US$ 433.78 billion by the end of 2026, growing at a CAGR of 4.05%, a dramatic increase from the US$ 336.33 billion in 2019 (QYResearch Group, 2020). As shown, it is important to highlight that bricks and mortar still represent, in most countries, the greatest proportion of lottery sales revenue. In that sense, analysis of lottery sales cannot ignore this relevant sales channel as it is still the bulk of worldwide lottery sales, including in Portugal. For this reason, the research on cannibalization included in this dissertation, considered both sales channels in order to obtain the most accurate results.

2.4 The Portuguese Legalized Gambling Market: A brief analysis of the most recent trends[2]

This section intends to identify and analyse the most recent trends in the Portuguese legalized gambling market, particularly since the Portuguese legal system allowed, in 2015, the possibility for private operators to obtain licenses for online gambling. In Portugal, the legalized gambling market considers the offer of lotteries,

[2] This section was adapted and updated from Chagas, B. T. (2019). "Mercado do jogo legalizado em Portugal: Uma breve análise das mais recentes tendências". In Livro de Actas/Proceedings 4º Fórum de Investigação CSG – 9 de Maio 2019. Org. CSG – Investigação em Ciências Sociais e Gestão do ISEG – Instituto Superior de Economia e Gestão, da Universidade de Lisboa. Lisboa.

casino, bingo, and online gambling. This empirical analysis is based, beyond other factors, on the expansion of the gambling supply and the entry of new operators.

In Portugal, the state-owned lottery is run by the *Departamento de Jogos da Santa Casa da Misericórdia de Lisboa* (DJ/SCML), through a concession. It is *SCML*'s mission to assure the protection of public order and the prevention of excessive gambling. SCML has registered, in recent years, the highest GGR ever, having in 2017 exceeded 3 billion euros for the first time. In the last 5 years, there has also been a trend of growth in the GGR of land-based casinos operating in Portugal. In 2019, Casinos' revenue exceeded EUR 319 million, but it dropped to nearly EUR 160 million in 2020. The latter has been considered by the land-based casinos, bingo halls and online gambling regulatory body (SRIJ) as an atypical year, due to the COVID-19 pandemic (SRIJ, 2020). Bingo halls have also been showing a recovery of total gross gaming revenue in the last 5 years as the total number of Bingo halls in operation had a total revenue of more than EUR 56 million in 2019. In 2020 the growth in revenue was stopped as Bingo halls revenue decreased 55% to circa EUR 25.5 million. Although the results of the land-based Casinos and Bingos, has shown growth for 4 of the last 5 years, the great driver of the market has been online gambling, which in just under 4 years has exceeded EUR 335 million in revenue and 15 licensed operators. Lottery's revenue has also contributed to this growth and has the largest market share as it accounted in 2020 for 84,2% of the total gross revenue of the legalized gambling in Portugal. In view of this scenario, it is relevant to address some questions, namely on the appropriate maximum size of the Portuguese market, considering issues of public order, responsible gambling practices and market regulation. These issues are intrinsically linked to the existing offer, to the

market segments and to the potential rivalry between competitors, namely from private operators, especially in online gambling.

The Portuguese legal system started to allow, in 2015, privatized online gambling (*Regime Jurídico dos Jogos e Apostas Online*, 2005), focused on sports betting, horse race betting and odds betting and games of chance. Since online gambling has only been available from late2015, early 2016, this section's analysis focused mainly in these years. This section identifies and observes the current panorama of legalized gambling in Portugal, considering the legislative changes, which allowed the expansion of the market with the entry of new operators and new ways to gamble, hitherto banned in the Portuguese territory.

Legalized gambling has a long tradition in Portugal, especially since, in 1783, Queen D. Leonor granted to *Santa Casa da Misericórdia de Lisboa* (SCML) an operating license for an annual class lottery (Neves, 1984). In Portugal, the legalized gambling market considers the offer the state lottery, land-based casinos and bingos games and online gambling and online betting. Games of chance are those whose result is contingent exclusively or fundamentally on luck (Decreto-lei n. º 422, 1989). The activity of games of chance is regulated by the State and tends to have two main concerns: to regulate public health and public order while simultaneously trying to minimize the potential harmfulness of this type of games. According to Alvarenga (2017, pp.25) "running games of chance is reserved to the State, as a way of defending the general interest and public order, having the State the right to manage them directly or to attribute their management to third parties. Thus, it is exclusively up to the Portuguese State to determine the terms and conditions of the management and organization, as well as the participation of games of chance, through regulation."

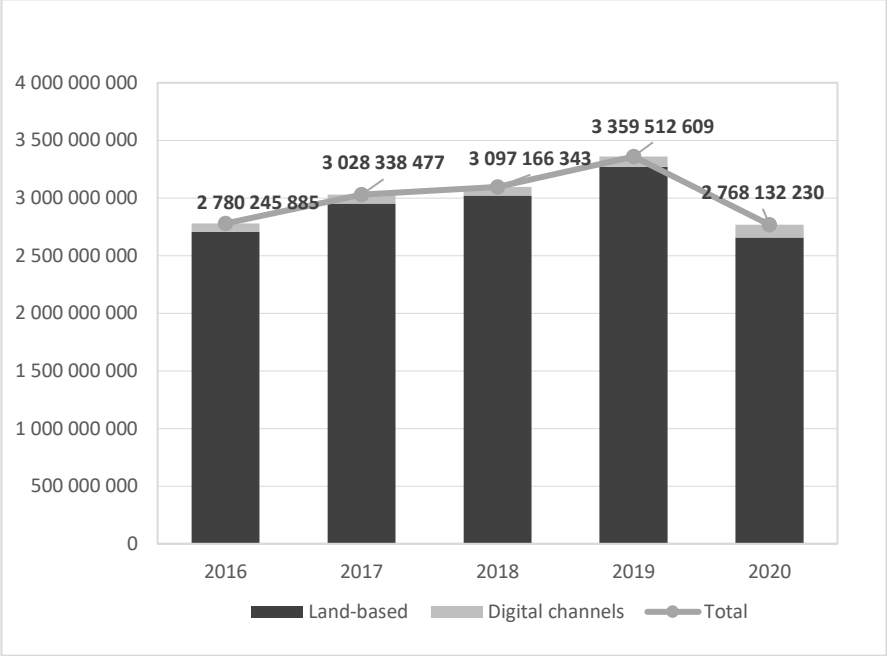
2.4.1 State sponsored games – The Portuguese National Lottery

State sponsored games in Portugal are dubbed *Jogos Sociais do Estado*, that literally translates to "State social games" which in Portuguese attaches a connotation of giving back to society. The State sponsored games are made available and managed by the *Departamento de Jogos da Santa Casa da Misericórdia de Lisboa* (DJ/SCML), as lottery games, and are provided with a view to "create the necessary conditions to channel the demand for games of chance to the provision of social games of the State, within the framework and the guidelines defined by the State itself, to ensure the protection of public order, the preservation of the families' assets and the prevention of excessive gambling."(DJ/SCML, 2019a). In 1961, SCML began to expand its product portfolio to several categories (different types of mutual games, passive/class lottery and instant lottery).

In the XXI century, DJ/SCML complemented its portfolio by adding new games such as land-based odds sports betting games (Placard), in 2015, and *Totosorteio* (*M1lhão*), in 2016, an add-on game (*Santa Casa da Misericórdia de Lisboa*, 2017). The Portuguese national lottery currently has a portfolio that comprises several product categories. The portfolio includes class / passive lotteries (*Lotaria Nacional*: *Lotaria Classica* and *Lotaria Popular*); instant lottery/scratchcards (*Lotaria Instantânea* / *Raspadinha*); lottos (*Totoloto* and *Euromillions*) mutual and pari-mutual games (sports mutual bets: *Totobola*; horse racing mutual bets: not yet available) as land-based odds sports betting games (*Placard*), as well as add-on games (*Joker* and *Totosorteio* / *M1lhão*).

Figure 2.1

Portuguese National Lottery Annual Revenue



Source: Data retrieved from DJ/SCML annual reports (2016 to 2020) with own data arrangement.

In recent years, DJ/SCML has recorded the highest gross revenue results ever, also increasing the return for its beneficiaries. The impact of the Covid-19 pandemic has halted this growth trend, and in 2020 there was a strong decline in total revenue, of around 18% (*Santa Casa da Misericórdia de Lisboa,* 2021). This drop was strongly influenced by a 19% decrease in the land-based channel revenue. The digital channels, on the other hand, showed a considerable growth with a 26% increase in revenue. As the digital sales channels only accounted for 4% of total sales in 2020, it was not enough to smooth the impact of the decline in total revenue. Despite land-based sales accounting for around 96% of sales in 2020, the digital channel grew 1.4% in its relative weight on total revenue in 2020. The evolution of revenue, in the last 5 years, can be seen in Figure 2.1. Overall, and except for 2020, the trend has been of significant growth in total revenue. Gross revenue of the lottery exceeded EUR 3 billion, for the first time,

in 2017 (*Santa Casa da Misericórdia de Lisboa*, 2017). Lottery's revenue grew 8% from 2018 to 2019 (*Santa Casa da Misericórdia de Lisboa*, 2019). This growth is, however, much lower than that seen from 2014 to 2015, when revenue grew 19.1% and surpassed, for the first time, a total of EUR 2 billion. From 2015 to 2016 growth was also quite significative as total revenue increased 24.1% (*Santa Casa da Misericórdia de Lisboa*, 2016).

It should be noted that the accumulated growth in the last 5 years (2016 to 2020) was slightly negative, due to significant decrease in revenue in 2020 (-0.25%) (*Santa Casa da Misericórdia de Lisboa*, 2013, 2014, 2015, 2016, 2017). When comparing 2016 with 2019, growth was a more expressive 21%. In the past 10 years the lottery revenue doubled and if comparing 2019 instead, growth in revenue would be even greater at 143%. It is also relevant to mention that until 2003, the total gross sales figures for the State lottery did not exceed EUR 1billion (prior to the launch, in 2004, of EuroMillions). In a decade and a half, the amount of revenue tripled, which also allowed for a significant increase in the distribution of results among beneficiaries. In 2003, EUR 267.3 million was distributed to beneficiaries, while in 2017, the amount was EUR 717.9 million an increase of 269%) (*Santa Casa da Misericórdia de Lisboa*, 2013, 2017). In 2004, DJ/SCML also started making its games available through digital channels, namely the Internet and by short messaging service (SMS). This digital channel has enriched its distribution approach by complementing the availability of games through the traditional land-based retailer channel, which, however, remains the most significant in terms of revenue. In addition to the existing channels, particularly the digital ones, a mobile application was launched in 2016. In this sense, it is also relevant to observe the sales record, by type of channel.

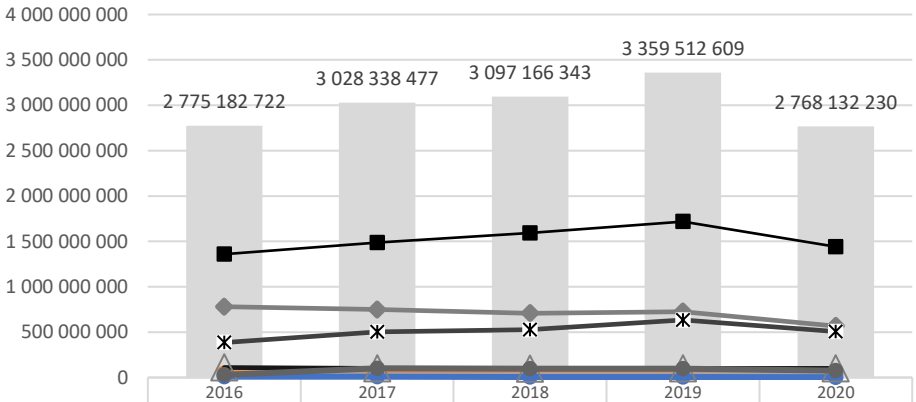
In 2020, the land-based channel, composed of a network of nearly 5 thousand points of sale, with an assortment of different establishments, accounted for 96% of total revenue (*Santa Casa da Misericórdia de Lisboa,* 2020). Digital channels registered 4% (*Santa Casa da Misericórdia de Lisboa,* 2020). This was a decrease in relative weight on total revenue, when compared to the previous years (2016 to 2019) as land-based sales accounted on average for about 97% of sales. With all the focus that is currently given by companies, users, media, researchers, and others to electronic commerce and digital communication channels, it would be expected that the revenue from this channel could have grown more significantly. Although in absolute terms it represented, in 2020, a sales volume higher than that of 2016, by almost 38 million Euros, its relative weight of the total revenue for the mentioned years, was only 1.4% higher (*Santa Casa da Misericórdia de Lisboa*, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020). This situation can be explained by the revenue growth in the traditional channel, which from 2016 to 2019 was 21.1% and since it is the predominant sales channel, the growth on the digital channel was out shadowed. Before 2016, land-based sales grew at a higher rate than for the digital channel. It should be noted that explanatory factors for this growth discrepancy, between digital channels and the land-based channel, may focus on situations of a commercial nature. This may have contributed to the launch of games on the traditional channel that were not simultaneously provided on the digital channel and the fact that the complementary offer of the latter, the APP for the national lottery, was only made available in 2016, and with an offer limited number of games compared to the traditional channel and even the website.

The launch of new games has changed the product portfolio of the Portuguese national lottery and certainly had an impact on results, including revenue. Although

global growth and by type of channel is important to observe, to better understand the dynamics of supply and demand, it is also relevant to analyse the relative weight of each of the games available. Until 2014, *EuroMillions* was the product that gathered most of the revenue, followed by scratchcards. This situation changed in 2015 and scratchcards took the lead in sales. The remaining games consider, among them, a smaller fraction of the sales. *Placard* (sports pools), launched in 2015, started to gain traction, from 2016 onwards. Thus, it is possible to perceive the great dependence of only two games in the totality of results, before 2016, which *Placard* has corrected since 2016, as can be seen in Figure 2.2. It should be noted that land-based sports betting (*Placard*), has become the 3rd game with the highest relative weight in revenue. This situation demonstrates the quick acceptance, by the players, of this new game.

Figure 2.2

Portuguese National Lottery Annual Sales by Product



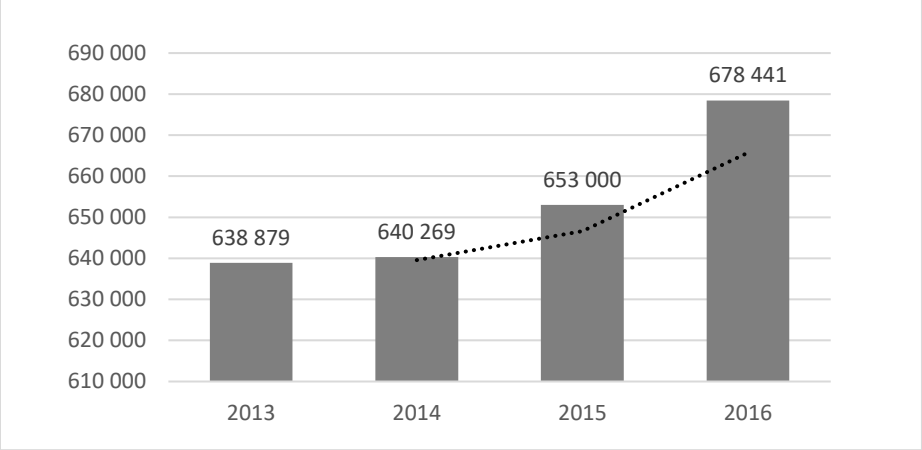
	2016	2017	2018	2019	2020
Total	2 775 182 722	3 028 338 477	3 097 166 343	3 359 512 609	2 768 132 230
Lotaria Clássica	46 750 821	40 719 620	45 759 181	51 533 355	46 083 167
Lotaria Popular	23 452 544	22 802 913	22 797 525	24 858 424	26 126 570
Lotaria Instantânea	1 359 094 888	1 487 090 097	1 594 177 161	1 718 099 341	1 440 242 889
Totobola	9 240 997	7 527 924	5 638 734	5 459 923	3 785 685
Totoloto	110 333 308	99 613 805	97 074 127	100 261 544	100 676 201
Euromilhões	780 293 185	748 807 784	708 496 709	726 801 375	566 599 097
Placard (Sports Pools)	385 380 411	502 126 940	526 596 702	634 278 698	507 178 512
M1LHÃO	29 443 058	102 118 152	96 626 204	98 219 948	77 440 108

Source: Data retrieved from DJ/SCML annual reports (2016 to 2020) with own data arrangement.

The complementarity / substitution between products should be considered, especially when acknowledging the increase in total revenue for the most part of the past 5 years. Also, except for the launch of *Placard* and *M1lhão* (add-on game), in 2015 and 2016 respectively, it has been more than 10 years since the launch of the other most recent game (*EuroMillion*s), in 2004. The lottery's decision to introduce a new product was quite relevant. The existence of a game, such as *Placard,* which accounted for 18.2% of total revenue in 2020, allowed DJ/SCML to diversify its portfolio, and make its offer not being so dependent on just two games. However, it should be noted that all other remainder products combined accounted for only 9.2% of total revenue, in 2020, which, still implies that just a few games/products have a very significant relative weight (Instant Lottery: 52% and *EuroMillions* 20% of total revenue in 2020), vis-à-vis to the rest.

Figure 2.3

Portuguese National Lottery - Digital Channels Registered Users[3]



Source: Data retrieved from DJ/SCML annual reports (2013 to 2016) with own data arrangement.

[3] DJ/SCML stopped disclosing the number of registered users in their annual report in 2016.

Bearing in mind that land-based horse race betting is already regulated and authorized by the government (although it is not yet been made available to players), this game may be a complement to the offer that allows a more equitable redistribution of revenue, which may also benefit the offer in terms of complementarity in the market segmentation, being able to broaden the player base by acquiring new players, without necessarily increasing the amount spent per player. Regarding the players that choose digital channels to engage in lottery playing, the number of players registered on *the Jogos Santa Casa* website has also grown steadily. Until 2016 (the last year for which information was made publicly available) there were already more than 670 thousand registered players (*Santa Casa da Misericórdia de Lisboa*, 2016)[3]. It should be noted that according to the responsible gaming policy of DJ/SCML and the conditions of the player card (DJ/SCML, 2019a), user data is requested to determine the identity of each player and that the player has only one unique registration, which limits abusive practices, namely the case of a player having more than one gambling account (Fiedler, 2011). The measures put in place by DJ/SCML and its certification in responsible gaming are in line with international directives, namely the *World Lottery Association (*WLA*)* and the *European State Lotteries and Toto Association,* generally referred to as *''European Lotteries''* (EL) (*Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*, 2019b).

2.4.2 Casino and Bingo in Portugal

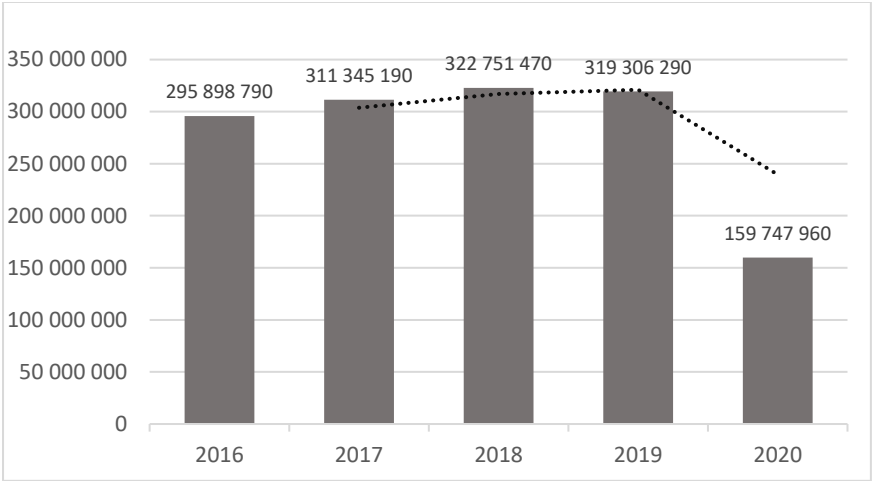
2.4.2.1. Casino

Land-based casinos were first regulated in Portugal by Decree Nº. 14643 of December 3rd, 1927. The first casino to open in Portugal was *Casino do Estoril* which was established in 1931. It is the oldest and largest casino on the European continent in operation today. Casinos operating in Portugal are divided into 10 gambling zones. These areas incude the Azores, Algarve, Espinho, Estoril, Figueira da Foz, Funchal, Porto Santo, Póvoa de Varzim, Tróia and Vidago-Pedras Salgadas (Serviço de Regulação e Inspeção de Jogos - SRIJ, 2019a). In the last 5 years, except for 2020, there has been a trend of growth in GGR in for this type of gambling offer in the Portuguese legalized gambling sector. Sales figures in 2018 and 2019 are in line with the GGR that this market was registering prior to previous economic and financial crisis that also affected Portugal (Chagas, 2007; Observatório sobre Crises e Alternativas, 2013). In 2018, the total GGR of Portuguese land-based casinos exceeded EUR 322 million and EUR 319 million in 2019, a slight decrease of little more than 1% from the previous year (Figure 2.4). In 2020, land-based casinos' revenue was hit hard because of the restrictions imposed to minimize the spread of SARS-CoV-2 and the impact of COVID-19. According to SRIJ (2020), the tourism industry was particularly affected by the prevention, contention and mitigation strategies and policies that were implemented by the government and imposed on casinos to close temporarily, from March to June 2020. The regulatory body further ascertain that the first semester of 2020 was highly atypical and in that sense no comparisons were possible to establish with the same period of the previous year. Land-

based casinos revenue had a 50% drop in gross revenue, in 2020, when comparing to the previous year. This has stopped, or postponed, at least for now the revenue growth trend that land-based casinos were seeing, since coming out of the great recession.

Figure 2.4

Land-based Casino (Annual Revenue)



Source: Data retrieved from SRIJ quarter reports (2016 to 2020) with own data arrangement.

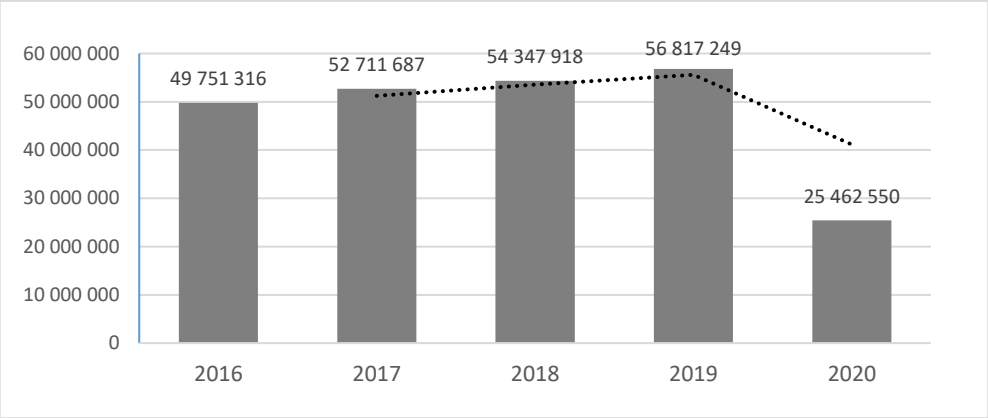
In Portuguese land-based casinos, most of the revenue typically originates from slot machine games (83.2%), followed at a great distance by roulette (4.8%) and poker "hold-em" (4.8%). Games such as black-jack and French banque occupy the 3rd and 4th positions, as the games with the highest revenue. The latter two games' revenue is residual when compared to slot machine games, which usually predominate with the highest revenue of all the games offered at Portuguese land-based casinos (Figure 2.4).

2.4.2.2 Bingo

Such as land-based casinos, bingo halls were also showing a steady increase in total GGR, in a path of revenue recovery over the last years (Figure 2.5). In 2019, all Bingo halls registered total GGR of more than EUR 56 million, from little over EUR 46

million in 2014. Such as the other land-based legalized gambling activities, bingo halls also had to close temporarily, in 2020, due to the COVID-19 pandemic. Therefore, revenue dropped significantly in 2020, to EUR 25.5 million, less than half of the registered in the previous year. It is however relevant to note that, when analysing a longer time series, it appears that this type of game has already lost a large market share. About 15 years ago, bingo halls' revenue in Portugal was close to double the GGR revenue of the two pre-pandemic years (2018 and 2019), which shows that this type of game has been losing importance in the sector (Chagas B. T., 2007). There are currently 14 bingo halls in operation (Almada; Amadora; Amora; Coimbra; Lisbon - 4 concessions; Nazaré; Odivelas; Olhão; Porto - 2 concessions; Setúbal), less than half of those existing just over 10 years ago. Bingo is, therefore, a type of game that has been losing relevance in the national legalized gambling market, regardless of the growth seen in recent years, its global revenue, as well as the number of Bingo halls in operation, is considerably smaller than just over a decade ago.

Figure 2.5
Bingo halls - Annual Revenue.



Source: Data retrieved from SRIJ quarter reports (2016 to 2020) with own data arrangement.

2.4.3. Online Gambling and Digital Gambling Sales Channels

The debate about new technologies and their impact on the games of chance market has been a relevant issue for several stakeholders. Some of the first researchers to focus on this new reality, which allows alternative ways of accessing and engaging in gambling activities, were Griffiths (1999) and Parke (2002). Even before the beginning of the century, Griffiths (1999) identified some of the most relevant differentiating characteristics of internet and online gambling and of all games available through digital channels in general: accessibility; game action speed; inability to protect underage and problem gamblers; inability to restrict marketing unethical practices; inability to prevent gambling activity when intoxicated; unknown levels on game security assurance. These concerns initiated a discussion about these new formats, channels, and business / game models, which extend to a public debate. This scrutiny took special relevance since 2011, when the European Commission published its Green Paper on the future of online gambling in the European internal market (European Commission, 2011).

The issues centred on gambling through digital channels have been gaining an ever-greater preponderance with the opening and regulation of several markets. This reality allowed, simultaneously, a deeper study of the real behaviour of players through their tracking data from online platforms and digital channels such as the Internet, namely through longitudinal studies with real playing data, something which was impossible until then.

In Portugal, the regulation of online gambling is still somewhat recent. The bill on online gambling was passed in 2015 (*Regime Jurídico dos Jogos e Apostas Online*, 2015) and allowed the opening of a "new" market for games of chance and odds sports

betting. Alvarenga (2017) mentions that all operators with websites offering gambling activities in Portugal, except for those available on the national lottery website, were illegal, until the *Regime Jurídico dos Jogos e Apostas Online* - RJO (*Legal Regime for Online Gambling and Betting*) was approved in 2015. Correia (2015) considers that with this legislation the lawmaker expanded gambling the gambling market, allowing private operators the unrestricted management of online gambling.

According to the legislation that sets the framework for the activity of the Portuguese regulatory body for online gambling *activities (Serviço de Regulação e Inspeção de Jogos e Comissão de Jogos do Instituto do Turismo de Portugal, I. P.* - SRIJ), this entity's objectives are to ensure the protection of "minors and the most vulnerable people, preventing excessive and unregulated gambling and addictive behaviours and practices; avoid fraud and money laundering, ensuring security and public order; prevent criminal behaviour in the field of online gambling; guarantee the integrity of sports, preventing and combating the gambling addiction associated with the manipulation of sports results " (SRIJ, 2019c). Many of these issues are also transversal to other gambling activities, which is why money laundering legislation also applies to gambling in casinos and bingo halls; wagers and lottery prize paying entities, regulated by the RJO (Lei n. º 83/2017).

The RJO includes the following categories for authorized online gambling: odds sports betting; horse racing betting (mutual and odds bets) and games of chance (which include various types of games such as baccarat; french banque; blackjack/21; bingo; slot machine games; poker and roulette). There are 15 licensed operators which include 25 licenses, 11 for sports betting at odds (44%) and 14 for casino, bingo and poker (56%)

(SRIJ, 2019b). Table 2.1 shows the licensed operators in Portugal (and respective brands).

Table 2.1

Online gambling - licensed operators in Portugal

				Activity / License				Games Ofered				
	Operator	Brand(S)	Website	Sports betting / odds Setting	License nº	Games of chance	License nº	Slot Machines	Blackjack/21	Roulette	French Banque / Baccarat	Poker
1	Bem Operations Limited	Betclic	www.betclic.pt	✓	1	✓	4	Slot Machines	-	-	-	-
2	Gobet-Entretenimento, S.A.	Bet	www.bet.pt	✓	2	✓	6	Slot Machines	Blackjack/21	American Roulette ; French Roulette	Baccarat Punto Banco Baccarat Punto Banco Macau	-
3	Estoril Sol Digital, Online Gaming Products And Services, S.A.	Casino Estoril; Casino Lisboa; Casino da Póvoa	www.estorilsolcasinos.pt	✓	8	✓	3	Slot Machines	Blackjack/21	French Roulette	-	-
4	REEL Europe Limited	Pokerstars	www.pokerstars.pt	-	-	✓	5	Slot Machines	Blackjack/21	French Roulette	-	Poker (Tournament ; «Hold´em»; «Omaha»)
5	SPF Online S.A.	Casino Portugal	www.casinoportugal.pt	✓	7	✓	9	Slot Machines	Blackjack/21	American Roulette ; French Roulette	Baccarat Punto Banco Baccarat Punto Banco Macau	-
6	Solverde - Sociedade De Investimentos Turísticos Da Costa Verde, S.A.	Casino Solverde	www.casinosolverde.pt	✓	24	✓	10	Slot Machines	-	French Roulette	-	-
7	A Nossa Aposta - Jogos e Apostas Online, S.A	Nossa Aposta	www.nossaaposta.pt	✓	12	✓	11	Slot Machines	-	-	-	-
8	SAS Apostas Sociais, Jogos e Apostas Online, S.A.	Placard.pt	www.placard.pt	✓	13	-	-	-	-	-	-	-
9	Luckia Portugal, S.A..	Luckia	www.luckia.pt	✓	14	✓	15	Slot Machines	-	-	-	-
10	888 Portugal Limited	888.00	www.888.pt	-	-	✓	16	Slot Machines	-	French Roulette	-	Poker
11	Kaizen Gaming International Limited	Betano	www.betano.pt	✓	18	✓	17	Slot Machines	-	-	-	-
12	Caravel Entertainment Limited	Moosh	www.moosh.pt	✓	19	✓	20	Slot Machines	Blackjack/21	American Roulette ; French Roulette	-	-
13	GM Gaming Limited	Betway	www.betway.pt	✓	21	✓	22	Slot Machines	Blackjack/22	French Roulette	-	-
14	Bidluck Sa	Bidluck	www.bidluck.pt	-	-	✓	23	Slot Machines	-	-	-	-
15	Skill On Net Limited	Bacanaplay	www.bacanaplay.pt	-	-	✓	25	Slot Machines	Blackjack/22	American Roulette ; French Roulette	-	-

Source: Data retrieved from SRIJ quarter reports (2020) with own data arrangement.

In just over 4 years, the regulated online gambling sector has reached a substantial annual gross revenue. In 2020, gross revenue exceeded EUR 335 million, which is more than double the EUR 152 million gross revenue of 2018 (Figure 2.6) and 56% more than in 2019 (EUR 215 million). In 2020, 48% of revenue came from odds sports betting (EUR 161.9 million) and 52% from games of chance (EUR 174 million). Until 2018 odds sports betting were the predominant form of gambling and in that year odds sports betting accounted for 52% and games of chance for 48.2% (SRIJ, 2017, 2018). In 2020, the betting volume was EUR 5,679.7 million (14% on odds sports betting and 86% on games of chance), which generated an amount of EUR 108,2 million in the form of a special tax created just for online gambling (*Imposto Especial sobre Jogo Online* - IEJO) (SRIJ, 2017, 2018). In 2020, 40.75% of players engaged in odds sports betting, with many of these placing bets on football, 37.55% of players played on games of chance, mainly on slots, and 21.73% of players engaged in both type of games (Table 2.2).

Table 2.2

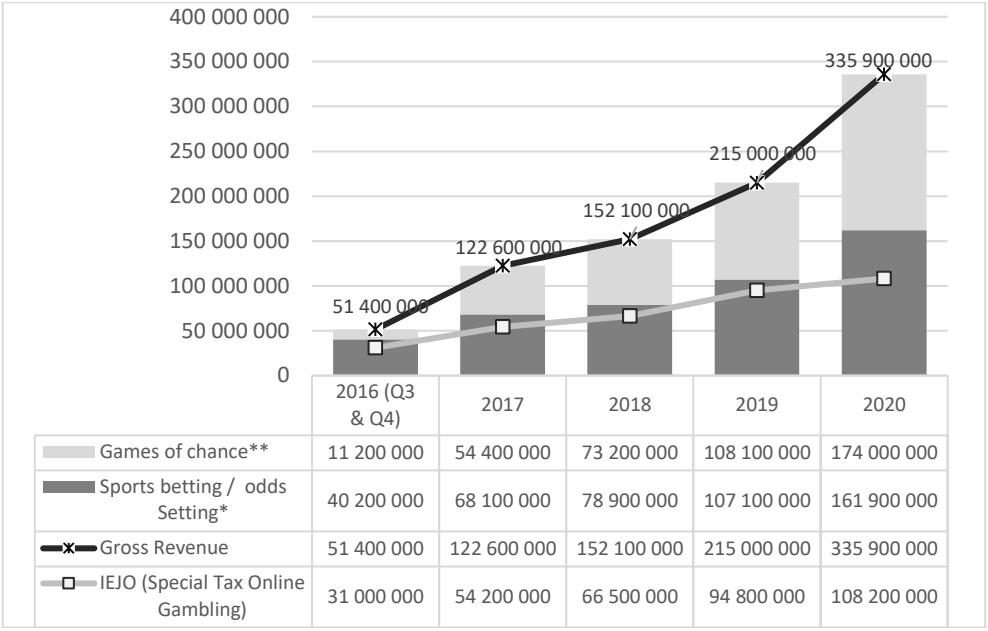
Online Gambling - Players Game Participation

Game category		Sports betting / odds Setting		Games of chance	
Sports betting / odds Setting	40.75%	Football	80.67%	Slots	68.74%
Games of chance	37.55%	Basketball	6.22%	French Roulette	13.52%
Both	21.73%	Tennis	9.79%	Poker	8.83%
		Hockey	2.53%	Black-jack / 21	6.47%
		Others	2.69%	French banque	3.25%

Source: Data retrieved from SRIJ quarterly reports (2020) with own data arrangement.

Figure 2.6

Online Gambling - Annual Revenue and Tax



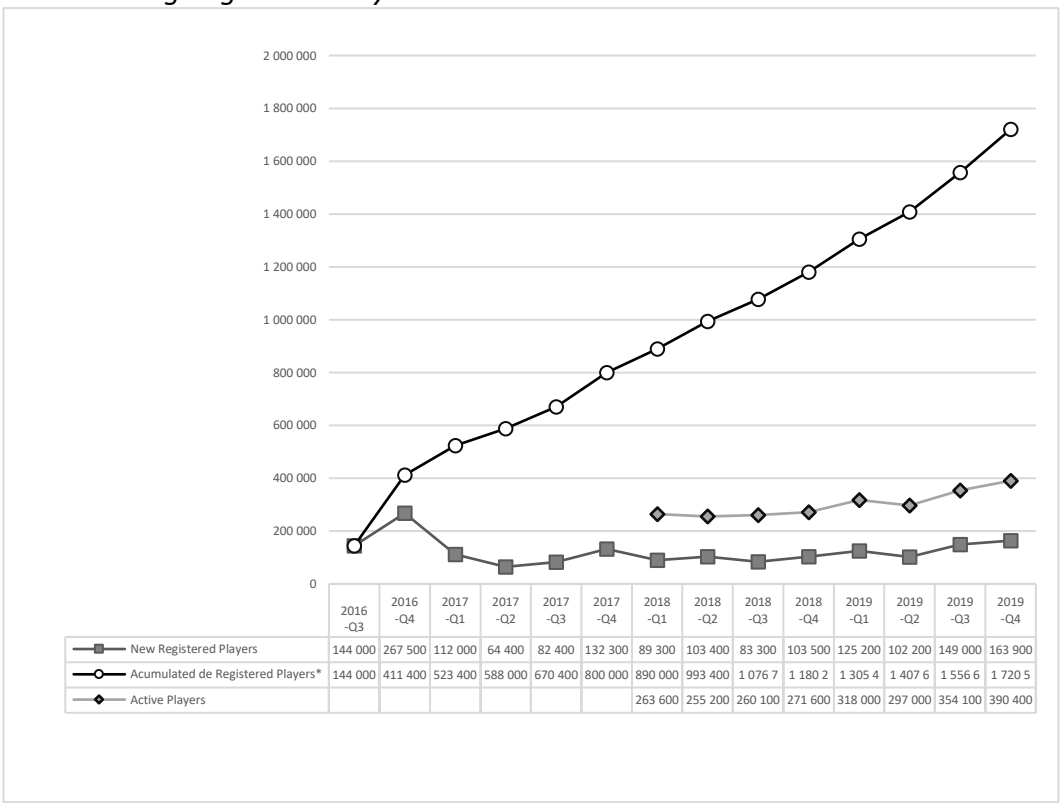
	2016 (Q3 & Q4)	2017	2018	2019	2020
Games of chance**	11 200 000	54 400 000	73 200 000	108 100 000	174 000 000
Sports betting / odds Setting*	40 200 000	68 100 000	78 900 000	107 100 000	161 900 000
Gross Revenue	51 400 000	122 600 000	152 100 000	215 000 000	335 900 000
IEJO (Special Tax Online Gambling)	31 000 000	54 200 000	66 500 000	94 800 000	108 200 000

Source: Data retrieved from SRIJ quarterly reports (2016 to 2020) with own data arrangement.

The figures for gross revenue, tax, and volume of bets, become more expressive when analysing the number of registered players (Figure 2.7). Although new player registrations fluctuate by quarter, the cumulative number of registered players has reached close to 2.5 million at the end of 2020. It should be noted that this figure refers to all operators on the market and that a player might be registered with more than one operator. Additionally, registering and opening an account does not imply that the player is active. In 2016, 411.5 (Q3 & Q4) thousand people registered as players. In 2017 there were 391 thousand player registrations. In 2018 there was a slight decrease to 379.5 thousand new player registrations, but in 2019 and in 2020, new player registration rose significantly to 540.3 thousand and 738.3 thousand new player registrations, respectively. It is also interesting to note that this figure is considerably higher than the number of registered players on the *Jogos Santa Casa* website (around

670 thousand registered players until the end of 2016, the last figure reported by DJ/SCML, regarding remote players). The SRIJ stopped publishing the region where registered players live, in 2018. In the last publicly available data (2018) it is noteworthy to highlight that most players (59,9%) are located in just 4 districts, with 21,7% in Porto, 19,6% in Lisbon, 9,5% in Braga and 8,1% in Setúbal.

Figure 2.7
Online Gambling Registered Players

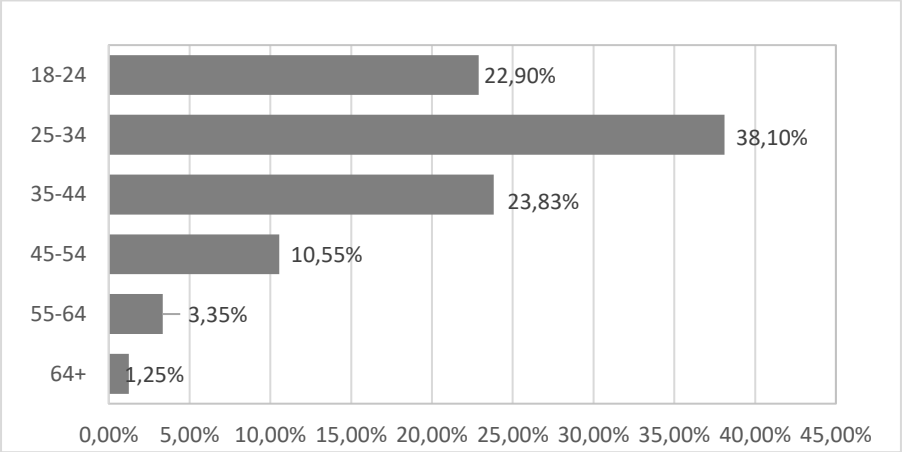


	2016 -Q3	2016 -Q4	2017 -Q1	2017 -Q2	2017 -Q3	2017 -Q4	2018 -Q1	2018 -Q2	2018 -Q3	2018 -Q4	2019 -Q1	2019 -Q2	2019 -Q3	2019 -Q4
New Registered Players	144 000	267 500	112 000	64 400	82 400	132 300	89 300	103 400	83 300	103 500	125 200	102 200	149 000	163 900
Acumulated de Registered Players*	144 000	411 400	523 400	588 000	670 400	800 000	890 000	993 400	1 076 7	1 180 2	1 305 4	1 407 6	1 556 6	1 720 5
Active Players							263 600	255 200	260 100	271 600	318 000	297 000	354 100	390 400

Source: Data retrieved from SRIJ quarterly reports (2016 to 2020) with own data arrangement

Most online players are young as 61% of registered players (Figure 2.9 and Figure 2.10) are 34 years old or younger and around 85% are younger than 44 years old. This means that it is a very young player base which is engaged in this gambling activity, in Portugal.

Figure 2.8
Online Gambling - Registered Players (2020)



Source: Data retrieved from SRIJ quarterly reports (2020) with own data arrangement.

2.4.4. Current trends of the Portuguese legalized gambling market

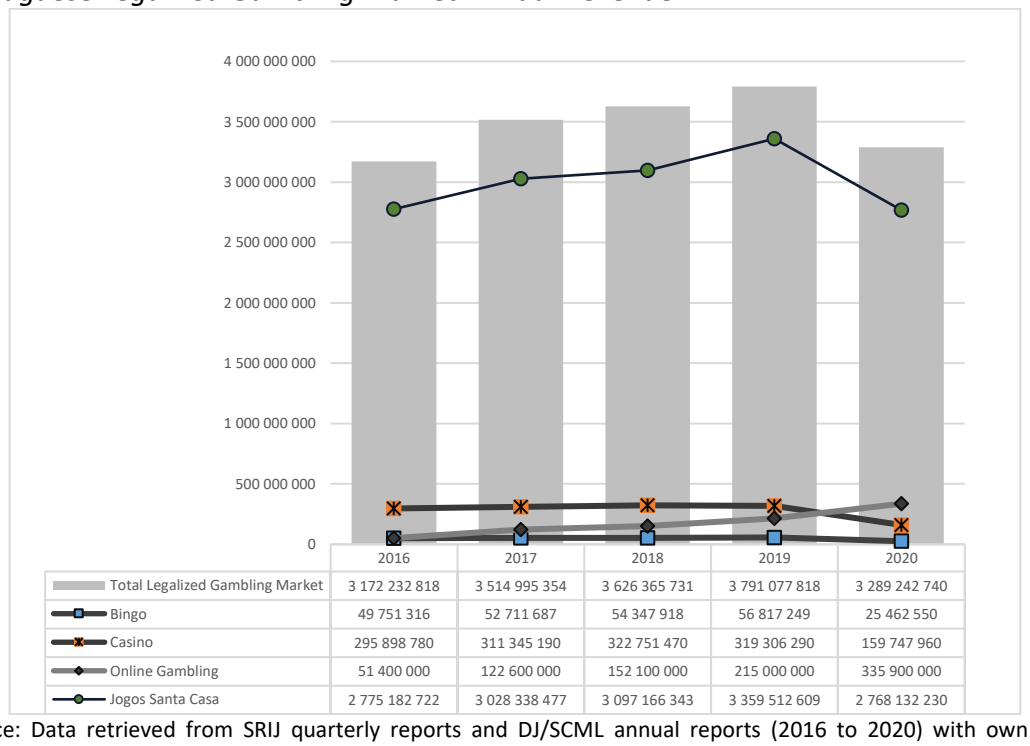
Through the analysis carried out on the different types of games available in Portugal, it is possible to notice a slowdown in the growth of the market in recent years. Between 2014 and 2016, total revenue grew by 44.6%. From 2016 to 2018 the market grew 14.3% and from 2018 to 2020 it lost 9.3% in total revenue. In fact, 2020 was a very atypical year, most likely because of the lockdowns and restrictions to land-based gambling venues and lottery points of sale. Sill, online gambling contributed significantly to the overall increase in revenue from games of chance and remote gambling. The introduction of this new approach to gambling appears to have changed the paradigm of gambling in Portugal, with a special emphasis in 2020.

Bingo halls revenue accounted for 1.6% of total revenue in the market in 2019 and 0.8% in 2020. The decrease in market share for this type of game was derived of a 55% decrease in total bingo revenue in 2020. Land-based casinos also had a strong

decline in total revenue in 2020, with a 50% drop in revenue in the previous year. At the same time as there has been a progressive increase in revenue and relative weight of online gambling. This market started in 2016, with a revenue of EUR 51.4 million (3rd and 4th quarter) and in its first full year of activity (2017), revenue grew to more than EUR 122.5 million. The trend in revenue growth in online gambling was even more accentuated in 2020 as this form of gambling grew 46% in gross revenue, compared to the previous year. Online gambling, together with internet lottery gambling, which grew 26% in 2020, were the two most resilient forms of gambling regarding the COVID-19 imposed changes (Figure 2.9).

Figure 2.9

Portuguese Legalized Gambling Market Annual Revenue



	2016	2017	2018	2019	2020
Total Legalized Gambling Market	3 172 232 818	3 514 995 354	3 626 365 731	3 791 077 818	3 289 242 740
Bingo	49 751 316	52 711 687	54 347 918	56 817 249	25 462 550
Casino	295 898 780	311 345 190	322 751 470	319 306 290	159 747 960
Online Gambling	51 400 000	122 600 000	152 100 000	215 000 000	335 900 000
Jogos Santa Casa	2 775 182 722	3 028 338 477	3 097 166 343	3 359 512 609	2 768 132 230

Source: Data retrieved from SRIJ quarterly reports and DJ/SCML annual reports (2016 to 2020) with own data arrangement

Although land-based casinos and bingo halls have had a growth trend for the past 5 years, apart from 2020, one the great drivers of the gambling market, has been online

gambling, which proved to be immune to the 2020 sanitary and circulation restrictions. Online gambling revenue grew 21% in 2020 to almost EUR 336 million. Along with this form of gambling, the national lottery sales have also been growing steadily, except for land-based sales in 2020, which decreased 19% (Figure 2.9). Lottery sales still account for most of the gambling market, and in 2020 represented 84.2% of the total market revenue, although the games offered by the Portuguese national lottery could be considered as a form of “soft gambling”.

The data presented in Figure 2.9, should not be seen in an isolated way, which merely focused on the forms of gambling, but in a global way, considering that the total market revenue has increased significantly in recent years. In general, when analysing the increase in revenue in a market, it may occur in three ways (Kotler & Armstrong, 2018, pp.555). In gambling this may imply growing through the acquisition of new players (people who did not play before); players who also started to play in other games and who had not previously done so; players who have increased their spending on gambling activity. Considering these growth justification scenarios, it is important to be able to understand how the Portuguese market has grown and determine what the maximum size of the market should be.

Ideal market size assessment is crucial for maintaining adequate levels of gambling involvement, ensuring that most players remain at recreational levels and that the number of players with unhealthy levels remains low and stable. According to Balsa, Vital, & Urbano (2014) the percentage of Portuguese with pathological gambling levels was 0.3% in 2012. As an example, this issue may gain relevance due to the non-limitation, on the part of the regulator, of the number of operators licensed for the online gambling market in Portugal (Correia, 2015). According to Alvarenga (2017), the

national level of consumer protection is particularly relevant given the jurisprudence of the Court of Justice of the European Union, which considers that the scale of moral, cultural, social, and religious values and traditions should be considered in each country.

2.4.5. Discussion and conclusions

In Portugal, the current legalized gambling market comprises a diversified offer, including casino, bingo, lottery, and online games. In that sense, and to support the development of the essays it was first important to understand the competitive landscape in this sector, especially due to the increasingly predominant role of the use of technology. Given the diversity of games on offer, it is extremely relevant to know players' profiles, as this is truly important to identify different market segments and be able to develop and perfect tools for the prevention and limitation of excessive gambling. Additionally, to determine effectively in which games does each player and player segment engage in, it is also pertinent to understand whether such involvement comes at the expense of product cannibalization, which is an indicative that, a game portfolio may need to be reconsidered in terms of its offering in order not to foster excessive gambling on the part of a specific player profile or segment.

In Portugal, the activity of games of chance, online gambling and lottery gambling has not been extensively studied. The only study on the prevalence of lottery gambling habits is from 2009 (Lopes, 2009) and is prior to the regulation of online gambling. Other studies such as those carried out by Hubert (2014a; 2014b) focused mainly on the nature of the psychological and social profiles of the players, and do not cover market issues,

which from the point of view of this analysis and the marketing practices that operators carry out would be useful to analyse and understand, namely how the players react to the marketing initiatives of the different operators. Regarding the studies by Hubert (2014a; 2014b), the questions about online gambling habits refers to 2009 and 2010. In that sense, although there is possibility that some of these respondents could be playing, at the time, with unlicensed operators, given the unregulated nature of online gambling in the Portuguese market in the afore mentioned period, the outlook has changed substantially since then, considering the legalization of online gambling and the accelerated growth of the Portuguese market in recent years.

Keizeler (2015) also studied gambling in Portugal, with a greater focus on the national lottery and concluded that online gambling has been identified as responsible for the decrease in revenue for land-based casinos and bingo halls. It should be noted that this researcher also completed her study prior to the approval of the legislation that regulates online gambling licensing in Portugal so, such conclusions, although indicative, do not consider the current market offerings brought by the legalized online operators. Magalhães (2011) also studied the phenomenon of online gambling, but, once again, the study precedes the approval of the RJO, and its sample is limited to university students of technological sciences and social sciences.

The national gambling market has been showing a growth trend for the past years, with the exceptions mentioned for 2020. It is noteworthy that online gambling seems to follow the same trend of the total Portuguese market, up until 2019. According to some estimates (Mordor Intelligence, 2018) the online gambling market is expected to grow, globally, by 8.77% until 2024, to values of USD 87.75 billion. Despite this projection being prior to the COVID-19 pandemic, and the virus and the disease it causes

created a great challenge to the social and economic establishment, until then, online gambling has seen increases in sales and registered players in some counties and jurisdictions around the world as the shutdown of physical gambling venues has shifted gambling participation to online platforms (Emond, Nairn, Collard, & Hollén 2021; Brown & Hickman, 2020; Håkansson, 2020; Hodgins & Stevens, 2021). This increased participation in online gambling has also raised concerns amongst researchers, public officials, and other stakeholders (Brown & Hickman, 2020; UK Gambling Commission, 2021; Håkansson, Fernández-Aranda, Menchón, Potenza, & Jiménez-Murcia, 2020; Harris, 2020; Yahya & Khawaja, 2020). It should be noted that despite concerns, some researchers report that there is preliminary evidence which suggests that gambling behaviour either decreased or stayed the same for most gamblers during the pandemic (Brodeur, Audette-Chapdelaine, Savard & Kairouz, 2021), namely for sports bettors and for online casino (Auer & Griffiths, 2021; Auer, Malischnig & Griffiths 2020). However, for the minority who showed increased gambling behaviour, it was frequently associated with problem gambling (Brodeur, et al., 2021).

Online gambling is the type of gambling activity with the highest growth in the sector. Contributing to this reality is the use of technology, artificial intelligence, chatbots and machine learning (Mordor Intelligence, 2018). Other factors that may contribute to this growth include the increase in the use of crypto currency, as a means of payment for online gambling activity. Additional relevant factors include the increase in the use of mobile telecommunications devices (mobile) in gaming and gambling activity. In the United Kingdom, in 2018, 55% of players preferred the use of mobile devices to carry out gaming activities, an increase of 4% compared to 2017 (UK Gambling Commission, 2019).

The gambling industry is going through a major shift as it is a form of entertainment that is very adaptable to online and digital environments. In fact, it may even become more appealing, both to current players as well as for prospect payers due to the settings where it may take place, which is much more individualistic than playing in land-bases venues, and to the possible characteristics of the games themselves that do not have the limitations of physical games. It should be noted that gambling activities, including lottery gambling, appeal to a broad spectrum of people. In that sense, many of its players still engage in land-based gambling activities. The Portuguese national lottery is no exception. Even though its website has been gaining traction steadily over the years, which is evident by the increase in revenue, in 2020 it still represented a small percentage of total lottery sales. In 2020, land-based retailers represented 96,0% of the Portuguese national lottery revenue (97,4%, in 2019). Digital sales channels reached EUR 110 million in revenue, in 2020, an all-time high, an increase of 27,0%, over the previous year (Santa Casa da Misericórdia, 2021), while sales of the land-based retailer network dropped 18,8%, to EUR 2.658 million, in 2020. The COVID-19 pandemic was, most likely responsible, for this change in the relative weight of each of the sales channels, and the different trends in the sales of each channel.

One of the research approaches taken in this study is related to the exploration of the possibility of the existence of several player profiles, with distinct sociodemographic characteristics, that engage in different games. In that sense, this may imply that distinct profiles might play in the same or in different games. As such, product/game portfolio cannibalization was also considered in this research to complement the segmentation approach. The next section presents the research conducted on these topics, with a greater emphasis on online lottery players with the

use of real playing data, due to the novelty of the topic and the data which was made available exclusively for this research. Additionally, and considering that players can be involved in playing on one or more single games and game categories, the issue of portfolio cannibalization becomes also relevant. In gambling, product cannibalization is of great relevance as it can imply that games are competing with one another which may imply a greater involvement from players with the same profiles and playing preferences. Considering that this situation may potentiate excessive gambling, it is important to ensure a balanced portfolio design, especially with the case of lotteries, considering their greater role in society as contributors to the support of good causes and ensuring gambling harm minimisation. As such, this topic is explored in the final paper presented in the next section, which closes the section dedicated to the research conducted purposely for this dissertation.

References

Alvarenga, A. N. (2017). *Jogos sociais do Estado: uma análise jus-internacionalista e comunitária*. Dissertação de Mestrado, Faculdade de Direito da Universidade de Lisboa, Lisboa.

Ariyabuddhiphongs, V. (2006). A test of the social cognitive model of lottery gambling in Thailand. *International Gambling Studies*, *6*(1), 77–93.

Ariyabuddhiphongs, V. (2011). Lottery gambling: a review. *Journal of Gambling Studies, 27*(1), 15-33.

Auer, M., & Griffiths, M.D. (2013). Voluntary limit setting and player choice in most intense online gamblers: An empirical study of gambling behaviour. *Journal of Gambling Studies, 29*, 647-660.

Auer, M., & Griffiths, M. (2014). Personalised feedback in the promotion of responsible gambling: a brief overview. *Responsible Gambling Review, 1*(1), 27-36.

Auer, M., & Griffiths, M. (2015). The use of personalized behavioural feedback for online gamblers: an empirical study. *Frontiers in Psychology, 6*, 1664-1078.

Baker, R., Forrest, D., & Perez, L. (2016). The compatriot win effect on national sales of a multicountry lottery. *Applied Statistics, 65*(4), 603–618.

Balsa, C., Vital, C., & Urbano, C. (2014). *III Inquérito Nacional ao Consumo de Substâncias Psicoativas na População Geral em Portugal 2012*. (C. E. SICAD, Ed.).

Barkho, G. (2021, August 23). *Lottery ticket sales are going digital. Retail revolution*. Retrieved from: https://www.modernretail.co/startups/lottery-ticket-sales-are-going-digital.

Benhsain, K., Taillefer, A., & Ladouceur, R. (2004). Awareness of independence of events and erroneous perceptions while gambling. *Addictive Behaviours, 29*(2), 399-404.

Bonello, M., & Griffiths, M. (2019). Behavioural tracking, responsible gambling tools, and online voluntary self-exclusion: implications for the gambling industry. *Casino and Gaming International*, *38*, 41-45.

Boone, L. E., & Kurtz, D. L. (2009). *Contemporary marketing*. Mason, Ohio: Cengage South-Western.

Britannica. (n.d.). (2021, March 4). *Gambling*. In Britannica.com dictionary. Retrieved from https://www.britannica.com/topic/gambling.

Brochado, A., Santos, M., Brochado, F. O., & Esperança, J. (2018). Gambling behaviour: Instant versus traditional lotteries. *Journal of Business Research, 88*, 560 - 567.

Brooks, G. A., & Clark, L. (2019). Associations between loot box use, problematic gaming and gambling, and gambling-related cognitions. *Addictive Behaviours,* 26-34.

Brown, R, & Hickman, A. (2020). *Changes in online gambling during the COVID-19 pandemic: April update* Australian Government - Australian Institute of Criminology (Statistical Bulletin 27, June 2020) https://apo.org.au/sites/default/files/resource-files/2020-06/apo-nid306090.pdf

Brown, R., & Rork, J. (n.d.). 2005. Copycat gaming: A spatial analysis of state lottery structure. *Regional Science and Urban Economics*, 35, 795–807.

Calado, F., & Griffiths, M. D. (2016). Problem gambling worldwide: An update and systematic review of empirical research (2000–2015). *Journal of Behavioural Addictions*, *5*(4), 592–613.

Chagas, B. T. (2007). *University student gambling consumption*. Master Dissertation, Universidade de Lisboa., Instituto Superior de Economia e Gestão, Lisboa.

Chagas, B. T., Gomes, J. F., & Griffiths, M. D. (2021). Consumer profile segmentation in online lottery gambling utilizing behavioural tracking data from the Portuguese national lottery. *Journal of Gambling Studies*, *13*, 1-23.

Charnessa, G., & Gneezyb, U. (2012). Strong evidence for gender differences in risk taking. *Journal of Economic Behaviour & Organization, 83*(1), 50-58.

Clark, T. L. (1987). *The dictionary of gambling and gaming*. Cold Spring, New York: Lexik House.

Close, J., Spicer, S. G., Nicklin, L. L., Uther, M., Lloyd, J., & Lloyd, H. (2021). Secondary analysis of loot box data: Are high spending "whales" wealthy gamers or problem gamblers? *Addictive Behaviours, 117*. Advance Online Publication: 10.31234/osf.io/fvdrx.

Clotfelter, C. T., & Cook, P. J. (1990). On the economics of state lotteries. *Journal of Economic Perspectives*, *4*(4), 105-119.

Cook, P. J., & Clotfelter, C. T. (1993). The peculiar scale economies of lotto. *The American Economic Review, 83*(3), 634-643.

Correia, C.B. (2015). *Do jogo de fortuna ou azar. O atual paradigma na exploração ilícita*. Dissertação de Mestrado, Faculdade de Direito da Universidade Nova de Lisboa, Lisboa. Obtido de https://run.unl.pt/bitstream/10362/16177/1/BatistaCorreia_2015.pdf

Costes, J., Kairouz, S., Monson, E., & Eroukmanoff, V. (2018). Where lies the harm in lottery gambling? A portrait of gambling practices and associated problems. *Journal of Gambling Studies, 34*, 1293-1311.

Court, D., Elzinga, D., Mulder, S., & Vetvik, O. J. (2009, June 1). The consumer decision journey. *McKinsey Quarterly*, 1-14. Retrieved October 16, 2020, from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-consumer-decision-journey

Culin, S. (1907/1992a). *Games of the North American Indians. Vol. 1: Games of chance*. Lincoln and London: Bison Books/University of Nebraska Press. Lincoln and London: Bison Books/University of Nebraska Press.

Culin, S. (1907/1992b). *Games of the North American Indians*. Vol. 2: *Games of skill*. Lincoln and London: Bison Books/University of Nebraska Press.

Decreto n.º 14643/1927, de 3 de Dezembro. (03 de Dezembro de 1927). Ministério do Interior - Secretaria Geral. Diário do Governo n.º 267/1927. 1ª Série. Lisboa.

Decreto-lei n.º 422/1989, de 2 de Dezembro (Lei do Jogo). (02 de Dezembro de 1989). Ministério do Comércio e Turismo. Diário da República n.º 277/1989, 1.ª série, 5244-5266. Lisboa.

Decreto-Lei n.º 66/2015 (Regime Jurídico dos Jogos e Apostas Online - RJO). (29 de abril de 2015). Diário da República, 1.ª série — N.º 83. Lisboa.

Del Barrio, J. M. (2020, Febrero). Los portugueses, enganchados a la 'raspadinha'. *El País*. Retrieved from https://elpais.com/internacional/2020/02/21/mundo_global/1582308868_274441.html

Departamento de Jogos da Santa Casa da Misericórdia de Lisboa. (02 de 05 de 2019(a)). Condições Gerais de Utilização do Cartão de Jogador. Obtido de Jogos Santa Casa: https://www.jogossantacasa.pt/web/SCMediador/verDetalhe?contentId=1

Departamento de Jogos da Santa Casa da Misericórdia de Lisboa. (27 de 06 de 2019(b)). *Política de Jogo Responsável*. Retrieved from Jogos Santa Casa: https://www.jogossantacasa.pt/Content/images/uploadedImages/content/pjmc/gc/cont/13990/DJ_POL_PoliticaJR.pdf

Derevensky, J. L., & Griffiths, M. D. (2019). Gaming: Does the gambling and gaming industry have a responsibility in protecting the consumer?. *Gaming Law Review, 23*(9), 633-639.

Drummond, A., & Sauer, J. (2018). Video game loot boxes are psychologically akin to gambling. *Nature Human Behaviour*, *2*, 530–532.

Edelman, D., & Singer, M. (2015). The new consumer decision journey. *McKinsey Quarterly*. Retrieved October 16, 2020, from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-new-consumer-decision-journey.

Emond, A., Nairn, A., Collard, S., Hollén, L. (2021). Gambling by young adults in the UK during cOVID-19 Lockdown. *Journal of Gambling Studies*. DOI: 10.1007/s10899-021-10029-y.

European Commission. (2011). *Green Paper: On on-line gambling in the Internal Market*. Strasbourg: European Commission. (Publication SEC2011, 321 final). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0128&from=EN.

European Commission (2012) *Commission staff working document: Green paper on online gambling in the internal market - Accompanying document* (Publication COM2012, 596 final). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012SC0345&from=IT.

Eurostat. (2019, October 21). *Eurostat Nuts Background*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/nuts/background.

Fiedler, I. (2011). The gambling habits of online poker players. *The Journal of Gambling Business and Economics, 6*, 1–24.

Forrest, D., Gulley, D., & Simmons, R. (2004). Substitution between games in the UK National Lottery. *Applied Economics, 36*, 645–651.

Forrest, D., & McHale, I. (2007). The relationship between a national and a multistate lotto game. *The Journal of Gambling Business and Economics*, *1*, 207–216.

Forrest, D., Gulley, D., & Simmons, R. (2000). Elasticity of demand for UK national lottery tickets. *National Tax Journal, 53*(4), 853-863.

Forrest, D., Perez, L., & Baker, R. (2010). Evaluating the effects of game design on lotto sales: A case study from Spain. *Journal of Gambling Business and Economics, 4*(2), 1-19.

Froberg, F., Rosendahl, I. K., Abbott, M., Romild, U., Tengstrom, A., & Hallqvist, J. (2015). The incidence of problem gambling in a representative cohort of Swedish female and male 16–24-year-olds by socio-demographic characteristics, in comparison with 25–44-year-olds. *Journal of Gambling Studies, 31*, 621–641.

Gadboury, A., & Ladouceur, R. (1989). Erroneous perceptions and gambling. *Journal of Social Behaviour & Personality, 4*(4), 411–420.

Garrett, T. A. (2001). An international comparison and analysis of lotteries and the distribution of lottery expenditures. *International Review of Applied Economics, 15*(2), 213-227.

Garrett, T. A., & Sobel, R. S. (2004). State lottery revenue: The importance of game characteristics. *Public Finance Review, 32*(3), 313-330.

Garrett, T., & Marsh, T. (2002). The revenue impacts of cross-border lottery shopping in the presence of spatial autocorrelation. *Regional Science and Urban Economics*, 32, 501–519.

Global Industry Analysts Inc. (2021). *Gambling - Global market trajectory & analytics*. California, USA: Global Industry Analysts Inc. Retrieved from https://www.strategyr.com/market-report-gambling-forecasts-global-industry-analysts-inc.asp

Grand View Research. (2020). *Online gambling market size and share - industry report, 2020-2027*. California, USA: Grand View Research. Retrieved from https://www.grandviewresearch.com/industry-analysis/online-gambling-market

Gray, H. M., Jonsson, G. K., LaPlante, D. A., & Shaffer, H. J. (2015). Expanding the study of internet gambling behaviour: trends within the Icelandic lottery and sportsbetting platform. *Journal of Gambling Studies, 31*(2), 483-499. doi:10.1007/s10899-013-9427-0.

Griffiths, M.D. (1999). Gambling Technologies: Prospects for problem gambling. *Journal of Gambling Studies*, *15*, 265–283.

Griffiths, M. D., & Parke, J. (2002). The social impact of internet gambling. *Social Science Computer Review, 20*, 312–320.

Griffiths, M. D. (2012). *Internet gambling, player protection and social responsibility*. In R. Williams, R. Wood, & J. Parke, Routledge handbook of internet gambling (pp. 227–249). London, United Kingdom: Routledge.

Griffiths, M.D. (2013). Social gambling via Facebook: Further observations and concerns. *Gaming Law Review and Economics, 17*(2), 104-106.

Griffiths, M.D. (2018). Hot topics in gambling: gambling blocking apps, loot boxes, and 'crypto-trading addiction'. *Online Gambling Lawyer, 17* (7), 9-11.

Griffiths, M.D. (2019). *Behavioural tracking in gambling. The use and efficacy of online responsible gambling tools*. In H. Bowden-Jones, C. Dickson, C. Dunand, & O. Simon, Harm Reduction for Gambling a Public Health Approach (p. 12). London: Routledge. doi: https://doi.org/10.4324/9780429490750.

Griffiths, M. D., & Parke, J. (2002). The social impact of internet gambling. *Social Science Computer Review*, *20*, 312–320.

Griffiths, M.D., & Wood, R. (2001). The psychology of lottery gambling. *International Gambling Studies*, *1*, 27-44.

Griffiths, M.D., Wood, R., & Parke, J. (2009). Social responsibility tools in online gambling: a survey of attitudes and behaviour among Internet gamblers. *CyberPsychology & Behaviour*, *12*(4), 413-421.

Grote, K., & Matheson, V. (2006). Duelling jackpots: Are competing lotto games complements or substitutes?. *Atlantic Economic Journal*, *34*, 85–100.

Grote, V. A., & Matheson, K. R. (2013). *The economics of lotteries: A survey of the literature*. In L. a. Vaughan-Williams, The Oxford Handbook of the Economics of Gambling (Vol. Paper No. 11, pp. 670-691). Oxford: Oxford University Press.

Gulley, O., & Scott, F. (1993). The demand for wagering on state-operated lotto games. *National Tax Journal*, *46*, 13–22.

Håkansson, A. (2020). Impact of COVID-19 on online gambling – A general population survey during the pandemic. *Frontiers in Psychology, 11,* 1-8.

Harris, A., & Griffiths, M. (2017). A critical review of the harm-minimisation tools available for electronic gambling. *Journal of Gambling Studies, 33,* 187–221.

Heskett, J. L. (1976). *Marketing*. New York: Macmillan.

Hodgins, D., Stevens, C., Rhys, M. (2021). The impact of COVID-19 on gambling and gambling disorder: emerging data. *Current Opinion in Psychiatry*, *34*(4), 332-343.

Hubert, P. (2014a). *Online e offline pathological gambler: Characterizing and comparing*. Paper presented at the 10th European Conference on Gambling Studies and Policy Issues.

Hubert, P. F. (2014b). *Jogadores patológicos online e offline: Caracterização e comparação*. Dissertação de Doutoramento em Psicologia, Universidade Autónoma de Lisboa - Departamento de Psicologia e Sociologia.

Hubert, P., & Griffiths, M. D. (2018). A comparison of online versus offline gambling harm in Portuguese pathological gamblers: An empirical study*. International Journal of Mental Health and Addiction, 16*(3), 1219–1237.

Huizinga, J. (1949). *Homo ludens: A study of the play-element in culture*. London: Routledge.

International Center for Responsible Gaming. (2021, July 22). *Milestones*. Retrieved from International Center for Responsible Gaming: https://www.icrg.org/about-ncrg/history/milestones

Jia, Y. (2011). Are lotteries substitutes for each other? *The Journal of Gambling Business and Economics, 5* (3), 1-14.

Jonsson, J. (2006). An overview of prevalence surveys of problem and pathological gambling in the Nordic countries. *Journal of Gambling Issues, 18*(18),31-38.

Kaizeler, M.J., & Faustino, H. C. (2011). Is the lottery product an inferior good in higher income countries? *International Journal of Economics and Finance, 3*(4), 54-59.

Kaizeler, M.J., & Faustino, H. C. (2012). Lottery sales and per-capita GDP: An inverted U relationship. *British Journal of Economics, Management & Trade, 2*(3), 225-238.

Kaizeler, M.J., Faustino, H. C., & Marques, R. (2014). The determinants of lottery sales in Portugal. *Journal of Gambling Studies, 30*, 729-736.

Kaizeler, M.J. (2015). *A procura de produtos de lotaria em Portugal: Uma análise socioeconómica*. Dissertação de doutoramento, ISEG - Instituto Superior de Economia e Gestão da Universidade de Lisboa, Lisboa. Retrieved from http://hdl.handle.net/10400.5/9848.

Kaplan, H. R. (1984). The social and economic impact of state lotteries. *The Annals of the American Academy of Political and Social Science*, 474(1), 91-106.

Kerin, A. R., Harvey, G. M., & Rothe, T. J. (1978). *Cannibalism and new product development. Business Horizons, 21*(5), 25-31.

Kerr, A. (2006). *The business and culture of digital games: gamework/gameplay*. London: Sage.

Kerr, A. (2017). *Global games. Production, circulation, and policy in the networked era*. New York: Routledge.

Kerr, A., O'Brennan, J., & Vazquez, M. (2021*). Gambling trends, harms and responses: Ireland in an international context*. Maynooth University. Maynooth: Maynooth University. Retrieved from http://mural.maynoothuniversity.ie/14258/

Kesting, T., & Rennhak, C. (2011). Market segmentation in German business practice: relevance, procedures and challenges. *World Review of Entrepreneurship, Management and Sustainable Development, 7*(4), 361-379.

Kotler, P. (1998). *Marketing and electronic marketing and the internet*. Australia: Prentice Hall.

Kotler, P., & Armstrong, G. (2018). *Principles of Marketing, Global Edition, 17th Edition*. London, United Kingdom: Pearson.

Kristia, R., Nielsen, L., & Grabarczyk, P. (2019). Are loot boxes gambling? random reward mechanisms in video games. *Transactions of the Digital Games Research Association, 4*(3), 171-207.

Kristiansen, S., & Severin, M. C. (2020). Loot box engagement and problem gambling among adolescent gamers: Findings from a national survey. *Addictive Behaviours, 103*, 1-10.

LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: A prospective longitudinal study of internet sports gambling behaviour. *Journal of Gambling Studies*, *23*(3), 347–362.

Ladouceur, R., & Sevigny, S. (2003). Interactive messages on video lottery terminals and persistence in gambling. *Journal of the National Association for Gambling Studies*, *15*(1), 45-50.

LaFleur, T. (2020). La Fleur's 2021 World Lottery Almanac. LaFleur's. https://lafleurs.com/product/vendor-la-fleurs-world-lottery-almanac.

LaPlante, D. A., Gray, H. M., Bosworth, L., & Shaffer, H. J. (2010). Thirty years of lottery public health research: Methodological strategies and trends. *Journal Gambling Studies*, *26*, 301–329.

Laruccia, M. M., Loureiro, S. M., & Martelli Tristão, J. A. (2012). A conceptual approach for cannibalism between goods. *Chinese Business Review*, *11*, 989-995.

Lei n.º 83/2017 - Medidas de combate ao branqueamento de capitais. (18 de agosto de 2017). Diário da República, 1.ª série — N.º 159. Lisboa.

Li, W., Mills, D., & Nower, L. (2019). The relationship of loot box purchases to problem video gaming and problem gambling. *Addictive Behaviours*, *97*, 27-34.

Lomax, W., Hammond, K., & East, M. C. (1996). The measurement of cannibalization. *Marketing Intelligence & Planning*, *14*(7), 20-28.

Lopes, H. (2009). *Epidemiologia da dependência do jogo a dinheiro em Portugal*. [Conference session]. Congresso de alto nível promovido pela Santa Casa da Misericórdia de Lisboa. Lisbon, Portugal.

Lopes, M. J. (2021, 03 27). Raspadinhas: SICAD com grande preocupação em relação ao potencial adictivo e de empobrecimento das famílias. *Público*. Retrieved from https://www.publico.pt/2021/03/27/sociedade/noticia/raspadinhas-sicad-preocupacao-relacao-potencial-aditivo-empobrecimento-familias-1956167.

Macey, J., & Hamari, J. (2019). eSports, skins and loot boxes: Participants, practices and problematic behaviour associated with emergent forms of gambling. *New Media & Society*, *21*(1), 20–41.

Maeda, A. (2008). Optimal lottery design for public financing. *Economic Journal, 118*(532), 1698-1718.

Magalhães, R. (2011). *Jogo a dinheiro na internet: estudo exploratório para a caracterização do consumo de jogo online, especializado nas populações de estudantes universitários de ciências tecnológicas e ciências sociais*. Dissertação de Mestrado, ISCTE - Instituto Universitário de Lisboa, Lisboa. Retrieved from http://tutorado.tecnico.ulisboa.pt/files/sites/40/JogoOnline-TeseMestradoRuiMagalh%C3%A3es2011.pdf#page=1&zoom=auto,-47,842.

Marionneau, V., & Nikkinen, J. (2017). Market cannibalization within and between gambling industries: A systematic review. *Journal of Gambling Issues*, *37*, 1-35.

Marktest Grupo. (2021, July). *Internet 2020: cresce a liderança dos smartphones*. Retrieved from Marktest: https://www.marktest.com/wap/a/n/id~269e.aspx

Mason, C. H., & Milne, G. R. (1994). An approach for identifying cannibalization within product line extensions and multi-brand strategies. *Journal of Business Research*, *31*(3), 163-170.

Matheson, V. A., & Grote, K. R. (2007). Gamblers' love for variety and substitution among lotto games. *Journal of Gambling Business and Economics*, *1*(2), 85-99.

McCaffrey, M. (2019). The macro problem of microtransactions: The self-regulatory challenges of video game loot boxes. *Business Horizons*, *62*(4), 483-495.

Mikesell, J., & Zorn, C. (1987). State lottery sales: Separating the influence of markets and game structure. *Growth and Change*, *18*, 10–19.

Mok, W. P., & Hraba, J. (1991). Age and gambling behaviour: A declining and shifting pattern of participation. *Journal of Gambling Studies*, *7*(4), 313-335.

Mordor Intelligence. (2018). *Online Gambling Market - Growth, Trends and Forecast* (*2019 - 2024*). Mordor Intelligence, Hyderabad, India. Retrieved from https://www.mordorintelligence.com/industry-reports/online-gambling-market.

Moon, H., Yang, T., Kim, S., & Park, J. (2017). Comparison of gambling industry through study analysis in the world. *Proceedings of the IEEE International Congress on Big Data*, *Honolulu, HI, USA, 2017*, 537-540. doi: 10.1109/BigDataCongress.2017.81.

Morgan, J. (2000). Financing public goods by means of lotteries. *The Review of Economic Studies*, *67*(4), 761–784.

Mota Pinto, C. A., Monteiro, A. P., & Silva, J. C. (1982). *Jogo e aposta: Subsídios e fundamentação ética e histórico-jurídica*. Coimbra: Santa Casa da Misericórdia de Lisboa.

Moutinho, L., & Hutchenson, G. (2011). *The sage dictionary of quantitative management research*. Thousand Oaks, California, USA: SAGE Publications Ltd.

Neves, P. C. (1984). *Lotaria Nacional – Subsídios para a sua história, 1783-1983*. Lisboa: Edição da Lotaria Nacional.

North American Association of State and Provincial Lotteries. (2021, August 17). *Glossary of lottery terms*. Retrieved from NASPL: https://www.naspl.org/glossaryoflotteryterms.

Observatório sobre Crises e Alternativas. (2013). *Anatomia da crise: Identificar os problemas para construir as alternativas - 1º Relatório preliminar*. Universidade de Coimbra, Centro de Estudos Sociais - Laboratório Associado, Coimbra.

Portaria n. º112/2013 - Alteração ao regulamento da Lotaria Instantânea (Ministério da Solidariedade e da Segurança Social, Março 21, 2013).

Portaria n.º 384/2015 de 26 de outubro (Ministério das Finanças e da Economia). (26 de outubro de 2015). Diário da República, 1.ª série — N.º 209. Lisboa.

Purfield, C., & Waldron, P. (1999). Gambling on lotto numbers: Testing for substitutability or complementarity using semi-weekly turnover data. *Oxford Bulletin on Economics and Statistics*, *61*, 527–544.

QYResearch Group (2020). *Global lottery market size, status and forecast 2020-2026*. (Report Nº QYR16223346). Retrieved from https://www.marketresearch.com/QYResearch-Group-v3531/Global-Lottery-Size-Status-Forecast-13203990.

Regime Jurídico Dos Jogos e Apostas Online, DL n.º 66/2015, de 29 de abril. Diário da República, 1.ª série — N.º 83 — 29 de abril de 2015, nº 2139 (2015).

Report Linker (2021). *Global online lottery industry. Report Linker* (Report Nº 5957571). https://www.reportlinker.com/p05957571/Global-Online-Lottery-Industry.html?utm_source=GNW

Ries, A., & Trout, J. (2000). *Positioning: the battle for your mind*. London: McGraw-Hill.

Roger, P. (2011). La demande de grilles d'Euromillions: Une comparaison internationale. *Revue Economique*, *62*(1), 29-55.

Roger, P., & Chabi, S. (2009). *La cannibalisation des produits à prix aléatoires: L'Euromillions a-t-il tué le loto français?* [Cannibalization of products of random cost: Has the Euromillions killed the French lottery?]. *Actes du 25e Congrès International de l'AFM* (pp. 1-17). London: Laboratoire de recherche en gestion & economie.

Rogers, P. (1998). The cognitive psychology of lottery gambling: A theoretical review. *Journal of Gambling Studies*, *14*, 111–134.

Roukka, T. (2016). Consumer behaviour and the welfare effects of gambling in Finland. paper presented at the 11th European Conference on Gambling Studies and Policy Issues. Lisbon: EASG - European Association for the Study of Gambling.

Santa Casa da Misericórdia de Lisboa. (2005). *Relatório e contas de 2004 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2014). *relatório e contas de 2013 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/ santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2015). *Relatório e contas de 2014 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/ santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2016). *Relatório e contas de 2015 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2017). *Relatório e contas de 2016 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2018). *Relatório e contas de 2017 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2018, November 18). *Institucional - Saiba mais sobre as atribuições, as competências e o historial dos Jogos Santa Casa*. Retrieved from Santa Casa da Misericórdia de Lisboa: https://www.jogossantacasa.pt/web/SCInstitucional.

Santa Casa da Misericórdia de Lisboa. (2019a). *Relatório e contas de 2018 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved 10 May, 2019, from: http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa - Departamento de Jogos. (2019b, May 10). *Página sobre informação Institucional*. Retrieved from Jogos Santa Casa: https://www.jogossantacasa.pt/web/SCInstitucional.

Santa Casa da Misericórdia de Lisboa. (2020). *Relatório e contas de 2019 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Retrieved 22 September, 2020, from https://backoffice.scml.pt/wp-content/uploads/2020/09/Relatorio_de_Contas_JSC_2019.pdf

Santa Casa da Misericórdia de Lisboa. (2021a). *Relatório e contas de 2020 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa*. Lisboa. Santa Casa da Misericórdia de Lisboa. Retrieved 23 January, 2022, from http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2021b, June 26). *Sobre nós – História*. Retrieved from Santa Casa da Misericórdia de Lisboa: https://scml.pt/sobre-nos/historia.

Semenik, R. J., & Bamossy, G. J. (1995). *Principles of marketing: A global perspective*. Cincinatti, Ohio: South-Western College Publishing.

Serviço de Regulação e Inspeção de Jogos -SRIJ. (2017). *Atividade do jogo online em Portugal: O mercado regulado* [Relatórios do 1º, 2º, 3º e 4º Trimestres]. Lisboa.

Serviço de Regulação e Inspeção de Jogos - SRIJ. (2018). *Atividade do jogo online em Portugal: O mercado regulado* [Relatórios do 1º, 2º, 3º e 4º Trimestres]. Lisboa.

Serviço de Regulação e Inspeção de Jogos - SRIJ. (2019a, June 20). *Concessionários de casinos*. Retrieved from: https://www.srij.turismodeportugal.pt/pt/casinos-e-bingos/concessionarios-de-casinos/

Serviço de Regulação e Inspeção de Jogos - SRIJ. (2019b, June 20). *Jogo online - 2018 Infografia*. Retrieved from: https://www.srij.turismodeportugal.pt/pt/gca/index.php?id=71

Serviço de Regulação e Inspeção de Jogos - SRIJ. (2019c, June 20). *Regime legal do Jogo online*. Retrieved from: https://www.srij.turismodeportugal.pt/pt/jogo-online/regime-legal/

Serviço de Regulação e Inspeção de Jogos - SRIJ. (2019d, June 20). *Entidades licenciadas*. Retrieved from: https://www.srij.turismodeportugal.pt/pt/jogo-online/entidades-licenciadas/

Serviço de Regulação e Inspeção de Jogos -SRIJ. (2020). *Impacto da COVID-19 nos jogos e apostas online*. Retrieved from https://www.srij.turismodeportugal.pt/fotos/editor2/estatisticas/Impacto_covid_JAO_vs4_1a.pdf

Shaffer, H.J. (2003). *Futures at stake: Youth, gambling, and society*. Reno, Nevada: University of Nevada Press.

Shaffer, H.J., Stanton, M.V. & Nelson, S.E. (2006). Trends in gambling studies research: Quantifying, Categorizing, and Describing Citations. *Journal of Gambling Studies*, *22*, 427–442.

Shaffer, H. J., Peller, A. J., LaPlante, D. A., Nelson, S. E., & LaBrie, R. A. (2010). Toward a paradigm shift in Internet gambling research: From opinion and self-report to actual behaviour. *Addiction Research and Theory, 18*, 270–283.

Shukla, P. (2008). *Essentials of marketing research*. Denmark: Bookboon. Retrieved from http://bookboon.com/en/marketing-research-an-introduction-ebook

SICAD. (2020). *Relatório anual de 2019 - Descritivo de respostas e intervenções do plano de ação para a redução dos comportamentos aditivos e dependências – Horizonte 2020*. Lisboa: SICAD. Retrieved from http://www.sicad.pt/BK/Publicacoes/Lists/SICAD_PUBLICACOES/Attachments/170/RelatorioAnual2019_DescritivoRespostasIntervencoesDoPARCAD_PT.PDF

Smith, A. (2012). *Wealth of Nations*. Ware: Wordsworth Editions Ltd.

Stehmann, J. (2020). Identifying research streams in online gambling and gaming literature: A bibliometric analysis. *Computers in Human Behavior*, *107*, 106219. https://doi.org/10.1016/j.chb.2019.106219.

Stevens, R. (2006). Internet gambling bibliography. *UNLV Gaming Research & Review Journal*, *10* (1), 95-100.

Stover, M. (1990). Contiguous state lotteries: Substitutes or complements?. *Journal of Policy Analysis and Management*, *9*, 565–568.

Subramaniam, M., Tang, B., Abdin, E., Vaingankar, J. A., Picco, L., & Chong, S. A. (2016). Sociodemographic correlates and morbidity in lottery gamblers: Results from a population survey. *Journal of Gambling Studies*, *32*, 291–305.

The European Lotteries and Toto Association (2020). *European Lotteries annual report 2019. The European Lotteries and Toto Association*. Retrieved from https://www.european-lotteries.org/sites/default/files/2020-06/EuropeanLotteries-AnnualReport2019_Final.pdf.

The Gambling Act 2005 (2005). (UK) Section 4: Remote gambling (UKGB).

The National Council on Problem Gambling. (2021, July 22). *Help and treatment*. Retrieved from The National Council on Problem Gambling. https://www.ncpgambling.org/help-treatment/faq.

The Royal College of Psychiatrists. (2021, July 22). *Problem gambling*. Retrieved from The Royal College of Psychiatrists: https://www.rcpsych.ac.uk/mental-health/problems-disorders/problem-gambling

Thompson, W. N. (2010). *The international encyclopaedia of gambling*. Santa Barbara, California: ABC-CLIO.

Tosun, M., & Skidmore, M. (2004). Interstate competition and state lottery revenues. *National Tax Journal*, *57*, 163–178.

UK Gambling Commission (2019). *Gambling participation in 2018: behaviour, awareness and attitudes Annual report*. Retrieved from https://www.gamblingcommission.gov.uk/PDF/survey-data/Gambling-participation-in-2018-behaviour-awareness-and-attitudes.pdf

UK Gambling Commission (2020) *COVID-19 and its impact on gambling—what we know so far*. Retrieved from https://www.gamblingcommission.gov.uk/news-action-and-statistics/Statistics-and-research/Covid-19-research/Covid-19-and-its-impact-on-gambling-%E2%80%93-what-we-know-so-far.aspx.

UK Gambling Commission (2021) *Statistics and research release: Exploring the impact of Covid-19 on gambling behaviour. Research commissioned to explore the impact coronavirus has had on gambling behaviours*. Retrieved from https://www.gamblingcommission.gov.uk/statistics-and-research/publication/exploring-the-impact-of-covid-19-on-gambling-behaviour.

Vilaverde, D., & Morgado, P. (2020). Scratching the surface of a neglected threat: huge growth of Instant Lottery in Portugal. *Lancet Psychiatry*, *7*(13), 1.

Walker, D. M., & Jackson, J. D. (1999). State lotteries, isolation and economic growth in the U.S. *Review of Urban and Regional Development Studies*, *11*(3), 187-192.

Walker, D., & Jackson, J. D. (2008). Do U.S. gambling industries cannibalize each other?. *Public Finance Review*, *36*, 308–333.

West, R. (2001). Theories of addiction [Editorial]. *Addiction*, *96(*1), 3–13.

Williams, R. J. & Wood, R. T. (2007). *Internet Gambling: A comprehensive review and synthesis of the literature*. Report prepared for the Ontario Problem Gambling Research Centre, Guelph, Ontario, Canada. https://www.greo.ca/Modules/EvidenceCentre/files/Williams%20et%20al(2007)Internet_gambling_A_comprehensive_review_and_synthesis_of_the_literature.pdf.

Wood, R., Shorter, G., & Griffiths, M. (2014). Rating the suitability of responsible gambling features for specific game types: A resource for optimizing responsible gambling strategy. *International Journal of Mental Health and Addiction*, 12, 94–112.

World Lottery Association (2016). *The Year 2015 in Review*. Retrieved from https://www.world-lotteries.org/volumes/downloads/Download_Center/Annual_Review/WLA-Annual-Review-2015.pdf.

Yuan, J. (2011). Are lotteries substitutes for each other? *The Journal of Gambling Business and Economics, 5*(3), 1-14.

Yuana, J., & Gaob, J. Z. (2015). What drives lottery demand? Evidence from China's lottery practice. *International Gambling Studies, 15*(1), 159–178.

Zendle, D., & Cairns, P. (2018). Video game loot boxes are linked to problem gambling: Results of a large-scale survey. *PLoS ONE, 13*(11).

Zendle, D., & Cairns, P. (2019). Loot boxes are again linked to problem gambling: Results of a replication study. *PLoS ONE, 14*(3), 1-13.

Zendle, D., Cairns, P., Barnett, H., & McCall, C. (2020). Paying for loot boxes is linked to problem gambling, regardless of specific features like cash-out and pay-to-win. *Computers in Human Behaviour, 102*, 181-191.

Zendle, D., Meyer, R., & Over, H. (2019). Adolescents and loot boxes: links with problem gambling and motivations for purchase. *Royal Society Open Science, 19*(6), 1-18.

PART II

ESSAYS ON GAMBLING CONSUMER BEHAVIOUR

Chapter 3

Essay 1

Internet gambling: A critical review of behavioural tracking research

Abstract

This paper reviews and analyses studies that are focused on Internet gambling with the use of behavioural tracking and big data to identify gambling behaviour. The behaviour of gamblers has been extensively studied and much has been published on the subject. The vast majority of research has relied on self-reported gambling behaviour or case study research. With the advent of the Internet, however, it has become possible for researchers to remotely study the real behaviour of gamblers.

The goal has been to empirically describe playing behaviour in several conditions and contexts. Existing research, conducted since the 2000s, focuses on several forms of gambling such as sports betting, casino, poker, and lottery, but there is still only a concise body of research on gambling behaviour with the use of Internet gambling tracking data. Most studies are based on the same databases, meaning that a few companies and websites were the basis for most of the research produced so far. It is important to explore new sources of information, methodologies, and approaches to

enrich discussion and contribute to a better understanding of this field. The empirical analysis of gambling behaviour with the use of tracking data was found to greatly contribute to the understanding of player behaviour, despite existing limitations. Considering that Internet gambling behavioural tracking is still a fairly recent phenomenon, much can still be done to further develop this field of research.

Keywords: consumption, consumer behaviour, online gambling, Internet gambling, behavioural tracking, tracking data, big data

JEL classification: D12; D18; D81; D91; H31; M31; O33.

3.1 Introduction

Until 2006, Internet gambling studies on gambling behaviour were mainly based on self-reported methods and data (Griffiths, Parke, Wood, & Parke, 2006). More recently, a new trend in gambling research has appeared that is based on the data records of gambling players to observe and understand their gambling behaviour.

Considering gambling history in its entirety, Internet gambling is a more recent phenomenon. As a result, research on Internet gambling, particularly on gambling behaviour with the use of tracking data, is still in its infancy (Shaffer, Peller, LaPlante, Nelson, & LaBrie, 2010). Despite being a recent trend, empirical studies and new analytical methodologies are emerging with increasing intensity. The current proliferation of Internet gambling and other platforms, such as mobile devices, smartphones, tablets, and Internet protocol television, among other devices, has also raised the awareness of public policy makers and other gambling-related stakeholders, who have further expressed concern regarding the difficulty in controlling and/or surveying Internet gambling (European Commission, 2011). Internet gambling is classified as an online game in which payment is required, monetary prizes may be awarded, and the outcome of the game is predominately determined by chance (Gainsbury, Hing, Delfabbro, & King, 2014). Gambling activities offered over the Internet usually demand a player account. Gainsbury (2011) considers this to be a result of escalating technological sophistication and the incorporation of these developments into gambling.

In this article, we review the published literature on Internet gambling that tries to explain gambling behaviour and describe how this behaviour is characterized. Another objective of this paper is to understand whether the observation of real gambling behaviour provides relevant outputs for the creation of gambling products and effective responses for player protection. We foremost highlight some of the gaps found in the research literature on Internet gambling behavioural tracking and we contribute to the current debate by providing future research directions that might overcome such gaps. To do so, we focused on reviewing research published in peer reviewed papers in which real Internet gambling player data were used to analyse players' behaviour. Other researchers have previously focused on reviewing Internet gambling, namely, Shaffer et al. (2010). In their review, they question the validity of the data in self-reported studies and add that such studies do not provide any empirical evidence about Internet gambling. Furthermore, they assert that research findings on real Internet gambling behaviour show inconsistencies with self-reported patterns of Internet gambling, particularly the estimation of gambling behaviour.

Although they highlight these limitations in self-reported research and state that behavioural tracking research can overcome them, they also identify shortfalls in real-world gambling behaviour research. Notably, although their paper addresses behavioural tracking in gambling, they mention that their literature search did not return any behavioural tracking data or any tracking data in Internet gambling studies. The reason for this probably lies in the fact that they limited their search to only two databases (PubMed and PsycINFO) and two terms: ''Internet [AND] gambling.'' This proved to be a poor methodological choice, as the final outcome presented limitations that resulted in the failure to identify some Internet gambling studies, as demonstrated

by Griffiths (2010). Shaffer et al.'s (2010) review had a different objective from that of the present study, as it was not limited to a specific approach in Internet gambling research. In contrast, the main objective of this study was to exclusively identify and review Internet gambling research with the use of behaviour tracking. The purpose was to cover the studies that have, so far, been conducted on this issue and with the use of this method. Considering that Internet gambling behavioural tracking research is a fairly recent phenomenon and that Shaffer et al.'s (2010) review was limited to 2008, we also covered studies conducted after that year up to January 2017. Studies on Internet gambling with the use of behavioural tracking methods have contributed to the identification of gambling behaviour, but most of the initial studies consisted of descriptive analyses of gambling behaviour that lacked the support of theoretical models or frameworks and added limited contributions to theory. In this paper, we analyse player behaviour published in these studies and try to identify which of the shortcomings can be overcome in future research.

3.2 Method

A systematic search was carried out to identify the research produced and the literature published with the use of tracking data tools to identify real gambling behaviour. Considering the technology that enables such analysis, the search was limited to the period from January 2000 to January 2017. In this search, only academic

journals that used players' real gambling data to analyse their behaviour were considered. The following search terms were used: ''actual,'' ''behavioural tracking,'' ''tracking data,'' ''big data,'' ''real world,'' ''player card,'' and ''loyalty card,'' always in association with the term ''gambling.'' The terms were searched in the keywords, titles, abstracts, and text of the published literature on Internet gambling behaviour with tracking data. In the search, the same terms were used in four languages, English, French, Spanish, and Portuguese, to minimize any English publication bias. For the search, the following databases were used: Scopus, PsycINFO, Science Direct, PsycARTICLES, PubMED, Wiley Online Library Dissertations and Theses Academic Search Complete, Google Scholar, ProQuest, and EBSCO. In addition, the reference list of the studies that resulted from the search and other reviews already available in the literature was also analysed to identify other possibly relevant studies. The objective was to be as comprehensive as possible in identifying all studies conducted on real-world gambling behaviour.

3.3 Results

The analysis of the results generated by the search in the above-mentioned databases and the reference lists from other studies followed a two-step process. In the first step, after a thorough analysis of the titles, abstracts, and contents, we identified 120 studies, of which 83 were peer reviewed and 55 were analysed because they matched the inclusion and exclusion criteria. The articles that we found focused on

several types of gambling activities for analysis, such as sports betting, casino gambling, and poker gambling; several studies focused on multiple forms of gambling. Papers on excessive gambling and the prevention of risk gambling were also found. In the second step, we included or excluded studies by considering the following criteria. Inclusion conditions were twofold: (1) texts that were peer reviewed or refereed articles and (2) texts dealing with real-world Internet gambling behaviour with the use of tracking data. Exclusion conditions were (1) unpublished studies, (2) texts not relevant to the field of gambling studies, and (3) texts that were relevant for the study of gambling but did not use real Internet gambling data for the analysis of gambling behaviour.

3.4 Behavioural Tracking Gambling Behaviour

Research on Internet gambling is a fairly recent phenomenon. According to Stevens (2006), the first casino websites appeared in 1995. One year later, the first academic study on Internet gambling was published (Griffiths, 1996), a theoretical paper. Following that, it took over 10 years for the first empirical paper on Internet gambling with the use of tracking data to be published (LaBrie, LaPlante, Nelson, Schumann, & Shaffer, 2007). Most of the studies found on actual playing behaviour, especially the first studies, resulted from one database provided by Bwin Interactive Entertainment.

Recently, more studies have been published with the use of other tracking database information, such as win2day; Íslensk Getspá; Betchoice/Unibet; GTECH and

GTECH G2; Online Poker Database of the University of Hamburg [Germany]; and PokerStars. Behavioural tracking information can include account data (user ID, date of birth, gender, postal codes), game data (game ID, game type, amount of winnings, amount of money spent, number of bets/spins), financial data (amount of deposits, number of money withdrawals, number of accounts), responsible gaming limit data (time and spend limits, changes of limits), and miscellaneous data (length of playing session, login information, number of cool-off periods (Griffiths, 2013). Note that from the early 2000s, researchers were already using tracking data to evaluate gambling behaviour, but these studies focused on loyalty card data of players who gambled in brick-and-mortar venues rather than over the Internet.

Because the purpose of the present study was to focus on Internet gambling, studies with the use of tracking data that do not respect this criterion were not considered in this review. The use of behavioural tracking has been considered a good opportunity for researchers to examine the real behaviour of gamblers in contrast to that in offline gambling (Griffiths & Whitty, 2010). Researchers also advise gambling operators to use their large behavioural tracking data sets to help identify problem gamblers and not just for marketing purposes.

Because of its characteristics, Internet gambling has generated many concerns. Some of these concerns include accessibility to gambling; fast action play; inability to protect underage and problem gamblers; inability to restrict unprincipled marketing techniques, such as embedding and serial pop-ups; capacity to prevent gambling while players are intoxicated or at work (Griffiths, 1999; Griffiths & Parke, 2002); and unknown product safety level (Labrie et al., 2007). These concerns have translated into research and the implementation of measures intended to protect consumers, focusing

particularly on preventing underage gambling and gambling-related addiction (Adami, Benini, Boschetti, & Canini, 2013). Despite these efforts it remains questionable whether players can benefit from interventions that are based on this type of measures (Griffiths & Parke, 2010; Auer & Griffiths, 2013). LaBrie and Shaffer (2011), however, suggest that Internet gambling offers good conditions for the study of real gambling behaviour, as it allows the identification of patterns and consequently the development of interventions to develop strategies that promote balanced gambling behaviours.

The first research that we found on real-world Internet gambling behaviour was published in 2007 by LaBrie et al. It was a longitudinal study of sports gambling behaviour that analysed fixed-odds and live-action bets. LaBrie et al. (2007) intended to identify Internet gambling behaviour and its impacts. The researchers focused on the outcome of sporting contests and live-action bets for 40,499 Internet sports gambling service subscribers who enrolled during February 2005 and followed them for 8 months. Gambling behaviour was determined by analysing three variables transformed to measure gambling involvement: daily totals of the number of bets made, money spent, and money won.

In more recent years, increased interest has been shown in online gambling in general and Internet gambling in particular. Despite the growing interest, there is a limited body of research and publications about Internet gambling that use real-world playing data to identify gambling behaviour, although some researchers consider this new approach to gambling research to be of great relevance. According to Shaffer et al. (2010), the scientific shift from self-report to actual behaviour represents a methodological paradigm change for the field of gambling studies. Shaffer et al. (2010) claim that an accurate epidemiology of Internet gambling behaviour requires the

examination of Internet gambling behavioural tracking, as in any other pattern of human behaviour. Furthermore, they mention that this type of technology-enabled research is a shift to behavioural conceptual frameworks and research methods.

Most of the studies found on real-world playing behaviour result from the Bwin Interactive Entertainment, A.G., and Harvard Medical School Division on Addictions (DOA) research collaboration. This cooperation resulted from the concern about Internet-related addiction and was established to take advantage of new technologies to alleviate or prevent addiction (Shaffer et al., 2010). The original bwin database used for these studies was divided into multiple data sets, which were then used in several other studies. These data sets are now available as part of the Transparency Project and, since the first DOA studies, have been used by other non-DOA researchers who have produced several papers (Adami et al., 2013, Brosowski, Meyer, & Hayer, 2012). DOA researchers tried to describe gambling behaviour and some studies focused on the more extreme gamblers. A few focused on one particular form of gambling activity to analyse behaviour, while others covered several games, namely, the studies that analysed players' self-limitation or account closing. Data sets of Internet sports gambling behaviour were used by LaBrie et al. (2007) to determine Internet sports gambling behaviour; by Braverman and Shaffer (2010) to examine betting patterns displayed during the first month of Internet gambling of live-action sports, especially of bettors who later closed their accounts because of gambling-related problems, in order to identify features associated with gambling that might influence the emergence of addiction; by Broda et al. (2008) to examine the effects on gambling behaviour of imposed limits on the amount of money that users can deposit into their online gambling accounts; by LaPlante, Schumann, LaBrie, Nelson, and Shaffer (2008) to analyse

gambling participation and activity among a population of newly subscribed Internet bettors; by Xuan and Shaffer (2009) to examine behavioural patterns of real-world Internet gamblers who experienced gambling-related problems and voluntarily closed their accounts; and by LaBrie and Shaffer (2011) to discriminate sports bettors with self-reported gambling-related problems from sports bettors without such difficulties. LaBrie and Shaffer (2011) aimed to contrast the behaviour of players who closed their accounts because of gambling-related problems with the behaviour of other account closers who were either not satisfied with the service or no longer interested in betting.

A study by Nelson et al. (2008) analysed the gambling behaviour of players who used the site's self-limit feature. In that study, the data analysed was composed of a majority of subscribers who engaged primarily in sports betting, although some also played other games such as casino or poker. In a later study by Braverman, LaBrie, and Shaffer (2011), a similar characterization of the types of games played could be observed. Most players engaged in betting or sports betting, with only 3% of players not engaged in these types of gambling activities, which, according to Braverman et al. (2011), was probably due to bwin's main focus being on sports gambling. The researchers applied taxometric techniques to determine whether a taxon of Internet sports gamblers could be identified, but results failed to provide support for the view that the most involved Internet sports gamblers included a distinct category of gamblers. As mentioned, most players who comprised the *bwin* databases were engaged in sports betting, and thus it would be expected that most studies would focus on such players. Aside from that area of study, DOA researchers also studied the single-game gambling behaviour of other players included in the bwin database.

LaBrie, Kaplan, LaPlante, Nelson, and Shaffer (2008) conducted a prospective longitudinal study of real Internet casino gambling behaviour and LaPlante, Kleschinsky, LaBrie, Nelson, and Shaffer (2009) performed an epidemiological study on Internet poker gambling behaviour.

Because of the partnership established between Harvard's DOA and bwin, and since the Transparency Project is still fairly recent, it would be expected that most studies produced to date on real-world gambling would be under such collaboration. Other researchers have also used the bwin databases to analyse actual gambling behaviour. Despite the nature of the databases, namely, being composed mainly of players who engage mostly in sports betting, different approaches have been taken to behavioural tracking gambling research. One research concern that seems to be common to several studies relates to the identification of markers and playing characteristics that may lead to greater involvement with gambling and the possibility of developing excessive or compulsive gambling. This increased gambling involvement has also been studied by other researchers, and one of the research contributions is the development of measures and features that help players limit or prevent such risks.

Behavioural tracking research has also been developed in Australia by Gainsbury, Sadeque, Mizerski, and Blaszczynski (2012), who analysed the player account data of 11,394 customers of a large Australian wagering operator over a 10-year period. This is the longest period that we found of all of the studies reviewed. Gainsbury et al. (2012) intended to investigate the characteristics and betting patterns of players. They found that more frequent bettors tended to make smaller bets but bet greater total amounts. They also found that this group of gamblers lost smaller proportions than less frequent bettors did. Less frequent bettors bet larger single bets and lost a greater proportion of

their total amounts bet (Gainsbury et al., 2012). Gainsbury et al. (2012) suggest that such findings indicate that players exhibit differential patterns of betting. They argue that this allows for player segmentation, which can be used for player education and responsible gambling strategies for players who present different levels of gambling involvement and intensity.

3.5 Gambling involvement and gambling Intensity

Player behaviour is considered to be moderate when players can control their gambling activity and can decrease or stop gambling when they engage in heavier gambling. Players with higher involvement in gambling might not be addicted but may be on the way to developing such an addiction. These different levels are now identified by researchers and can provide relevant clues for identifying players who may need support and additional gambling control measures.

Dragicevic, Tsogas, and Kudic (2011) assessed the first month of play following registration by using four behavioural markers of casino gambling: trajectory, frequency, intensity, and variability. Their results did not provide concrete evidence of loss chasing among the website's players and so they could only infer that more intensive and frequent gamblers spend most of their time gambling on slot-type games, in contrast to moderate gamblers, who, although playing across all gaming types, have a preference for table games. Different games have distinctive characteristics and affect players in diverse ways; hence, studies that focus on specific types of games might produce

different results. Poker is such an example. To LaPlante et al. (2009), poker gambling poses a concern for public health by allegedly potentiating addictive behaviours. This game has specific characteristics, as it is considered a game in which player skill can influence outcomes and might create in players the illusion of control over the outcome (Fiedler, 2011). In addition, professionals can influence the behaviour patterns of gamblers. Fiedler (2011) analysed the data from the Online Poker Database of the University of Hamburg to determine player behaviour. In this study, he found that a small group of heavily involved poker players was responsible for most of the playing volume. In another study with the same database, Fiedler (2013) explored gambling habits over a 6-month period to analyse the playing habits of three subgroups of players: regulars, newcomers, and dropouts. The description of these subgroups depicts regulars as players with high expenditures and long-playing periods, newcomers as players with no (or very low) expenditures, and dropouts as players who stopped playing despite having played before. In Fiedler's (2013) research, the analysis of gambling activity included number of sessions, session length, total time spent playing, average number of tables played simultaneously, playing intensity in amount raked per hour, and playing volume in amount raked per hour over the total observation period. The aforementioned variables were referred to as gambling behaviour and are part of the players' ''gambling habits,'' which also include playing duration (days played from the first to the last observation) and the relationship between playing duration and the variables of the playing behaviour. Fiedler (2013) found that regular players tend to increase their playing volume over time, whereas for most newcomers, their playing volume tends to decrease over time (for a small but relevant group of newcomers in terms of prevention of pathological gambling, playing volume increased sharply). The

third group of players, dubbed by Fiedler (2013) as the dropouts, also have a tendency to decrease their playing volume over time. When analysing the correlation between variables, Fiedler (2013) found that when the total playing time of a player increases, the average number of tables played simultaneously also increases. Playing frequency in sessions per day was found to be negatively correlated to the variables of the playing behaviour of newcomers and dropouts, working as a moderator of gambling involvement for these groups, which does not apply to regular players.

Fiedler (2013) concluded that, although it seems counterintuitive, the more often that someone gambles, the lower the person's gambling involvement. One possible explanation given by this researcher is that losing money quickly prevents most people from playing more.

LaPlante et al. (2009) followed 3,445 Internet gamblers in a 2-year period to study their poker gambling behaviour in what the investigators consider to be the first prospective epidemiological study of real Internet poker gambling behaviour. They concluded that most Internet poker players moderated their behaviour on based on their wins and losses, but the most involved players did not show such moderation. Fiedler's (2011) results were consonant with those of LaPlante et al. (2009). Nevertheless, Fiedler (2011) considers that LaPlante et al.'s (2009) results should be interpreted carefully because he points out that the data sets are not representative, as bwin is mainly a sports betting operator and offers poker only on the side.

Furthermore, Fiedler (2011) considers LaPlante et al.'s (2009) study not to have addressed the role of skill in poker, which can lead to professional gamblers influencing the variables of gambling behaviour.

In a study with a more generalized approach to the assessment of online gambling and player behaviour, with the use of real data, Ma, Kim and Kim (2014) found that individuals' online gambling increases with any increase in cumulative net gains or cumulative net losses. They also found that recent losses reduce online gambling, whereas recent gains increase it. Another of their findings, which can be consider particularly relevant for the study of gambling involvement, namely in repeated behaviour situations, shows that regular use and extended use moderated the relationship between current and subsequent gambling, which they considered to be a series of risk-taking attempts with the potential of eventually becoming routine behaviours (Ma, Kim & Kim, 2014).

3.5.1 Discussing the best construct to measure gambling activity: A debate on theoretical loss

When analysing gambling activity, one of the most important aspects is to identify how players engage in such activities. Internet gambling is no exception. Regarding real gambling data, the issue of identifying the best method to assess individual levels of gambling engagement has raised a debate among several researchers in the field. The debate has mainly focused on two key concepts to determine a player's commitment to gambling: gambling involvement and gambling intensity.

To Auer and Griffiths (2015b), gambling intensity and gambling involvement are essentially the same concept descriptors of gambling activity, although they mention in a response to Braverman, Tom, and Shaffer (2013) that gambling involvement is a vague

concept. To these researchers (Auer & Griffiths, 2013; Auer, Schneeberger, & Griffiths, 2012), the most consistent measure for gambling intensity, or the amount risked by a player, is what they dubbed ‘‘theoretical loss,’’ which reflects a player’s risk propensity. Notably, although they consider the constructs of gambling intensity and gambling involvement to be equivalent when assessing gambling activity, they also mention that theoretical loss measures only monetary gambling intensity (Auer & Griffiths, 2014a, 2015b). Tom and Shaffer (2016) state that Auer and Griffiths’ (2014a, 2015b) definition of gambling intensity has shown inconsistencies across different studies. For Tom and Shaffer (2016), the evaluation of gambling involvement and intensity has been motivated by the specific variables and data they have collected or calculated. For these researchers, each of these constructs emerged because of the availability of the analogous gambling measures. In addition, Braverman, Tom, and Shaffer (2013) consider that calculating theoretical loss might not be that straightforward. They suggest that in games of skill and in games in which there is an interaction between the player, the house, and third parties or other agents (e.g., poker, prediction markets, and some sports betting frameworks), the calculation of theoretical loss may be different. Another issue when calculating theoretical loss is that it is assumed that a player will make optimal decisions at every opportunity to maximize expected value, although is not clear whether all players will always play optimally, especially recreational or infrequent gamblers (Tom & Shaffer, 2016). Tom and Shaffer (2016) argue that, on average, these players will have higher total amounts lost than their corresponding theoretical losses would imply. Tom and Shaffer (2016) also commented that theoretical loss is not a new concept, as it derives from the formula relating return on investment to expected value, and that it is a biased and flawed proxy that may not measure what it aims to (amount

lost or expected amount lost). Despite these claims, Auer and Griffiths (2015b, 2015c) maintain that when considering pure monetary measures of gambling intensity, theoretical loss is a more robust and accurate measure than other financial proxy measures, such as bet size, regarding the financial risk that players are willing to take while gambling.

Auer and Griffiths (2013) argue that previous studies that have used different approaches to determine gambling intensity (i.e., bet size and number of games played; Broda et al., 2008; Dragicevic et al., 2011; LaBrie et al., 2008; LaPlante et al., 2008, 2009; Nelson et al., 2008) did not take into account the element of chance and house advantages across different game types and that other variables could also have been considered (time spent gambling and/or the amount of money won or lost while gambling). In a more recent study, Auer and Griffiths (2015b) also argue that none of the bwin behavioural tracking studies has directly examined gambling duration, which they consider important for determining gambling involvement, especially among some specific types of gamblers such as poker players. Auer and Griffiths (2015b) also criticize the analysis of gambling activity that uses only one variable (bet/stake or total amount wagered) for gamblers who engage in different game types, as it can be misleading when comparing the degree of risky gambling behaviour. Despite the controversy over the issue of theoretical loss, Braverman Tom, and Shaffer (2013) agree that it is an interesting concept that can be useful to determine gambling intensity as long as it can be correctly calculated. In some cases, such as poker and other games or skills, such a calculation can be difficult to perform (Braverman, Tom, & Shaffer, 2013). For this reason, these researchers state that it is too early to dismiss other previous measures of gambling intensity and to replace them with a single construct. Braverman, Tom, and

Shaffer (2013) advise researchers to continue using multiple indicators of online gambling behaviour and to determine empirically which indicators are most useful.

When reviewing these studies, and in order to contribute to the debate raised by these researchers about the best way to assess involvement and intensity, we believe that different circumstances (games, players, type of data [cross-sectional or longitudinal], demographic, and geographic characteristics, etc.) must influence the methods and tools chosen, which should dictate the most appropriate ways to evaluate gambling involvement for each specific study.

Another important aspect is to understand whether players are really aware of their gambling activity. An approach that has recently been used to assess such player perceptions combines two methods of collecting gambling data. This approach results from comparing self-reported with real Internet gambling data. By combining the information collected from these two methods, researchers are able to understand how players picture their own gambling behaviour. This becomes even more relevant when considering the advantages, but especially the limitations, of each of these methods. By combining the two methods, researchers can also be more aware of real gambling behaviour and the motivations that can explain such behaviours. Only two studies have been conducted so far that evaluate the discrepancies between real gambling behaviour and players' estimations of their gambling activity. The first was done by Braverman, Tom, and Shaffer (2014). They compared individual-level gambling activity of self-reported data and real gambling data. The authors used real gambling data from bwin and compared it with players' responses to a questionnaire. The objective was to assess whether players' self-perception of their gambling activity corresponded to the data from actual betting results. The researchers found that, on average, between 34% and

40% of the participants underestimated their losses or overestimated their gains. They also found that the size of the discrepancy was associated with the self-reported presence of a gambling related problem. The second study was carried out by Auer and Griffiths (2017), who used real online gambling data from Norsk Tipping, the Norwegian operator.

They explored the relationship between objective (actual money spent gambling) and subjective (self-reported) information in relation to the individual players' attributes across different demographic (such as gender and age) and behavioural characteristics. Auer and Griffiths (2017) also aimed to assess whether players who engaged in high event frequency games (e.g., casino-type games) would be less accurate in estimating their losses compared with those players who engaged in low event frequency games (e.g., lottery games). They found that 9% of the players underestimated their losses or overestimated their wins, and 17% of the players overestimated their losses or underestimated their wins. The skewed perception of players also meant that, on average, players underestimated their losses by 15%. The estimation bias increased with the intensity of play. In addition, the types of games played were found to be predictive of the magnitude of the estimation bias. Lottery players were found to be the most accurate in their estimates, whereas scratch-card players and sports bettors were the worst. Scratch-card players showed the highest percentage of favourable bias and sports bettors the highest percentage of unfavourable bias in their gambling expenditure estimations. Auer and Griffiths (2017) mention that their findings suggest players with higher losses also tend to have more difficulty estimating their gambling expenditure accurately. These studies present interesting results that help in understanding gambling self-perception. One limitation, though, is that they assessed only gambling

expenditure. It would be interesting to see further research undertaken that uses other variables to evaluate gamblers' bias of the gambling perception of their gambling activities, such as time spent playing, the number of games played, and the number of bets placed.

3.5.2 At-risk, high-involvement, and excessive gambling

When players exceed what is designated as normal gambling activity, they may be considered at risk of developing gambling problems or may already be heavily involved or actively engaged in excessive gambling. The identification of such thresholds has been a challenge for researchers and a recurrent topic in gambling research, including behaviour tracking research.

The early detection of problem gambling has been a possible solution that researchers have explored. Some indicators that players might be having problems include (1) chasing losses, (2) total preoccupation with gambling, (3) increase in gambling behaviour over time, (4) playing with a variety of stakes, (5) playing a variety of games, (6) player ''reload'' of money within a gambling session, (7) frequent payment method changes, (8) verbal aggression within chat rooms, and (9) constant customer complaints (Griffiths, 2009). Adami et al. (2013) tried to identify at-risk gamblers in the early period of active betting, resorting to a segmentation strategy based on the analysis of behavioural player data from bwin. They identified two markers of gambling. The first focuses on a rapid drop in wager size over a wide range of fluctuation periods, which they ascribe to players exceeding their economic sustainability limits. The second

considers the number of games a player is involved in simultaneously, with the objective of predicting possible consequences of an excessive amount of time dedicated to gambling (Adami et al., 2013). According to these researchers, the use of such markers allows identification of larger segments of high- and medium-risk gamblers when compared with previous research on tracking data betting behaviours. In a study by the DOA, Braverman and Shaffer (2010) selected a sample of 530 live-action sports bettors from a data set that included 48,114 players who opened an account with bwin. They studied the betting patterns displayed during the first month of Internet gambling. The objective of their study was to predict the development of gambling-related problems by grouping gamblers who presented similar gaming patterns (Braverman & Shaffer, 2010). They found that players who are characterized by high intensity and frequency of gambling, as well as by high variability of wager (bet) sizes during their first month of gambling, were at higher risk than others of reporting gambling-related problems on closing their accounts. To analyse the risk factors of problem gambling behaviour, Braverman and Shaffer (2010) used four variables (intensity, frequency, variability, and trajectory). Braverman et al. (2011) analysed other indicators of betting behaviour, including total money lost, total number of bets, and total money wagered. According to Braverman et al. (2011), the results failed to provide support for the idea that the most involved Internet gamblers are a different group of players, and they found it too early to declare that excessive gambling behaviour is not qualitatively different from recreational sports gambling. In another approach, Gray, LaPlante and Shaffer (2012) used what they dubbed as nonmonetary indices of intensity of betting activity, which includes variables such as total bets placed, the number of active betting days, and the duration of the gambling activity. According to them, these variables can accurately

differentiate the playing behaviour of players who have triggered responsible gambling responses from players who did not face such interventions. Brosowski et al. (2012) also explored several data sets provided by the DOA as part of the Transparency Project to investigate the associations between participation in different gambling segments and at-risk gambling.

They chose transgression of day and net win/loss cut-offs as indicators of probable problematic involvement. They found that 60% of gamblers were involved in more than one form of gambling and that of these, 41% of the total stakes stem from casino games; they also found that the higher the number of games played consistently, the higher the risk of developing excessive gambling habits.

Studies on real-world gambling, so far, have aimed to increase the identification and understanding of early-stage problem gambling. Early identification can help in better comprehending gambling behaviour and in developing tools to help minimize the impacts of such practices. The following section describes how research was able to contribute to the development of player protection measures as part of responsible gaming policies. A key issue of these policies and measures is in understanding how useful they really are.

3.6 Social responsibility and player protection measures

Internet gambling allows players to play in different settings. In that sense, players may be gambling alone at home on their computer, or they might be playing in a myriad of different places, especially if using mobile devices. In addition, when playing online, there are no social constraints on the time or money spent on gambling. This has made social responsibility in gambling a central issue for the gaming industry (Auer & Griffiths, 2013).

On the other hand, the Internet allows implementation of preventive measures such as players' own pre-commitment and self-limitation, which are arguably easier to implement than in offline or land-based gambling venues (Dragicevic et al., 2011). Additional measures include self-exclusion and deposit and loss limit setting, which are now part of the player protection process featured in responsible gaming codes of practice and online gaming operators' social responsibility measures (Auer & Griffiths, 2013; Dragicevic, Percy, Kudic, & Parke, 2015). Despite the availability of such measures, researchers question whether they are really effective in long-term gambling behaviour (Auer & Griffiths, 2013; Dragicevic et al., 2015). In addition, only a few studies have validated the effectiveness of such social responsibility tools. While some report a positive impact in player behaviour, others have failed to find significant effects (Auer & Griffiths, 2014b). In order to understand whether such social responsibility practices have a positive impact, more research on the subject is needed (Auer & Griffiths, 2014b).

3.6.1 Self-Limitation, account closing, and other responsible gaming measures

3.6.1.1 Self-limitation

One of the social responsibility measures made available today by online gambling providers is the self-setting of time and money limits. Limits can be set on deposits, play limits, loss limits, and bets placed.

Auer and Griffiths (2013) argue that voluntary (rather than mandatory) limits are the most appropriate responsible gambling strategy to be implemented by gaming companies. They describe deposit limits as the maximum amount of money that a player can deposit into their play account at any given time. They also categorize play limits as the maximum amount of money that a player can play with at any given time. Loss limits refer to the maximum amount of money that a player is allowed to lose in one session and bet limits as the maximum amount of money that can be bet on a single game or on concurrent games (Auer & Griffiths, 2013). It is easy for a gambling operator to identify its top percentile players, being in total wagers, total amount spend, loss, etc. In such cases mandatory limits can be of use.

Gray et al. (2015), among other objectives, tried to understand whether they could find any sub-group of subscribers who gambled in a relatively intense way. Their study used data from an Icelandic internet gambling operator (*Íslensk Getspa*). They found that those who wagered the most money and those who made the most bets evidenced very high values for several variables compared to their less intense counterparts. But what about the situations where players might be below those limits but still might consider limiting their gambling activity in order to prevent further

engagement? This can be performed, by enabling players to place their own limits, usually below the ones set by the operator. Auer and Griffiths' (2013) study of self-limitation of gambling was performed by analyzing a random sample of 100,000 players who gambled on the win2day gambling website. The gambling website made all new players set time and cash-in limits. The researchers analysed a 3-month period of a subset of 5,000 gamblers, namely, the 10% with the most intense gambling activity, particular money losses. They found that casino and lottery gamblers had the highest significant effect on monetary spending after setting limits and that poker players had the highest significant decrease in playing duration (Auer & Griffiths, 2013). They further explain that because playing poker is a more time-consuming activity than other forms of gambling, setting time limits for the duration of playing activity can have a positive impact on this particular type of player. They also found that the most intense players set limits appropriately and decreased their time and/or money playing the month after the limits were set. Other research conducted by Nelson et al. (2008) was centred on bettors who imposed limits on the amount they were allowed to deposit on a betting site. They analysed betting transactions of more than 47,000 gamblers over 18 months. Self-limiting gamblers accounted for 567 players and were found to play a wider variety of games and place more bets than others, prior to imposing limits. After imposing their limits, self-limiters continued to wager the same amounts per bet but reduced their gambling activity. The researchers also found other indicators of gambling activity and gambling problems such as time spent gambling.

Broda et al. (2008) tried to evaluate the effects on gambling behaviour of imposed limits in account deposits of 47,000 bwin sports betting subscribers. Their period of analysis was greater than that of Nelson et al. (2008), as their research covered

2 years of gambling activity. Broda et al. (2008) found that only a small percentage of players (0.3%) exceeded deposit limits and concluded that Internet gamblers who exceed deposit limits are more willing to take high risks than are gamblers who do not exceed those limits. When the initial data were collected, there was a maximum deposit limit of EUR 1,000 per day or EUR 5,000 per 30 days, and players could also set lower depositing limits in the same period. They found that most players (95%) never deposited more than EUR 1,050 per 30 days, which is significantly lower than the maximum allowed. The analysis of the deposit limits was part of bwin's corporate social responsibility program. This limit-imposing strategy allows, according to Broda et al. (2008), a small loss of revenue while enabling the promotion effect for the company of being regarded as socially responsible. This argument is somewhat limited: In the case of this Internet gambling provider, deposit limits were company imposed, which means that in some cases, they might still be high and allow significant losses for some gamblers. Auer and Griffiths (2013) also draw consonant conclusions, as they found that self-limits have an effect on reducing gambling activity among the most intense players, both on time and money spent, although voluntary setting of time limits was considered less important than was voluntary setting of monetary limits. Such results regarding lottery games should be interpreted with care, as it is questionable as to whether setting limits (particularly time limits) would be beneficial because of the frequency of draws (e.g., once or twice a week). Another limitation of their study is the inability to determine whether changes in players' behaviour were due solely to voluntary limit setting or whether other variables also had an impact on such behaviour, as it is a significant change in usual behaviour that is most indicative of a problem gambler (Griffiths, 2009).

3.6.1.2 Account closing and self-exclusion

There are other measures that operators make available to protect players from engaging in excessive gambling, namely, the possibility of closing their own account or self-excluding from a particular gambling website. Xuan and Shaffer (2009) compared the behaviour of players who willingly closed their accounts to others who kept their accounts open during an 18-month study period. The researchers studied a cohort of 47,603 bwin subscribers. From this cohort, 226 gamblers who closed accounts because of gambling problems were selected and another 226 matched-case controls were selected from the group of gamblers who did not close their accounts. Xuan and Shaffer (2009) measured outcomes such as daily aggregates of stake, odds, and net loss. They also examined the number of bets to measure the trajectory of gambling frequency and found that account closers experienced increasing monetary loss and increased their stake per bet as the closure date approached, although their choice of wagers was more probabilistically conservative (i.e., short odds) compared with that of the controls.

Their findings suggest an involvement-seeking yet risk-averse tendency among self-identified problem gamblers that challenges the notion that problem gamblers seek ‘‘long odds’’ during ‘‘chasing.’’ Another study that also focused on account closing had a complementary approach, as it tried to identify the reasons that players closed their accounts. LaBrie and Shaffer (2011) tried to identify patterns of sports gambling that distinguished bettors with self-reported gambling-related problems from bettors without such problems; they analysed data from a 2-year period for 679 bettors who self-reported the reason for closing their accounts. They compared the behaviour of two

types of account closers. The first group reported closing their accounts because of dissatisfaction with the service or losing interest in playing.

The second group members reported having closed their accounts because of gambling-related problems. The researchers found that half of the account closers had gambling-related problems and exhibited a distinct pattern of sports-betting behaviour. When compared with other players, these gamblers made more and larger bets, bet more frequently, and were more likely to exhibit intense betting soon after enrolment. Haefeli, Lischer, and Schwarz (2011) focused on the identification of early warning signs for problem gambling and found that, to some extent, self-exclusion can be predicted by using information about communication between the player and operator. More recently, other researchers (Dragicevic et al., 2015) also studied players' self-exclusion in order to comprehend drivers of self-exclusion and contribute to consumer protection. Dragicevic et al. (2015) proposed a three-tier model for assessing at-risk gambling behaviours by using data that covers exhibited, declared, and inferred behaviour, which, according to them, eliminates weak features of any specific individual approach. They examined a data set of 240,482 casino and poker players and found that self-exclusioners tend to either wager more overall or to place riskier bets. These players also play significantly fewer types of games than do non-self-exclusion players. Dragicevic et al. (2015) also found that self-excluding players typically concentrated on casino playing and tended to spend less time on their most played game. These results are somewhat different from the conclusions of other studies, which found that multiple gambling involvement robustly predicted at-risk gambling (Brosowski et al., 2012). Dragicevic et al. (2015) also found that a quarter of players self-excluded within the same day of opening their accounts, which could imply that players self-excluded for

commercial purposes, such as seeking more attractive bonuses, or because they were already problem gamblers who gamble at other venues or Internet sites. Self-excluders tend to be predominantly men and individuals in their twenties or thirties (Hayer & Meyer, 2011).

3.6.1.3 Behavioural feedback and self-appraisal

In addition to self-limitation and account-closing features, other responsible gaming measures such as behavioural feedback, including pop-up messages, and self-appraisal have also been made available to players, with the aim of alerting players to excessive gambling to limit or reduce gambling behaviour. This type of tool can help players, especially if it is used in a tailored, non-judgmental, and motivational way, to increase the likelihood that players will gamble more responsibly (Auer & Griffiths, 2014b).

Auer and Griffiths (2015c) evaluated the effectiveness of a responsible gambling tool (mentor) that provides personalized feedback to online gamblers at a European online gambling site. They investigated whether players' gambling behaviour (i.e., time and money spent gambling) changed after receiving personalized feedback.

The authors indicate that the feedback system they analysed was able to significantly reduce time and money spent gambling. They suggest that such responsible gambling tools may help gamblers play more responsibly, although they did not approach problem gambling in this study. Auer and Griffiths (2016a) also examined the impact of the use of three types of information (i.e., personalized feedback, normative feedback, and/or a recommendation) from a behavioural tracking tool on players'

behaviour. They used three measures to assess the impact of the information given to players (theoretical loss, amount of money wagered, and gross gaming revenue).

Participants in their study sample (5,528) were drawn from the *Norsk Tipping* online platform (*Instaspill*) during April 2015. Auer and Griffiths (2016a) found that online gamblers who received personalized feedback spent significantly less money and time gambling in comparison to those who did not receive personalized feedback (i.e., the matched controls). They argue that the results support that personalized behavioural feedback can enable behavioural change in gambling, but that normative feedback does not appear to change behaviour significantly more than personalized feedback.

They also mention that the effect of the three types of messaging (i.e., personalized feedback, normative feedback, and a recommendation) appear to depend on players' gambling habits, as well as demographic and game-type factors. Lottery players and female scratch-card players were found to be more likely to read the message and act on messages than were casino players. However, despite the positive results, Auer and Griffiths (2016a) argue that because the gamblers who had used the behavioural tracking tool had volunteered to use it and had not been randomly assigned, the effect might not only be due to the feedback but also to other factors not controllable by them. In another study, Auer and Griffiths (2015a) investigated the effects of enhanced content of pop-up messages on player behaviour among online slot machine players of a gambling operator who used this feature as part of a responsible gambling program. Pop-up messages were triggered whenever a customer played 1,000 consecutive games on slot machines during a single online gambling session. When analysing the 6-month-period data, these investigators found that enhanced pop-up

messages doubled the number of gamblers who stopped playing when compared with gamblers who received a simple message, although they comment that pop-up messages influence only a small number of gamblers in ceasing gambling over long periods. In a previous study, Auer, Malischnig, and Griffiths (2014) were given access to a large, anonymized data set by a gambling operator (i.e., win2day) in which weekly cash-in limits cannot exceed 800 h at any time during and after registration, but players can voluntarily lower their time and money limits at any time. Their data set included two representative random samples of 200,000 gamblers who were exposed to pop-up messages intended to give feedback to players regarding time and money spent gambling on slot machines. They found that the introduction of a mandatory pop-up message on slot machines had a positive effect on deterring gambling behaviour in a small number of gamblers, although sample characterization variables such as age, sex, income, ethnicity, and levels of pathology were not taken into account and the data analysed was cross-sectional. Their results indicate that when players are exposed to a pop-up message after 1,000 consecutive gambles on an online slot machine game, which corresponds to playing time of between 50 and 66 minutes, nine times more gamblers ceased their gambling session than did gamblers who had not been exposed to such messages. The researchers concluded that pop-up messages can influence some gamblers to terminate their playing session; hence, pop-up messaging can help reduce excessive gambling within a session. Future research in this field could, for instance, try to better determine which player attributes correlate with positive behavioural changes and whether there are interactions with other variables, such as types of games played or the intensity of gambling that can be used to optimize behavioural changes (Auer & Griffiths, 2014b). Other directions of research might include showing personalized

behavioural feedback messages (including information about their recent wins and losses) to players on a regular basis and with varying content (e.g., emotional vs. warning vs. informative) to positively influence their gambling behaviour (Auer & Griffiths, 2016a). The results mentioned above show that some measures can increase the level of player protection. The study of the efficiency of such measures has benefited from the empirical analysis of real-world gambling behaviour. Among other advantages of using real gambling data to study behaviour and identify playing patterns is that it is also of possible benefit to players. The following section discusses the benefits and advantages that this methodology has brought to gambling research.

3.7 Advantages and limitations of behavioural tracking gambling research

3.7.1 Advantages of behavioural tracking gambling research

The field of gambling research has undoubtedly benefited from the possibility of studying actual playing behaviour by analysing real gambling data. Griffiths (2009) considers that the analysis of real gambling data presents an opportunity for gaming operators and researchers to examine players' real-time gambling behaviour, which may

be useful in the diagnosis of problem gambling. Griffiths and Whitty (2010) add that problem gambling can be identified without the need to assess the negative psychosocial consequences of problem gambling and even before being detected by empirical research, which can be used to trigger an online intervention (Griffiths, 2009).

This method has many advantages, one of the most immediate being the possibility to objectively monitor and examine individual gambling behaviour on a particular website (Auer et al., 2012; Griffiths & Auer, 2011) at relatively small expense (Adami et al., 2013). Other advantages include the possibility of recording players' individual gambling behaviour to later analyse it and allowing the analysis of big data in large sample sizes (Auer & Griffiths, 2014a; Griffiths & Auer, 2011).

In addition, real gambling behaviour analysis provides researchers with the ability to track site visitors as they gamble and enables the analysis of the actual environment and conditions under which gamblers place wagers, which can be revisited after the event itself has finished (Auer & Griffiths, 2013, 2014a; Auer et al., 2012).
Other reasons highlighted are based on the difference between behaviour tracking research and other methods such as self-reporting. The latter does not allow researchers to assess longitudinal gambling behaviour, nor does it allow players to risk their own money, whereas both are possible with behaviour tracking gambling analysis, which enables unbiased behaviour analysis (Peller, LaPlante, & Shaffer, 2008). It simultaneously avoids other drawbacks of self-reporting in which subjects have to remember past experiences, such as memory errors, self-presentation strategies, simple miscomprehension, and the phrasing of survey questions (Shaffer et al., 2010).

Real gambling data allow researchers to examine Internet gambling behaviour that is not influenced by the respondent's recollection of the events and is not affected

by biases in sampling (Shaffer et al., 2010). It also offers researchers the possibility of being in different geographic locations from the participants and peers, which allows multicultural research and makes the research process easier to perform (Griffiths, 2010). Real-world online gambling research is also considered to be relevant in areas such as gaming addictions, as it can be useful in gathering rich and sensitive information (Griffiths, 2010). Online gambling data allow the collection of larger, more diverse, and extreme samples (e.g., addicts), which would be more difficult or even impossible to attain in an offline situation (Griffiths, 2010).

Arguments in favour of these methods are centred on the possibility of allowing researchers a greater understanding of the probable influential factors responsible for gambling-related problems. In addition, researchers argue that it can be not only relevant for the study of player behaviour, but also to provide helpful insights for public policy makers (Shaffer et al., 2010), although this is not new to gambling research or exclusive of gambling research in which behaviour tracking data is used.

3.7.2 Limitations of internet gambling behavioural tracking research

The analysis of real gambling data to determine Internet players' behaviour has proved to be a research method that has enriched the study of gambling, but like any other method, it also has its limitations. One example is the situation in which the analysed period of a specific study might not be representative of typical behaviour (LaBrie et al., 2007). Another is that data are usually drawn from one website and players

tend to, or might, play on various websites (Adami et al., 2013; Auer & Griffiths, 2013, 2014a; Auer, Schneeberger, & Griffiths, 2012; Dragicevic et al., 2011, 2015; Fiedler, 2011; Griffiths, 2012; Shaffer et al., 2010). To Griffiths (2012,), after players reach their money or time limit, they may initiate gambling activities on other online gambling websites. In addition, players might play in land-based or offline venues (Adami et al., 2013; Dragicevic et al., 2011, 2015; LaBrie et al., 2007; Xuan & Shaffer, 2009). This might induce a researcher to incorrectly characterize players, as their gambling activity on the analysed gambling website data might be only a small fraction of their gambling activity and expenditure (Griffiths, 2012). Moreover, information regarding the number of websites in which a player might be a subscriber is usually unavailable. Because data are generally collected from only one gambling site, this does not allow researchers to identify and indicate general online gambling. Although less likely, players might also use different player accounts within the same website (Fiedler, 2011). The study of real Internet gambling data, specifically in longitudinal studies, allows real gambling behavioural tracking, but it is difficult to understand whether the player account might also be used by more than one person (Auer & Griffiths, 2013, 2014a; Fiedler, 2011; Griffiths, 2012; Shaffer et al., 2010). The registered person could also be placing bets for others, which can influence playing activity and hence determine individual playing behaviour (Shaffer et al., 2010). This happens in situations in which other individuals choose not to, or cannot, register an account themselves. The latter is the case with minors (Fiedler, 2011). In addition, gamblers might engage only in unregistered online gambling activities (Dragicevic et al., 2015).

There are many gambling websites offering different types of games. When a researcher analyses gambling data from a specific website, that specific website's

subscribers might be more likely to engage in the form of gambling that the website is specialized in. Shaffer et al. (2010) consider that the subscriber population in their study, on the basis of bwin data, might be more likely to engage in sports betting because of the nature of the operator. Thus, the findings of their study might not be indicative of Internet gamblers' gambling behaviour. Representativeness is also challenged when player information is lacking. Researchers are dependent on subscriber's self-reported demographic information to characterize players, and the information provided might not always be correct (Shaffer et al., 2010). This raises the question as to whether, in such cases, players are representative of the customer base of a particular website, as well as other providers, or even of the entire online gambling community (Brosowski et al., 2012). Marketing campaigns and other factors might also influence gamblers' acquisition and player registry. This may impact on gamblers' characteristics and profiles, although longer longitudinal studies can overcome such limitations (Brosowski et al., 2012; LaBrie et al., 2007; LaBrie & Shaffer, 2011). Other limitations are related to the fact that there is usually no information about subscribers' income, which does not allow a comparison of their expenditure with their earnings (LaBrie et al., 2007; Xuan & Shaffer, 2009). Griffiths (2010) also raises the issue of the validity of reported players' characteristics, namely, demographic data, or concerning players' psychological characteristics, including addictiveness. This resides in the fact that players' demographic characteristics are still collected by using the subscriber's self-reported information (Shaffer et al., 2010). Griffiths (2011) also considers that these limitations do not allow examination of other behaviours and habits, such as alcohol and tobacco use, and are limited in determining problem gambling. The clinical characteristics and perceptions of players and the consequences of their gambling behaviour are also

difficult to evaluate under such research methods. Perhaps the greatest limitation of this method is related to the fact that real gambling data does not explain why people gamble or why they engage in a particular online activity (Griffiths, 2012). Additional limitations are related to ethical issues in using behavioural tracking data without gamblers' awareness. This raises issues on informed consent and invasion of the gambler's privacy (Griffiths & Whitty, 2010).

3.8 Discussion

The body of published work on real-world Internet gambling behaviour is still limited. This is probably because researchers started to have access to such data only a few years ago. Despite this fact, there is a noticeable trend in the industry to make data available to researchers, as shown by recent studies. With some markets moving to more liberalized regulation models and the increasing availability of data, it may be possible in the near future for more researchers to become interested in this field and dedicate their research efforts to studying gambling behaviour by using real gambling data. So far, studies have essentially been conducted with data from European and Australian players. It would be interesting to conduct studies in different locations, namely, North America, which is a big market for gambling. In addition, it is important to explore new sources of information, methodologies, and approaches to enrich

discussion and contribute to a better understanding of this field. In the literature reviewed, it was possible to identify the advantages, the limitations, and some of the future research directions that may contribute to advancing the body of knowledge in this field. To Dragicevic et al. (2011), future research might include risk factors and the assessment of trends of player spending, deposits, losses, changes in player funding sources, and gambling behaviour related to time spent gambling. Another direction for future research is the integration of findings from studies of behavioural tracking with self-report data (Adami et al., 2013; Dragicevic et al., 2011; Shaffer et al., 2010, 2011). One such possibility is to combine these methods so they can be used to identify players' clinical characteristics or perceptions, or the social consequences associated with their betting behaviour. An efficient combination of self-report with analysis of real player behaviour may provide important insights into betting behaviour for key stakeholders, including policy makers, which can lead to the development of appropriate regulation that does not overly restrict recreational players, but offers appropriate safeguards (Gainsbury & Russell, 2015).

3.9 Future research

Other further research paths also involve safer gaming parameters. Auer and Griffiths (2013) address the need to further study gambling behaviour of players when they are approaching their self-limitation or mandatory time and money limits. These

future studies should try to understand whether the setting of limits brings only benefits for players or whether it can also be, in some cases, counterproductive and encourage greater gambling. Auer and Griffiths (2013) consider that more research is needed to assess the impact that spending limits might have on a player's behaviour over time, in order to provide evidence of changes made in gambling behaviour so that responsible gambling measures can be developed accordingly. Other measures for player protection that can be found today include players' self-exclusion. Future research on this subject intends to better identify types of self-excluders, as they might have different behaviours of self-exclusion and different motives to self-exclude. Some might engage in repeated patterns of self-exclusion, whereas others exclude themselves only after spending a considerable amount of time and money on gambling (Dragicevic et al., 2015).

As discussed in the present paper, one of the limitations of conducting research on gambling with behavioural tracking is that researchers do not know what compels players to behave in a certain way. Xu and Harvey (2014) conducted a study on sports betting to access players' beliefs on next outcomes after a series of winning or losing plays. They found that the behaviour of players changed their games according to whether they had been winning or losing. Sports gamblers expected their luck to reverse in such situations. Although their study does not entirely explain why players behave in a certain way, it helps to draw some conclusions that may get researchers closer to understanding players' beliefs and behaviours. This type of research reinforces the need to better understand players' motivations and is a pillar of one of the future trends in player behaviour research. Working with data that are extracted from the Internet or other online gambling databases enables the study of the real behaviour of individuals

and helps researchers to better understand how players behave. To explain the motivations and reasons for such behaviour, researchers should use complementary approaches and methods so that, when combined, a clearer and more in-depth picture of player behaviour can be drawn.

This approach can help researchers, operators, and policy makers to better deal with gambling regulations, thresholds, and policies that can better serve players in a responsible way.

A different research direction may be based on the current trends in online social networks, which also include gaming activities and are becoming increasingly entangled with classic gambling activities. Gambling and gaming are converging as gaming operators begin offering gambling products and as gambling operators use social games as stand-alone products as well as marketing opportunities (Gainsbury et al., 2014). Today's social casino games (the central theme of which is simulation of a gambling activity; e.g., poker, slots, roulette, bingo, keno, betting), together with virtual worlds and augmented reality games, are blurring the boundaries between gaming and gambling. Also contributing to this situation are virtual currencies that are often used in games in which monetary payments are required to play but do not provide monetary prizes. Examples include console games and paid mobile apps with gambling themes (Gainsbury et al., 2014). Monetization is a current trend across many industries and sectors, from which gaming activities appear not to have escaped.

In conclusion, and regardless of the course chosen to conduct further research, it is clear that the analysis of tracking data has already greatly contributed to better identifying and understanding player behaviour, despite existing limitations and problems. It is important to sustain the trend found in the analysis of the latest studies

published and reviewed here, and this should point to further research. Researchers must not solely analyse empirical data and describe behaviour but should also take advantage of such information as a basis for the development of solid gambling theory in order to advance science in this field.

References

Adami, N., Benini, S., Boschetti, A., & Canini, L. (2013). Markers of unsustainable gambling for early detection of at-risk online gamblers. *International Gambling Studies*, *13*, 188–204.

Auer, M., & Griffiths, M. D. (2013). Voluntary limit setting and player choice in most intense online gamblers: An empirical study of gambling behaviour. J*ournal of Gambling Studies*, *29,* 647–660.

Auer, M., & Griffiths, M. D. (2014a). An empirical investigation of theoretical loss and gambling intensity. *Journal of Gambling Studies, 30*, 879–887.

Auer, M., & Griffiths, M. D. (2014b). Personalised feedback in the promotion of responsible gambling: A brief overview. *Responsible Gambling Review, 1*, 27–36.

Auer, M., & Griffiths, M. D. (2015a). Testing normative and self-appraisal feedback in an online slot-machine pop-up in a real-world setting. *Frontiers in Psychology*, *6*(339), 1-7.

Auer, M., & Griffiths, M. D. (2015b). Theoretical loss and gambling intensity (revisited): A response to Braverman et al. (2013). *Journal of Gambling Studies*, *31*, 921–931.

Auer, M., & Griffiths, M. D. (2015c). The use of personalized behavioural feedback for online gamblers: An empirical study. *Frontiers in Psychology*, *6*, 1406. doi:10.3389/fpsyg.2015.01406.

Auer, M., & Griffiths, M. D. (2016a). Personalized behavioural feedback for online gamblers: A real world empirical study. *Frontiers in Psychology*, *7*, 1875.

Auer, M., & Griffiths, M. D. (2017). Self-reported losses versus actual losses in online gambling: An empirical study. *Journal of Gambling Studies*, *33*(3), 795–806.

Auer, M., Malischnig, D., & Griffiths, M. D. (2014). Is ‘‘pop-up’’ messaging in online slot machine gambling effective as a responsible gambling strategy? *Journal of Gambling Issues, 29*, 1–10.

Auer, M., Schneeberger, A., & Griffiths, M. D. (2012). Theoretical loss and gambling intensity: A simulation study. *Gaming Law Review and Economics, 16*, 269–273.

Braverman, J., LaBrie, R. A., & Shaffer, H. J. (2011). A taxometric analysis of actual Internet sports gambling behaviour. *Psychological Assessment, 23,* 234–244.

Braverman, J., LaPlante, D. A., Nelson, S. E., & Shaffer, H. J. (2013). Using crossgame behavioural markers for early identification of high-risk Internet gamblers. *Psychology of Addictive Behaviours, 27*, 868–877.

Braverman, J., & Shaffer, H. J. (2010). How do gamblers start gambling: Identifying behavioural markers for high-risk internet gambling. *European Journal of PublicHealth, 22*, 273–278.

Braverman, J., Tom, M., & Shaffer, H. J. (2013). Tilting at windmills: A comment on Auer and Griffiths. *Journal of Gambling Studies, 31*, 359–366.

Braverman, J., Tom, M. A., & Shaffer, H. J. (2014). Accuracy of self-reported versus actual online gambling wins and losses. *Psychological Assessment, 26*, 865–877.

Broda, A., LaPlante, D. A., Nelson, S. E., LaBrie, R. A., Bosworth, L., & Shaffer, H. J. (2008). Virtual harm reduction efforts of internet gambling: Effects of deposit limits on actual Internet sports gambling behaviour. *Harm Reduction Journal, 5,* 1–27.

Brosowski, T., Meyer, G., & Hayer, T. (2012). Analyses of multiple types of online gambling within one provider: An extended evaluation framework of actual online gambling behaviour. *International Gambling Studies, 12,* 405–419.

Dragicevic, S., Percy, C., Kudic, A., & Parke, J. (2015). A descriptive analysis of demographic and behavioural data from Internet gamblers and those who self-exclude from online gambling platforms. *Journal of Gambling Studies, 31*, 105–132.

Dragicevic, S., Tsogas, S. B., & Kudic, A. (2011). Analysis of casino online gambling data in relation to behavioural risk markers for high-risk gambling and player protection. *International Gambling Studies, 11*, 377–391.

European Commission. (2011). Green paper on on-line gambling in the Internal Market. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0128&from=EN.

Fiedler, I. (2011). The gambling habits of online poker players. *The Journal of Gambling Business and Economics, 6, 1*–24.

Fiedler, I. (2013). Gamblers' habits: Empirical evidence on the behaviour of regulars, newcomers and dropouts. J*ournal of Gambling Studies, 29*, 289–309.

Gainsbury, S. (2011). Player account-based gambling: Potentials for behaviour based research methodologies. *International Gambling Studies, 11*, 153–171.

Gainsbury, S., Hing, N., Delfabbro, P. H., & King, D. L. (2014). A taxonomy of gambling and casino games via social media and online technologies. *International Gambling Studies, 14*, 196–213.

Gainsbury, S., & Russell, A. (2015). Betting patterns for sports and races: A longitudinal analysis of online wagering in Australia. *Journal of Gambling Studies, 31*, 17–32.

Gainsbury, S., Sadeque, S., Mizerski, R., & Blaszczynski, A. (2012). Wagering in Australia: A retrospective behavioural analysis of betting patterns based on player account data. *Journal of Gambling Business & Economics, 6*, 50–68.

Gray, H. M., Jónsson, G. K., LaPlante, D. A., & Shaffer, H. J. (2015). Expanding the study of internet gambling behaviour: Trends within the Icelandic lottery and sportsbetting platform. *Journal of Gambling Studies, 31*, 483–499.

Gray H.M., LaPlante, D.A., & Shaffer, H.J. (2012). Behavioral characteristics of Internet gamblers who trigger corporate responsible gambling interventions. *Psychology of Addictive Behaviors*, *26*(3), 527-535.

Griffiths, M. D. (1996). Gambling on the internet: A brief note. *Journal of Gambling Studies, 12*, 471–473.

Griffiths, M. D. (1999). Gambling technologies: Prospects for problem gambling. *Journal of Gambling Studies, 15,* 265–283.

Griffiths, M. D. (2009). Social responsibility in gambling: The implications of real-time behavioural tracking. *Casino and Gaming International, 5*, 99–104.

Griffiths, M. D. (2010). The use of online methodologies in data collection for gambling and gaming addictions. *International Journal of Mental Health Addiction, 8*, 8–20.

Griffiths, M. D. (2011). Empirical Internet gambling research (1996–2008): Some further comments. *Addiction Research and Theory, 19*, 85–86.

Griffiths, M. D. (2012). Internet gambling, player protection and social responsibility. In R. Williams, R. Wood, & J. Parke (Eds.), *Routledge handbook of internet gambling* (pp. 227–249). London, United Kingdom: Routledge.

Griffiths, M. D. (2013). *Behavioural tracking in gambling: New empirical data and the development of a new social responsibility tool* [Powerpoint slides]. Retrieved from http://www.responsiblegambling.org/docs/discovery-2013/behaviouraltracking-in-gambling-new-empirical-data-and-a-new-social-responsibility-tool.pdf?sfvrsn=4

Griffiths, M. D. (2014). *The use of behavioural tracking methodologies in the study of online gambling*. SAGE Research Methods Cases. Retrieved from http://methods.sagepub.com/case/behavioural-tracking-methodologies-in-the-study-of-online-gambling.

Griffiths, M. D., & Auer, M. (2011). Approaches to understanding online versus offline gaming impacts. *Casino and Gaming International, 7*, 45–48.

Griffiths, M. D., Parke, A., Wood, R., & Parke, J. (2006). Internet gambling: An overview of psychosocial impacts. *UNLV Gaming Research & Review Journal, 10*, 27–39.

Griffiths, M. D., & Parke, J. (2002). The social impact of internet gambling. *Social Science Computer Review, 20*, 312–320.

Griffiths, M. D., & Parke, J. (2010). Adolescent gambling on the internet: A review. *International Journal of Adolescent Medicine and Health, 22*, 58–75.

Griffiths, M. D., & Whitty, M. W. (2010). Online behavioural tracking in Internet gambling research: Ethical and methodological issues. *International Journal of Internet Research Ethics, 3,* 104–117.

Haefeli, J., Lischer, S., & Schwarz, J. (2011). Early detection items and responsible gambling features for online gambling. *International Gambling Studies, 11*, 273–288.

Hayer, T., & Meyer, G. (2011). Internet self-exclusion: Characteristics of self-excluded gamblers and preliminary evidence for its effectiveness. International *Journal of Mental Health and Addiction, 9*, 296–307.

LaBrie, R. A., Kaplan, S., LaPlante, D. A., Nelson, S. E., & Shaffer, H. J. (2008). Inside the virtual casino: A prospective longitudinal study of actual Internet casino gambling. *European Journal of Public Health, 18*, 410–416.

LaBrie, R. A., LaPlante, D.A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: A prospective longitudinal study of Internet sports gambling behaviour. *Journal of Gambling Studies, 23*, 347–362.

LaBrie, R. A., & Shaffer, H. J. (2011). Identifying behavioural markers of disordered Internet sports gambling. *Addiction Research, & Theory, 19*, 56–65.

LaPlante D A., Kleschinsky J H., LaBrie R A., Nelson S E., & Shaffer H. J. (2009). Sitting at the virtual poker table: A prospective epidemiological study of actual Internet poker gambling behaviour. *Computers in Human Behaviour, 25*, 711–717.

LaPlante, D. A., Schumann, A., LaBrie, R. A., Nelson, S. E., & Shaffer, H. J. (2008). Population trends in Internet sports gambling. *Computers in Human Behaviour, 24*, 2399–2414.

Ma, X., Kim, S. H., & Kim, S. S. (2014). Online gambling behaviour: The impacts of cumulative outcomes, recent outcomes, and prior use. *Information Systems Research, 25*, 511–527.

Nelson, S. E., LaPlante, D. A., Peller, A. J., Schumann, A., LaBrie, R. A., & Shaffer, H. J. (2008). Real limits in the virtual world: *Self-limiting behaviour of Internet gamblers. Journal of Gambling Studies, 24*, 463–477.

Peller A J., LaPlante D A., & Shaffer, H. J. (2008). Parameters for safer gambling behaviour: Examining the empirical research. *Journal of Gambling Studies, 24*, 519–534.

Shaffer, H. J., Peller, A. J., LaPlante, D. A., Nelson, S. E., & LaBrie, R. A. (2010). Toward a paradigm shift in Internet gambling research: From opinion and self-report to actual behaviour. *Addiction Research and Theory, 18*, 270–283.

Shaffer, H. J., Peller, A. J., LaPlante, D. A., Nelson, S. E., & LaBrie, R. A. (2011). Research using actual behaviour encourages and confirms accurate self-report: A response

to Griffiths' (2010) further comments. *Addiction Research and Theory, 19*, 87–88.

Stevens, R. (2006). Internet gambling bibliography: Update and analysis. *UNLV Gaming Research & Review Journal, 10,* 95–100.

Tom, M. A., & Shaffer, H. J. (2016). Devil in the details: A critical review of ''theoretical loss.'' *Journal of Gambling Studies, 32*, 865–875.

Xu, J., & Harvey, N. (2014). Carry on winning: The gamblers' fallacy creates hot hand effects in online gambling. *Cognition, 131*, 173–180.

Xuan, Z., & Shaffer, H. J. (2009). How do gamblers end gambling: Longitudinal analysis of Internet gambling behaviours prior to account closure due to gambling related problems. *Journal of Gambling Studies, 25*, 239–252.

Chapter 4

Essay 2

Consumer profile segmentation in online lottery gambling utilizing behavioural tracking data from the Portuguese national lottery[4]

Abstract

The present study is the first to examine account-based tracking data of Portuguese online lottery players comprising the gambling activity of all active players over a one-year period (N=154,585). The main research goal was the identification of groups or segments of players by their engagement levels (high, neutral, low) and to assess preferences in product category with the use of CHAID (Chi-Square Automatic Interaction Detection) segmentation models, based on expenditure and sociodemographic variables. Findings showed that (i) age was found to be the most influential differentiating variable in player segmentation and had a positive correlation

[4] Reproduced with permission from Springer Nature.

with expenditures and wagers, (ii) gender was the second most influential variable (males represented 78.7% of players), (iii) education the third most influential variable and had a negative correlation with expenditure, and (iv) region was the least relevant variable. The models generated several players segments that engaged in different games. Older males (54-64 years; ≥ 65 years) were the most engaged overall. Younger males (18-34 years) were the least engaged but showed preferences for lotto as did females (35-49 years). Lower educated males and older males (49 years+) with a high school education were the most engaged in instant lottery games. These findings show that Portuguese lottery players can be grouped into several segments with distinct demographic characteristics and corresponding engagement levels. These findings help support more effective marketing segmentation and will help in the targeting of responsible gambling approaches.

Keywords: lottery gambling; internet gambling; online gambling; behavioural tracking; segmentation models; big data.

JEL classification: C32; C33; D12; D18; D91; M31.

4.1 Introduction

Up until 2010, self-report surveys dominated the existing lottery literature (LaPlante, Gray, Bosworth, & Shaffer, 2010) but despite increasing use of tracking data to examine gambling behaviour, to date, only a few studies have included lottery tracking data in their analysis of gambling behaviour. Of the studies that include real lottery playing activity most do not examine lottery exclusively but also include other forms of gambling within the same operator's datasets (e.g., Auer & Griffiths, 2013, 2014, 2017, 2018; Challet-Bouju, et al., 2020; Yuan, 2015). Consequently, this does not allow for an exclusive determination of online lottery players characteristics. The approach taken in previous studies did not focus on segmenting lottery players using real playing data. The present study aimed to identify online lottery players segments using real playing data from the Portuguese national lottery with nationally representative data.

Segmentation is a strategy commonly used in marketing to recognize differences between consumers and their needs or preferences and grouping them according to a set of common characteristics (Dickson & Ginter, 1987; Kotler & Armstrong, 2018). When recognizing the existence of consumers with different preferences, marketers often apply "differentiated" marketing strategies for different market segments (Kotler & Armstrong, 2018). In lottery gambling this can be very useful because lottery operators can better segment their customers and devise the best marketing and responsible gaming strategies to reach different groups of players, with different objectives. The present study uses a behavioural segmentation approach which is a

marketing strategy that is considered the best for building market segments (Kotler & Armstrong, 2018), as it can be used to divide buyers into segments based on their usage rate, or responses to a product. It is of particular importance for both researchers and gambling operators because it can differentiate players by engagement levels (e.g., low, medium, and high engagement).

Many of the previous studies that used real playing tracking data did not use nationally representative data which does not allow to extrapolate their results to the population nor compare their results with the general population, which was possible in the present study. Additionally, the present study is the first to be conducted on Portuguese lottery players with the use of real player account data. The objectives of the present study stemmed from previous studies' theoretical assumptions and gaps, in which sociodemographic variables were used to study gambling behaviour (Gray, Jonsson, LaPlante, & Shaffer, 2015; Kaizeler & Faustino, 2010, 2011, 2012, 2014). Previous studies' limitations in addressing players' common socio-demographic and playing characteristics allowed the present study to go further and understand how online lottery players behavioural activity enables the identification of specific segments with similar sociodemographic characteristics, within the same group but distinguishable from other segments. To identify these groups of players, specific hypotheses were formulated to define online lottery players' segments and meet the present study's main aim. Additionally, the study was able to identify and rank sociodemographic variables by their potential to form specific identifiable segments that can address both marketing and responsible gaming purposes.

4.2 Literature review and theoretical background

There is a considerable amount of literature on lottery gambling behaviour but the body of published research with nationally representative data is considerably narrower. Additionally, there are only a few studies that have used actual playing data and very few studies have included nationally representative datasets, such as used in the present study. Popular approaches in the study of lottery gambling include socio-demographic and economic analysis of gambling behaviour alongside player profiling, but no studies have taken a player segmentation approach by using real playing data, such as the one employed in the present study, which allows a more precise picture of how players group according to sociodemographic variables and game playing preferences. Studies on countries with higher levels of education sell fewer lottery products (Ariyabuddhiphongs, 2011; Kaizeler & Faustino, 2010) and lottery sales are higher in countries in which the percentage of males is higher than that of females for that country's whole population (Clotfelter and Cook, 1989; Kaizeler & Faustino, 2010). A 1% increase in the number of males in the gender ratio of the overall population produces an increase of 13.4% of a country's per-capita lottery sales, which corresponds to about $270 US annually (Kaizeler & Faustino, 2010), although this gender ratio has not been tested or observed for online lottery gamblers specifically, namely with the use of with real playing data.

Older studies on gambling report that age is negatively related to gambling behaviour, so as age increases gambling participation decreases, (Mok & Hraba, 1991).

Contradictory findings were reported by (Clotfelter & Cook, 1989) and later by (Kaizeler & Faustino, 2012) as they reported that the pattern of lottery participation by age was an inverted U, with the broad middle range (aged 25-64 years) playing more than the young (18-24 years) and the old (65 years and above) (Ariyabuddhiphongs, 2011) reported that the relationship between age and lottery participation was no longer in an inverted U-shape and reported that all ages play lottery and although the 61+ years age group has the lowest rate of participation in lottery gambling, their mean individual lottery expenditures are the highest. A 2011 study asserted that the shape of this pattern could be somewhat different as Barnes, Welte, Tidwell, & Hoffman, 2011) report that the frequency of gambling on the lottery increased sharply from mid-adolescence to age 18 years (which is the legal age to purchase lottery tickets in most US states) and continued to increase into the thirties when it levelled off and remained high through the sixties and then decreased among those 70 years and older. Despite these findings, Afifi, LaPlante, Taillieu, Dowd, & Shaffer (2014) claimed the role of gender and age in the relationship between gambling and engagement had not been established. The present study analysed these relationships further to clarify the role of these and other sociodemographic variables in lottery gambling playing and engagement.

4.2.1 Lottery gambling in Portugal

Studies on lottery playing in Portugal are scarce and most research has not been published in peer-reviewed journals (Hubert & Griffiths, A Comparison of Online Versus Offline Gambling Harm in Portuguese Pathological Gamblers: An Empirical Study, 2018).

Also, there are no previous studies that focus specifically on online lottery players, especially with the use of real playing data. Additionally, there is only one study on lottery gambling in Portugal that can be considered nationally representative (N=3,850; ages 18–70 years) (Lopes, 2009, 2010). However, the study was based on self-report data, and it has not been published in a peer-reviewed journal and does not analyse specifically online and offline lottery players. In this study, the prevalence rate of lottery gambling was found to be 51.3% over a one-year period in 2007 (Lopes, 2009, 2010). Calado and Griffiths (2016) noted that the prevalence of gambling and problem gambling in Portugal appeared to be similar to other European countries.

In their worldwide studies, Kaizeler, Faustino and Marques (2014) also analysed lottery sales in Portugal, considering socio-demographic variables for the characterization of the players. They found that for each Eur1 increase in the income of the habitants of a particular district, there was an increase of 4.4% in the same district's aggregate lottery sales. They also highlighted that, richer Portuguese districts spent more on lottery gambling than poorer ones (Kaizeler et al., 2014). Kaizeler et al.'s (2014) five-year analysis of lottery sales in Portugal (2004 to 2008) showed that lottery sales reach their maximum when annual per capita income was 13,208.15 Eur, with a corresponding annual lottery sales value per capita of 291.68 Eur, and declined thereafter.

Portuguese players' education level has also been found to have a negative correlation with lottery spending. Each 1% increase in a district's secondary school graduation rate leads to an approximate decrease of 162 Eur in lottery sales (Kaizeler et al., 2014). Using a non-representative sample, Brochado, Santos, Brochado and Esperança (2018), also examined the relationship between lottery playing frequency and

education among Portuguese lottery games players. They only established a relationship for scratch-cards and did not find a specific relationship between passive/class lottery playing frequency and education. More specifically, Portuguese lower educated lottery players were found to have higher scratch-card gambling frequency than more educated Portuguese lottery players (Brochado et al., 2018). Brochado et al.'s (2018) study focused on motivations to play on *EuroMillions* and passive/class lottery players versus playing scratch-cards. They found that *EuroMillions* players tended to be males with lower incomes who are driven by motivations to buy a car, buy a home, and pay off debt (i.e., *financial motivations*). Among passive/class lottery players, high-frequency gamblers were more likely to be elderly males with lower incomes and who were motivated by increase savings and helping their families (i.e., *safety motivations*). High-frequency scratch-card players presented a different profile and were more likely to be younger females, with lower income and education, but motivated by self-esteem reasons, whereas males who played scratch-cards were more motivated by *financial* or *safety motivations*.

Brochado et al.'s (2018) study did not consider relevant variables such as expenditure, which is one of the most relevant in determining high involvement gambling. Also, they did not consider online gamblers. Additionally, their findings only apply to offline lottery players and their results cannot be extrapolated to all players, nor to the population due the convenience sample used. Only one Portuguese study has examined the effect of age on lottery expenditure (Kaizeler, Faustino, & Marques, 2014). Kaizeler et al. (2014) were only able to establish statistical significance between age and lottery gambling on people aged between 15 and 24 years, where a 1% increase in the population of a particular region led to an annual decrease of approximately 3,700 Eur

in the same region. They were not able to establish a statistically significant relationship between age and lottery gambling, for people 25 years and older (a factor which is addressed in the present study).

There is also only one Portuguese study that has compared online and offline gambling habits of Portuguese players, but it was not nationally representative and did not focus exclusively on lottery playing (Hubert & Griffiths, 2018). Compared to offline players, online players were found to gamble more days per week but spend less money, consume less alcohol, drugs, and tobacco, and have less suicidal ideation, depression, anxiety, and stress (Hubert & Griffiths, 2018). Most players gambled both online and offline, although they had a preferred channel to play (Hubert & Griffiths, 2018).

To date, studies on lottery gambling among Portuguese players, have all used non-representative samples, with the exception Lopes' (2009, 2010) study which used data collected in 2008 but did not discriminate between online and offline players, and did not use real playing data. Additionally, after 2010, the Portuguese legislation concerning scratch-cards was changed to allow the possibility of increasing the net prize payouts from 48.75% to 50%-70% which is not reflected in Lopes' (2009, 2010) studies.

4.2.2 Gambling studies using behavioural tracking player data

Gambling studies that use account-based behavioural tracking and real playing data to assess gambling behaviour were first published in 2007 (LaBrie, LaPlante, Nelson, Schumann, & Shaffer, 2007). Chagas and Gomes (2017) reported that initial studies on lottery tracking data relied on the same database (*Bwin*) and later ones were limited to

a few databases and focused on very narrow time frames such as account opening or closing. More recently, additional gambling operators (e.*g., ComeOn Group, Íslensk Getspá, Kindred, Leo Vegas, Norsk Tipping, Svenska Spel and win2day*) have made their databases available for researchers to study gambling behaviour (Auer & Griffiths, 2013, 2016, 2017, 2018, 2020; Auer, Hopfgartner, & Griffiths, 2018, 2019a, 2019b, 2020; Fiedler, 2011, 2013; Gainsbury, Sadeque, Mizerski, & Blaszczynski, 2012; Gray, Jonsson, LaPlante, & Shaffer, 2015; Ukhov, Bjurgert, Auer & Griffiths, 2021). These studies cover different forms of gambling and only a few include lottery gambling (e.g., Auer & Griffiths, 2013, 2014, 2016; Auer, Hopfgartner, & Griffiths, 2018; Gray, Jonsson, LaPlante, & Shaffer, 2015) and none of these studies used a player/consumer segmentation method, such as the one we used in the present study, for the study of lottery gambling or even studied the population of a southern European country.

From the studies that include online lottery gambling, some focused on the evaluation of responsible gambling practices. For instance, Auer and Griffiths (2013) found that voluntary limits setting had the highest significant effect on the monetary spending of the most intense players including lottery players. Another study (Auer & Griffiths, 2016) found that personalized behavioural feedback can enable players to gamble more responsibly. Also, gamblers receiving personalized feedback in relation to limit-setting showed significant reductions in the amount of money they gambled (Auer, Hopfgartner & Griffiths, 2018).

4.3 Objectives of the present study

The present study is the first to examine actual online lottery gambling data from Portuguese players. The present study used account-based data made available by the Portuguese national lottery. The dataset used is novel, has never been analysed before, and was provided exclusively for the purpose of the present research. The dataset is representative of all Portuguese active online lottery players. The study had several research objectives including the identification of lottery players' segments and their engagement levels by analysing actual online gambling data. The main objective of the study was the identification of different player segments for Portuguese online lottery players and understand the differences between them, including by their engagement levels (high, neutral, low). Another objective was to determine the best approach for the identification of the players' segmentation and behaviour.

The study used variables comprising sociodemographic and playing records which were originally in the database and added new variables by using information that was not in the database and was added to or combined with existing variables such as county, district, and NUTS (Nomenclature of Territorial Units for Statistics), a hierarchical system for dividing the economic territory of the EU (Eurostat, 2019) that was used to better classify and group players by their location/place of residence. The study also assessed differences in gambling from several lottery product categories (i.e., scratch-cards, lotto, Toto, and passive/class lotteries) to understand if there are any distinct sub-groups (segments) of players by gambling engagement in the different

forms of lottery games. The cohort was also compared with the general Portuguese population aged 18 years and older to assess for differences in sociodemographic variables distribution between them.

The objectives of the present study led to the following sub-questions: (i) Are there groups of lottery players with different gambling profiles? (ii) Do different types of lottery players engage in different product types and if so, are there significant variations in gambling patterns across the several classes of games? (iii) Are there gender differences across the playing of different lottery products? (iv) Is age a relevant factor in online lottery playing? (v) Does education have a negative correlation with online lottery gambling? (vi) Do players who live in richer regions play lottery games more often and spend more money on lottery games than players who live in poorer areas? (vii) Is there one socio-demographic variable that is more influential in determining online lottery gambling segments than others?

4.4 Methods

4.4.1 Participants

The dataset comprised 218,987 active individual players which accounts for 34.3% of all registered players (*Santa Casa da Misericórdia de Lisboa*, 2014, 2015). Of the active players, those who did not complete all the data in their player registration form were

excluded from further sample analysis. Consequently, the final cohort that underwent data analysis comprised 154,585 valid active players and 14,685,575 data points.

4.4.2 Data

The present study utilized a cross-sectional dataset of a full year aggregate lottery playing activity, from June 30, 2013, to May 31, 2014. The data were anonymized to ensure player identity protection. As data were not normally distributed, missing values were not imputed. The dataset's original variables included date of player registration, age, gender, zip/postal code, education, occupation, amount of money spent (total amount of money spent and amount of money spent per game), wagers[5] (total number of wagers made and number of wagers made per game), number of lottery draws that occurred during the analysed period (total and per game), number of lottery draws in which each player placed wagers (total and per game), and total number of weeks in which each player placed wagers.

[5]We use the term 'wagers' as used by other authors on lottery gambling (Forrest, Gulley, & Simmons, 2004; Gulley & Scott, 1993).

4.4.3 Measures

To identify the players' profiles and to help in segmentation, new variables were created. New variables aggregated products by game design and structural characteristics, features, and play action. Previous research has consistently shown that structural characteristics have an important role in the development and maintenance of lottery gambling (Griffiths & Wood, 2001; Parke & Griffiths, 2007). The games on the portfolio comprise: *EuroMillions,* the only multi-national game, and *Totoloto* which are lotto games where the first has a 5/50 + 2/12 number picking mechanics and the second is a typical 6/49 lotto game; Toto/sports lottery (*Totobola*) has a 1x2 (first team win, draw, second team win) game mechanic, based on football game outcomes; passive/class lotteries which are lottery games with pre-printed numbers and fixed prize structures, that are also pre-determined, and are not dependent on the number of players and money wagered for the determination of the size of the jackpot (such as in lotto and pari-mutuel games); and scratch-cards which are games based on a card with a section or sections which may be scratched away to reveal a symbol indicating whether a prize has been won in a competition (Ariyabuddhiphongs, 2011; North American Association of State and Provincial Lotteries, 2021). This resulted in five product categories: lotto games (*EuroMillions*; *Totoloto)*; lotto games with the inclusion of an add-on game (*EuroMillion*s; *Totoloto* and *Joker*; because *Joker* could only be played in association with lotto, it was included in the 'all lotto' category analysis); Toto/sports

lottery (*Totobola*), passive/class lotteries[6] (*Lotaria Clássica* and *Lotaria Popular*); and scratch-cards *(Lotaria Instantânea).*

Other new variables included "amount lost" (total amount spent vs. total amount won) and amount spent per wager (mean average). Amount lost variables were created for the total individual gambling activity and were also created for each lottery game individually and for each of the lottery product categories created. These new variables were used to assess playing engagement. Some of the existing variables were converted into new variables by using exogenous information such as the ones created by converting postal codes into NUTS II and III regions.

4.4.4 Data analysis

Considering the large sample size and the known population parameters such as mean, standard deviation, and variance, bilateral Z-tests were used to assess for the final cohort's representativeness. The cohort proved to be representative of the Portuguese residents who played the national lottery over remote channels. Z-tests were run for total amount spent (P[Z<=z] bilateral 0.99; confidence interval 0.0007) and for each product group category (lotto [P(Z<=z] bilateral 0.9918; confidence interval 0.0082); lotto plus add-on game (P[Z<=z] bilateral 0.9952; confidence interval 0.0048) and scratch-cards (P[Z<=z] bilateral 0.9606; confidence interval 0.0394). Lotto plus add-

on game and scratch-cards represented the bulk of total revenue with 97% of total expenditure (lotto plus add-on game 80.82%; scratch-cards 16.13%). Toto/sports lottery (P[Z<=z] bilateral 0.2456; confidence interval 0.7544) and passive lotteries (P[Z<=z] bilateral 0.8937; confidence interval 0.1063) were found to have poor representativeness as Toto represented 0.9% of total revenue and passive lotteries 2.1% of total revenue and cannot be considered representative of all the players that play these games online. Because of this, separate segmentation models for the latter two game categories were not run.

The analysis in this study comprised three main steps. The first step compared the profiles of the individuals in the sample to the general population with estimate information from Statistics Portugal, the Portuguese official agency for economic and demographic data and Pordata. The second step focused on a univariate and bivariate statistical analysis, to characterize the sample. This analysis described the main characteristics of the players and how they compared to the findings of other studies. The third step comprised a multivariate Chi-square Automatic Interaction Detector (CHAID) analysis (Kass, 1980) which was used to identify different profiles and segments of players. CHAID analysis builds a model, represented as a tree to determine the best merges between variables to explain the outcome in the given dependent variable (Breiman, Freidman, & Stone, 1984; Kass, 1980). The dependent variable in this study was total amount of money spent. An explanatory CHAID model was built to identify player segments and identify the most relevant among them (target market). Separate CHAID analysis was also run to assess amount spent by game type/product category, for the two product categories with the highest expenditures (lotto and scratch-cards), and by amount lost. IBM SPSS 22 was used for the CHAID decision trees.

4.5 Results

4.5.1 Characteristics of the online lottery player sample vs. Portuguese population

The study's dataset contained all active Portuguese online lottery players, and the final sample was representative of all active online lottery players. Note that previous studies did not disclose the activity status of players but based their analysis solely on active players, as inactive players do not have any playing records during the specific periods under analysis. Therefore, the first analysis was performed to understand how players' sociodemographic characteristics and profile compared to the general Portuguese adult population (over 18 years of age). The total dataset's active online lottery players accounted for 7.5% of the general adult population and the final sample of this study for 2.6% of the same population. The findings indicated that there was a large discrepancy between the gender distribution of the adult population and online lottery players. Results showed that the differences were statistically significant as there was no overlap, and the proportional value was outside the calculated confidence interval (confidence level 96%; $p<0.05$). Male online lottery players comprised 78.7% of total players (n=121,601) whereas in Portugal there are 46.7% adult males (approximately 3.99 million males) (Pordata, 2019b). Female online lottery players comprised only 21.3% of the cohort (n=32,984) but are the majority of the adult population (53.3%; approximately 4.56 million females) (Pordata, 2019b).

Another variable used in the comparison was age. Online lottery players and the adult population were split into four sensibly distributed age groups (Table 4.1). The age group distribution was designed to assess potential skews in lottery players' representativeness when compared to the adult population. Results showed that online lottery players had a different distribution regarding age groups when compared to the Portuguese adult population (p<0.05; see Table 1). Overall, online lottery players' age group representation tended to be younger than the Portuguese adult population given that three-quarters of online lottery players were below 49 years of age (74.4%). Although these are the most represented online lottery players in terms of gender and age, it does not mean that they are the players that had the highest gambling engagement and expenditure.

Table 4.1

Age groups of the general Portuguese adult population versus active online lottery players

Age groups	General adult population (≥ 18 years)		Active online lottery players	
18-34	2,005,264	23.50%	44.505	28.79%
35-49	2,342,230	27.40%	70.465	45.58%
50-64	2,097,546	24.50%	31.959	20.67%
≥ 65	2,105,167	24.60%	7.656	4.95%
Total	8,550,207	100.00%	154.585	100.00%

The data were also analysed for geographic distribution utilizing NUTS III. In general, the geographic location and distribution of players was similar to the geographic concentration of the general Portuguese adult population but there were differences in two main regions. For online lottery players, the Lisbon Metropolitan Area was the most represented while among the general population it is second, after the North region (Table 4.2).

Table 4.2

Geographic distribution of the general Portuguese adult population versus active online lottery players.

Geographic distribution - NUTS II	General adult population (≥18 years)		Active online lottery players	
Lisbon Metropolitan Area	2,277,826	26.64%	53,319	34.49%
North	2,992,782	35.01%	46,819	30.29%
Centre	1,898,503	22.21%	31,167	20.16%
Alentejo	615,121	7.19%	8,847	5.72%
Algarve	360,417	4.22%	6,311	4.08%
Mainland	8,144,649	95.27%	146,463	94.75%
Madeira	209,484	2.45%	4,799	3.10%
Azores	195,074	2.28%	3,323	2.15%
Portugal	8,549,207	100.00%	154,585	100.00%

Considerable differences were also found in relation to education (Table 4.3). Online lottery players had on average a much higher educational level than the general population (p<0.05). Most players had a higher education (51.7%) compared to 20.6% of the general Portuguese adult population and there were no players without any formal education.

Table 4.3

Education distribution of the general Portuguese adult population versus active online lottery players

Education	General adult population (≥18 years)		Active online lottery players	
Without formal education	167,350	2.60%	0	0.00%
Primary education (4th grade)	1,081,560	16.70%	2,920	1.90%
Primary education (6th grade)	891,880	13.70%	9,745	6.30%
Secondary education	3,015,590	46.40%	61,925	40.10%
Higher education	1,337,700	20.60%	79,995	51.70%
Total	6,494,080	100.00%	154,585	100.00%

4.5.2 Gambling participation

In more specific analysis, the final sample was found to be representative of all active online lottery players on several variables (p<0.01), including total expenditure, total amounts lost, and total number and amount of prize money won (Table 4.4). It was also found that the 25% players with the highest average annual expenditures (Q3=324 Eur), represented 79.7% of total expenditures and showed higher total expenditures than the lower two quartiles combined (Q1 expenditure=29.40 Eur, Median=109.00; IQR=294.6). The most popular games among online lottery players were lotto (including add-on games; 98.05%, n=151,758) and scratch-cards (34.66%, n=53,580). The least played games were passive lotteries (10.34%, n=15,996) and Toto/sports lottery (9.02%, n=13,959).

Table 4.4

Total online lottery gambling participation (expenditure, prizes and losses in Euros)

Total Sample	n	Mean	Mode	Median	SD of total expenditure	VAR*	SD** mean expenditure	Q1	Q3
Expenditure	154,585	337.04	10.00	109.00	1,103.08	1,216,786.95	2.81	29.40	324.00
Nº prizes won	154,585	23.12	0.00	6.00	143.78	20,672.20	0.37	1.00	19.00
Amount won	154,585	116.01	0.00	28.28	642.04	412,209.78	1.63	4.32	93.32
Amount lost	154585	-221.13	-10.00	-74.99	724.37	524,711.52	1.84	-223.67	-20.00
Amount per wager	154585	3.56	2.00	2.52	3.64	13.24	0.01	1.90	4.21

*Variance **Standard Deviation

4.5.3 Sample analysis by gender, age group, education and region

Male online lottery players were found to spend more money on average than female online lottery players (Table 5; $p<0.01$). This trend was also confirmed when assessing for product categories' mean differences, including on lotto plus add-on game ([males: mean=EUR 311.53; median= EUR 109.60; SD= EUR 826.09]; [females mean= EUR 152.11; median= EUR 48.90; SD= EUR 591.90]; [$p<0.01$]); The only game category where no statistically significant differences in mean expenditures were found between males and females was instant lottery games ([males: mean= EUR 157.61; median= EUR 20.00; SD= EUR 1,108.97]; [females mean= EUR 154.36; median= EUR 17.50; SD= EUR 1,073.00]; [$p<0.05$]). During the one-year period analysed, males placed more and larger wagers. Males' average amount per wager was also higher than that of females ([males: mean= EUR 3.74; median= EUR 2.69; SD= EUR 3.83]; [females: mean= EUR 2.89; median= EUR 2.09; SD= EUR 2.70]; $p<0.01$). Males also placed more wagers than females during the one-year period ([males: mean=117.03; median: 44; SD=546.24]; [females: mean=93.18; median: 26.00; SD=476.40], $p<0.01$).

In assessing age and online lottery gambling, each age group was analysed individually and compared with all other age groups. Statistically significant differences were found in expenditures (Table 5) and wagers placed across all age groups with a steady increase from the youngest to the oldest age groups ($p<0.01$). Players in the 18-34-year age group placed on average 59.39 wagers per year (median=20.00; SD=143.64), with an average amount per wager of EUR 3.06 (median=EUR 2.18; SD=EUR 3.00). Players in the 35-49-year age group placed on average 103.86 wagers per year

(median=38.00; SD=687.14), with an average amount per wager of EUR 3.62(median= EUR 2.59; SD= EUR 3.56). Players in the 50-64-year age group placed on average 178.35 wagers per year (median=81.00; SD=470.27) with an average amount per wager of EUR 3.95 (median= EUR 2.87; SD= EUR 4,17). The oldest players (65 years and older) had an annual average of 214.51 wagers (median=99.00; SD=533.43), with an average amount per wager of EUR 4.35 (median= EUR 3.31; SD= EUR 4.81).

The findings also indicated that annual lottery expenditures decreased as education levels increased (Table 4.5) and differences in expenditures between all the age groups were found to be statistically significant (p<0.01). The cohort comprised almost entirely individuals with a high school or higher education (141,920 players: 91.8%).

Table 4.5

Lottery expenditure by age group, education, and region

	n	Mean	Mode	Median	SD* of total expenditure	VAR**	SD* mean expenditure	Q1	Q3
Age groups									
18-34-years	44,505	151.89	10.00	50.00	402.74	162,197.70	1.91	16.00	154.00
35-49-years	70,465	300.15	10.00	109.00	1,119.11	1,252,401.05	4.22	31.00	304.00
50-64-year	31,959	580.41	10.00	237.00	1,472.23	2,167,450.47	8.24	74.00	595.50
≥ 65 years	7,656	736.95	4.00	326.30	1,559.70	2,432,660.02	17.83	118.80	761.58
Gender									
Male	121,601	371.10	10.00	127.00	1,143.05	1,306,565.56	3.28	34.00	364.40
Female	32,984	211.45	4.00	62.00	930.47	865,782.32	5.12	18.00	200.00
Education									
Fourth grade	2,920	532.90	10.00	193.95	1,348.36	1,818,065.60	24.95	55.88	558.13
Sixth grade	9,745	438.72	10.00	140.00	2,229.05	4,968,680.58	22.58	37.00	411.50
High school	61,925	341.99	10.00	112.00	1,032.95	1,066,981.20	4.15	30.00	338.90
Higher education	79,995	313.67	10.00	101.80	922.29	850,617.93	3.26	28.00	298.55
Region									
Alentejo	8,847	343.51	10.00	116.50	827.83	685,302.80	8.80	30.00	346.95
Algarve	6,311	347.40	10.00	112.50	1,090.45	1,189,073.47	13.73	30.00	330.25
Center	31,167	314.47	10.00	104.00	934.13	872,603.24	5.29	28.00	312.00
Lisbon	53,319	362.61	10.00	116.00	1,079.22	1,164,720.56	4.67	30.00	343.00
North	46,819	317.83	10.00	104.00	1,035.27	1,071,779.44	4.78	28.00	311.00
Madeira	4,799	389.92	10.00	114.60	2,623.19	6,881,102.97	37.87	31.50	325.55
Azores	3,323	295.79	10.00	95.40	766.59	587,659.48	13.30	24.00	276.95

* Standard Deviation

** Variance

Mean expenditures difference for the regions were more diffused. Analysis showed that the expenditure mean differences were not statistically significant in the five region combinations ([Center vs. North; $p<0.05$]; [Center vs. Azores; $p<0.01$]; [Lisbon vs, Madeira; $p<0.05$]; [North vs. Madeira; $p<0.05$]; [North vs. Azores; $p<0.05$]). For the other five region combinations, mean expenditures differences were found to be statistically significant ([Center vs. Lisbon; $p<0.01$]; [Center vs. Madeira; $p<0.05$]; [Lisbon vs. North; $p<0.01$]; [Lisbon vs. Azores; $p<0.01$]; [Madeira vs. Azores; $p<0.01$]).

4.5.4 Chi-Square Automatic Interaction Detection (CHAID) Segmentation Model

The present study utilized a decision tree technique, based on a chi-square test algorithm to identify the most relevant interacting variables to build a classification model of online lottery players. CHAID analysis was chosen because it does not require the data to be normally distributed and nor does it require the variables to be standardized which was a characteristic of the online lottery gambling activity in this dataset. CHAID was used to identify the relationship between variables and helped understand how variables merged and explained the outcomes on a particular dependent variable. The development of the models considered the total monetary expenditure as a dependent variable to understand which independent variables accounted for the development of single or several groups or segments of online lottery players.

The total individual expenditure CHAID decision tree generated 22 nodes at four levels (Figure 4.1). Each node was considered a different player segment. From these 22 nodes, the model generated 14 final nodes or customer segments (Figure 4.1). The final nodes corresponded to individual player segments. The model detailed a hierarchical structure of the variables in order, starting with the one (age) that most reduced the variance in the division of the segments (i.e., the variable that maximizes the residual variance). Consequently, in the first level, age was found to be the most influential variable, as it was the variable that made each segment as homogeneous as possible and had a positive correlation with amount of money spent and number of wagers.

Gender was found to be the second most influential variable. Education was the third most influential and had a negative correlation with lottery expenditure. Place of residence was the variable with the least influence in the model.

Figure 4.1

Online lottery players' total expenditure segmentation CHAID decision tree

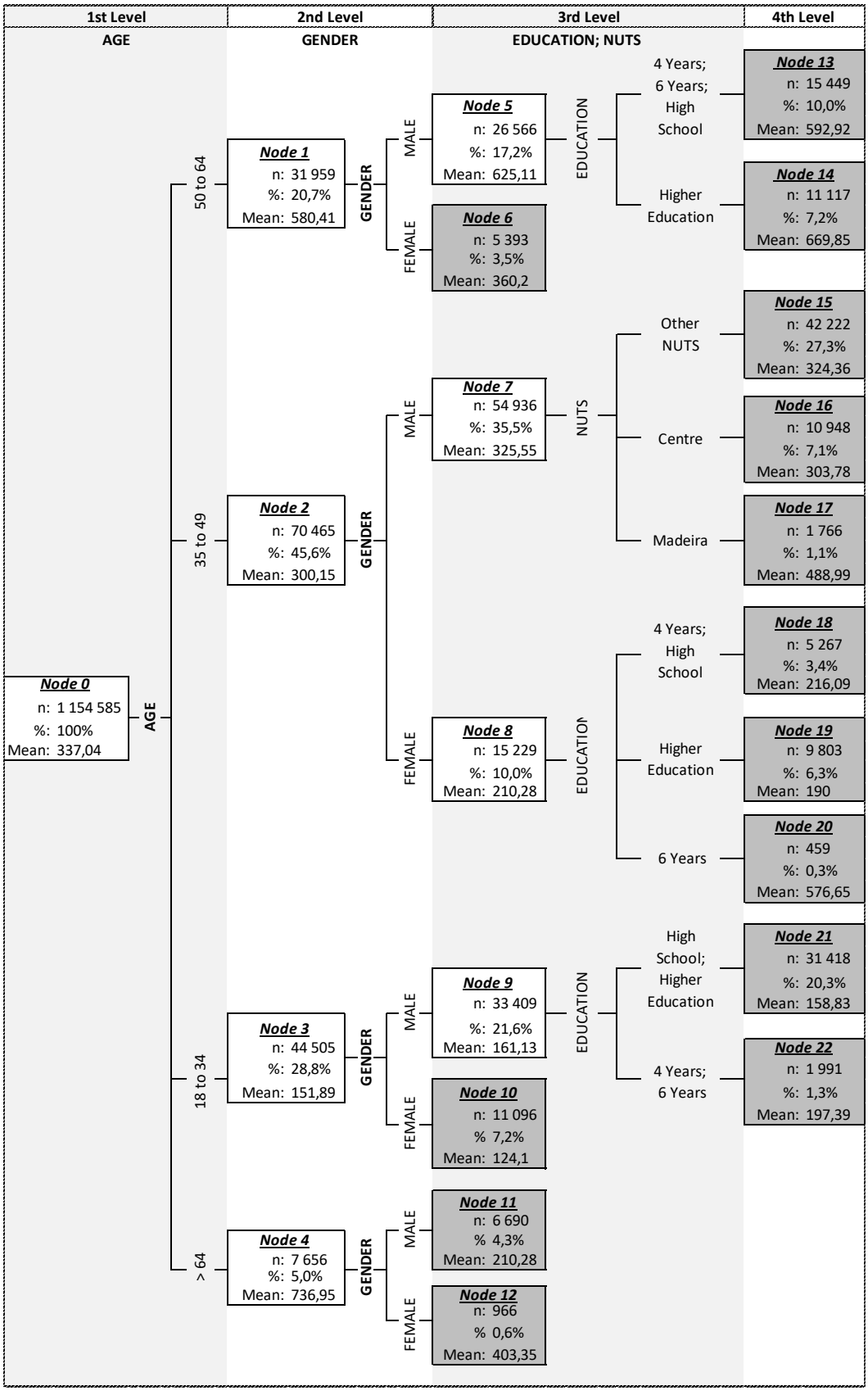


Table 4.6

High, neutral, and low engagement player segments

Nodes/Segments		Characterization Variables			Players			Expenditures		
Segment	1			2	3	4	5	6=3x5	7=6/total 6	8=7-4
Engagement	Node nº	Age Group	Gender	Education / Location	N	Segment Weight %	Mean	Segment Expenditure	Segment Expenditure %	Segment Relevance
High	13	50-64	Male	4th grade; 6th grade; High School	15,449	10.00%	592.92	9,159,936.30	17.58%	7.58%
	14	50-64	Male	Higher Education	11,117	7.20%	669.85	7,446,715.20	14.29%	7.09%
	11	≥ 65	Male	-	6,690	4.30%	785.12	5,252,464.40	10.08%	5.78%
Neutral	17	35-49	Male	Madeira	1,766	1.10%	488.99	863,556.90	1.66%	0.56%
	6	50-64	Female	-	5,393	3.50%	360.2	1,942,559.60	3.73%	0.23%
	20	35-49	Female	6th grade	459	0.30%	576.65	264,681.30	0.51%	0.21%
	12	≥ 65	Female	-	966	0.60%	403.35	389,632.40	0.75%	0.15%
	22	18-34	Male	4th grade; 6th grade	1,991	1.30%	197.39	393,008.30	0.75%	-0.55%
	16	35-49	Male	Centre	10,948	7.10%	303.78	3,325,781.20	6.38%	-0.72%
Low	15	35-49	Male	Lisbon; North; Alentejo; Azores	42,222	27.40%	324.36	13,695,149.50	26.29%	-1.11%
	18	35-49	Female	4th grade; High School	5,267	3.40%	216.09	1,138,152.80	2.18%	-1.22%
	19	35-49	Female	Higher Education	9,803	6.30%	190	1,862,597.40	3.57%	-2.73%
	10	18-34	Female	-	11,096	7.20%	124.1	1,376,962.10	2.64%	-4.56%
	21	18-34	Male	High School; Higher Education	31,418	20.30%	158.83	4,990,036.90	9.58%	-10.72%
			TOTAL		154,585	100.00%	337.04	52,101,234.30	100.00%	

The CHAID model provided a hierarchical structure that regards the importance of the segments in terms of player engagement. Player segments were divided by node relevance into three lottery engagement categories: high engagement, neutral engagement, and low engagement. The most relevant nodes in terms of engagement are those with the highest positive difference between segment weight percentage and segment expenditure percentage which represents a higher engagement per player. Segments with high engagement are those in which the difference between the percent contribution of each segment to total expenditure and the percentage of the sample within each segment (segment weight) is >1%. Segments where parameters fall within 1% more or less were considered neutral engagement segments. Differences lower than 1% were not considered as having a relevant skew regarding the segment relative expenditure and segment relative weight. Segments in which the difference was greater than -1% were considered low engagement (Table 4.6). The findings indicated that in the (i) high engagement level, 21.5% of players were responsible for 42.0% of overall expenditure, (ii) neutral engagement level, 13.9% of players were responsible for 13.8% of overall expenditure, and (iii) low engagement segment, 64.6% of players were responsible for 44.3% of overall expenditure.

The most expressive nodes for profile characterization were 13, 14, and 11. Node 13 comprised male players aged 50-64 years with one of three educational levels: 4th grade, 6th grade, or high school. The second most relevant node (14) comprised males from the same age group but with a higher education. The third most relevant node (11) comprised male players aged above 65 years or above. These findings tell us that although age is positively correlated with lottery gambling expenditures, the most engaged are not necessarily the elderly (65+) but the 50 -64 years age group. The least

engaged players were found to be from the youngest age group (18-34 years) with high school or higher education. For the two most engaged groups and for the least engaged group, place of residence was not found to be a relevant variable. To confirm the results of the total expenditures CHAID model, another CHAID model was built with the total amount of money lost variable, which confirmed the results of the first model. The same method was used to identify the most relevant segments for each of the two most participated product categories (lotto and instant lottery games account for more than 90% of total expenditures). Lotto's two most relevant segments comprised younger males (18-34 years) with either a very low or a very high education (4^{th} grade or higher education) or with a mid-level education (6^{th} grade or high school) (segments node relevance of 6.20% and 5.58%).

Another relevant segment in this product category were females aged 35-49 years (segment node relevance of 4.56%). The least engaged players were males aged 50-64 years, independent of their education (segments node relevance of -7.86% and -8.40%). For instant lottery games, the most engaged segments comprised lower educated males (4^{th} and 6^{th} grade) from the following regions: Lisbon; North; Center; Alentejo; Azores, and Algarve (segment node relevance 4.98%); males older than 49 years, with a high school education (segment node relevance 3.96%) and higher educated players older than 49 years (segment node relevance 3.56%). The least engaged instant lottery players were those with higher educated younger males (18-34 years) (segment node relevance -6.69%) and higher educated players aged 35-49 years from the following regions: Lisboa; Madeira; Azores) (segment node relevance -5.23%).

4.6 Discussion

In the present study, sociodemographic variables in the dataset, complemented by new variables, were used to build online lottery player segmentation models. Consequently, several different player segments were identified. Consequently, this approach provided a better understanding of which (and how) sociodemographic characteristics of players may be used to create groups of players that present the same lottery gambling preferences and engagement levels. Moreover, results of the present study are generalizable to the Portuguese population. Generalizability to other populations should be cautious as other countries will have different economic characteristics (GDP, GINI Index, etc.) that may impact the generalizability of the results of the present study, but the same methods used in this study could be applied to other populations in order to establish comparability.

The use of CHAID models is a novel approach in the field of gambling studies which enables a better understanding of how players group together or differentiate from one another to create specific player segments, which are important to understand the relation between player sociodemographic characteristics and its related player activity and engagement. The findings of the present study provide evidence of a hierarchization of the variables (age being the most important in the hierarchy) because it is the one that most reduces the variance in the segmentation process (i.e., it is the variable that maximizes the residual variation). Age was the biggest differentiating factor and the variable that most maximized the residual variation (i.e., made each segment as homogeneous as possible). Hierarchization of the CHAID nodes concerns the definition

in terms of variable segment determination relevance. The second most influential variable was gender, education, and place of residence. Results showed several specific segments, which differed in player engagement that was assessed by players' expenditure and number of wagers by product category, and in total. These findings enable both researchers and practitioners to better understand how to better address different groups of players according to these sociodemographic variables. The results have implications for the developments of specific marketing practices or advertising campaigns that can be at the same time more effective while promoting better targeted responsible gambling practices.

Sociodemographic variables were also used to compare the distribution of the Portuguese adult population to online lottery players in the dataset. The findings indicated a large discrepancy between the gender distribution in the Portuguese adult population and Portuguese online lottery players. These findings are of significant relevance for the identification of specific player segments and profiles, including to help build a profile of potential problematic players, which is useful both for practitioner and researcher alike in the identification and prevention of problem gambling and developing better and more efficient and responsible marketing practices. Male online lottery players comprised 78.7% of total players whereas in Portugal there are 46.7% adult male citizens, which shows a large skew of the online lottery player population regarding the general adult population. Female online lottery players comprised 21.3% in the present study but are the majority in the general Portuguese adult population (53.3%). The present study demonstrates that the online lottery player profile distribution differs significantly from the adult population and that males play online lottery games more than females, advancing knowledge that previous studies were not

able to establish among the Portuguese population (Brochado et al., 2018; Hubert, 2014; Kaizeler et al., 2014; Lopes, 2009, 2010). Some of the findings from our study are in line with Gray et al. (2015), such as males being more involved in gambling overall, whereas other findings in the present study contradicted some of the findings of their study. Gray et al. (2015) found a greater percentage of females played traditional lottery games whereas males were more likely to engage in soccer betting. The present study had different findings because males were much more represented and were more engaged with online lottery gambling overall, which sheds new insight concerning online lottery gambling.

The mean age of online lottery players in Portugal tended to be younger than the national adult population. Millennials, who are considered one of the most important demographic consumer groups (Eastman, Iyer, Liao-Troth, Williams, & Griffin, 2014; McCasland, 2005; Moreno, Lafuente, Ávila-Carreón, & Moreno, 2017; Ordun, 2015; Smith, 2011, 2012), were not very engaged in online lottery playing in the present study. This may imply that young adults have little interest in online lottery gambling, which is an interesting finding given the many studies on underaged gambling, including lotteries (Ariyabuddhiphongs, 2011; Derevensky & Gupta, 2001; Felsher, Derevensky, & Gupta, 2004a, 2004b; Wood & Griffiths, 1998, 2004). The present study found a positive association between age and lottery gambling expenditure (i.e., the older an online lottery player was, the higher the expenditure). These findings do not concur with previous studies findings reporting an inverted U shape distribution regarding age and lottery gambling expenditures (Barnes, Welte, Tidwell, & Hoffman, 2011; Clotfelter & Cook, 1989; Kaizeler & Faustino, 2012) and supports Ariyabuddhiphongs' (2011) findings that this inverted U-shaped relationship is no longer present and advances knowledge

by confirming that this also applies specifically to online lottery players and not just to offline lottery players. Findings from the present study challenge other previous findings, including age being negatively correlated with gambling behaviour (Mok & Hraba, 1991). Previous studies examining Portuguese online lottery players did not address or failed to establish a relationship between age and lottery playing (Brochado et al, 2018.; Hubert, 2014; Kaizeler et al., 2014; Lopes, 2009, 2010), unlike the present study.

The same trend was observed for the number of wagers placed. This confirms recent findings on the positive association between age and gambling engagement (Auer, Hopfgartner, & Griffiths, 2018). The present study also found that age-related lottery expenditures differed between product categories. Older males (≥ 54 years) tended to be the most engaged players overall. Younger male players (18-34 years old) and females aged 35-49 years tended to be more engaged in lotto games whereas the most relevant socio-demographic variables for instant lottery games were being male over 49 years old, without a higher education, from one of the following regions: Lisbon; North; Center; Alentejo; Azores or Algarve. It was found that the 25% of players with the highest average expenditures, accounted for about 80% of the total amount wagered. Although these results are in line with other studies (e.g., Garibaldi et al., 2015; Tom et al., 2014), further research on these players may be of interest, to assess their specific profiles and gambling habits.

The player profile characterization in the study also showed that the most represented age group was 35-49 years although the largest difference found regarding the player profile and the Portuguese adult population was among those aged 65 years and older (5% in the present sample compared to 24.6% in the general population).

Clotfelter and Cook (1990) reported that individuals between 25 and 64 years have a greater propensity to play on lottery products. Although the present study found older players to have higher gambling engagement, older age groups comprised few players. This contrasts with other online gambling activities, especially sports betting and in-play betting, where younger players tend to play more games and be more involved (Gray et al., 2015).

In the present study, players aged 18 to 34 years old represented 28.8% of players, although most of the players in this category were between 25 and 34 years (21.3%). These younger players had the lowest engagement of all online lottery players. Although the two youngest age groups were the most represented (18-34 years, 35-49 years) – most likely due to the type of sales channel (internet/mobile) – they are not the most active or most engaged. The oldest group (≥ 65 years; 5%) and the youngest subgroup (16 to 24 years; 7.5%) were the least represented. There may be different reasons for this such as disposable income, game design, and play action but further research is needed to confirm such speculations. For the younger age group, some of these games may simply not be attractive and older players may prefer more traditional (offline) venues to engage in lottery playing.

Generally, gambling activities tend to increase with higher educational levels, but previous studies found that lottery gambling tends to show the opposite (Brown & Kaldenberg, 1992; Clotfelter & Cook, 1989; Clotfelter et al., 1999; Forrest & Gulley, 2009; Rogers & Webley, 2001). The present study confirmed this negative association among Portuguese online lottery players because they tended to decrease lottery gambling expenditure and engagement as their education increased. This also confirms the findings from previous studies examining offline lottery players concerning the

relationship between education and lottery expenditures (Albers & Hubl, 1997; Clotfelter & Cook, 1989; Griffiths & Wood, 2001), including for Portuguese offline lottery players (Brochado et al., 2018; Kaizeler & Faustino, 2008). The only exception found in the present study was among older scratch-card players where no negative association with expenditure was observed relating to an increase in education level. Although an increase in level of education was associated with a decrease in expenditure, higher educated players were found to be the most represented (52%) in the dataset (50% of males and 61% of female players had a higher education). Playing lottery games online appears to appeal to 'tech savvy' educated players.

When examining place of residence, the present study also found differences between the Portuguese adult population's geographic distribution and online lottery players' place of residence distribution. This was observed in five of the seven areas, although it was more evident in the two most populated areas. The major difference was found for the Lisbon area, where 34.5% of lottery players reside which is 7.9% higher than the adult population distribution. The second largest difference was found in the north region where the distribution of players was 4.7% higher among online lottery players. Explanation for this may be due to the higher per capita earnings of individuals living in the Lisbon area (Pordata, 2019a, 2020).

As in any research, the present study has some limitations. Typical limitations found in behavioural tracking studies are also applicable to the present study. Data used were from only one website and players might be gambling on various websites and/or gambling in offline land-based venues (Adami, Benini, Boschetti & Canini, 2013; Auer & Griffiths, 2014; Dragicevic, Tsogas, Kudic, 2011, Dragicevic, Percy, Kudic & Parke, 2013; Fiedler, 2011; Griffiths, 2012; LaBrie et al., 2007; Shaffer et al., 2010; Xuan & Shaffer,

2009). Consequently, the present study can only be considered representative of Portuguese active online lottery players and not of offline lottery players or of all other online gambling activities. Moreover, in some cases, users might share their accounts and access passwords with other individuals, which means that an account might be used by more than one person (Auer & Griffiths, 2014; Fiedler, 2011; Griffiths, 2012; Shaffer et al., 2010). Another drawback of using tracking data to study consumer behaviour is that actual gambling data does not provide answers on why individuals behave as they do (Griffiths, 2012). Self-report methods are best for collecting such data. This is a common disadvantage of using secondary data because it is limited in the ability to provide causal relationship explanations. Considering that the data analysed in the present study was cross-sectional, longitudinal analysis was not possible. Furthermore, a time variable was missing from the present database and there was no direct or indirect way to measure the time spent gambling (although most lottery games tend to be discontinuous forms of gambling, so the time element is not necessarily important).

4.7 Conclusions and further research

This study demonstrates that the socio-demographic profile distribution of online lottery players differs significantly from the Portuguese adult population and that males were found to be much more represented than females. The mean age of online lottery players in Portugal tends to be lower than in the adult population. The present study found that millennials are not very engaged in online lottery playing. One of the

questions that might be addressed in further research is the reason for this. Findings from this study shed new insight into age and lottery gambling and present new empirical evidence on age being negatively associated with online lottery gambling behaviour in Portugal. The present study also found considerable differences regarding education. Online lottery players tend to have an average level of education that is much higher than the adult population, although as the present study confirmed, as education level increased, overall lottery gambling expenditures tended to decrease.

The CHAID segmentation models determined a four-level hierarchy of the demographic variables ranked by relevance and engagement. The most influential variable was found to be age, followed by gender, education, and place of residence. Males were found to play online lottery games more and be more engaged in gambling overall, with higher number of wagers and higher expenditures than females. It was found that as age increased, so did lottery expenditures and the number of wagers. Another finding showed that age-related lottery expenditures differed between product categories. It was also found that the 25% of players with the highest average expenditures, accounted for about 80% of the total amount wagered.

In further research, studies focusing on drawing a wider profile of gamblers would be beneficial and add to the existing knowledge in this field namely by including the possibility of identifying the profile of the players across multiple gambling activities, including from different providers. This would help in understanding differences in players and behaviours across multiple platforms. This has obvious challenges, namely ensuring player anonymity and possible conflicts of interest as well as business protection across the several operators. Such studies can be performed with tracking data only or combined with self-report data. Studies combining playing tracking data

with self-reported gambling data enabling a wider knowledge of online lottery players which could help further explain motivations that can provide insight into the way players may be segmented.

Since longitudinal data were not available for the present study, further studies on Portuguese lottery players, utilizing longitudinal tracking data, would also help significantly improve behavioural analysis. The Portuguese national lottery added a new odds sports betting game to its portfolio in 2016 (i.e., *Placard*). This new game accounted for 18.9% of overall sales in 2019 (Santa Casa da Misericórdia de Lisboa, 2020). Therefore, it would be useful to assess if these sales represent a shift in lottery players from pre-2016 existing games to this new game or whether these are all entirely new players. It would also be useful to assess if the current COVID-19 pandemic has driven offline players to start playing online as most points of sale were closed during the lockdowns.

References

Adami, N., Benini, S., Boschetti, A., & Canini, L. (2013). Markers of unsustainable gambling for early detection of at-risk online gamblers. *International Gambling Studies, 13*(2), 188–204.

Albers, N., & Hubl, L. (1997). Gambling market and individual patterns of gambling in Germany. *Journal of Gambling Studies, 13*, 125-144.

Afifi, T.O., LaPlante, D.A., Taillieu, T.L. & Shaffer, H. J. (2014). Gambling involvement: considering frequency of play and the moderating effects of gender and age. *International Journal of Mental Health and Addiction, 12*, 283–294.

Ariyabuddhiphongs, V. (2011). Lottery gambling: A review. *Journal of Gambling Studies*, *27*(1), 15-33.

Auer, M., & Griffiths, M. D. (2013). Voluntary limit setting and player choice in most intense online gamblers: An empirical study of gambling behaviour. *Journal of Gambling Studies, 29*, 647–660.

Auer, M., & Griffiths, M. D. (2014). An empirical investigation of theoretical loss and gambling intensity. *Journal of Gambling Studies, 30*, 879–887.

Auer, M., & Griffiths, M. D. (2016). Personalized behavioural feedback for online gamblers: A real world empirical study. *Frontiers in Psychology, 7*(1875), 1-13.

Auer, M., & Griffiths, M. D. (2017). Self-reported losses versus actual losses in online gambling: An empirical study. *Journal of Gambling Studies, 33*(3), 795–806.

Auer, M., & Griffiths, M. D. (2018). Cognitive dissonance, personalized feedback, and online gambling behaviour: An exploratory study using objective tracking data and subjective self-report. *International Journal of Mental Health and Addiction, 16*, 631–641.

Auer, M., & Griffiths, M. D. (2020). The use of personalized messages on wagering behaviour of Swedish online gamblers: An empirical study. *Computers in Human Behaviour, 110*, 106402.

Auer, M., Hopfgartner, N., & Griffiths, M. D. (2018). The effect of loss-limit reminders on gambling behaviour: A real-world study of Norwegian gamblers. *Journal Behavioural Addiction, 7*(4), 1056-1067.

Auer, M., Hopfgartner, N., & Griffiths, M. D. (2019a). An empirical study of the effect of voluntary limit-setting on gamblers' loyalty using behavioural tracking data. *International Journal of Mental Health and Addiction, Advance Online Publication*, 1-12. doi:https://doi.org/10.1007/s11469-019-00084-3.

Auer, M., Hopfgartner, N., & Griffiths, M. D. (2019b). The effects of a mandatory play break on subsequent gambling among Norwegian video lottery terminal players. *Journal of Behavioural Addictions, 8*(3), 522-529.

Auer, M., Hopfgartner, N., & Griffiths, M. D. (2020). The effects of voluntary deposit limit-setting on long-term online gambling expenditure. *Cyberpsychology, Behaviour, And Social Networking, 23*(2), 113-118.

Baker, R., Forrest, D., & Pérez, L. (2016). The compatriot win effect on national sales of a multicountry lottery. *Applied Statistiscs, 65*(4), 603–618.

Barnes, G. M., Welte, J. W., Tidwell, M.-C. O., & Hoffman, J. H. (2011). Gambling on the lottery: Sociodemographic correlates across the lifespan. *Journal of Gambling Studies, 27*(4), 575–586.

Baumöhl, E., & Výrostováb, E. (2017). Do people gamble more in good times? Evidence from 27 European countries. *Applied Economics Letters, 24*(18), 1311–1314.

Breiman, L., Freidman, J. H., Olshen, R. A., & Stone, C. J. (1984). *Classification and regression trees.* Boca Raton, Florida: Routledge.

Brochado, A., Santos, M., Brochado, F. O., & Esperança, J. (2018). Gambling behaviour: Instant versus traditional lotteries. *Journal of Business Research, 88*, 560 - 567.

Brown, D. J., & Kaldenberg, D. O. (1992). Socio-economic status and playing the lotteries. *Sociology & Social Research, 76*, 161–167.

Byrnes, J. P., Miller, D. C., & William, S. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin, 25*(3), 367-383.

Calado, F., & Griffiths, M. D. (2016). Problem gambling worldwide: An update and systematic review of empirical research (2000–2015). *Journal of Behavioural Addictions, 5*(4), 592–613.

Chagas, B. T., & Gomes, J. F. (2017). Internet gambling: A critical review of behavioural tracking research. *Journal of Gambling Issues, 36*, 1-27.

Challet-Bouju, B., Hardouin, J., Thiabaud, E., Saillard, A., Donnio, Y., Grall-Bronnec, M., & Perrot, B. (2020). Early gambling behaviours of newly registered online lottery gamblers: Longitudinal analysis using gambling tracking data. *Journal of Medical Internet Research, 22*(8), 1-13.

Charnessa, G., & Gneezyb, U. (2012). Strong evidence for gender differences in risk taking. *Journal of Economic Behaviour & Organization, 83*(1), 50-58.

Clotfelter, C. T., & Cook, P. J. (1989). *The demand for lottery products: Working Paper No. 2928.* Cambridge, MA: National Bureau of Economic Research.

Clotfelter, C. T., & Cook, P. J. (1990). On the economics of state lotteries. *Journal of Economic Perspectives, 4*(4), 105-119.

Clotfelter, C. T., Cook, P. J., Edell, J. A., & Moore, M. (1999). *State lotteries at the turn of the century: Report to the National Gambling Impact Study Commission.* Duke University. Retrieved October 10, 2020, from http://govinfo.library.unt.edu/ngisc/reports/lotfinal.pdf.

Derevensky, J. L. & Gupta, R. (2001). *Lottery ticket purchases by adolescents: A qualitative and quantitative examination*. Report to the Ministry of Health and Long-Term Care - Alberta Gambling Research Institute. https://prism.ucalgary.ca/handle/1880/41343

Dickson, P., & Ginter, J. (1987). Market segmentation, product differentiation, and marketing strategy. *Journal of Marketing*, *51*(2), 1-10.

Dragicevic, S., Tsogas, S. B., & Kudic, A. (2011). Analysis of casino online gambling data in relation to behavioural risk markers for high-risk gambling and player protection. *International Gambling Studies, 11*, 377–391.

Dragicevic, S., Percy, C., Kudic, A. & Parke, J. (2015). A descriptive analysis of demographic and behavioural data from internet gamblers and those who self-exclude from online gambling Platforms. *Journal of Gambling Studies, 31*, 105–132.

Eastman, J. K., Iyer, R., Liao-Troth, S., Williams, D. F., & Griffin, M. (2014). The role of involvement on millennials' mobile technology behaviours: The moderating impact of status consumption, innovation, and opinion leadership. *Journal of Marketing Theory and Practice, 22*(4), 455-470.

Eriksson, K., & Simpson, B. (2010). Emotional reactions to losing explain gender differences in entering a risky lottery. *Judgment and Decision Making, 5*(3), 159–163.

Eurostat (2019, October 21). *Eurostat NUTS background*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/nuts/background

Felsher, J.R., Derevensky, J.L. & Gupta, R. (2004a). Lottery participation by youth with gambling problems: are lottery tickets a gateway to other gambling venues? *International Gambling Studies*, *4*(2), 109-125.

Felsher, J.R., Derevensky, J.L. & Gupta, R. Lottery Playing (2004b). Amongst youth: Implications for Prevention and Social Policy. *Journal of Gambling Studies*, *20*, 127–153.

Fiedler, I. (2011). The gambling habits of online poker players. *Journal of Gambling Business and Economics, 6*, 1–24.

Fiedler, I. (2013). Gamblers' habits: Empirical evidence on the behaviour of regulars, newcomers, and dropouts. *Journal of Gambling Studies, 29*, 289–309.

Forrest, D., & Gulley, O. D. (2009). Participation and level of play in the UK National Lottery and correlation with spending on other modes of gambling. *International Gambling Studies, 9*, 65–178.

Gainsbury, S., Sadeque, S., Mizerski, R., & Blaszczynski, A. (2012). Wagering in Australia: A retrospective behavioural analysis of betting patterns based on player account data. *Journal of Gambling Business and Economics, 6*(2), 50-68.

Garibaldi, S., Frisoli, K., Ke, L., & Lim, M. (2015). Lottery spending: A non-parametric analysis. *PloS One*, *2*: *e0115730*, 10. doi: https://doi.org/10.1371/journal.pone.0115730.

Gray, H. M., Jonsson, G. K., LaPlante, D. A., & Shaffer, H. J. (2015). Expanding the study of internet gambling behaviour: Trends within the Icelandic lottery and sportsbetting platform. *Journal of Gambling Studies, 31*(2), 483-499.

Griffiths, M. D. (2012). Internet gambling, player protection and social responsibility. In R. Williams, R. Wood, & J. Parke (Eds.), *Routledge handbook of internet gambling* (pp. 227–249). London, United Kingdom: Routledge.

Griffiths, M. D., & Wood, R. (2001). The psychology of lottery gambling. *International Gambling Studies, 1*, 27–45.

Gulley, O. D., & Scott, J. F. (1993). The demand for wagering on state operated lotto games. *National Tax Journal, 46*(1), 13-22.

Hubert, P. (2014, September 9-12). *Online e offline pathological gambler: characterizing and comparison* [Conference presentation]. 10th European Conference on Gambling Studies and Policy Issues, Helsinki, Finland.

Hubert, P., & Griffiths, M. D. (2018). A comparison of online versus offline gambling harm in Portuguese pathological gamblers: An empirical study. *International Journal of Mental Health and Addiction, 16*(3), 1219–1237.

Kaizeler, M. J., & Faustino, H. C. (2008). *Lottery sales and per-capita GDP: An inverted U relationship.* Lisbon, Portugal: Technical University of Lisbon, School of Economics and Management. Working Paper No. WP 41/2008/DE/SOCIUS.

Kaizeler, M. J., & Faustino, H. C. (2010). Demand for lottery products: An international study. *Revista de Economia e Administração, 9*(1), 1-16.

Kaizeler, M. J., & Faustino, H. C. (2011). Is the lottery product an inferior good in higher income countries? *International Journal of Economics and Finance, 3*(4), 54-59.

Kaizeler, M. J., & Faustino, H. C. (2012). Lottery sales and per-capita GDP: An inverted U relationship. *British Journal of Economics, Management & Trade, 2*(3), 225-238.

Kaizeler, M. J., Faustino, H. C., & Marques, R. (2014). The determinants of lottery sales in Portugal. *Journal of Gambling Studies, 30*, 729-736.

Kass, G. V. (1980). An exploratory technique for investigating large quantities of categorical data. *Applied Statistics, 29*(2), 119-127.

Kotler, P., & Armstrong, G. (2018). *Principles of marketing, global edition, 17th Edition*. London: Pearson.

LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: A prospective longitudinal study of internet sports gambling behaviour. *Journal of Gambling Studies, 23*(3), 347–362.

LaPlante, D. A., Gray, H. M., Bosworth, L., & Shaffer, H. J. (2010). Thirty years of lottery public health research: Methodological strategies and trends. *Journal Gambling Studies, 26*, 301–329.

Lopes, H. (2009, October 19). *Epidemiologia da dependência do jogo a dinheiro em Portugal* [Conference presentation]. Congresso de Alto Nível promovido pela Santa Casa da Misericórdia de Lisboa. Lisbon, Portugal.

Lopes, H. (2010, September 14-17). *Update of gambling dependence research in Portugal* [Conference presentation]. 8th European Conference on Gambling Studies and Policy Issues. Vienna, Austria.

Lutter, M., Tisch, D., & Beckert, J. (2018). Social explanations of lottery play: New evidence based on national survey data. *Journal of Gambling Studies, 34*, 1185–1203.

McCasland, M. (2005). Mobile marketing to millennials. *Young Consumers: Insight and Ideas for Responsible Marketers, 6*(3), 8-13.

Mok, W. P., & Hraba, J. (1991). Age and gambling behaviour: A declining and shifting pattern of participation. *Journal of Gambling Studies, 7*(4), 313-335.

Moreno, F. M., Lafuente, J. G., Ávila Carreón, F., & Moreno, S. M. (2017). The characterization of the millennials and their buying behaviour. *International Journal of Marketing Studies, 9*(5), 135-144.

Ordun, G. (2015). Millennial (Gen Y) consumer behaviour, their shopping preferences and perceptual maps associated with brand loyalty. *Canadian Social Science, 11*(4), 40-55.

Parke, J. & Griffiths, M.D. (2007). The role of structural characteristics in gambling. In G. Smith, D. Hodgins & R. Williams (Eds.), *Research and Measurement Issues in Gambling Studies* (pp.211-243). New York: Elsevier.

Perez, L., & Humphreys, B. (2013). The 'who and why' of lottery: Empirical highlights from the seminal economic literature. *Journal of Economic Surveys, 27*, 915-940.

Pordata (2019a). Poder de compra per capita 2013-2014. *Pordata*. Retrieved August 26, 2021, from https://www.pordata.pt/Municipios/Poder+de+compra+per+capita-118.

Pordata (2019b). População residente: total e por grandes grupos etários 2013-2014. *Pordata*. Retrieved August 26, 2021, from https://www.pordata.pt/Municipios/Popula%C3%A7%C3%A3o+residente+total+e+por+grandes+grupos+et%C3%A1rios-390.

Pordata. (2020). PIB per capita (base=2016*). Pordata*. Retrieved August 26, 2021, from https://www.pordata.pt/Municipios/PIB+per+capita+(base+2016)-896.

Rogers, P. (1998). The cognitive psychology of lottery gambling: A theoretical review. *Journal of Gambling Studies, 14*, 111–134.

Rogers, P., & Webley, P. (2001). "It could be us!": Cognitive and social psychological factors in UK National Lottery play. *Applied Psychology: An International Review, 50*, 181–199.

Santa Casa da Misericórdia de Lisboa (2014). *Relatório e Contas do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Departamento de Jogos da Santa Casa da Misericórdia de Lisboa. Lisboa: Santa Casa da Misericórdia de Lisboa. Retrieved August 26, 2021, from http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas/

Santa Casa da Misericórdia de Lisboa (2015). *Relatório e Contas do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved August 26, 2021, from http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas/

Santa Casa da Misericórdia de Lisboa (2020). *Relatório e Contas do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved August 26, 2021, from http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas/

Shaffer, H. J., Peller, A. J., LaPlante, D. A., Nelson, S. E., & LaBrie, R. A. (2010). Toward a paradigm shift in internet gambling research: From opinion and self-report to actual behaviour. *Addiction Research and Theory, 18*, 270–283.

Smith, K. T. (2011). Digital marketing strategies that millennials find appealing, motivating, or just annoying. *Journal of Strategic Marketing, 19*(6), 489-499.

Smith, K. T. (2012). Longitudinal study of digital marketing strategies targeting millennials. *Journal of Consumer Marketing, 29*(2), 86-92.

Tom, M. A., & Shaffer, H. J. (2016). Devil in the details: A critical review of "theoretical loss". *Journal of Gambling Studies, 32*, 865–875.

Tom, M. A., LaPlante, D. A., & Shaffer, H. J. (2014). Does pareto rule internet gambling? Problems among the "vital few" & "trivial many". *Journal of Gambling Business & Economics, 8*(1), 73-100.

Ukhov, I., Bjurgert, J., Auer, M., & Griffiths, M. D. (2021). Online problem gambling: A comparison of casino players and sports bettors via predictive modelling using behavioural tracking data. *Journal of Gambling Studies*, *37,* 877-897**.**

Wood, R.T.A. & Griffiths, M. D. (1998). The acquisition, development and maintenance of lottery and scratchcard gambling in adolescence. *Journal of Adolescence*, *21*(3), 265-273.

Wood, R.T.A. & Griffiths, M. D. (2004). Adolescent lottery and scratchcard players: do their attitudes influence their gambling behaviour? *Journal of Adolescence*, *27*(4), 467-475.

Xuan, Z., & Shaffer, H. J. (2009). How do gamblers end gambling: Longitudinal analysis of internet gambling behaviours prior to account closure due to gambling related problems. *Journal of Gambling Studies, 25*, 239–252.

Yuan, J. (2015). Examining the gambling behaviours of Chinese online lottery gamblers: Are they rational? *Journal of Gambling Studies, 31*, 573–584.

Chapter 5

Essay 3

The effects of new product launches and rollovers on lottery sales: An analysis of product cannibalization in the Portuguese national lottery

Abstract

Corporate cannibalization is a marketing phenomenon that occurs when a product's sales decrease in volume or market-share due to the release of a new product that is introduced by the same company. The new product then absorbs demand for the current product, therefore reducing its sales. When considering institutions that operate in monopolistic, oligopolistic, or highly regulated markets as is the case with lotteries, it may be expected for the gambling activity to grow by the expansion of total demand. Very few studies so far have focused on the impact of new lottery games on other pre-existing lottery games. This study is the first to assess for the impact of cannibalization on the Portuguese national lottery portfolio and is also the first to include games such as passive lotteries. Results show that cannibalization was found at the product category level and for individual products. Scratchcards is the product that most cannibalize other products as it cannibalizes most other games. Complementarity for product category and individual products was found. The national lotto was found correlate positively with *EuroMillions*' except for situations when there is a rollover than increases one of

these games' jackpots, which bring new findings that complement previous research on lottery cannibalization.

Keywords: Lottery gambling; longitudinal analysis; panel data; product cannibalization**.**

JEL classification: C22; C46; D12; D18; M31

5.1 Introduction

Due to the monopolistic, oligopolistic, and highly regulated characteristics of the gambling markets, especially on lotteries, including in Europe, product or corporate cannibalization can be overlooked. This may be the result of the assumption that introducing new products can possibly lead to total market expansion by recruiting new players/customers instead of assuming the possibility of substitution in consumption between products or product categories, within the same portfolio. Lottery corporate cannibalization can occur when lottery players choose to spend on one lottery game in detriment of another lottery game, from the same operator. By acknowledging that lottery players can be grouped into different segments that show distinct preferences in the lottery games in which they engage (Chagas, Gomes, & Griffiths, 2021), a question that arises is whether such preferences come at the expense of game cannibalization. Lottery playing is dependent on players' perceptions and expectations as it is a form of gambling that has two distinctive features when compared to other forms of gambling, as generally lottery games have a very low probability of winning and low pay-out ratios, regarding the total amount of money returned to the gamblers (Ariyabuddhiphongs V. , Lottery gambling: a review, 2011). When taking a finer look at the sales of lotteries across different counties and jurisdictions, the existence of product cannibalization is admissible both with other gambling offerings in the same market, in neighbouring or other markets as well as withing the product portfolio (Marionneau & Nikkinen, 2017). Studies on corporate or product portfolio cannibalization are generally industry related (Lomax, Hammond, & East, 1996) and not many studies can be found on lottery gambling product portfolio cannibalization (Marionneau & Nikkinen, 2017). This is

relevant as lottery gambling is one of the most prevalent forms of gambling (Ariyabuddhiphongs V. , Lottery gambling: a review, 2011) and in 2020, worldwide lottery revenue reached at US$372.6, which represented 52.4% of the total worldwide legalized gambling market (Global Industry Analysts Inc., 2021). Additionally, lottery product portfolio cannibalization raises issues of optimal product portfolio strategy and game design and its impacts on players and their gambling habits. A poorly designed game and a poorly structured portfolio may impact problem gambling rates and lottery revenue as a source of income for good causes and public policy funding. This study is the first to analyse product portfolio cannibalization within the Portuguese National Lottery, with novel data, which was made available exclusively for this study and has never been analysed before.

5.2 Literature review and theoretical background

Product cannibalization is a concept approached both in the fields of economics and marketing. It occurs when there are potential negative effects on sales of existing products from the introduction of new products into the market or on a product portfolio (Kerin, Harvey, & Rothe, 1978). More specifically it has been considered a process by which a new product gains a portion of its sales by diverting them from an existing product (Heskett, 1976; Lomax, Hammond, & East, 1996) or the extent to which one product's customers are at the expense of other products offered by the same firm (Mason & Milne, 1994). Kotler (1998), Semenik & Bamossy (1995), Ries and Trout (2000)

and Boone and Kurtz (2009), warn about the risks of cannibalization when companies do product line extensions or introduce new products. Cannibalization is a very real threat for many new product launches and is even more significant if the new product is launched under the same brand name as an existing product (Lomax, Hammond, & East, 1996). Laruccia, Loureiro, & Martelli Tristão (2012) state that the launch of new products is critical to companies who want to stand out next to their markets and need to survive over time but there is a high probability of transfer of results obtained by established products to new products when they appear to be similar, to customers. In economics, the theoretical roots of product cannibalization can be traced to the cross-elasticity of demand theory (Kerin, Harvey & Rothe, 1978). This theory sates that the demand interrelationship of two products may be described as independent, complementary, or substitutable (cannibalization) (Kerin, Harvey, & Rothe, 1978). While some cannibalization may be planned or expected, considerable amounts of cannibalization may be an unexpected, consequence of an improperly managed new product development process (Kerin, Harvey, & Rothe, 1978). According to (Kerin, Harvey, & Rothe, 1978) new or reformulated products acquire their sales revenue from three sources: (1) new consumers who were not previously buyers of the product type, (2) consumers of competitive brands, and (3) consumers of an existing company brand who switch to the new or reformulated brand or product. The first two sources represent, respectively, incremental revenue for the product portfolio because of market expansion, and the capturing of competitors' market share. The remaining source represents "redistributed" revenue, or cannibalization, in that existing buyers are substituting one item for another in the company's product portfolio (Kerin, Harvey, & Rothe, 1978). Cannibalization becomes a problem when it provides no incremental

competitive or financial benefit to the firm's product portfolio (Kerin, Harvey, & Rothe, 1978). It is important to highlight that these researchers did not consider the consumers' perspective, but merely the firm's perspective. This becomes increasingly relevant in situations where this cannibalization comes at the expense of current customers. Without broadening the pool of customers or acquiring new ones it can lead to the increase usage by existing ones. With gambling activities, including lottery gambling, this situation requires extra attention in order not to foster excessive and problem gambling behaviours. The purpose of introducing new lottery games, should be to increase overall lottery spending, but if new lottery games merely attract ticket sales from already existing games, an effect often referred to as "cannibalization," then the lottery authority has not benefited from introducing a new game to the lottery mix (Grote & Matheson, 2013).

Most studies on lottery cannibalization regard the US market (Garrett & Marsh, 2002; Grote & Matheson, 2006; Gulley & Scott, 1993; Stover, 1990; Tosun & Skidmore, 2004), which has very different characteristics from the European market, including Portugal, in which no studies have been performed on this subject. Of the studies conducted on the US market almost all concern cross state or multistate cannibalization between different lotteries (Garrett & Marsh, 2002; Grote & Matheson, 2006; Gulley & Scott, 1993; Stover, 1990; Tosun & Skidmore, 2004). These studies found a cross state or neighbouring state cannibalization between lotteries (Brown & Rork, 2005; Garrett & Marsh, 2002; Stover, 1990; Tosun & Skidmore, 2004; Walker & Jackson, 2008) or cannibalization when a multistate lottery was introduced (Grote & Matheson, 2006). The introduction of lotteries in neighbouring states serves to reduce lottery spending within a state as people will cross state boundaries to buy lottery tickets (Garrett and

Marsh, 2002; Mikesell and Zorn, 1987; Walker and Jackson, 1999). Only one study found no evidence of such cross-state cannibalization (Gulley & Scott, 1993).

Studies on lottery cannibalization on the European market are scarce and were published by a very strict number of researchers (Forrest, Gulley, & Simmons, 2004; Forrest & McHale, 2007; Purfield & Waldron, 1999; Roger & Chabi, 2009). Of the studies conducted on European countries, none covered passive lotteries and only one included scratch cards (Forrest, Gulley & Simmons, 2004). Forrest, Gulley & Simmons (2004) found evidence of partial cannibalization between scratch-card sales and the UK National Lottery lotto sales (10% increase in scratch-card sales is associated with a 1.07% decrease in National Lottery lotto sales) but no impact between scratch-card sales and Thunderball lottery sales. The same study found evidence of cannibalization between Thunderball lottery sales and lotto sales, as when sales of the first game increased 10%, the sales of the latter decreased 0.025% (Forrest, Gulley & Simmons, 2004). Despite these findings Forrest, Gulley and Simmons (2004) mention that sales from one game do not seem to seriously cannibalize the sales of the other games, with the exceptions noted above. In a previous study on the UK and Ireland which focused on Lotto and Lucky Numbers bets (Purfield, & Waldron, 1999), no evidence of cannibalization was found. Purfield and Waldron (1999) found that larger Lotto sales also lead to larger Lucky Numbers sales even in when there were rollovers. Purfield, and Waldron (1999) add that Lucky Numbers betting appeals o players who, despite being attracted by the high prize offered by the Lotto game, are also concerned with the increasing expected return on their portfolio of bets and reducing the variance of that return. Hence, these products are complements. It is important to highlight that both Forrest, Gulley and Simmons (2004) and Purfield, and Waldron (1999) studies predate the launch of

EuroMillions, a transnational lottery that was first introduced in France, Spain and the United Kingdom, in 2004. Still, later studies such as the one conducted by Forrest and McHale (2007) found that the introduction *EuroMillions* lottery led to a 5.45% increase in the UK National Lottery sales. No evidence is found of cannibalization and UK Saturday Lotto and *EuroMillions* are found to be complements, rather than substitutes. Despite these findings in the UK, contradictory findings for *EuroMillion*s were found in France where sales of this game cannibalized sales of the French National Lottery (Roger & Chabi, 2009). In a different approach, Roger (2011) focused on comparing price elasticities of *EuroMillion*s in the countries where this game is available and demonstrated that there are differences in those countries. Spain and Portugal exhibited a low-price elasticity and high mean sales, meaning a low sensitivity to jackpot increases (Roger, 2011). On the contrary, Ireland and the United Kingdom exhibit a very high long-run elasticity and a large sensitivity to jackpot variations (Roger, 2011). This is relevant as, although *EuroMillions* is a multi-state game, and has the same game rules, play mechanics, odds of winning and price across the different counties where it is available, players behave differently, namely in what regards its jackpots and rollovers.

In general, studies on lottery cannibalization have not considered the relation between more than two products or have overlooked the analysis of complete product portfolios. Only two studies covered product portfolio cannibalization (Mikesell & Zorn, 1987; Tosun & Skidmore, 2004) and product life cycle maturity (Mikesell & Zorn, 1987) in which they found that that the introduction of a new lotto product cannibalized the sales existing lotto's, although the addition of new games increases overall lottery ticket sales (Mikesell & Zorn, 1987; Grote & Matheson, 2006; and Matheson & Grote, 2007). Matheson and Grote (2007) add that the overall increase in ticket sales is larger if the

new game is sufficiently different in odds or prize structure from the existing games. A different scenario was observed in Canada where Jia (2011) found that the substitution effect between two national lottery lotto games (Lotto 6/49 and Lotto Max), show that if the nominal ticket price of one lottery doubles, the demand for the other lottery does not change significantly.

When assessing for cannibalization or complementarity between lottery games, one important issue is the effect of rollovers and jackpots. Cook and Clotfelter (1993), Gulley and Scott (1993), and Forrest, Gulley and Simmons (2004) concluded that lotto rollovers do not impact sales of other lottery products. Yuana and Gaob (2015) found that due to a particular policy cap on the grand prize, in China, which limits the reward of each jackpot winner, neither the effective price nor the jackpot size could explain the observed variation in lottery sales. They found instead that the size of the lottery rollover fitted well in explaining the variation in lottery demand.

5.3 Objectives of the present study

The need for studying product cannibalization and its relevance has been established in the literature in the marketing and economics fields. However, studies are mostly industry focused and literature on product portfolio/corporate cannibalization on lottery gambling is somewhat scarce (Marionneau & Nikkinen, 2017). From the studies found on lottery cannibalization none has studied this phenomenon from a marketing perspective nor have any studies been conducted on the Portuguese market or on the

Portuguese national lottery product portfolio. In this study the Portuguese national lottery product portfolio is analysed, and the study focuses on the potential cannibalization between product categories as well as between single / individual products, to understand the sales relationship between them. The work hypothesis of this study is grounded on an empirical analysis of cannibalization on product category sales and single / individual product sales and the potential cannibalization effects of rollovers and jackpots on lotto sales. From the literature review, not a single study was found which followed this double approach taken in the present study, as it is broader and more complete to study the sales relationships between products/games. The purpose is to study whether there is cannibalization between products and product categories and to understand how games sales influence each other regarding players' expenditures and how are they modulated by game design and play mechanics. As found in previous studies on lottery gambling and player profiles (Chagas, Gomes & Griffiths, 2021), players tend to engage in more than one game or game category. This then makes it relevant to understand if such multigame playing activity comes at the expense of product or corporate cannibalization, which is addressed in the present study.

5.4 Methods

5.4.1 Data

For the development of this study, two datasets were used. The first is a panel data of annual sales of 10 years, from 2010 to 2020, with information for total sales and sales by product (single games) and product category. The second dataset is longitudinal and comprises two years of gambling activity (2013 and 2014). This second dataset includes all individual games and game categories in the product portfolio with weekly and draw sales data. The second dataset was made available by the Portuguese National Lottery, exclusively for the development of this study and has never been analysed before.

The games that comprise the portfolio and are present on the datasets are the following: *EuroMillions,* the only multi-national game, and *Totoloto* which are lotto games, where the first has a 5/50 + 2/12 number picking mechanics and the second was a typical 6/49 lotto game (the game mechanics have changed since and today *Totoloto* game play consist on a 5/49 + 1/13 "Lucky number"); Toto/sports lottery (*Totobola*) has a 1x2 (first team win, draw, second team win) game mechanic, based on football game outcomes; passive/class lotteries which are lottery games with pre-printed numbers and fixed prize structures, that are also pre-determined, and are not dependent on the number of players and money wagered for the determination of the size of the jackpot (such as in lotto and pari-mutuel games); and scratchcards which are games based on a card with a section or sections which may be scratched away to reveal a symbol indicating whether a prize has been won in a competition (Ariyabuddhiphongs, 2011;

North American Association of State and Provincial Lotteries, 2021). This resulted in five product categories: lotto games (*EuroMillions* and *Totoloto)*; lotto games with the inclusion of add-on games (*EuroMillion*s; *Totoloto; Joker* and *M1lhão*), as the latter games could only be played in association with lotto games; Toto/Sports Pools (*Totobola; Totogolo* and *Placard*), passive/class lotteries (*Lotaria Clássica* and *Lotaria Popular*); and scratchcards *(Lotaria Instantânea).*

5.4.2 Measures and data analysis

In this study a mix method quantitative approach was used to assess product cannibalization of the Portuguese national lottery product portfolio. For the analysis of the data, single/individual products sales were assessed, and these were also compiled into product categories as described in 4.1. In the analysis of the data, a common approach was set for the analysis of the first dataset, a 10-year panel data (2010-2020), and the second dataset, a two-year (2013-2014) times series dataset. In the second dataset, a complementary analysis was also used to assess the impact of jackpots and rollovers on sales, with the use of multiple regression. In both datasets a product category sales and single/individual products' sales assessment was carried out. To deepen the analysis and better explain the sales relation between games and explore the extent of such relations, two multiple regression analysis were performed on the 2-year period dataset. On the multiple regression models, both for the national lotto (*Totoloto;* Tables 5.5, 5.6 and 5.7) and for *EuroMillions (*Tables 5.8, 5.9 and 5.10) all the variables were transformed to their logarithmic values to estimate elasticities and to

stabilize the variance. A correlation analysis was also performed with the variables which were included in the multiple regression models to assess for their individual relation This regression included sales data and jackpot amount for all the national lotto and *EuroMillions* draw under the mentioned period. The dataset also included sales for all the other products but were only available on a weekly basis and for that reason were not included in this further analysis which intended to assess for the effects of jackpots and rollovers on sales.

A detailed analysis by sales channel was considered, but when looking at sales for the 10-year period, the online channel showed to have a small representativeness as accounted for 2.5% (mean) of total sales. For this reason and considering the vastly larger percentage of sales of the offline channels (mean=97.4%) the analysis focused on total sales and individual channels' sales were not assessed.

In this study, a four-phase approach was taken to assess and understand whether there is corporate cannibalization on the product portfolio of the Portuguese national lottery. The first three analysis conducted focused on the 2010-2020 panel data sales by product category and single products. The fourth and final approach was based on multiple regression to analyse the two-year biweekly draw sales dataset (2013-2014). Regression was used to assess the effects of jackpots and rollovers on *Totoloto* and *EuroMillions* sales, including potential cannibalization caused by the rollover of one game's jackpots on the other game and jackpot size/amount. In this analysis all variables were converted to their logarithmic values to assess for elasticity and to stabilize the variance.

The first approach consisted of a descriptive statistical analysis of the four product categories and single products, by analysing central tendency, location, and dispersion

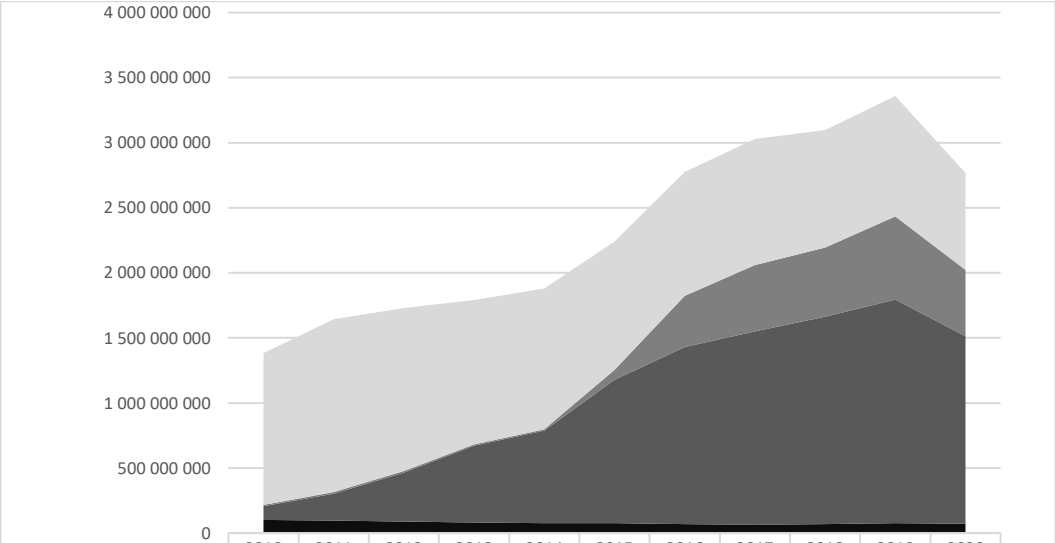
measures. The distribution that fitted the data the most is a polynomial distribution (low R^2). For convenience, a 3-period moving average was considered instead of the polynomial distribution as the latter would require a 5-term equation, which was not feasible for the trend analysis and, hence, it was more adequate to use moving average. The second approach considered an analysis of product category correlations and single product correlations to assess for cannibalization between the different product's sales. Statistical relevant negative correlations were identified as the occurrence of sales cannibalization between different products. Positive correlation on products sales were also found and are approached in the results section. The third approach consisted of a cluster analysis to better identify the resemblance in the behaviour of sales between products, both by product category as well as for single products. The fourth and final analysis consisted of multiple regression for the assessment of the effects of jackpot size and rollovers on potential product cannibalization. *EuroMillions* and *Totoloto* were the only products in which sales were available biweekly / by draw. In that sense analysis of the rollover and jackpot analysis focused on these two games. Sensitivity to jackpot size and to rollover would not provide the same results if analysis was carried out on a week basis and, for that reason, the other games were not included in this last step. IBM SPSS 26 (*IBM SPSS Statistics v.24 - Statistical Package for the Social Sciences*), was used for the descriptive statistics, correlation and cluster analysis and STATA for the multiple regression.

5.5 Results

In the analysis of the data, a broader assessment was set for the 10-year period panel data (2010-2020), in which product category sales and single/individual products' sales were assessed. A finer analysis of the longitudinal set of a two-year period (2013/2014), both for product category and single/individual products' sales, was also carried out. An analysis by sales channel was also considered, but sales for the online sales channel, regarding the 10-year period, showed to have a small representativeness as it accounted for 2.5% (mean) of total sales (minimum of 2.5% and maximum of 4.0%). For this reason and considering the vastly larger percentage of sales of the offline channels (mean=97,4%; minimum=96.1%; maximum=97.5%), sales by sales channels were not assessed individually, and the focus of the analysis was on total sales, for both online and offline sales combined. Total sales grew steadily from 2010 until 2019 and dropped in 2020 (Figure 1), probably because of the covid-19 pandemic and the lockdowns that were put in place, and which closed temporarily many of the retailers that comprise the offline sales channel. This trend was observed in all product categories (passive/class lotteries; scratchcards; toto and sports betting and lotto type games). Sales for the Portuguese national lottery grew steadily across almost all the product categories, expect for the passive/class lotteries, especially from 2014 to 2019. Passive lottery is the only product category in which sales were stagnant on even declined in the past 10years.

Figure 5.1

Total sales by product/game category

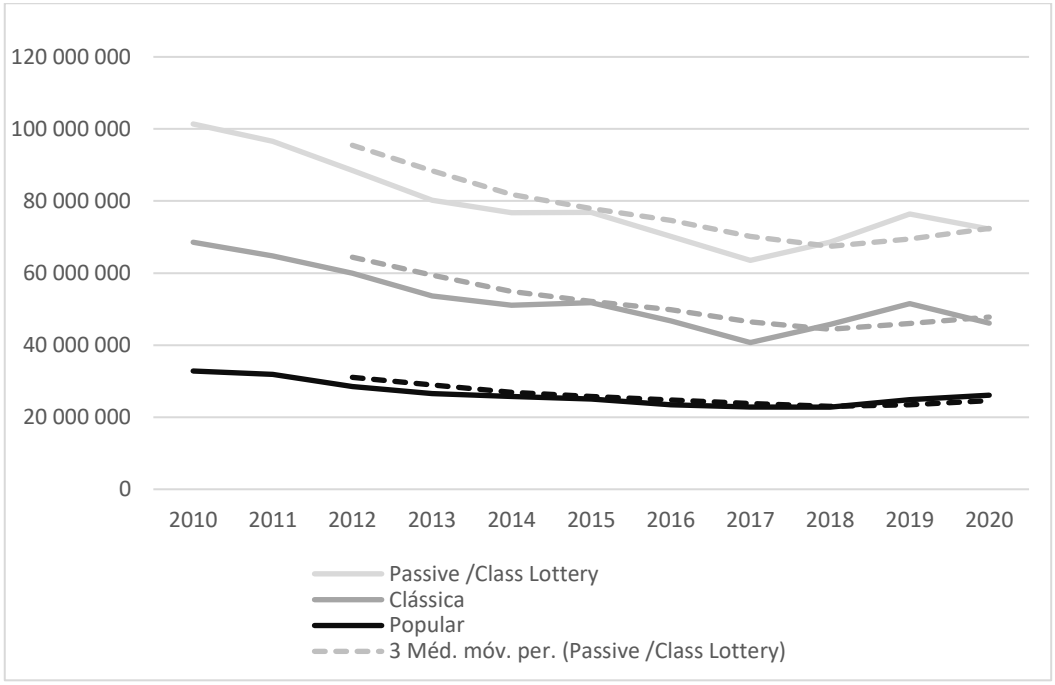


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lotto	1 164 93	1 327 64	1 252 09	1 108 65	1 082 52	985 211	951 263	968 070	902 197	925 282	744 715
Toto / Sports Pools	10 427 4	11 095 0	12 067 0	10 466 0	10 235 7	76 736 9	394 621	509 654	532 235	639 738	510 964
Scratchcards	105 557	207 193	376 516	590 716	710 778	1 101 51	1 359 09	1 487 09	1 594 17	1 718 09	1 440 24
Passive / Class Lottery	101 380	96 576 0	88 449 0	80 193 5	76 791 3	76 871 2	70 203 3	63 522 5	68 556 7	76 391 7	72 209 7

Whew assessing for each product category individually it was observed that the distribution that best fits the data is the polynomial. For the reasons described in 4.2, the methods chosen was based on a three-period moving average, to assess the data. This analysis was run to understand the sales behaviour of the product categories and for each of the single / individual products that fit each of those categories, to understand whether the total sales behaviour would be reflected in the same way on all individual products.

Figure 5.2

Passive/Class Lottery sales

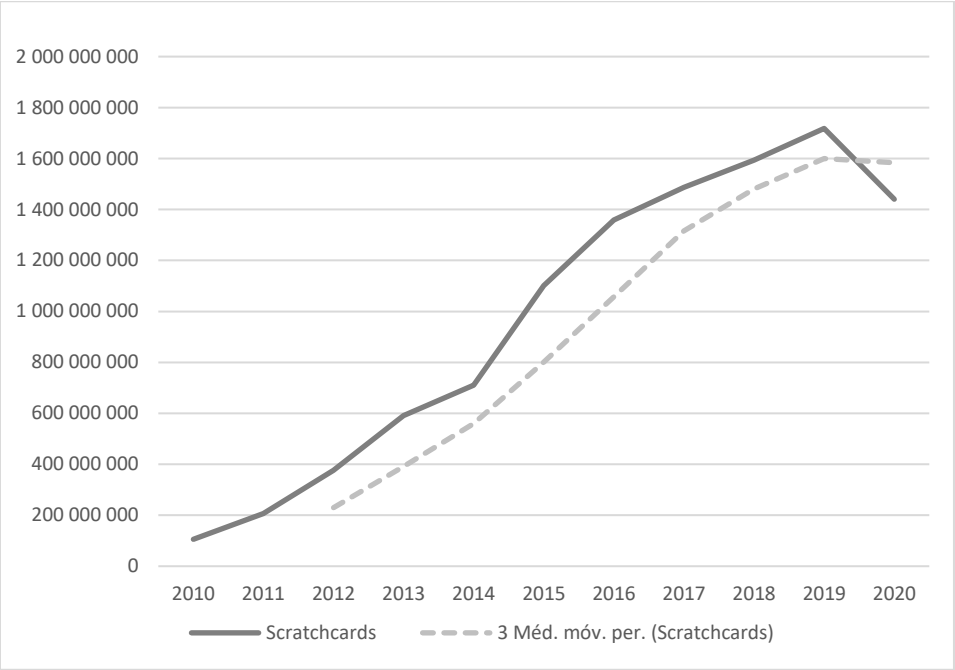


As shown in figure 5.2, class / passive lottery sales declined from 2010 to 2017, when there was a small recovery, halted by the decline in 2020 sales. Sales for *Lotaria Clássica*, the product with the highest price point (EUR 5; EUR 10 and EUR 15 tickets) and the highest sales, was the most influential in the general trend of the moving average of this product category as *Lotaria Popular* (EUR 2; EUR 3 and EUR 5 tickets) represents less than half the sales of the first.

Figure 5.3 shows the sales for scratchcards (*Lotaria Instantânea*) have seen a steady increase since 2010, until 2019. This product saw changes in regulatory legislation that allowed an increase in prize payout, from 48.75% to 55% up to 70%, which can be one of the explicative factors for such growth.

Figure 5.3

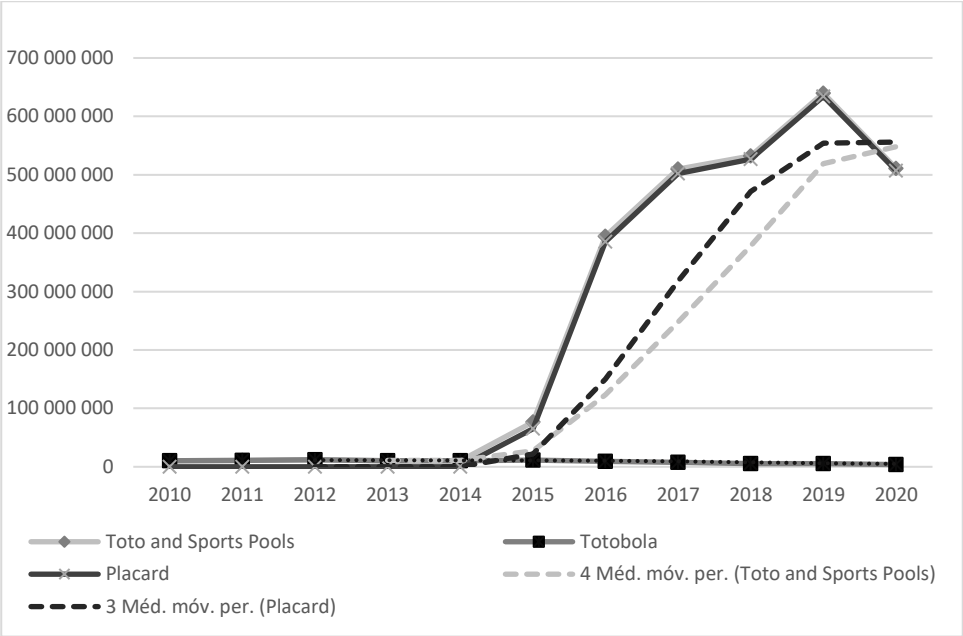
Scratchcards sales



The Portuguese national lottery product portfolio had an offer on sports that, before 2015 relied essentially on *Totobola*, a toto type game. In that year *Placard,* a sports pool-based game was introduced. As can be seen in Figure 5.4, *Placard* is responsible for almost all the sales of this product category, as toto sales are quite inexpressive in comparison. Overall, the launch of Placard in 2015, drove total demand for this product category to have a dramatic increase from 2015 to 2019, with a decrease in 2020, caused by the afore mentioned reasons.

Figure 5.4

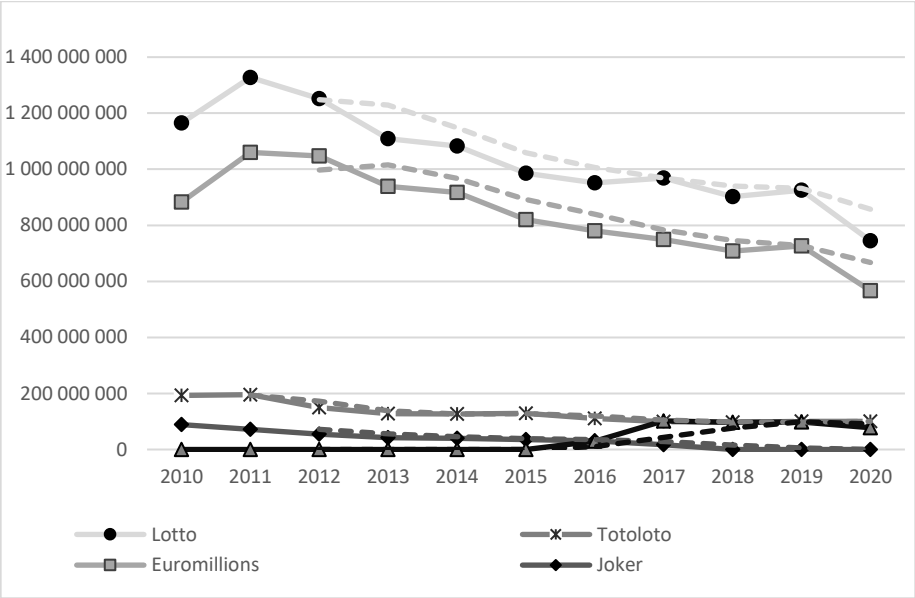
Toto and Sports Pools sales



Sales of the lotto products (Figure 5.5) have been showing a declining tendency since 2011. This is shown both for *Euromillions, Totoloto,* a 6/49 type-based lotto and for *Joker*, an add on game that is only playable with those two lotto games. In 2016, changes to *Euromillions,* implied that players must also play on *M1lhão,* another add on game to the lotto, which explain the rise in sales for this product from 2016 to 2019, when it also started to decline on the piggyback of the other lotto games.

Figure 5.5

Lotto sales



Considering the sales pattern of the different games in the analysed period (2010 to 2020), we can see that the greatest similarity in the sales profile is verified, in ascending order of differentiation for [[[*Totobola; Lotaria popular*]; *Lotaria clássica*] *Totoloto*] [*Euromillions*; Scratch Cards (Instant Lottery)].

Table 5.1

Product Category Statistics

		Passive / Class Lottery	Scratchcards	Toto / Sports Pools	Lotto
N	Valid	11	11	11	11
Mean		79195054.43	971907022.67	247112979.34	1037508673.12
Standard mean error		3552718.16	178346455.98	79992377.71	50916635.12
Median		76791366.00	1101510844.00	76736967.00	985211801.00
Mode		63522533.00	105557360.40	10235785.00	744715406.80
Variance		138839866055722.83	349882041975869950.00	70386585399690944.00	28517541052010520.00
Minimum		63522533.00	105557360.40	10235785.00	744715406.80
Maximum		101380301.76	1718099341.00	639738621.00	1327641000.00
Percentiles	10	64529367.60	125884488.32	10274117.10	776211733.44
	25	70203365.00	376516000.00	10466049.00	925282867.00
	50	76791366.00	1101510844.00	76736967.00	985211801.00
	75	88449000.00	1487090097.00	510964197.20	1164936658.50
	90	100419441.41	1693314905.00	618237984.00	1312530800.00

Correlation was tested between product categories (Table 2) to better understand sales pattern behaviours, especially when confronting the several product categories with each other. Potential cannibalization was found for several product categories, with sound statistical findings. Passive lotteries appear to cannibalize with toto/sports pools sales as a negative correlation between the two was found (Pearson=-.711; p=.014). Scratchcards were found to have a negative correlation with passive lotteries (Pearson=-.884; *p*=.000) and with lotto games (Pearson=-.881; *p*=.000), denouncing a possible cannibalization between these product categories. A negative correlation between Lotto games and Toto/Sports Pools was also found (Pearson=-.800, *p*=.003), demonstrating the existence of a possible cannibalization between these two product categories. In this analysis a strong positive correlation between several product categories was also found, which indicates that they have a similar behaviour (when the sales of a product category rise, the other rises as well) as sales behave in the same

direction (Passive lotteries and Lotto games: Pearson=,784, *p*=,004; Scratchcards and Toto/Sports Pools: Pearson=.919, *p*=.000).

Table 5.2

Product Category Correlations

		Passive / Class Lottery	Scratchcards	Toto / Sports Pools	Lotto
Passive / Class Lottery	Pearson correlation	1			
	Sig. (2-tailed)				
	N	11			
Scratchcards	Pearson correlation	-.884**	1		
	Sig. (2-tailed)	0.000			
	N	11	11		
Toto / Sports Pools	Pearson correlation	-.711*	.919**	1	
	Sig. (2-tailed)	0.014	0.000		
	N	11	11	11	
Lotto	Pearson correlation	.784**	-.881**	-.800**	1
	Sig. (2-tailed)	0.004	0.000	0.003	
	N	11	11	11	11

**. The correlation is significant at the 0.01 level (2 tails).

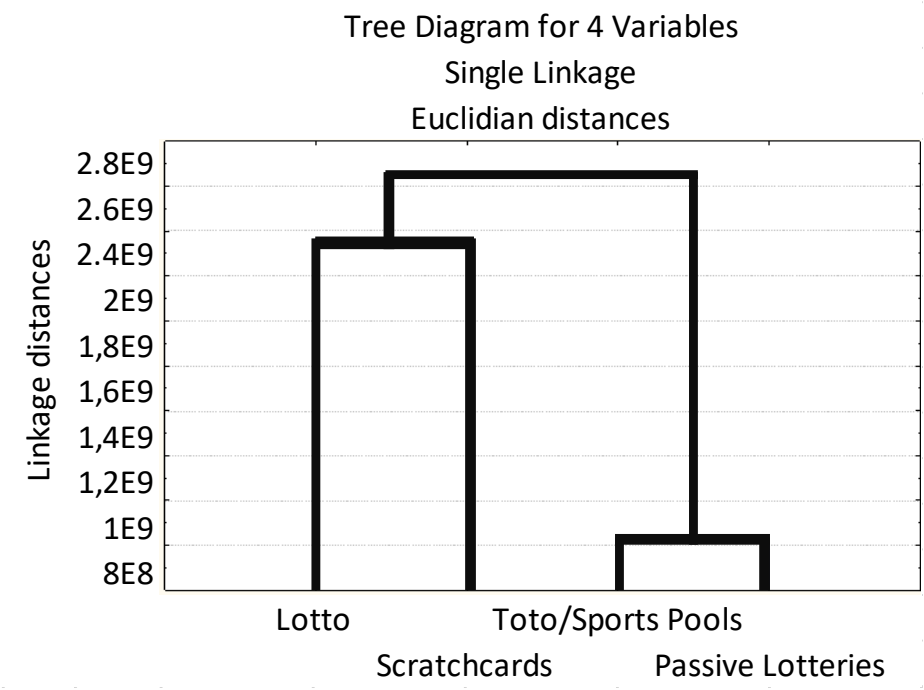
*. Correlation is significant at the 0.05 level (2 tails).

The correlations found show the existence of cannibalization between passive lotteries and scratchcards (*Pearson*=-.884; *p*=0.000), between passive lotteries and toto/sports pools (*Pearson*=-.711; *p*=0.014), between lotto games and scratchcards and between lotto games (*Pearson*=-.881; *p*=0.000) and toto/sports pools (*Pearson*=-.800; *p*=0.003). This analysis shows that scratchcards cannibalize with passive lotteries (*Pearson*=-.884; *p*=0.000), and that toto/sports pools also cannibalize with passive lotteries (*Pearson*=-.711; *p*=0.014), and with lotto games pools (*Pearson*=-.800; *p*=0.003). The work hypothesis on cannibalization was assessed again when analysing each game individually to understand whether cannibalization exists only at the product category

level or also for individual products. Considering the sales pattern of the four game categories in the analysed period (2010 to 2020), we can see through a cluster analysis (Figure 6), that the greatest similarity in the sales profile is verified for passive lotteries and toto / sports pools; then, and the distant from this first group, in terms of sales profile similarity, scratchcards and lotto games.

Figure 5.6

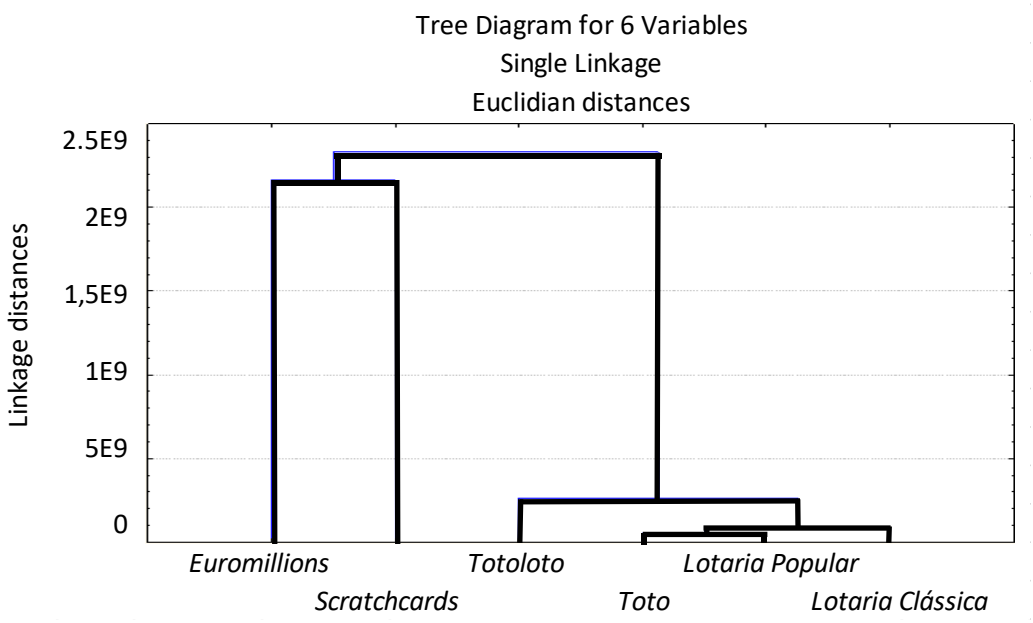
Product Category Cluster Analysis



To better understand the relationship and the behaviour of product sales between games, further analysis at the individual games' sales level was conducted. When analysing for individual product clustering, some of the findings of the product category cluster analysis findings were confirmed and it was also possible to deepen the understanding of such relationships (Figure 5.7).

Figure 5.7

Individual Product Cluster Analysis



Considering the sales pattern for single / individual games, when analysed individually (2010 to 2020), it is possible to see through in the cluster analysis that the greatest similarity in the sales profile is verified for passive lotteries and toto / sports pools (Figure 7). This applies especially to *Lotaria Popular* and *Totobola* (toto); and the similarities of these two are also closely related to *Lotaria Clássica*. Another close relationship was found for *Totoloto* (lotto 6/49) and passive lotteries (*Lotaria Clássica* and *Lotaria Popular*), which this individual analysis brought out in contrast with the product category clustering (Figure 6). Then, distant from these three first groups, in terms of profile similarity, are scratchcards and *EuroMillions* (Figure 5.7).

Table 5.3

Individual Product Statistics

		Statistics								
		Passive / Class Lottery		**Scratchcards**	**Toto / Sports Pools**		**Lotto Games**			
		Lotaria Clássica	*Lotaria Popular*	*Lotaria Instantânea*	*Totobola*	*Placard*	*Totoloto*	*Euromillions*	*Joker*	*M1lhão*
N	Valid	11	11	11	11	11	11	11	11	11
Mean		52 779 322	26 415 733	971 907 023	8 844 604	238 268 375	129 858 444	836 222 069	34 714 754	36 713 406
Standard mean error		2 567 287	1 021 286	178 346 456	842 035	80 750 969	10 785 183	45 332 903	8 910 900	13 963 962
Median		51 533 355	25 729 626	1 101 510 844	10 235 785	65 390 867	126 190 792	820 542 070	35 632 865	0,00
Mode		40 719 620	22 797 525	105 557 360	3 785 685	0,00	97 074 127	566 599 097	0,00	0,00
Variance		72 500 605 928 057	11 473 268 613 445	349 882 041 975 870 000	7 799 255 703 906	71 727 908 071 246 000	1 279 521 990 569 760	22 605 793 091 128 900	873 445 576 597 649	2 144 914 616 887 400
Minimum		40 719 620	22 797 525	105 557 360	3 785 685	0,00	97 074 127	566 599 097	0,00	0,00
Maximum		68 559 202	32 821 099	1 718 099 341	12 067 000	634 278 698	195 668 000	1 059 982 000	88 830 686	102 118 152
Percentiles	10	41 727 532	22 798 603	125 884 488	4 120 533	0,00	97 582 063	594 978 620	0,00	0,00
	25	46 083 167	23 452 544	376 516 000	5 638 734	0,00	100 261 544	726 801 375	0,00	0,00
	50	51 533 355	25 729 626	1 101 510 844	10 235 785	65 390 867	126 190 792	820 542 070	35 632 865	0,00
	75	59 938 000	28 511 000	1 487 090 097	11 095 000	507 178 512	149 426 000	939 051 132	55 064 000	96 626 204
	90	67 792 362	32 627 079	1 693 314 905	11 922 820	612 742 299	195 096 043	1 057 505 600	85 462 749	101 338 511

After the product category analysis, cannibalization between individual products was also tested, by looking at the negative correlations between games (Table 4). Scratchcards (*Lotaria Instantânea*) is the product that most cannibalize the other products (Table 4). Scratchcards cannibalize passive lotteries, both *Lotaria Clássica* (*Pearson*=-.875; *p*=0.000), and *Lotaria Popular* (*Pearson*=-.877; *p*=0.000), *Totobola* (toto: *Pearson*=-.711; *p*=0.014) and both lotto games, *Totoloto* (*Pearson*=-.917; *p*=0.000), and *EuroMillions* (*Pearson*=-.848; *p*=0.000). Passive lotteries, both *Lotaria Clássica and Lotaria Popular,* are cannibalized by scratchcards, as mentioned, and sports pools (*Placard*). Sports pools (*Placard*) negative correlation strengths with passive lotteries, *Lotaria Clássica* (*Pearson*=-.716; *p*=0.013) and *Lotaria Popular* (*Pearson*=-.671; *p*=0.024), is considered moderate to strong. Sports pools also cannibalize toto (*Totobola*: *Pearson*=-.902; *p*=0.000), and lotto games, *Totoloto* (*Pearson*=-.768*; p*=0,006*)* and *EuroMillions* (*Pearson=*-.844; *p=*0.001), with very strong negative relations.

These findings confirm the findings at the product category level analysis and present additional findings. Positive correlations between single /individual games were also found, which means that the sales of such games are related and move in tandem (Table 4). *Lotaria Clássica'*s sales show a very strong positive correlation to those of *Lotaria Popular (Pearson=*.951; *p=*0.001) and *Totoloto (Pearson=*.942; *p=*0.000), two games from two different product categories. *Lotaria Clássica'*s sales show a moderate to strong relationship with those of *Totobola* (toto: *Pearson=*.612; *p=*0.045) similarly to the correlation strength found with *EuroMillions' sales* (*Pearson=*.713; *p=*0.014). Additional findings show that *Lotaria Popular'*s sales correlate positively with lotto games' sales (*Totoloto Pearson=*.945; *p=*0.000 and *EuroMillions: Pearson=*.615; *p=*0.044 and *EuroMillions*). Totoloto's sales are also correlated positively to *Totobola* (toto

Pearson=.685; *p*=0.020). Scratchcard sales were found to correlate positively with sports betting's (*Placard: Pearson*=.918; *p*=0.000) sales. Finally, *EuroMillions*' sales were found to correlate positively with passive lottery sales, both *Lotaria Clássica* (*Pearson*=.713; *p*=0.014) and *Lotaria Popular* (*Pearson*=.615; *p*=0.044), and with *Totobola* (toto: *Pearson*=.890; *p*=0.000) and with the other lotto game: *Totoloto* (*Pearson*=.750; *p*=0.008).

Table 5.4

Single Product Correlations

		Lotaria Clássica	*Lotaria Popular*	*Lotaria Instantânea*	*Totobola*	*Placard*	*Totoloto*	*EuroMillions*
Lotaria Clássica	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	11						
Lotaria Popular	Pearson Correlation	.951**	1					
	Sig. (2-tailed)	0.000						
	N	11	11					
Lotaria Instantânea	Pearson Correlation	-.875**	-.877**	1				
	Sig. (2-tailed)	0.000	0000					
	N	11	11	11				
Totobola	Pearson Correlation	.612*	.496	-.792**	1			
	Sig. (2-tailed)	0.045	0.121	0.004				
	N	11	11	11	11			
Placard	Pearson Correlation	-.716*	-.671*	.918**	-.902**	1		
	Sig. (2-tailed)	0.013	0.024	0.000	0.000			
	N	11	11	11	11	11		
Totoloto	Pearson Correlation	.942**	.945**	-.917**	.685*	-.768**	1	
	Sig. (2-tailed)	0.000	0.000	0.000	0.020	0.006		
	N	11	11	11	11	11	11	
EuroMillions	Pearson Correlation	.713*	.615*	-,848**	.890**	-.844**	.750**	1
	Sig. (2-tailed)	0.014	0.044	0,001	0.000	0.001	0.008	
	N	11	11	11	11	11	11	11

The relation between the national lotto (*Totoloto*) and *EuroMillions* sales for the 10-year period is of a strong to very strong positive correlation (*Pearson*=.750; *p*=0.008), as mentioned before. In that sense, and contrarily to findings in previous studies (Baker, Forrest, & Perez, 2016; Marionneau & Nikkinen, 2017; Roger & Chabi, 2009), findings of the present study show that *EuroMillions* does not cannibalize the national lotto. In fact, in Portugal it is the opposite, except for jackpots with rollovers which may cause cannibalization. Sales correlation between the national lotto and *EuroMillions* for the 2-year draw by draw analysis, support the findings of the 10-year annual sales analysis as the sales of these two products show a strong positive correlation (*Pearson*=.689; *p*=0.000). *EuroMillions*' sales were also found to be positively correlated with its own jackpots (*Pearson*=.632; *p*=0.000), which implies that jackpots may drive sales. *Totoloto'*s sales also show a positive correlation with its own jackpots but are less sensitive to its effects, than *EuroMillions* (*Pearson*=.243; *p*=0.000). Although *Totoloto'*s jackpots do have a positive influence on driving the national lotto's sales, the association is much weaker that that found between *EuroMillions* and its jackpots.

Both the national lotto and *EuroMillions* showed the same trend in weekday draws' sales, as weekend draws account for most total sales, although this was more evident with *EuroMillions* (*EuroMillions* Friday draw sales=59.33%; *Totoloto* Saturday draw sales =55.96%). This was sustained by the correlation analysis of the variables included in the multiple regression models. Correlation analysis showed that *EuroMillion*s Friday draws showed a strong positive correlation with EuroMillions total sales (*Pearson*=.722; *p*=0.000) and with *Totoloto*'s total sales (*Pearson*=.914; *p*=0.000). *Totoloto'*s Saturday draw also showed a very strong positive correlation with its total sales (*Pearson*=.914; *p*=0.000).

The multiple regression model for the national lotto (*Totoloto;* Tables 5.5, 5.6 and 5.7) showed that when the national lotto jackpot increases by 1%, lotto sales increase by 0.05% and that *Totoloto* sales increase about 20% on the Saturday draw when compared to Wednesday draw. It also shows that when *EuroMillions'* sales increase 1% those of *Totoloto* increase by 0.12% (*Totoloto;* Tables 5.5, 5.8 and 5.9). The regression also showed a relation between *EuroMillions*' jackpots and *Totoloto*'s sales. When there is a rollover on a *EuroMillions* draw that is immediately prior to a *Totoloto* draw, each 1% increase on the *EuroMillions* jackpot causes a sales decrease of 0.025% on the following *Totoloto* draw, which is an indication of product portfolio cannibalization.

Table 5.5

ANOVA (Totoloto)

	SS	*df*	*MS*	*F*	*p*
Regression	3.51785968	5	.703571936	381.64	0.0000
Residual	.372400646	202	.001843568		
Total	3.89026032	207	0.018793528		

Table 5.6

Coefficients *(Totoloto)*

Log. *Totoloto* total sales	Coef.	SE	*t*	*p*	[95% Conf. Interval]	
Log. *Totoloto* jackpot amount	.0487303	.0043375	11.23	0.000	.0401777	.0572828
Log. *EuroMillions* total sales	.1219323	.0269897	4.52	0.000	.0687146	.17515
Log. *EuroMillions* jackpot amount previous draw	-.02458	.0077538	-3.17	0.002	-.0398687	-.0092913
Log. *EuroMillions* jackpot amount following draw	-.0075706	.0049871	-1.52	0.131	-.017404	.0022628
Totoloto dummy Saturday draw	.2041577	.0114905	17.77	0.000	.181501	.2268144
Constant	11.77884	.3477752	33.87	0.000	11.0931	12.46457

Table 5.7

Model Summary (*Totoloto*)

Model	*R*	*R-squared*	*Adj R-squared*	*RMSE*
	0.951	0.9043	0.9019	.04294

When looking at the multiple regression model for *EuroMillions* (Tables 8, 9 and 10), results show that sales are sensitive to its own jackpots and rollovers. For each 1% increase on the jackpot amount, sales increase by 0.22%. A relation between the national lotto's jackpots and *EuroMillions*' sales was also found. When the national lotto jackpot increases by 1%, *EuroMillions'* sales decrease by 0.05%. This shows that *EuroMillions'* sales are more elastic to changes in *Totoloto*'s jackpots, than the contrary. It should be noted that *EuroMillions'* sales are 732% times higher than those of *Totoloto*. It is also relevant to highlight that, like *Totoloto*, *EuroMillions* sales on draw days that are closer to weekends (Fridays) are also superior to Tuesday draws by 16%.

Table 5.8

ANOVA (*EuroMilllions*)

	SS	*df*	*MS*	*F*	*p*
Model	13.2525438	4	3.31314	293.24	0.0000
Residual	2.30489354	204	.011298498		
Total	15.5574374	208	.074795372		

Table 5.9

Coefficients (*EuroMilllions*)

Log. *EuroMillions* total sales	*Coef.*	*Std. Err.*	*t*	*P>|t|*	*[95% Conf. Interval]*	
Log. *EuroMillions* jackpot amount	0.2171972	.0103423	21	0.000	.1968057	.2375888
Log. *Totoloto* total sales	.7743414	.1628789	4.75	0.000	.4531994	1.095483
Log. *Totoloto* jackpot amount	-0.051749	.0130512	-3.97	0.000	-.0774816	-.0260164
Log. *EuroMillions* dummy Friday draw	.1684836	.0432122	3.90	0.000	.0832838	.2536835
Constant	2.040926	2.167655	0.94	0.348	-2.232954	6.314806

Table 5.10

Model Summary (*EuroMilllions*)

Model	*R*	*R-squared*	*Adj R-squared*	*RMSE*
	0.92293012	0.8518	0.8489	.10629

5.6 Discussion

Lotteries are used around the world as a "tool" to increase the provision of the public good and improve welfare (Clotfelter & Cook, 1990; Kaplan, 1984; Morgan, 2000). They are also used to address illegal gambling and to promote public order (Clotfelter & Cook, 1990; Kaplan, 1984). This situation creates a great pressure on lotteries to optimize their portfolio to better support raising revenue for the state, whilst promoting public order, responsible gambling and combat illegal gambling. For that reason, choices regarding the optimization of product portfolio and the minimization of cannibalization are crucial. Lottery product portfolio management should consider some of the concerns that are commonly addressed in marketing for product portfolio cannibalization. Such concerns relate to the development of a full line of products that aims to increase overall market share in a product class (Kerin, Harvey, & Rothe, 1978). In the case of lottery gambling, it implies revenue growth without necessarily increasing share of wallet or incurring in the risk of promoting excessive gambling in single individuals.

For lottery games, optimal Lottery design has traditionally mainly considered its public financing potential and a standpoint that views players as economic agents that buy lottery tickets as a form of entertainment (Maeda, 2008). Although the leisure perspective is an important one, lottery design should always consider potential addictiveness and optimize game/product design to cater for entertainment, whilst minimizing risks for excessive gambling by using responsible gaming tools. This concern has resulted in the development of several responsible gaming tools (Auer & Griffiths, 2014, 2015; Bonello & Griffiths, 2019; Griffths, 2019; Griffiths, Wood, & Parke, 2009; Harris & Griffiths, 2017; Wood, Shorter, & Griffiths, 2014) policies and practices such as

the responsible gambling codes of practice promoted by the European Lottery Association (EL), the World Lottery Association (WLA) and the European Gaming and Betting Association (EGBA), among others. Classical marketing explanations for product portfolio cannibalization should also be addressed in lottery product portfolio design. Such marketing concerns include the (1) inadequate positioning of new products resulting in them seeking the identity of existing products; (2) unrealistic or excessive market segmentation resulting in "two segments" with demands for identical product attributes or end-use needs and (3) aggressive promotional efforts reflected in sales representatives' overemphasis on new brands and neglect of existing products (Kerin, Harvey, & Rothe, 1978).

Although it is argued that Product cannibalization by itself should not be viewed only negatively (Kerin, Harvey, & Rothe, 1978) it may reveal an inefficient product portfolio design and poor planning or decision making in product management. Laruccia, Loureiro, & Martelli Tristão (2012) argue that new products should be carefully designed to avoid cannibalizing older products, unless this process is carefully planned.

To address the impact of cannibalization, when planning for new products, it should be considered throughout the product development process, beginning with concept testing, and continuing through commercialization (Kerin, Harvey, & Rothe, 1978). Cannibalization potential can be identified during the concept evaluation stage, providing that product concepts are examined considering end-use contexts rather than in an isolated, product-specific fashion (Kerin, Harvey, & Rothe, 1978). More specifically, product attributes should be evaluated in terms of their importance in satisfying a specific need (Kerin, Harvey, & Rothe, 1978).

In the case of lotteries, this may several implications such as new product revenue coming at the expenses of current games or even games that may drive excessive gambling. For these reasons, carefully drafting a lottery portfolio design, in not just desirable for marketing purposes, but also for public policy. For instance, an analysis of the UK National Lottery portfolio (Forrest , Gulley, & Simmons, Substitution between games in the UK National Lottery, 2004), concluded that Camelot has successfully designed and marketed three games that each appeal to bettors in different ways. Appealing to different segments of players implies that the games do not cannibalize the sales of the other. This should be the ideal situation for every lottery around the world, although it should be noted that this study (Forrest , Gulley, & Simmons, Substitution between games in the UK National Lottery, 2004) is prior to the creation of the multistate game EuroMillions and its induction on the British market.

It is noteworthy that none of the studies on lottery cannibalization found have studied it from a marketing perspective nor have any studies been conducted on the Portuguese market or on the Portuguese national lottery product portfolio. Some of the studies on lottery product cannibalization have a very different focus as they do not investigate cannibalization on the entire product portfolio cannibalization, such as the present study, but merely between two single products (Marionneau & Nikkinen, 2017). From a marketing perspective it is valuable to understand that as line extension is the most common branding strategy for new products, it is important that managers develop their understanding of the effect, and that little empirical work has been published on the subject (Lomax, Hammond, & East, 1996).

In the present study, an approach was developed and carried out to assess product portfolio cannibalization on the Portuguese national lottery game portfolio. It was

possible to observe both complementarity and cannibalization occurring between games in the portfolio. While it is more natural to suppose that lottery products are substitutes for one another, Grote and Matheson (2013) conclude that transactions costs and the ability to buy multiple types of game tickets at the same time are responsible for the complementarities exhibited by lottery ticket buyers. This implies that both situation – substitution and complementarity - in lottery product portfolio may occur.

In this study, cannibalization was found at the product category level and for individual products. This is a fresh approach on lottery product cannibalization as it addresses product categories and not just single products, as previous studies have done (Marionneau & Nikkinen, 2017). This allows a better understanding of which game categories "compete" with each other which, in turn, may allow a more in-depth awareness of product cannibalization and enables a better portfolio decision making process for practitioners.

Findings showed that, at the product category level, passive lotteries cannibalize toto/sports pools and that scratchcards cannibalize passive lotteries and lotto games. Findings also showed that lotto games cannibalize toto/sports pools which, in turn, cannibalize passive lotteries. In the single product analysis, scratchcards were found to be the game that most cannibalize other products, namely both passive lottery games, *Lotaria Clássica* and *Lotaria Popular,* sports pools game *Totobola* and both lotto games, *Totoloto* and *EuroMillions*. These findings demonstrate that results found in this study prove the difference in gambling consumption in different European countries. In the UK, Forrest, Gulley, and Simmons (2004) found that lotto and scratchcards games are merely partial substitutes for one another. In the Portuguese lottery portfolio, Sports

pools (*Placard*) were found in the present study to cannibalize *Lotaria Clássica* and *Lotaria Popular*, toto (*Totobola*) and lotto games (*Totoloto* and *EuroMillions)*. These findings confirmed the findings at the product category level analysis.

Findings of this study also show that some product's sales reinforce each other's sales, such as passive lotteries (*Lotaria Clássica* with *Lotaria Popular*) with lotto games (*Totoloto* and *EuroMillions)* and scratchcards with toto/sports pools (*Placard*). The study also shows that *EuroMillions*' sales and *Totoloto*'s sales were found to be positively correlated with *Totobola's* (toto) and with each other. When *EuroMillions'* sales increase, *Totoloto's* sales also increase, contradicting finding from previous studies on the effects on *EuroMillions* on national lotto games. In France, the opposite trend was also found when contrasting to the findings of the present study regarding the Portuguese national lotto game and EuroMillions as (Roger & Chabi, 2009) the launching of *EuroMillions*, led to the cannibalization of the French 6/49 lotto sales. This situation later prompted a change in the design of the French proposed by La Française des Jeux.

The exception found in this study is dependent on a jackpot increase from rollovers specifically when there is a rollover that elevates the jackpot on a *EuroMillions* draw, immediately before a national lotto draw. For each 1% increase on the *EuroMillions* jackpot there is a 0.025% sales decrease on the following *Totoloto* draw. The decrease is higher when it comes to national lotto rollover jackpot. When the national lotto jackpot increases by 1%, *EuroMillions'* sales decrease by 0.05%. These findings are an indication that lotto game product portfolio cannibalization occurs in specifics situations when there is a rollover the increases the jackpot. Findings from the present study complement existing findings from previous studies, focusing on EuroMillions, namely Forrest and McHale's (2007), who concluded that the UK Lotto and

EuroMillions games are complements rather than substitutes. Their study also adds that it would not be unreasonable to view large jackpot draws in the multi-state game as opportunities to gain extra benefit from a boost in sales of the local game, which is contrary to what was found by the present study, in Portugal.

In this study it was also found that *EuroMillions* and *Totoloto* sales are reinforced by their own jackpots which demonstrated that jackpots impact sales of their own products. The same trend was also reported by Baker, Forrest, & Perez (2016) who state that UK players have a greater willingness to increase their purchases when the jackpot is high enough to generate headline-making payouts to UK players. The specific amount for headline-making payouts was not disclosed but these findings support the findings from the present study on the effects of jackpots in increasing sales. A previous study by Roger (2011) also showed that a greater proportion of UK sales occurred when the draw offered better value and that such pay-out has the potential to have a strong and long-lasting effect on subsequent sales. Roger (2011) focused on comparing price elasticities of EuroMillions playing in the countries where this game is available and demonstrated that there are differences in those countries. Spain and Portugal exhibited a low-price elasticity and high mean sales, meaning a low sensitivity to jackpot increases and on the contrary, Ireland and the United Kingdom exhibit a very high long-run elasticity and a large sensitivity to jackpot variations (Roger, 2011) lower per capita GDP and the large development of syndication play in Spain and to the special tax regime in Portugal. On the contrary, Ireland and the United Kingdom exhibit a very high long-run elasticity and a large sensitivity to jackpot variations.

In Portugal, for each 1% increase on the jackpot amount in EuroMillions, its sales increase by 0.22%. Also, both the national lotto and EuroMillions showed the same trend

in weekday draws' sales, as weekend draws account for most sales, although this was more evident with EuroMillions. It also established that *Totoloto*'s sales increase about 20% on the Saturday draw when compared to Wednesday draw. Finally, it is also relevant to highlight that, like Totoloto, *EuroMillions* sales on draw days that are closer to weekends (Fridays) are also superior to Tuesday draws by 16%.

This demonstrated that cannibalization occurs between specific product categories and games, whilst on the same portfolio complementary sales also do occur. This does imply that when designing a product portfolio, great care should be placed in understanding which games substitute each other and which ones reinforce other's games sales. Lottery product design involves considering several variables, such as the odds of winning, prize tiers, prize payouts, jackpots, tickets emission and other game characteristics. Roger and Chabi (2009) argue that the success of a lottery product is essentially linked to the design of the game, that is the structure of prizes offered to players, and the competitive universe of betting markets in which it is embedded.

For example, in the case of the Portuguese National Lottery, adjusting for the odds of winning on lotto and pondering the induction of new products could offset the current situation where instant lottery is becoming the main sole driver of revenue (*Santa Casa da Misericórdia de Lisboa*, 2021, 2020). Given that lotteries are optimally designed, the fundraising potential of a lottery is independent of its type (specifically, of whether it is a fixed-prize type or a pari-mutuel) and the ratio of the optimal winning prize amount in each prize class to total lottery sales is equalized to the elasticity of demand for lottery ticket purchases with respect to the winning prize in each prize class (Maeda, 2008).

In 2005 the Spanish National Lottery Agency (LAE) made several modifications to the design of one of its lotto games from a 6/49 format was replaced by 5/54 + 1/10, although the entry fee remained unchanged, which lengthened the odds against winning a share of the grand prize (Forrest, Perez, & Baker, 2010). However, extra lower tiers of prizes were added and a guaranteed jackpot of Eur5m introduced. The changes in design appear in this case to have allowed the operator to better satisfying players' preference for skewness in the distribution of returns and achieve greater sales results (Forrest, Perez, & Baker, 2010).

As in any research, the present study has some limitations. This study approaches lottery product portfolio cannibalization to shed light on the design of an optimal product portfolio, where there is no cannibalization, or its effects are limited. In that sense, although this approach considers all the products/games in the portfolio it does not consider other legalized gambling activities in the jurisdiction where de study was conducted (Portugal). As such, it was not possible to control the exogenous effects of such legalized gambling activities in the portfolio, as performed in other countries (Walker & Jackson, 2008). Additionally, since no weekly/draw data was available for the three past years, it was not possible to assess accurately the effects of the COVID-19 pandemic and its correspondent lockdowns on sales and on cannibalization on product category, single products, or sales channels. A 5-year weekly/draw longitudinal time series, for the part 5 years would also allow a more detailed analysis of cannibalization and complementarity and assess in more detail the effects of jackpot size and seasonality.

5.7 Conclusions and further research

In the present study, an approach was developed and carried out to assess product portfolio cannibalization on the Portuguese national lottery game portfolio. It was possible to observe both complementarity and cannibalization occurring between games in the portfolio. A cluster analysis showed that the greatest similarity in sales profile was verified for passive lotteries and toto / sports pools, namely *Lotaria Popular* and *Totobola* (toto). Another close relationship was found at the single product level analysis for *Totoloto* (lotto 6/49) and passive lotteries (*Lotaria Clássica* and *Lotaria Popular*). Distant from these groups, but also with similarities in sales profile were scratchcards and lotto games, namely *EuroMillions*.

Cannibalization was found at the product category level and for individual products. At the product category level, passive lotteries were found to cannibalize toto/sports pools and scratchcards. The latter were found to cannibalize, passive lotteries and lotto games. Lotto games were found to cannibalize toto/sports pools. Toto/sports pools also cannibalize passive lotteries and lotto games. Cannibalization between single products was also tested and found. Scratchcards is the product that most cannibalize other products as it cannibalizes passive lotteries, both *Lotaria Clássica* and *Lotaria Popular, Totobola* and both lotto games, *Totoloto* and *EuroMillions*. Sports pools (*Placard*) cannibalize *Lotaria Clássica* and *Lotaria Popular*, toto (*Totobola*) and lotto games (*Totoloto* and *EuroMillions)*. These findings confirm the findings at the product category level analysis and show that regulatory changes to the prize payout for scratchcards, introduced in 2013 (Portaria n.º 112/2013 - Alteração ao Regulamento da Lotaria Instantânea, 2013), which changed its prize payout from a 48.75% net prize

payout to a dynamic net prize payout, between 50% and 70%, and the introduction of sports pools (Placard) in 2016 (Decreto-Lei n.º 67/2015 - Regime jurídico da exploração e prática das apostas desportivas à cota de base territorial, 2015) drastically changed the sales pattern of lottery products in the past 5 years. Forrest, Gulley, and Simmons (2000) concluded that when setting a take-out rate for a state lottery, in the UK, where the operation of the National Lottery is franchise, the figure of 50 percent appears to be well chosen as it was found to be consistent with maximizing the amount of money available for Good Causes. The cannibalization found in the present the study, namely for scratchcards, confirms that the changes made to this game's design and the introduction of sports pools, offset the balance of the product portfolio. In that sense, the Portuguese national lottery should warrant a deeper portfolio segmentation analysis to ensure these games cater to different player segments, including considering recent public concerns for scratchcards playing (Del Barrio, 2020; Lopes, 2021; Vilaverde & Morgado, 2020).

Findings of this study also show that some products' sales move in tandem and reinforce each other's sales. Complementarity at the product category level was found between passive lotteries and lotto games and scratchcards and toto/sports pools. Individual product's complementarity was found for *Lotaria Clássica* with *Lotaria Popular,* with *Totoloto,* with *EuroMillions* and with *Totobola*. *Lotaria Popular'*s sales correlate positively with *Totoloto's* and *EuroMillions'. Totoloto*'s sales were found to be positively correlated with *Totobola's* (toto). Scratchcards sales were found to correlate positively with sports pools' (*Placard*) sales. Finally, *EuroMillions*' sales were found to correlate positively with both passive lotteries, with *Totobola* and with the national lotto game: *Totoloto*. When *EuroMillions'* sales increase 1% those of *Totoloto* also increase by

0.12%. This study demonstrates that the national lotto (*Totoloto*) has a very strong positive correlation with *EuroMillions*, contradicting finding from previous studies. This study demonstrated that, in general, *EuroMillions* does not cannibalize the national lotto, except in specific situations when there is a rollover that elevates the jackpot on a *EuroMillions* draw immediately before a national lotto draw. For each 1% increase on the *EuroMillions* jackpot there is a 0.025% sales decrease on the following *Totoloto* draw. A relation between the national lotto's jackpots and *EuroMillions*' sales was also found. Each 1% national lotto jackpot increase leads to a *EuroMillions'* sales decrease of 0.05%. This shows that *EuroMillions'* sales are more elastic to changes in *Totoloto*'s jackpots, than the contrary. It should be noted that *EuroMillions'* sales are 732% times higher than those of *Totoloto*. These findings are an indication that lotto game cannibalization occurs in situations when there is rollover that increases the jackpot.

EuroMillions and *Totoloto* sales were also found to be reinforced by their own jackpots which demonstrated that jackpots impact sales of their own products. For each 1% increase on the jackpot amount in *EuroMillions*, its sales increase by 0.22%. Also, both the national lotto and *EuroMillions* showed the same trend in weekday draws' sales, as weekend draws accounted for most sales, although this was more evident with *EuroMillions*. It also established that *Totoloto'*s sales increase about 20% on the Saturday draw when compared to Wednesday draw. Finally, it is also relevant to highlight that, like *Totoloto*, *EuroMillions* sales on draw days that are closer to weekends (Fridays) are also superior to Tuesday draws by 16%.

In hindsight of the findings of the present study, several indications for further research can be addressed. Considering the Portuguese national lottery introduced its sports pool game (*Placard*) in 2016, there is enough data today to be used for a weekly

analysis that can address in further research a deeper look into the impact of the introduction of new products on the product portfolio.

In 2005 the Spanish National Lottery Agency (LAE) made several modifications to the design of one of its lotto games from a 6/49 format was replaced by 5/54 + 1/10, although the entry fee remained unchanged, which lengthened the odds against winning a share of the grand prize (Forrest, Perez, & Baker, 2010). However, extra lower tiers of prizes were added and a guaranteed jackpot of Eur5m introduced. The changes in design appear in this case to have allowed the operator to better satisfying players' preference for skewness in the distribution of returns and achieve greater sales results (Forrest, Perez, & Baker, 2010). Similar changes were introduced, in Portugal, to Totoloto, in 2011, to offset the introduction of a second weekly draw on EuroMillions. Totoloto went from a 6/49 game mechanics to a 5/49 + 1/13 number picking game mechanic. According to the findings of the present study, these changes appear not to have negatively impacted *Totoloto,* as complementarity was found between Totoloto and EuroMillions and cannibalization was only found in situation when there are increased jackpots due to rollovers.

In the same year, 2016, legalized online gambling (casino, bingo and online sports betting and odds betting) was approved by the Portuguese government. Since then, this activity has grown to almost 5 billion euros in gross gaming revenue in 2020. In that sense, an interindustry relationship with other legalized gambling activities should also be considered, as it has been done in other jurisdictions (Walker & Jackson, 2008).

Also, considering the large percentage of sales deriving from scratchcards and the media attention that this has generated in Portugal, with allegations from different

stakeholders of scratchcards fostering excessive gambling (Del Barrio, 2020; Lopes, 2021; Vilaverde & Morgado, 2020), further analysis on this topic would also be relevant to study the social impact of the national lottery products. Finally, considering the COVID-19 pandemic has had an impact on the Portuguese lottery sales (Santa Casa da Misericórdia de Lisboa, 2020, 2021), possibly due to many stores closing during lockdown, in which overall sales declined, from 2019 to 2020.

References

Ariyabuddhiphongs, V. (2006). A test of the social cognitive model of lottery gambling in Thailand. *International Gambling Studies, 6*(1), 77–93.

Ariyabuddhiphongs, V. (2011). Lottery gambling: a review. *Journal of Gambling Studies, 27*(1), 15-33.

Auer, M., & Griffiths, M. (2014). Personalised feedback in the promotion of responsible gambling: a brief overview. *Responsible Gambling Review, 1*(1), 27-36.

Auer, M., & Griffiths, M. (2015). The use of personalized behavioral feedback for online gamblers: an empirical study. *Frontiers in Psychology, 6*, 1664-1078.

Baker, R., Forrest, D., & Perez, L. (2016). The compatriot win effect on national sales of a multicountry lottery. *Applied Statistics, 65*(4), 603–618.

Benhsain, K., Taillefer, A., & Ladouceur, R. (2004). Awareness of independence of events and erroneous perceptions while gambling. *Addictive Behaviors, 29*(2), 399-404.

Bonello, M., & Griffiths, M. (2019). Behavioural tracking, responsible gambling tools, and online voluntary self-exclusion: implications for the gambling industry. *Casino and Gaming International, 38*, 41-45.

Boone, L. E., & Kurtz, D. L. (2009). *Contemporary marketing.* Mason, Ohio: Cengage South-Western.

Britannica. (n.d.). (2021, March 4). *Gambling*. In Britannica.com dictionary. Retrieved from https://www.britannica.com/topic/gambling.

Brochado, A., Santos, M., Brochado, F. O., & Esperança, J. (2018). Gambling behavior: Instant versus traditional lotteries. *Journal of Business Research, 88*, 560-567.

Brooks, G. A., & Clark, L. (2019). Associations between loot box use, problematic gaming and gambling, and gambling-related cognitions. *Addictive Behaviors*, 26-34.

Brown, R., & Rork, J. (2005). Copycat gaming: A spatial analysis of state lottery structure. *Regional Science and Urban Economics, 35*, 795–807.

Calado, F., & Griffiths, M. D. (2016). Problem gambling worldwide: An update and systematic review of empirical research (2000–2015). *Journal of Behavioral Addictions, 5*(4), 592–613.

Chagas, B. T. (2007). *University student gambling consumption.* Master Dissertation, Universidade de Lisboa., Instituto Superior de Economia e Gestão, Lisboa.

Chagas, B. T., Gomes, J. F., & Griffiths, M. D. (2021). Consumer profile segmentation in online lottery gambling utilizing behavioural tracking data from the Portuguese national lottery. *Journal of Gambling Studies*, *13*, 1-23.

Charnessa, G., & Gneezyb, U. (2012). Strong evidence for gender differences in risk taking. *Journal of Economic Behavior & Organization, 83*(1), 50-58.

Clark, T. L. (1987). *The dictionary of gambling and gaming.* Cold Spring, New York: Lexik House.

Close, J., Spicer, S. G., Nicklin, L. L., Uther, M., Lloyd, J., & Lloyd, H. (2021). Secondary analysis of loot box data: Are high-spending "whales" wealthy gamers or problem gamblers? *Addictive Behaviors, 117*, *1-8*.

Clotfelter, C. T., & Cook, P. J. (1990). On the economics of state lotteries. *Journal of Economic Perspectives, 4*(4), 105-119.

Cook, P. J., & Clotfelter, C. T. (1993). The peculiar scale economies of lotto. *The American Economic Review, 83*(3), 634-643.

Costes, J., Kairouz, S., Monson, E., & Eroukmanoff, V. (2018). Where lies the harm in lottery gambling? A portrait of gambling practices and associated problems. *Journal of Gambling Studies, 34*, 1293-1311.

Court, D., Elzinga, D., Mulder, S., & Vetvik , O. J. (2009, June 1). The consumer decision journey. *McKinsey Quarterly*, 1-14. Retrieved October 16, 2020, from https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-consumer-decision-journey.

Culin, S. (1907/1992a). *Games of the North American Indians. Vol. 1: Games of chance. Lincoln and London: Bison Books/University of Nebraska Press.* Lincoln and London: Bison Books/University of Nebraska Press.

Culin, S. (1907/1992b). *Games of the North American Indians. Vol. 2: Games of skill.* Lincoln and London: Bison Books/University of Nebraska Press.

Decreto-Lei n.º 66/2015 (Regime Jurídico dos Jogos e Apostas Online - RJO). (29 de abril de 2015). *Diário da República, 1.ª série — N.º 83*. Lisboa.

Del Barrio, J. M. (2020, 02 23). Los portugueses, enganchados a la 'raspadinha'. *El País*. Retrieved from https://elpais.com/internacional/2020/02/21/mundo_global/1582308868_274441.html.

Derevensky, J. L., & Griffiths, M. D. (2019). Gaming: does the gambling and gaming industry have a responsibility In protecting the consumer? *Gaming Law Review, 23*(9), 633-639.

Drummond, A., & Sauer, J. (2018). Video game loot boxes are psychologically akin to gambling. *Nature Human Behaviour, 2*, 530–532.

Edelman, D., & Singer, M. (2015). The new consumer decision journey. *McKinsey Quarterly*. Retrieved October 16, 2020, from

https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-new-consumer-decision-journey.

European Commission. (2012). *Online gambling in the Internal Market.* Strasbourg: European Commission. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012SC0345&from=IT.

Eurostat. (2019, October 21). *Eurostat nuts background*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/nuts/background.

Forrest, D., Gulley, D., & Simmons, R. (2004). Substitution between games in the UK National Lottery. *Applied Economics, 36*, 645–651.

Forrest, D., & McHale, I. (2007). The relationship between a national and a multistate lotto game. *The Journal of Gambling Business and Economics, 1*, 207–216.

Forrest, D., Gulley, D., & Simmons, R. (2000). Elasticity of demand for UK national lottery tickets. *National Tax Journal, 53*(4), 853-863.

Forrest, D., Perez, L., & Baker, R. (2010). Evaluating the effects of game design on lotto sales: A Case Study from Spain. *Journal of Gambling Business and Economics, 4*(2), 1-19.

Froberg, F., Rosendahl, I. K., Abbott, M., Romild, U., Tengstrom, A., & Hallqvist, J. (2015). The incidence of problem gambling in a representative cohort of Swedish Female and male 16–24-year-olds by socio-demographic characteristics, in comparison with 25–44-year-olds. *Journal of Gambling Studies, 31*, 621–641.

Gadboury, A., & Ladouceur, R. (1989). Erroneous perceptions and gambling. *Journal of Social Behavior & Personality, 4*(4), 411–420.

Garrett, T. A. (2001). An international comparison and analysis of lotteries and the distribution of lottery expenditures. *International Review of Applied Economics, 15*(2), 213-227.

Garrett, T. A., & Sobel, R. S. (2004). State lottery revenue: The importance of game characteristics. *Public Finance Review, 32*(3), 313-330.

Garrett, T., & Marsh, T. (2002). The revenue impacts of cross-border lottery shopping in the presence of spatial autocorrelation. *Regional Science and Urban Economics, 32*, 501–519.

Global Industry Analysts Inc. (2021). *Gambling - global market trajectory & analytics.* CA, USA: Global Industry Analysts Inc. Retrieved from https://www.strategyr.com/market-report-gambling-forecasts-global-industry-analysts-inc.asp.

Grand View Research. (2020). *Online gambling market size and share - Industry report, 2020-2027.* San Francisco, California: Grand View Research. Retrieved from

https://www.grandviewresearch.com/industry-analysis/online-gambling-market.

Gray, H. M., Jonsson, G. K., LaPlante, D. A., & Shaffer, H. J. (2015). Expanding the study of internet gambling behavior: Trends within the Icelandic lottery and sportsbetting platform. *Journal of Gambling Studies, 31(2)*, 483-499. doi:10.1007/s10899-013-9427-0.

Griffiths, M. (2018a). Hot topics in gambling: gambling blocking apps, loot boxes, and 'crypto-trading addiction'. *Online Gambling Lawyer, 17* (7), 9-11.

Griffiths, M. D. (2013). Social gambling via Facebook: Further observations and concerns. *Gaming Law Review and Economics, 17*(2), 104-106.

Griffiths, M., & Wood, R. (2001). The psychology of lottery gambling. *International Gambling Studies, 1*, 27-44.

Griffiths, M., Wood, R., & Parke, J. (2009). Social responsibility tools in online gambling: a survey of attitudes and behavior among Internet gamblers. *CyberPsychology & Behavior, 12*(4), 413-421.

Griffiths, M. (2019). *Behavioural tracking in gambling: The use and efficacy of online responsible gambling tools*. In H. Bowden-Jones, C. Dickson, C. Dunand, & O. Simon, Harm reduction for gambling: A public health approach (p. 12). London: Routledge. doi: https://doi.org/10.4324/9780429490750.

Grote, K., & Matheson, V. (2006). Duelling jackpots: Are competing lotto games complements or substitutes?. *Atlantic Economic Journal, 34*, 85–100.

Grote, V. A., & Matheson, K. R. (2013). *The economics of lotteries: A survey of the literature*. In L. A. Vaughan-Williams, The Oxford Handbook of the Economics of Gambling (Vol. Paper No. 11, pp. 670-691). Oxford: Oxford University Press.

Gulley, O., & Scott, F. (1993). The demand for wagering on state-operated lotto games. *National Tax Journal, 46*, 13–22.

Harris, A., & Griffiths, M. (2017). A critical review of the harm-minimisation tools available for electronic gambling. *Journal of Gambling Studies, 33*, 187–221.

Heskett, J. L. (1976). *Marketing.* New York: Macmillan.

Hubert, P., & Griffiths, M. D. (2018). A comparison of online versus offline gambling harm in portuguese pathological gamblers: An empirical study. *International Journal of Mental Health and Addiction, 16*(3), 1219–1237.

Huizinga, J. (1949). *Homo ludens: A study of the play-element in culture.* London: Routledge.

International Center for Responsible Gaming. (2021, July 22). *Milestones*. Retrieved from International Center for Responsible Gaming: https://www.icrg.org/about-ncrg/history/milestones.

Jia, Y. (2011). Are lotteries substitutes for each other? *The Journal of Gambling Business and Economics, 5* (3), 1-14.

Jonsson, J. (2006). An overview of prevalence surveys of problem and pathological gambling in the Nordic countries. *18*, 31-38.

Kaizeler, M. J., & Faustino, H. C. (2011, September). Is the lottery product an inferior good in higher income countries? *International Journal of Economics and Finance, 3*(4), 54-59.

Kaizeler, M. J., & Faustino, H. C. (2012). Lottery sales and per-capita GDP: An inverted U relationship. *British Journal of Economics, Management & Trade, 2*(3), 225-238.

Kaizeler, M. J., Faustino, H. C., & Marques, R. (2014). The determinants of lottery sales in Portugal. *Journal of Gambling Studies, 30*, 729-736.

Kaplan, H. R. (1984). The social and economic impact of state lotteries. *The Annals of the American Academy of Political and Social Science, 474*(1), 91-106.

Kerin, A. R., Harvey, G. M., & Rothe, T. J. (1978). Cannibalism and new product development. *Business Horizons, 21*(5), 25-31.

Kerr, A. (2006). *The business and culture of digital games: gamework/gameplay.* London: Sage.

Kerr, A. (2017). *Global games. production, circulation and policy in the networked era.* New York: Routledge.

Kerr, A., O'Brennan, J., & Vazquez, M. (2021). *Gambling trends, harms and responses: Ireland in an international context.* Maynooth University. Retrieved from http://mural.maynoothuniversity.ie/14258.

Kesting, T., & Rennhak, C. (2011). Market segmentation in German business practice: relevance, procedures and challenges. *World Review of Entrepreneurship, Management and Sustainable Development, 7*(4), 361-379.

Kotler, P. (1998). *Marketing and electronic marketing and the internet.* Australia: Prentice Hall.

Kotler, P., & Armstrong, G. (2018). *Principles of marketing, Global Edition, 17th Edition.* London, United Kingdom: Pearson.

Kristia, R., Nielsen, L., & Grabarczyk, P. (2019). Are Loot Boxes Gambling? Random Reward Mechanisms in Video Games. *Transactions of the Digital Games Research Association, 4*(3), 171-207.

Kristiansen, S., & Severin, M. C. (2020). Loot box engagement and problem gambling among adolescent gamers: Findings from a national survey. *Addictive Behaviors, 103*.

LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: A prospective longitudinal study of internet sports gambling behavior. *Journal of Gambling Studies, 23*(3), 347–362.

Ladouceur, R., & Sevigny, S. (2003). Interactive messages on video lottery terminals and persistence in gambling. *Journal of the National Association for Gambling Studies, 15*(1), 45-50.

LaPlante, D. A., Gray, H. M., Bosworth, L., & Shaffer, H. J. (2010). Thirty years of lottery public health research: Methodological strategies and trends. *Journal Gambling Studies, 26*, 301–329.

Laruccia, M. M., Loureiro, S. M., & Martelli Tristão, J. A. (2012). A conceptual approach for cannibalism between goods. *Chinese Business Review, 11*, 989-995.

Li, W., Mills, D., & Nower, L. (2019). The relationship of loot box purchases to problem video gaming and problem gambling. *Addictive Behaviors, 97*, 27-34.

Lomax, W., Hammond, K., & East, M. C. (1996). The measurement of cannibalization. *Marketing Intelligence & Planning, 14*(7), 20-28.

Lopes, M. J. (2021, March 27). Raspadinhas": SICAD com "grande preocupação em relação ao potencial adictivo e de empobrecimento das famílias. *Público*. Retrieved from https://www.publico.pt/2021/03/27/sociedade/noticia/raspadinhas-sicad-preocupacao-relacao-potencial-aditivo-empobrecimento-familias-1956167.

Macey, J., & Hamari, J. (2019). eSports, skins and loot boxes: Participants, practices and problematic behavior associated with emergent forms of gambling. *New Media & Society, 21*(1), 20–41.

Maeda, A. (2008). Optimal lottery design for public financing. *Economic Journal, 118*(532), 1698-1718.

Marionneau, V., & Nikkinen, J. (2017). Market cannibalization within and between gambling industries: A systematic review. *Journal of Gambling Issues, 37*, 1-35.

Marktest Grupo. (2021, July 27). *Internet 2020: cresce a liderança dos smartphones*. Retrieved from Marktest: https://www.marktest.com/wap/a/n/id~269e.aspx.

Mason, C. H., & Milne, G. R. (1994). An approach for identifying cannibalization within product line extensions and multi-brand strategies. *Journal of Business Research, 31*(2–3), 163-170.

Matheson, V. A., & Grote, K. R. (2007). Gamblers' Love for Variety and Substitution among Lotto Games. *Journal of Gambling Business and Economics, 1*(2), 85-99.

McCaffrey, M. (2019). The macro problem of microtransactions: The self-regulatory challenges of video game loot boxes. *Business Horizons, 62*(4), 483-495.

Mikesell, J., & Zorn, C. (1987). State lottery sales: Separating the influence of markets and game structure. *Growth and Change, 18*, 10–19.

Mok, W. P., & Hraba, J. (1991). Age and gambling behavior: A declining and shifting pattern of participation. *Journal of Gambling Studies, 7*(4), 313-335.

Morgan, J. (2000). Financing public goods by means of lotteries. *The Review of Economic Studies, 67*(4), 761–784.

Moutinho, L., & Hutchenson, G. (2011). *The sage dictionary of quantitative management research.* Thousand Oaks, California, USA: SAGE Publications Ltd.

North American Association of State and Provincial Lotteries. (2021, August 17). *Glossary of lottery terms*. Retrieved from NASPL: https://www.naspl.org/glossaryoflotteryterms.

Portaria n.º 112/2013 - Alteração ao regulamento da lotaria instantânea (Ministério da Solidariedade e da Segurança Social, março 21, 2013).

Purfield, C., & Waldron, P. (1999). Gambling on lotto numbers: Testing for substitutability or complementarity using semi-weekly turnover data. *Oxford Bulletin on Economics and Statistics, 61*, 527–544.

Ries, A., & Trout, J. (2000). *Positioning: The battle for your mind.* London: McGraw-Hill.

Roger, P. (2011). La demande de grilles d'Euromillions: Une comparaison internationale. *Revue Economique, 62*(1), 29-55.

Roger, P., & Chabi, S. (2009). La cannibalisation des produits à prix aléatoires: L'Euromillions a-t-il tué le loto franc¸ais? [Cannibalization of products of random cost: Has the Euromillions killed the French lottery?]. *Actes du 25e Congrès International de l'AFM* (pp. 1-17). London: Laboratoire de recherche en gestion & economie.

Roukka, T. (2016). Consumer behaviour and the welfare efects of gambling in Finland. *paper presented at the 11th European Conference on Gambling Studies and Policy Issues.* Lisbon: EASG - European Association for the Study of Gambling.

Santa Casa da Misericórdia de Lisboa. (2004). *Relatório e Contas do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Retrieved Maio 10, 2019, from http://www.scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2018, November 18). *Institucional - Saiba mais sobre as atribuições, as competências e o historial dos Jogos Santa Casa*. Retrieved from Santa Casa da Misericórdia de Lisboa: https://www.jogossantacasa.pt/web/SCInstitucional/

Santa Casa da Misericórdia de Lisboa. (2020). *Relatório e contas de 2019 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Santa Casa da Misericórdia de Lisboa. Lisboa. Retrieved 09 22, 2020, from

https://backoffice.scml.pt/wp-content/uploads/2020/09/Relatorio_de_Contas_JSC_2019.pdf.

Santa Casa da Misericórdia de Lisboa. (2021). *Relatório e contas de 2020 do Departamento de Jogos da Santa Casa da Misericórdia de Lisboa.* Lisboa. Retrieved January 23, 2022, from http://www. scml.pt/pt-PT/santa_casa/relatorio_e_contas.

Santa Casa da Misericórdia de Lisboa. (2021, June 26). *Sobre nós – história*. Retrieved from Santa Casa da Misericórdia de Lisboa: https://scml.pt/sobre-nos/historia.

Semenik, R. J., & Bamossy, G. J. (1995). *Principles of marketing: A global perspective.* Cincinatti, Ohio: South-Western College Publishing.

Shaffer, H. J. (2003). *Futures at stake: Youth, gambling, and society.* Reno, Nevada: University of Nevada Press.

Shukla, P. (2008). *Essentials of marketing research.* Denmark: Bookboon. Retrieved from http://bookboon.com/en/marketing-research-an-introduction-ebook.

SICAD. (2020). *Relatório Anual 2019 - Descritivo de respostas e intervenções do plano de ação para a redução dos comportamentos aditivos e dependências – Horizonte 2020.* Lisboa: SICAD. Retrieved from http://www.sicad.pt/BK/Publicacoes/Lists/SICAD_PUBLICACOES/Attachments/170/RelatorioAnual2019_DescritivoRespostasIntervencoesDoPARCAD_PT.PDF.

Smith, A. (2012). *Wealth of Nations.* Ware: Wordsworth Editions Ltd.

Stover, M. (1990). Contiguous state lotteries: Substitutes or complements? *Journal of Policy Analysis and Management, 9*, 565–568.

Subramaniam, M., Tang, B., Abdin, E., Vaingankar, J. A., Picco, L., & Chong, S. A. (2016). Sociodemographic correlates and morbidity in lottery gamblers: Results from a population survey. *Journal of Gambling Studies, 32*, 291–305.

The National Council on Problem Gambling. (2021, July 22). *Help and treatment*. Retrieved from The National Council on Problem Gambling: https://www.ncpgambling.org/help-treatment/faq.

The Royal College of Psychiatrists. (2021, July 22). *Problem gambling.* Retrieved from The Royal College of Psychiatrists: https://www.rcpsych.ac.uk/mental-health/problems-disorders/problem-gambling.

Thompson, W. N. (2010). *The International encyclopaedia of gambling.* Santa Barbara, California: ABC-CLIO.

Tosun, M., & Skidmore, M. (2004). Interstate competition and state lottery revenues. *National Tax Journal, 57*, 163–178.

Vilaverde, D., & Morgado, P. (2020). Scratching the surface of a neglected threat: huge growth of Instant Lottery in Portugal. *Lancet Psychiatry, 7*(13), 1.

Walker, D. M., & Jackson, J. D. (1999). State lotteries, isolation and economic growth in the U.S. *Review of Urban and Regional Development Studies, 11*(3), 187-192.

Walker, D., & Jackson, J. (2008). Do U.S. gambling industries cannibalize each other? *Public Finance Review, 36*, 308–333.

West, R. (2001). Theories of addiction [Editorial]. *Addiction, 96*(1), 3–13. Retrieved from https://doi.org/10.1046/j.1360-0443.2001.96131.x.

Wood, R., Shorter, G., & Griffiths, M. (2014). Rating the suitability of responsible gambling features for specific game types: A resource for optimizing responsible gambling strategy. *International Journal of Mental Health and Addictionn*, *12*, 94–112.

Yuan, J. (2011). Are lotteries substitutes for each other? *The Journal of Gambling Business and Economics, 5*(3), 1-14.

Yuana, J., & Gaob, J. Z. (2015). What drives lottery demand? Evidence from China's lottery practice. *International Gambling Studies, 15*(1), 159–178.

Zendle, D., & Cairns, P. (2018). Video game loot boxes are linked to problem gambling: Results of a large-scale survey. *PLoS ONE, 13*(11), 1-12.

Zendle, D., & Cairns, P. (2019). Loot boxes are again linked to problem gambling: Results of a replication study. *PLoS ONE, 14*(3), 1-13.

Zendle, D., Cairns, P., Barnett, H., & McCall, C. (2020). Paying for loot boxes is linked to problem gambling, regardless of specific features like cash-out and pay-to-win. *Computers in Human Behavior*, *102*, 181-191.

Zendle, D., Meyer, R., & Over, H. (2019). Adolescents and loot boxes: links with problem gambling and motivations for purchase. *Royal Society Open Science, 19*(6), 1-18.

PART III

GENERAL DISCUSSION AND CONCLUSIONS

Chapter 6
Conclusion

6.1 Introduction

This dissertation is comprised of three essays that have analysed a particular form of consumer behaviour, focused on lottery gambling. Gambling is viewed by some marketing academics as a form of injurious consumption which "occurs when individuals or groups make consumption decisions that have negative consequences for their long-run well-being" (Mothersbaugh, & Hawkins, 2016, pp22). Gambling is still considered superfluous and viewed with scepticism, by others. Solomon, Bamossy, Askegaard, Hogg, (2013, p56) state that "risky consumption behaviours" include "smoking, drinking, and gambling. Yet most of the people in the world face limited consumption opportunities and struggle to meet even basic nutritional needs". It should be noted that in countries where the levels of education are higher, lottery products' sales are lower (Forrest & Gulley, 2009; Kaizeler & Faustino, 2008), which sheds some light on the basic broader motivations for gambling. But it should also be noted that forms of gambling such as lotteries have several purposes. The Portuguese national lottery, for example, has as its main objective "to create the necessary conditions to channel the demand for gambling to the supply of lottery games by the State" as to "ensure the protection of public order, the preservation of family assets and the excessive gambling prevention".

The DJSCML further mentions that it plays “a pivotal role in promoting moderate gambling habits and preventing problem gambling” by “providing its players with a moderate offer of games, accessible to all people, with low stakes, simple mechanics and different levels of prizes” to “guarantee an attractive offer that, at the same time, promotes responsible gaming habits” (*Santa casa da Misericórdia de Lisboa*, n.d.). These objectives, although noble, require the attention of several stakeholders, namely policy makers and academics to understand and assess, from a non-biased and scientific standpoint, whether such objectives are being met. This was one central key point in the development of the essays included in this dissertation.

Lotteries are one of the most prevalent forms of gambling and generate substantial revenues. In that sense and given the role that lotteries have as fund raisers for good causes and social welfare, it is important to maintain responsible levels of gambling so that the benefits that they provide to society are not outweighed by its risks. Especially at the expense of the development of gambling issues on subsets of players with more sensitive profiles. In that sense, and as demonstrated in this dissertation, it is important to know the profiles of the lottery players and to understand how they group together (market segmentation). Knowing players profiles allows the creation of marketing and advertising strategies and the according responsible gambling policies and practices, that are better suited to maintain a social “homeostasis”. To accomplished that, lotteries must develop and maintain an appropriated and balanced product (game) portfolio that curtails cannibalism between its own games so that it maximizes its revenue stream by engaging different payer segments, without fostering excessive gambling on one, or a few segments. These issues were addressed in this dissertation which reached several

relevant conclusions, that surely contribute to academia as well as to the application of the generated knowledge in gambling, by lotteries and other gambling operators.

6.2 Theoretical and practical implications and contributions

The study of games of games of chance, including lotteries, has an extensive body of published literature. However, research gaps still exist, and the current dissertation was able to contribute to the field of consumer behaviour and gambling studies with three novel essays. The contribution of this dissertation is centred on a marketing approach, focused on consumer behaviour, namely in the study of lottery gambling. This is a novel approach as, due to the sensitive nature of the topic, most research on gambling behaviour stems from a psychology, public health or public finance and taxation approach. In that sense, the marketing approach taken in this dissertation contributes by widening the approach on gambling consumer behaviour, without neglecting the responsible gambling perspective.

Considering the nature of gambling, it is extremely relevant to know players' profiles, as this is truly relevant to identify different market segments and to develop and perfect tools for the prevention and limitation of excessive gambling. Additionally, to determine effectively in which games does each player and player segment engage in, it is was also relevant to understand whether such involvement comes at the expense of product cannibalization, which is an indication that a game portfolio may need to be

reconsidered in terms of its offering, in order not to foster excessive gambling of players with specific profiles or belonging to specific segments.

Gambling activity today, including lottery gambling, is conducted in land-based venues as well as through remote channels. Gambling in the latter has grown steadily for the past ten years, across most jurisdictions. The COVID-19 pandemic has also contributed to this situation, in Portugal. Albeit the increasing attention by customers /players, research on online gambling with the use of real playing tracking data, is still somewhat scarce and no previous studies have been conducted, with such data, on Portuguese players. This dissertation is the first to include studies that do so, and which are nationally representative of Portuguese players (Chapter 4 – Essay 2 and Chapter 5 – Essay 3).

As a starting point, and to understand the state of the art of the research in the field of gambling studies, especially with the use of tracking data, a first essay was conducted on the topic (Chapter 3 – Essay 1). This essay (Chapter 3 – Essay 1) is an extensive in-depth critical review of the most relevant and recent literature on lottery gambling with, the use of real gambling data, as it is one of the most recent trends in gambling research, although with a narrow body of literature, due to the difficulty in obtaining such data. After establishing such foundation, the next step was to analyse the behaviour of players, with the use of real playing data, and to identify specific player segments.

The use of new methodologies to assess gambling behaviour, with the use of real playing data, has been increasing in relevance in the gambling studies field, as it has been seen also I other fields of consumer research. The contribution of the present dissertation to this debate was carried out and accomplished in the second essay (Chapter 4 – Essay 2). This essay (Chapter 4 – Essay 2) used a novel approach in the study

of lottery gambling to identify players' profiles by developing segmentation CHAID models, with the use of a cross sectional dataset. The CHAID segmentation models determined a four-level hierarchy of the demographic variables ranked by relevance and engagement. It is the first study in the field to establish a hierarchization of the relevance of sociodemographic variables in player segmentation. The most influential variable was found to be age, followed by gender, education, and place of residence. This essay (Chapter 4 – Essay 2) is the first study in Portugal to use real gambling behaviour tracking data from players of the Portuguese national lottery, which is also demonstrative of the contribution and innovation of this work. The methodologies followed in this dissertation have also proved to stand for the development of new approaches to assess gambling behaviour with the use of real lottery playing data. Conclusions from this essay (Chapter 4 – Essay 2) showed that players present different profiles and engage in multigame lottery playing activities. Results showed several specific profiles, which differed according to the mentioned variables, regarding player engagement. Player engagement was assessed by players' expenditure and number of wagers by product category, and in total. The second essay (Chapter 4 – Essay 2) also found that the socio-demographic profile distribution of online lottery players is significantly different from the Portuguese adult population. One of such differences was that men were found to be much more prevalent than females, in the online lottery gambling cohort than the adult population. Men were found to be more engaged overall, with higher number of wagers and higher expenditures than females. It was also found that the 25% of players with the highest average expenditures accounted for about 80% of the total amount wagered. Another difference found was that online lottery players in Portugal mean age is younger than the adult population average. Younger players, such as millennials, were

found not to be very engaged in online lottery playing. Additional findings showed that as age increases, so do lottery expenditures and the number of wagers. Another finding showed that age-related lottery expenditures differed between product categories. There are novel findings, not presented in previous studies. Considerable differences regarding education were also found as internet lottery players tend to have an average level of education that is much higher than the adult population. The second essay (Chapter 4 – Essay 2) confirmed that, for remote Portuguese players, as education level increases, overall lottery gambling expenditures tend to decrease.

The identification of distinct profiles with specific preferences makes it possible to address such profiles in marketing and responsible gaming campaigns to be more efficient in managing lottery product portfolios, its sales and minimizing risks.

Having identified the players profiles, it was also relevant to understand whether players preferences for similar games would translate to product cannibalization, which was the focal point of the third essay (Chapter 5 – Essay 3). An approach was developed and carried out to assess product portfolio cannibalization on the Portuguese national lottery game portfolio, with the use of two longitudinal datasets.

In the third essay (Chapter 5 – Essay 3), a cluster analysis showed that passive lotteries and toto / sports pools, namely *Lotaria Popular* and *Totobola* (toto), have the greatest similarity in sales profile, between all lottery games, followed closely by *Totoloto* (lotto 6/49) and passive lotteries (*Lotaria Clássica* and *Lotaria Popular*), at the single product level. Similarities in sales profile were also found for scratchcards and lotto games, namely *EuroMillions*. This analysis is relevant as it helps researchers and practitioners alike to visualize and better understand how remote lottery sales profiles

resemble each other so that it complements the analysis of the second essay, on players segmentation profiles and how players preferences may induce product cannibalization. It was possible to observe both complementarity and cannibalization occurring between games in the portfolio, which also contributes to the literature as it is a less common situation to observe such phenomenon on a product portfolio. Cannibalization was found at the product category level and for individual products.

The third essay (Chapter 5 – Essay 3) showed the existence of cannibalization, at the product category level, between passive lotteries and toto/sports pools and scratchcards. The latter is the product that most cannibalize other products as it cannibalizes passive lotteries, both *Lotaria Clássica* and *Lotaria Popular, Totobola* and both lotto games, *Totoloto* and *EuroMillions*. Sports pools (*Placard*). Toto/sports pools also cannibalize passive lotteries and lotto games. The findings at the single product level confirmed the findings at the product category level analysis and showed, for the first time, that regulatory changes to the prize payout for scratchcards, and the introduction of sports pools (Placard), drastically changed the sales pattern of lottery products in the past 5 years. Such results demonstrate that changes made to this game's design and the introduction of sports pools, offset the balance of the product portfolio. These findings are extremely important to warrant decisions makers on the need for lottery games to potentiate the highest possible segmentation possible with the minimum overlap, to ensure these games cater to different player segments to maintain healthy levels of gambling.

Findings of this essay also show that some products' sales move in tandem and reinforce each other's sales. Complementarity was found at the product category level, between passive lotteries and lotto games and scratchcards and toto/sports pools. As

this is the first study on cannibalisation to consider games such as passive lotteries, these results are relevant for decision makers in countries where similar games are also sold and ads to the existing literature as, to the best knowledge, no previous studies exist on such games on this topic, including on the specific markets where these games are offered.

Complementarity was found between game categories and single games. This study demonstrated that, in general, *EuroMillions* does not cannibalize the national lotto, contradicting findings from previous studies and advancing the field. *EuroMillions* and *Totoloto* sales were also found to be reinforced by their own jackpots which demonstrates that jackpots impact sales of their own products, which supports the indication that *EuroMillions* is not a replacement for the national lotto. Whilst some complementary was expected, such as *Lotaria Clássica* with *Lotaria Popular* as they are relatively similar games, from the same product category, *Lotaria Clássica's* complementary with *Totoloto,* with *EuroMillions* and with *Totobola* are novel findings as this is the first time a study identifies this phenomenon between passive lottery games and lotto games as well as with toto*. The national lotto game was* found to be positively correlated with toto. Again, two relations not covered in previous studies. Another important finding, especially considering the relevance that scratchcards sales have achieved in the Portuguese market in the past 10 years, is in the complementarity between scratchcards and sports pools' (*Placard*) sales. Considering these are games with very high sales percentage (market share), in the portfolio, this relation is also quite relevant to highlight and may well be a topic of research in further studies.

As mentioned previously, when conducting this dissertation, no studies were found that consider cannibalization in products such as passive lotteries and very few

covered cannibalization between products from different categories, as most of the studies found focus on the relationship between lotto games (especially between multistate and national lotto). As such, the present study adds to the existing literature in that extent by considering scratch cards and passive lotteries and having found cannibalization and complementarity between different product families and individual products, with games, never studied in this way. These results contribute to the literature as, so far, cannibalization withing an entire lottery portfolio was not studied in the way performed in the third essay (Chapter 5 – Essay 3).

6.3 Conclusions

Conclusions of the essays in this dissertation add to the existing knowledge on the field of gambling studies and bring a new marketing perspective which, so far, has been mostly overlooked. Determining the profiles of players, for example, is extremely relevant both for academics and gambling operators alike. The reason for such relevance stem from the harms associated with moderate gambling risk and problem gambling which are found to be concentrated in specific subpopulations (Costes, Kairouz, Monson, & Eroukmanoff, 2018). Given the widespread participation in lotteries and concentration of harm within specific subgroups, prevention efforts, despite the lower levels of harm associated with lottery gambling become extremely pertinent. In the "framework for deviant consumer behaviour", Solomon, Bamossy, Askegaard, and Hogg, (2013, p472) mention that the existence of physical/ psychological abnormalities

in the presence of deviant usage behaviour can lead to abusive consumption, where compulsive gambling is included. Additionally, industry and marketing practices may also perpetuate behaviours like compulsive Gambling" Solomon, Bamossy, Askegaard, and Hogg, (2013, p475). In that sente, this dissertation followed a trifold study approach, comprised of three essays in which, the first (Chapter 3 – Essay1) established the groundwork for understanding how new methods of data collection and analysis, such as real playing tracking data, which have led to new challenges in research, can be addressed in designing new theories, methods, approaches, and outcomes in the study of consumer, behaviour focused on gambling.

The first essay (Chapter 3 - Essay 1) clearly established that, the use of tracking data has greatly contributed to better identify and understand player behaviour, despite existing limitations. The approach taken in the second essay (Chapter 4 – Essay 2) led to finding a new perspective on segmentation of lottery players, with sociodemographic variables. This essay reached the foregone conclusion that such variables have different relevance in the determination of playing habits and profiles. In this second essay, a new and exclusive real playing dataset of a nationally representative cohort of Portuguese internet lottery players was used. The findings on the hierarchical relation of variables showed that the most influential variable in internet lottery gambling was found to be age, followed by gender, education, and place of residence. The sociodemographic variables used in the in the second essay (Chapter 4 – Essay 2) were also used to compare the profiles of the online lottery players with the Portuguese adult population. A large discrepancy between the gender distribution in the Portuguese adult population and Portuguese online lottery players was found. This study also demonstrated that males play online lottery games more than females, advancing knowledge that previous

studies were not able to establish among the Portuguese population. This was also the case for age and lottery playing as the second essay found a relation between both, with different gambling engagements according to the age groups established, which previous studies on Portuguese online lottery players did not address or failed to establish**.** These findings are novelty as no researchers have conducted any similar comparison on the Portuguese population, especially with the use of real playing data.

The third essay (Chapter 5 – Essay 3) intended to assess product portfolio cannibalization on the Portuguese national lottery game portfolio. It was possible to observe both complementarity and cannibalization occurring between games in the portfolio. Cannibalization was found at the product category level and for individual products. Findings of this study also show that some products' sales move in tandem and reinforce each other's sales, adding to the existing knowledge in the field, especially in the relation between *EuroMillions* and the national lotto.

6.4 Suggestions for further research

The previous chapters and sections presented the findings and their contributions. In this section further research paths and directions are presented that complement the ones mentioned in the essays. This section's approach to further research embodies the dissertation topic as a whole, to complement the individual future research suggestions of each of the essays.

Many activities and sectors are becoming increasingly more digital, especially those marked strongly by intangibility. This is also the case with gambling activities. With the digitalization of the economy, the spectrum of intangibility is growing and the boundaries in digital offerings are becoming increasingly blurred and complex. Communication and interaction between people are commonly carried out through a myriad of platforms and online social media. Today, these also include gaming and gambling activities which are entangled with activities that traditionally were not related to gambling. Additionally, payment methods are also changing, and today crypto and virtual currencies can now be used in gaming and gambling activities, which reduces the transparency and accountability in gambling related businesses and can potentially be detrimental to safeguarding responsible gambling practices.

Considering the multitude of offerings, payment methods and hybrid gambling approaches, it is becoming also more difficult to identify players behaviours across multiple platforms and gambling formats, including with the use of tracking data. The reason for this being that there are not any studies that have looked at the full activity of players, using data from all the operators in a particular jurisdiction, for example. Players can register with multiple online operators, and that information is usually confidential and is solely accessible to of the operators or the regulators. Traditionally, studies on gambling, including lottery gambling, require primary data collection to study the full activity of players, with the limitations known for this type of research. Given the diversity of the market offerings, in most jurisdictions, it is extremely relevant to truly know player's profiles, since there are no studies that have used real gambling tracking data to determine the full dimension of the total individual gambling activity, across different operators. This is also the case with Portuguese players and the Portuguese

population. To increase the challenge further, to understand such behaviours, including understanding players motivations, researchers must also collect primary data to fully comprehend the observed players' behaviour, as result from the analysis of the tracking data. As an example, one of the main questions regarding the activity of players is whether internet players also play in physical retailers. Analysing if online accessibility is a driver of internet lottery demand and considering players' locations and online access as well as land-based retailers' locations and concentration should be considered in future studies. Such studies should assess if these two channels are substitutes or if they complemented each other. From a marketing – and a responsible gambling – perspective, it is not in the best interest of a gambling operator to encourage cross-channel sales cannibalization, especially in situations where companies analyse the sales and customer profile in a particular channel (online) and not know exactly, in real time, what the profile is of the customers in a different channel, namely a land-based one.

In a sector such as gambling, the primary focus must always be on protecting players and in the prevention and limitation of excessive gambling. As mentioned, research focusing on drawing the full picture of players gambling activity across different operators and platforms, is lacking. To add to this situation, it is also not clear today whether such gambling activity is conducted by a single individual, or by a group of players sharing the same account. This "syndicate playing" activity is an underexplored research topic, both on land-based gambling but especially regarding online gambling. It assumes that some of the gambling activity may be carried out by a group of players instead of a single player who places the wager or who owns the account This is one of the factors that may influence the results of the gambling activity recorded in the databases which, eventually, may not correspond entirely to the activity of individual

players, as assumed. “Syndicate playing”, both on online and offline, is mostly untapped in what concerns gambling research and further research should be developed on this topic. Additionally, it is usually not known in how many operators the individual players are registered on, or have open and active accounts, which also adds to the difficulty in assessing total gambling activity. One marketing implication regards the study of gambling consumer behaviour on brand loyalty and its short- and long-term effects. Trust is a key element in the gambling industry as players gamble in the hopes of getting something of greater value in return, and in that sense player loyalty and brand equity are central in player loyalty.

Since the full playing activity by individual gamblers is not known, especially with the use of tracking data, and studies based in primary data are subjected to recall bias and other limitations, it is relevant to ponder some more questions. Such questions should address individual playing habits but also microeconomic concerns, namely the maximum appropriate size of each market, including the Portuguese market, considering public order and responsible gambling practices. These issues are intrinsically linked to the existing offer, to the market segments, and to the potential rivalry between competitors, namely from private operators, especially in online gambling. The role of the regulator itself, regarding games of chance, including in the context of online gambling, although recent, is extremely decisive for ensuring a balanced market and for the prevention of excessive gambling, whilst trying to maintain these rates within the lowest possible limits.

Another relevant issue lies in the fact that recent research on lottery gambling, with the use of real playing tracking data, is empirical and lacking supporting theory. This happens mainly due to the nature of the secondary data. For this field to advance

further, researchers must not solely analyse empirical data and describe behaviour but should also take advantage of such information as a basis for the development of solid gambling theory to advance science in this field.

References

Costes, J., Kairouz, S., Monson, E., & Eroukmanoff, V. (2018). Where lies the harm in lottery gambling? A portrait of gambling practices and associated problems. *Journal of Gambling Studies, 34*, 1293-1311.

Forrest, D., & Gulley, O. D. (2009). Participation and level of play in the UK National Lottery and correlation with spending on other modes of gambling. *International Gambling Studies*, *9*, 65–178.

Kaizeler, M. J., & Faustino, H. C. (2008). *Lottery sales and per-capita GDP: An inverted U relationship.* Lisbon, Portugal: Technical University of Lisbon, School of Economics and Management. Working Paper No. WP 41/2008/DE/SOCIUS.

Mothersbaugh, D.; and Hawkins, D. (2016) *Consumer behaviour: Building marketing strategy* (13th ed.) McGraw-Hill Education, New York.

Santa Casa da Misericórdia de Lisboa. (n.d.). *Jogos Santa Casa - Institucional*. Jogos Santa Casa. Retrieved February 14, 2022, from https://www.jogossantacasa.pt/web/SCInstitucional.

Solomon, M. R., Bamossy, G. J., Askegaard, S. T., Hogg, M. K. (2013). *Consumer behaviour: A European perspective* (5th ed.) Pearson Education Limited.

APPENDIXES

Appendix I

List of Outputs Arising from this Thesis

Peer-reviewed journal papers

Essay 1

Chagas, B. T. & Gomes, J. F.S. (2017). Internet Gambling: A Critical Review of Behavioural Tracking Research. *Journal of Gambling Issues, 36,* 1-27.

Cited by (2022):

Barsulai, C. (2022). *Master of arts.* PhD Thesis, Daystar University. ResearchGate.

Currie, S.; Hodgins, D.; Williams, R.; Fiest, K. (2021). Predicting future harm from gambling over a five-year period in a general population sample: A survival analysis. *BMC Psychiatry, 21*(15) 1-22. Manuscript submitted for publication.

Drosatos, G., Arden-Close, E., Bolat, E. and Ali, R. (2020). Gambling data and modalities of interaction for responsible online gambling: A qualitative study. *Journal of Gambling Issues*, *44*, 139-169.

Forsström, D., Rozental, A., Wiklund, E., Carlbring, P., Lindner, P. (2021). Gamblers' perception of the Playscan risk assessment: A mixed-methods study. *Journal of Gambling Studies*. https://doi.org/10.1007/s10899-021-10043-0.

Frisone, F. (2021). *Dipendenza dal gioco d'azzardo? Una lettura fenomenologica sulle dipendenze comportamentali*.(1st ed.). Generis Publishing.

Frisone, F. (2021). *Fenomenologia del gioco d'azzardo: La questione dei disturbi da addiction nella visione del mondo tecno-scientifica*. Tesi di dottorato in scienze cognitive, Università Degli Studi di Messina. Dipartimento di Scienze Cognitive, Psicologiche, Pedagogiche e degli Studi Culturali. Messina, Italia.

Frisone, F.; Settineri, S.; Sicari, F.; Merlo, E. M. (2020). Gambling in adolescence: a narrative review of the last 20 years. *Journal of Addictive Diseases, 38*(4), 438-457. DOI: 978-1-63902-358-5.

Gainsbury S., Nicola, B., Blaszczynski, A., Callaghan, S., Clancey, G., Starcevic, V., Tymula, A. (2020). Reducing internet gambling harms using behavioral science: A stakeholder framework. *Frontiers in Psychiatry*, 11:598589. doi: 10.3389/fpsyt.2020.598589.

Ghaharian, K., Abarbanel, B., Phung, D., Puranik, P., Kraus, S., Feldman, A., & Bernhard, B. (2022) Applications of data science for responsible gambling: a scoping review. *International Gambling Studies*. DOI: 10.1080/14459795.2022.2135753

Hassanniakalager, A., & Newall, P. (2019). A machine learning perspective on responsible gambling. *Behavioural Public Policy*, 1-24. Cambridge University Press.

Hing, N., Russell, A.M.T., Thomas, A., & Jenkinson, R. (2019). Hey big spender: An ecological momentary assessment of sports and race betting expenditure by gambler characteristics. *Journal of Gambling Issues*, *42*, 42-61.

Ivanova, E. (2020). *Responsible provision of online gambling: Effects, usability and gamblers' experiences of protective measures implemented in online gambling environments*. Doctoral dissertation, Department of Psychology, Stockholm University. Retrieved from: https://www.diva-portal.org/smash/get/diva2:1373426/FULLTEXT01.pdf.

Jesus, D. E da Silva de (2019). *Análise da proposta de valor potencial na aplicação do blockchain à indústria de jogo online em Portugal*. Dissertação de Mestrado, Universidade de Lisboa. Instituto Superior de Economia e Gestão. Lisboa, Portugal. Retrieved from: https://www.repository.utl.pt/bitstream/10400.5/19709/1/DM-DESJ-2019.pdf.

Kabiru, E. W. (2021). *The influence of telecommuting on job engagement levels of employees in the gambling industry in Kenya*: A *case study of Betika in Nairobi*, *Kenya*. Doctoral dissertation, United States International University-Africa.

Kainulainen, T. (2019) A new measure of risk-taking in gambling. *International Gambling Studies, 19*(1), 167-182.

Kirchhof P.J. (2021) *The marionette question: What is yet to be answered about the ethics of online behaviour change?*. In: Cowls J., Morley J. (eds) The 2020 yearbook of the digital ethics lab. Digital ethics lab yearbook. Springer, Cham. https://doi.org/10.1007/978-3-030-80083-3_4.

Lakew, N. (2022). "Show me the money: Preliminary lessons from an implementation of intervention tools at the payment gateway Level. *Journal of Gambling Studies*, *38*, 297–317. https://doi.org/10.1007/s10899-021-10023-4.

Lawn, S.; Oster, C.; Riley, B.; Smith, D.; Baigent, M.; Rahamathulla, M. (2020) A literature review and gap analysis of emerging technologies and new trends in gambling. *International Journal of Environmental Research and Public Health*, *17*(3), 744.

Lopez-Gonzalez, Hibai; Jimenez-Murcia, Susana; Rius-Buitrago, Alicia; Griffiths, M. D. (2021) Do online gambling products require traditional therapy for gambling disorder to change? Evidence from focus group interviews with mental health professionals treating online gamblers. *Journal of Gambling Studies*. Advance Online Publication DOI: 10.1007/s10899-021-10064-9.

Newall, P.W.S., Moodie, C., Reith, G.; Stead, M.; Critchlow, N.; Morgan, A.; Dobbie, F. (2019). Gambling marketing from 2014 to 2018: A literature review. *Current Addiction Reports*, *6*, 49–56.

Newall, P. W.S., Walasek, L., Kiesel, R. V., Ludvig, E. A., Meyer, C. (2020). Request-a-bet sports betting products indicate patterns of bettor preference and bookmaker profits. *Journal of Behavioural Addictions*, 10(*3*), 381–387.

Newall, P.W.S., Walasek, L., Kiesel, R.V., Ludvig, E. A., Meyer, C. (2019, November 17). Betting on intuitive longshots. *PsyArXiv*. November 17.

Newall, P.W.S., Weiss-Cohen, L., Thoma, V. & Ayton, P. (2022). Differences amongst estimates of the UK problem gambling prevalence rate are partly due to a methodological artefact. *International Journal of Mental Health and Addiction*. https://doi.org/10.1007/s11469-022-00877-z

Nower, L.; Caler, K. R. (2018) Widening the net: A syndemic approach to responsible gambling. *Sucht*, *64*, 317-323.

Nerilee, H.; Russell, A. M. T.; Thomas, A.; Jenkinson, R. (2019). Hey big spender: An ecological momentary assessment of sports and race betting expenditure by gambler characteristics. *Journal of Gambling Issues*, *42*, 42-61.

Rimal, R. (2020). *Electronic gaming machines: an integrated mixed-methods examination of the spectrum of gambling-related harms*. Doctoral dissertation. The University of Auckland. ResearchSpace.

Rooij, A.J. van, Tuijnman, A., Kleinjan, M. (2021). *Kansspelverslaving, gokgerelateerde schade en gokproblematiek: Kennissynthese en onderzoeksagenda* [*Gambling addiction, gambling related damage and gambling problems: Knowledge synthesis and research agenda*]. Trimbos-instituut – Netherlands Institute of Mental Health and Addiction.

Scholten, Oliver J. (2022) *On the behavioural profiling of gamblers using cryptocurrency transaction data*. PhD thesis, University of York. White Rose eTheses Online.

Scholten, O.J.; Zendle, D.; Walker, J. A. (2020) Inside the decentralised casino: A longitudinal study of actual cryptocurrency gambling transactions. *Plos One*, *15*(10), 1-18.

Suzuki, H.; Nakamura, R.; Inagaki, A.; Watanabe, I.; Takagi., T. (2019). Early detection of problem gambling based on behavioral changes using shapelets. *2019 IEEE/WIC/ACM International Conference on Web Intelligence (WI)*, Thessaloniki, Greece, 2019, 367-372.

Syvertsen, A., Leino, T., Pallesen, S., Smith, O. R. F., Mentzoni, R. A., & Erevik, E. K. (2022). Telescoping and gender differences in high-risk gambling: Loss limit behavior in a population of electronic gaming machine players. *Psychology of Addictive Behaviors*. Advance online publication. https://doi.org/10.1037/adb0000844

Whiteford, S., Hoon, A., James, R., Tunney, R., Dymond, S. (2022). Quantile regression analysis of in-play betting in a large online gambling dataset. *Computers in Human Behavior*. Advance online publication. DOI: 100194. 10.1016/j.chbr.2022.100194.

Essay 2

Chagas, B. T., Gomes, J. F.S., Griffiths, M. D. (2021). Consumer profile segmentation in online lottery gambling utilizing behavioural tracking data from the Portuguese national lottery. *Journal of Gambling Studies, 13*, 1–23.

Cited by (2022):

Ghaharian, K., Abarbanel, B., Phung, D., Puranik, P., Kraus, S., Feldman, A., & Bernhard, B. (2022). Applications of data science for responsible gambling: a scoping review. *International Gambling Studies*, 1-24.

Papers ready for submission

Essay 3

Chagas, B. T. (2022). *The effects of new product launches and rollovers on lottery sales: an analysis of product cannibalization in the Portuguese National Lottery*.

Conference presentations

Chagas, B. T. (2019). *Mercado do jogo legalizado em Portugal: Uma breve análise das mais recentes tendências* [Conference presentation]. 4º Fórum de Investigação do CSG. Lisboa: ISEG - Instituto Superior de Economia e Gestão da Universidade de Lisboa.

Chagas, B. T. (2022). *Consumer profile segmentation in lottery gambling utilizing behavioral tracking data from the Portuguese national lottery*. Presented at the 13th European Conference on Gambling Studies and Policy Issues. Oslo, Norway.