



**LISBOA
SCHOOL OF
ECONOMICS &
MANAGEMENT**

**MASTER IN
FINANCE**

**MASTER'S FINAL WORK
PROJECT**

EQUITY RESEARCH – THE VORTAL CASE

FILIFE AMARAL ANAHORY VILLARINHO PEREIRA

SEPTEMBER 2014



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ORIENTAÇÃO:

PROF^ª. DOUTORA RAQUEL MARIA MEDEIROS GASPAR

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ABSTRACT

During the course of the last couple of years, some of the largest modern enterprises have progressed to engage in the public trading environment. The most notable of these colossal structures are Facebook, Twitter and Alibaba. It has been debated that companies providing internet services gather some kind of extra appeal not made explicit by the application of traditional valuation techniques. So much so that stocks were issued at a value that is much higher than the base valuation.

Meanwhile, in spite of strong limitations dictated by the weak economic cycle and financial domestic distress, the Portuguese industry has seen some successful technological ventures. One of these is an international SaaS provider named Vortal – the target of our research.

In our study, we value Vortal's current operations at 34.5 M€ using DCF methodologies and find its present market price – when compared with others within the sector – is significantly higher at 41.7 M€. The difference is explained by considering the value of a call option to expand which reflects the potential growth of the firm and Equity is valued at 40.6 M€.

RESUMO

Recentemente, algumas das maiores empresas da actualidade prepararam a colocação das suas acções no mercado. Destas, destacam-se as gigantes Facebook, Twitter e Alibaba. A propósito destes eventos, discute-se a hipótese de que os métodos de avaliação tradicionais não captam completamente o valor reconhecido às empresas que prestam serviços nas tecnologias de informação. Efectivamente, em alguns casos os preços de subscrição de capital de empresas nestas condições atingiram valores muito mais altos do que a avaliação inicial.

Entretanto, apesar das limitações impostas por um ciclo económico fraco e uma conjuntura financeira local adversa, a indústria portuguesa das tecnologias de informação tem contado com alguns casos de sucesso. Um desses casos é uma empresa que se dedica à prestação multinacional de serviços de software chamada Vortal - o objecto do nosso estudo.

No presente estudo, avaliamos a actual operação da Vortal em 34.5 M€ com recurso à metodologia DCF e determinamos que o seu preço de mercado – quando comparada com outras empresas do sector – é significativamente superior, 41.7 M€. A diferença encontrada é explicada através da avaliação de uma opção (de compra) para expandir o negócio que reflecte o crescimento potencial da empresa e o seu Capital Social é estimado em cerca de 40.6 M€.

LIST OF SYMBOLS AND NOTATIONS

PV – Present Value of the Projected Cash-Flows

n – Number of Periods, Number of Time-Steps

CF_i – Cash-Flow at Period i

r – Discount Rate

g_S – Sales Growth Rate

g_D – Debt Growth Rate

r_f – Risk-Free Rate

r_m – Market Expected Return

r_d – Cost of Debt

T_m – Corporate Income Tax Rate

β_u – Unlevered Beta

r_u – Unlevered Cost of Equity

r_e – Cost of Equity

r_{wacc} – Weighted Average Cost of Capital

S_o – Asset Price at Inception

K – Strike Price or Exercise Price

t – Time to Maturity

dt – Time-Step Period

σ – Asset Volatility

$E[x]$ – Expected Value Function

f_o – Option Price at Inception

q – Dividend Rate

e – Exponential Operator

$N(x)$ – Cumulative Probability Distribution Function for a Standardized Normal Distribution

Note: all rates on an annual basis

LIST OF ABBREVIATIONS

Acc. – Accounts
APV – Adjusted Present Value
B2B – Business-to-Business
B-S – Black & Scholes
CAGR – Compound Annual Growth Rate
CAPEX – Capital Expenditure
CAPM – Capital Asset Pricing Model
CF – Cash-Flow
Cont. – Continuing
CV – Coefficient of Variation
D&A – Depreciation and Amortization
D – Debt
DCF – Discounted Cash-Flow
E – Equity
EBIT – Earnings Before Interest and Taxes
EBITDA – Earnings Before Interest, Taxes, Depreciation and Amortization
EDCF – Enterprise Discounted Cash-Flow
EV – Enterprise Value
FCF – Free Cash-Flow
GDP – Gross Domestic Product
IPO – Initial Public Offering
ISEG – Lisboa School of Economics & Management
IT – Information Technology
ITS – Interest Tax Shield
Liab. – Liabilities
M&A – Mergers and Acquisitions
MFW – Master's Final Work
MM – Modigliani–Miller
NASDAQ – National Association of Securities Dealers Automated Quotations
NOPLAT – Net Operating Profit Less Adjusted Taxes
NYSE – New York Stock Exchange
P&L – Profit and Loss Statement
PERL – Progressive Equity Research
PV – Present Value
R&D – Research and Development
SaaS – Software-as-a-Service
SD – Standard Deviation
SEG – Software Equity Group
SME – Small and Medium Enterprises
UK – United Kingdom
USA – United States of America
WACC – Weighted Average Cost of Capital

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1. INTRODUCTION

The purpose of this work is to establish a reasonable value for a business which provides software services. Vortal operates in several countries and offers specific applications in a few industries.

Given the nature of this particular business, two complementary approaches to valuation are considered. Traditional methods based on the calculation of the present value of future cash-flows form the core of our study but we also investigate results from the use of real options valuation to compare with the excess value obtained using comparable multiples from the industry.

The valuation presented herein must be valid from the point of view of any investor. Otherwise, we would be presenting results lacking the genuineness found in unbiased market conditions. Therefore, only publicly issued information by the firm is used to pursue our aspirations.

This work is supported by the valuation techniques described both by Koller et al. (2010) and Damodaran (2002). We also take in consideration the works of Eduardo S. Schwartz and Mark Moon (2000) as well as of Baek, Dupoyet and Prakash (2008) regarding the stochastic analysis to be implemented. Furthermore, the approaches to IT and R&D valuation by Serradas (2011) and Tsui (2005) – respectively – are useful to guide our exploratory exercise. In addition, we take advantage of geographical and sectorial data listed by Damodaran (2014).

The structure of our work is based on a deductive sequence from the general analysis to specific implementation and discussion of results. Firstly, we start with a brief overview of the company in evaluation. Next, we discuss the methodologies available and applicable to our research. Then, we describe the implementation of the chosen models with references to the selected data, calculation procedures and outcomes. Finally, we present our conclusions.

2. COMPANY OVERVIEW

Vortal is a privately owned Portuguese company engaged in providing e-procurement software services across several countries in Europe as well as in other parts of the world.

With over 50,000 supplier organizations and over 2,000 buyer corporations using Vortal at the present time, it's structure is clearly able to meet the needs of the largest companies although the focus has been towards mid-market and smaller businesses.

The company has a headcount of 140 and has developed an international trail with operations in Portugal, Spain, the Czech Republic and (lately) Colombia.

Clients are predominantly some form of public sector organizations - Vortal has roughly a 9:1 ratio between public and private/commercial accounts, which translates approximately into 200 private sector buying organizations using their solution.

Vortal provides a web platform for professional B2B e-Sourcing and e-Commerce services, enabling an efficient process through which buyers and suppliers can connect. The company improves buyer-supplier performance for international customers in assorted industries including Health, Government, Construction and Utilities.

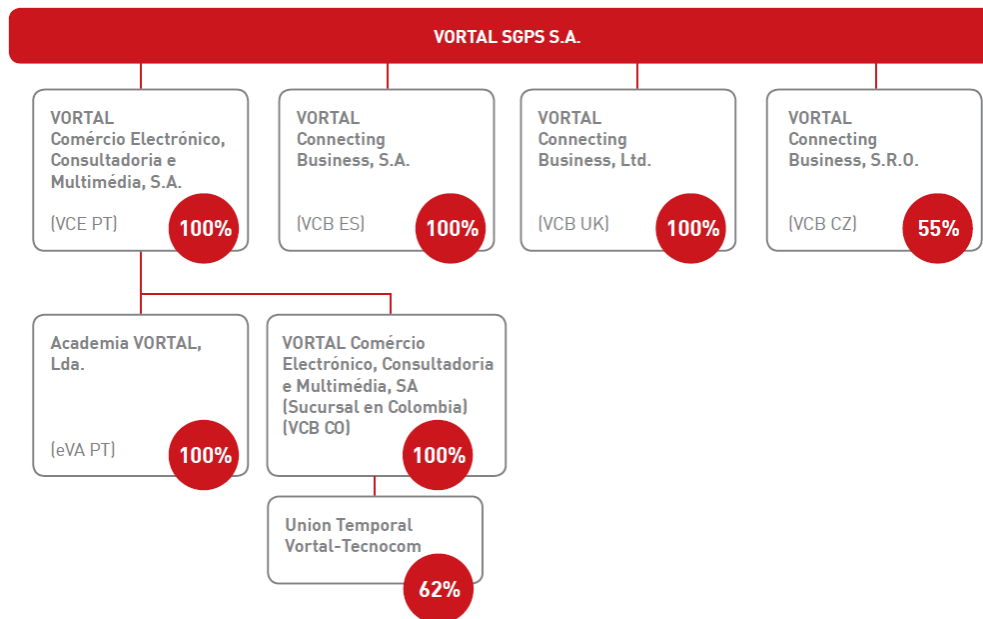


Figure 1 - Business Structure [Source: 2013 Vortal Annual Report]

Recently, Vortal launched eureka.com, a B2B social network with business transactions as the main driver, supported by a reputation engine to aid purchasing decisions, replacing unstructured and arduous buying processes such as email, fax, or phone. Eureka is built on top of a community of agents that drive business and are rewarded with a share of revenues.

Vortal is the market leader in Spain and Portugal in the Public e-tendering field, with a market share of 60% and an annual turnover of contracts of about 5,000 million Euros, about 3% of Portuguese GDP and 15% of all public purchases.

2.1. FINANCIAL POSITION

The firm relies on the utilization of intangible assets in form of software developed in-house as the main resource from which cash-flows are derived.

Vortal maintains a convenient level of cash; typical of a company which is preparing for investments in the future and does not want to be dependent on external sources for these accomplishments. What would otherwise be

considered excessive may, in the context of the industry and need for flexibility, allow for the growth that will meet the potential of the company.

Meanwhile, debt is very diminutive relatively to other sources of financing operations and equity represents almost 60% of the right side of its balance sheet.

This structure reflects the last 5 years of operation since Vortal engaged in international campaigns and expanded its market base to include products and services not customized to a specific industry but rather aiming to reach additional suppliers and buyers through a more horizontal approach.

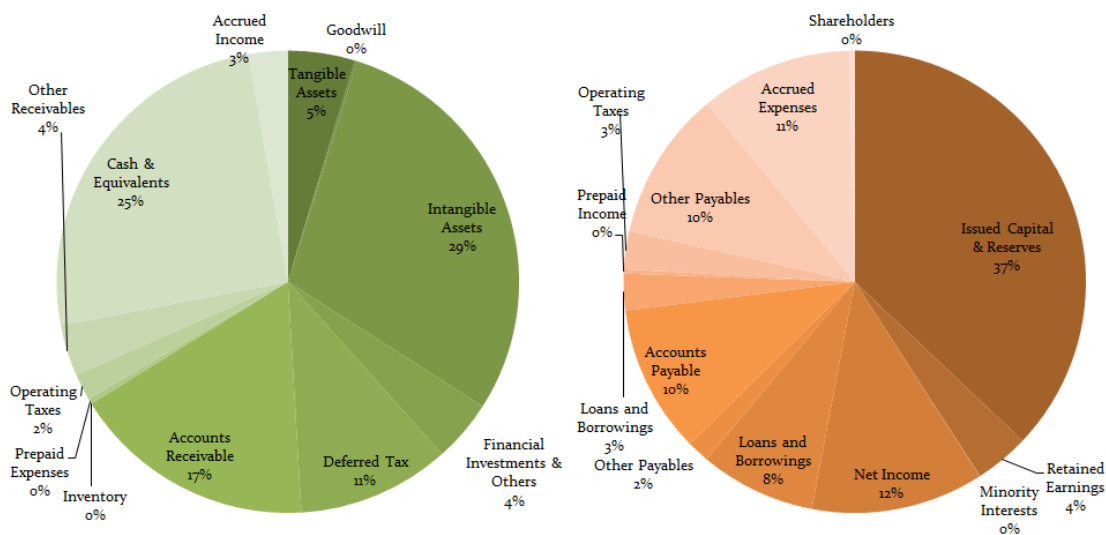


Figure 2 - Detailed Balance Sheet Proportions

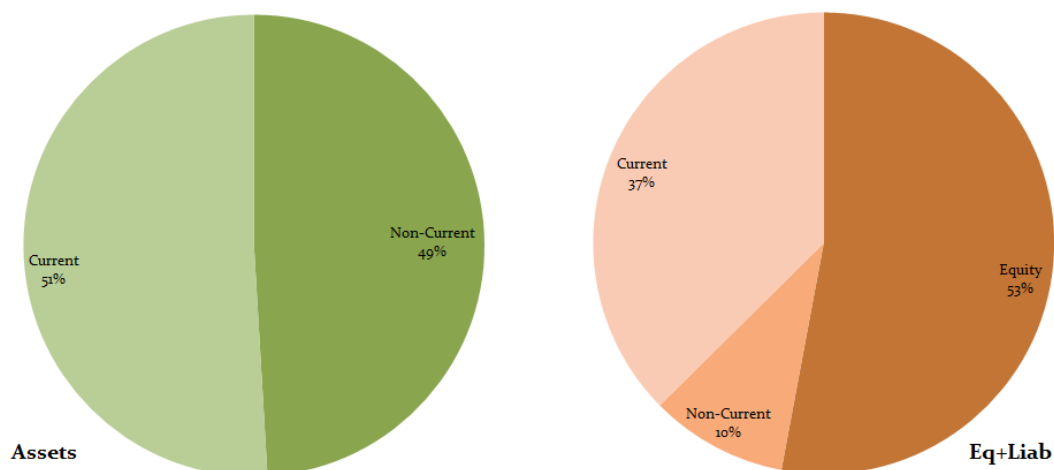


Figure 3 - Aggregated Balance Sheet Proportions

2.2. REVENUES

Revenue sources in this business may be classified in five major groups from which Vortal is able to monetize their investments:

- Transaction Fees – charged as a fraction of a certain transaction volume in a particular operation, mainly directed to the buyer side;
- Subscription Fees – charged on the assumption of anticipated usage and exposure to the network on an annual basis, more suited to suppliers;
- Advertising – charged for banners, links and logotypes;
- Professional Service Fees – as consultant services to customers at implementation and training stages;
- Value Added Services Fees – charged for extra services targeted to specific solutions or information required by nonstandard customers.

Vortal has been enjoying a healthy rise in revenues since its deployment in 2001 adapting to and taking advantage of several events that mark the history of the development of the electronic procurement industry in Portugal and abroad.

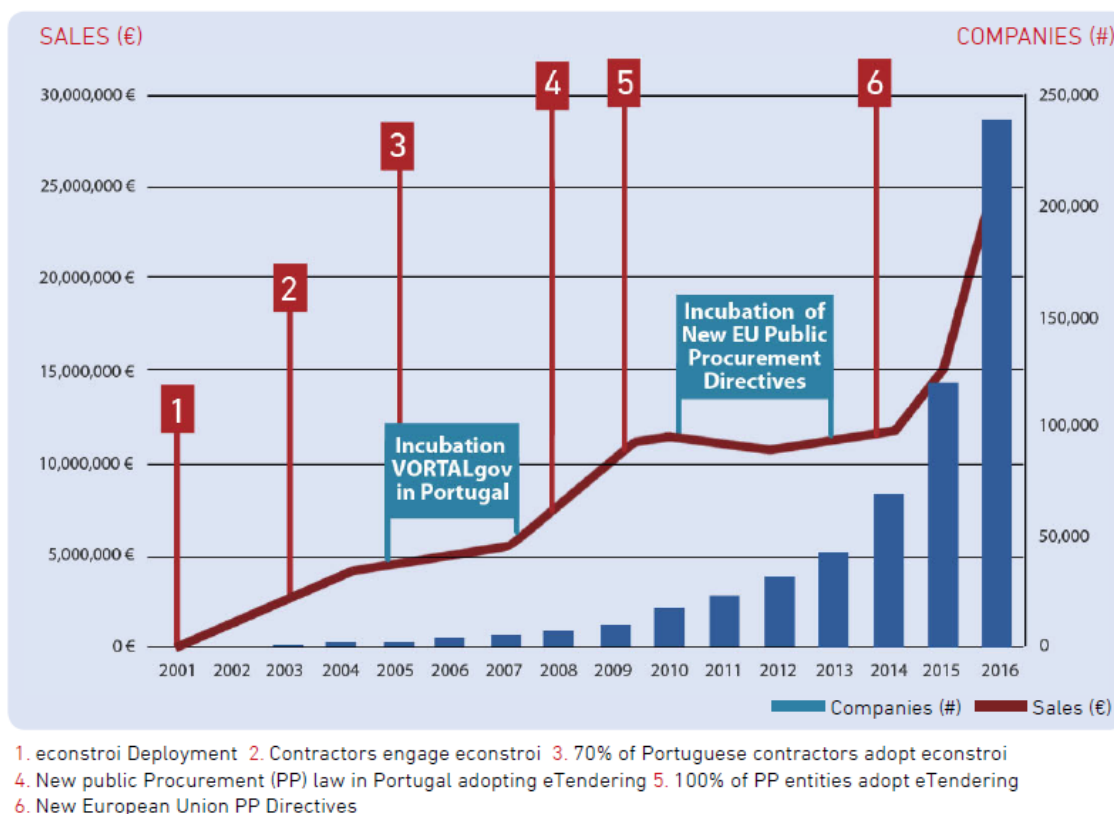


Figure 4 - Historical and Forecast Revenues [Source: 2013 Vortal Annual Report]

Currently, high expectations are in place for the implementation of the New European Union Public Procurement Directives which will enforce the use of technological services and digital platforms for transactions across the continent in an effort to make the process more transparent and reliable.

Gartner, a highly acclaimed American IT research firm with worldwide acceptance in the industry, has placed Vortal in the top 5 for e-sourcing and technology platform and in the top 3 for public sector sourcing. Moreover, in their latest report “Gartner Magic Quadrant for Strategic Sourcing Suites 2013 Benchmark Report”, Vortal is referred to as having an “exceptional” know-how as well as being classified as “visionary” in its processes. This appreciation allows

Vortal management to feel confident they are able to meet successfully future challenges either originated externally or from their own development projects.

2.3. EARNINGS

A slightly erratic earnings profile during the last previous 5 fiscal years shows nevertheless an interesting maintenance of the level of operating margin which is not the signature of most of the similar businesses we came across during our research.

During this period, the company has been able to provide a positive and relevant net income on a yearly basis. Historically, Vortal has been delivering an interesting return on investments to its shareholders from which the bulk has been retained in the firm; dividend policy is subject to shareholders approval for each financial exercise.

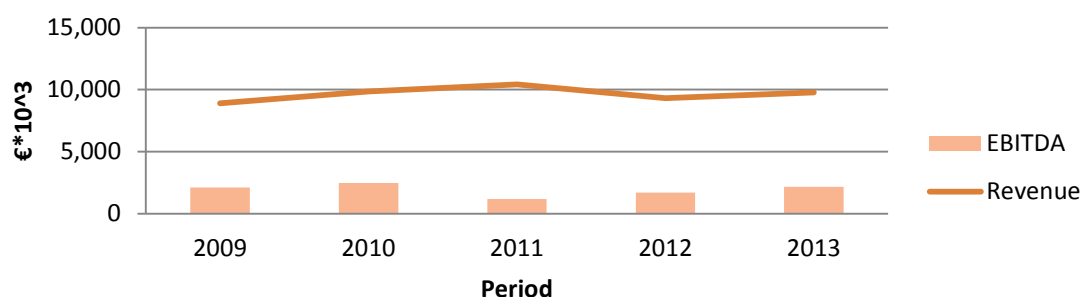


Figure 5 - Recent Revenues and Earnings

3. METHODOLOGY

The subjective nature of estimating the value of a certain company allows for a number of methodologies that may complement one another and provide different values depending on the objective of the task. Nevertheless, nowadays most of the authors would agree on four major groups of models which may be used to accomplish the desired valuation. (Damodaran, 2002)

A comprehensive classification includes:

- **Asset Based Valuation** – focusing on Liquidation Value or Replacement Cost of the firm's Assets;
- **Discounted Cash-Flow Models** – either dedicated solely to Equity within the Firm or considering the whole enterprise as the object, and applied to different growth stages;
- **Relative Valuation** – based on ratios extracted from comparable companies for which the value is known;
- **Contingent Claim Models** – applying real options theory in order to estimate the worth of a claim on a future payoff attributed to the difference in value occurring from a change in a particular resource price.

Amongst the above methods, we chose not to include the first one which is more suitable for companies in distress since it relates to short-term liquidation of the components of the firm. Moreover, considering the information within reach and the nature of the business to be valued, we elect the remaining three methodologies which are detailed ahead in the text.

3.1. DISCOUNTED CASH-FLOW

The concept behind valuation of financial instruments relying on DCF is useful in a number of applications, including firm valuation. We produce our best estimate

for future inflows generated by selected assets through a predefined period of time (which may be extended until perpetuity) and calculate the sum of the present value of each cash-flow employing a suitable discount rate which allows for the time-value concession within our results. In general,

$$(1) \quad PV = \sum_{i=1}^n \frac{CF_i}{(1+r)^i}$$

The selection of the discount rate to use in our present value calculations is not trivial and depends on the information available. This discount rate may be interpreted as the opportunity cost the investor bears while having his resources allocated to that particular project or firm. We may also refer to this discount rate as a return on the capital employed to generate the desired cash-flows.

Since we are focusing our valuation on the information released by the company in the form of its annual reports for the last 5 fiscal years, we need to compute an appropriate discount rate referring to the obtainable data.

Consequently, we prefer the model which simultaneously allows us to employ the simplest discount rate that we can estimate as well as to build a cash-flow sequence that may be predicted taking into account the recent performance of the firm and conventional assumptions for the future. This model is referred to as the Adjusted Present Value (APV) method and consists of the use of DCF to a virtually unlevered firm adding eventually the fiscal benefits resulting from the incurred debt to finance operations.

As a means to support the APV valuation we also calculate the present value based on the Enterprise Discounted Cash-Flow (EDCF) approach which relies on the Weighted Average Cost of Capital (WACC) and the assumption of a predetermined target for the capital structure to finance the operations that may not be a good conjecture in our case. Nevertheless, and since we depend on the industry statistics in either case, we expect to reach values that should lead to very similar results.

Both models are built in two parts regarding the time frame of our forecasts for the future cash-flows. The first three years of forecasted operations are designated by the **explicit period** and the fourth year represents a repeating pattern for the perpetuity (Terminal Value) which we refer to as the **continuing period**.

3.2. RELATIVE VALUATION

Regarding the means to compare our firm to others in the industry in order to search for a value which replicates the current conditions in the market, the approach recommended is the Relative Valuation.

Assuming we are able to find similar companies for which we may successfully investigate a certain number of valuation ratios applicable to the firm in study, we would then be able to estimate the worth of our firm by multiplying those ratios by the appropriate measure found in the company's records. Usually referred to as Multiples, these ratios are references for the price of an asset (or a set of assets that jointly compose a company) that should point towards the current context within the stock markets or the M&A activity.

Although simple in its formulation, this method requires a sound process of selecting the so-called similar companies and a certain degree of good chance that for those few truly comparable firms that are chosen there is enough information available at the relevant time.

Finding similar businesses with accessible data is challenging because no two enterprises are alike and only publicly traded firms have the obligation to provide financial details and a credible market value.

3.3. CONTINGENT CLAIM MODELS

In the event of obtaining results - generated from the above mentioned methodologies - which are diverse by a significant margin that cannot be

explained otherwise, we establish a rationalization for that difference in value by referring to some theoretical justifications which recommend the use of real options methods to value some part of the company's assets that may not be fully integrated in the previous calculations.

In this context, a contingent claim may be interpreted as an option contained within the special characteristics of a firm which would allow its owners, sometime in the future, to capitalize on a particularly favorable turn of events that would increase the value of the original project, investment or operation. The described prospect has in itself a quantifiable value and may be the cause for certain discrepancies recorded recently in stock markets.

In our study we apply two different approaches in order to try to establish an eventual discrepancy exposed by the results obtained from the traditional methods.

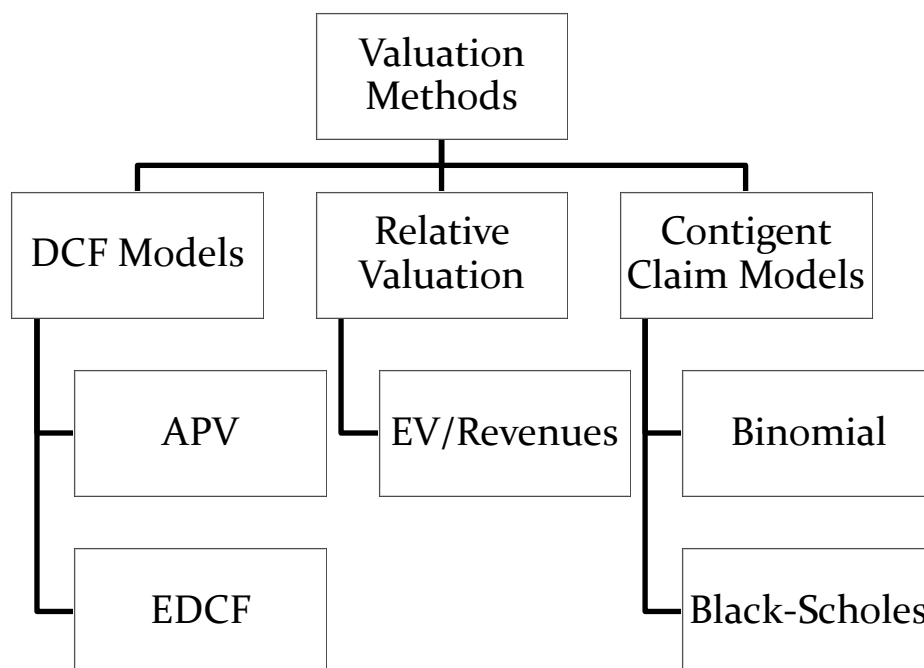


Figure 6 - Selected Valuation Methods

4. IMPLEMENTATION

4.1. DISCOUNTED CASH-FLOW

4.1.1. FINANCIAL STATEMENT REARRANGEMENT

We select the last five years (ending in 2103) of financial information issued by Vortal because they represent the most recent stable characteristics of the firm in its newest setup as an internationalized group of subsidiaries. *Appendix 1* and *Appendix 2* summarize all the historical data collected.

By rearranging the above mentioned information, we are able to proceed on our analysis independently of the accounting principles followed by the firm besides allowing us to identify other major traits of the operation such as: CAPEX, Debt and Working Capital; Risk Assessment and Capital Structure; Efficiency and Performance. *Appendix 3* and *Appendix 4* show the result of this procedure.

4.1.2. DATA ANALYSIS

The rearrangement of the firm's information together with the analysis of patterns and trends for the major items in the financial statements allows us to organize a forecast for the future operations of Vortal.

FORECASTING RATIOS AND STATISTICS

For the appropriate lines in the financial statements, we study the historical patterns and trends in order to choose the suitable ratios which allow us to project the operations into the future. These ratios refer to Sales and are summarized in the next table.

In general, we opt to attribute a reversion to the mean as the expected value to consider in our forecast. Elsewhere, we consider the parameter to be static over time.

| | <i>Adopted</i> | <i>Historical</i> | | | |
|-----------------|-------------------------|-------------------|-------------|-----------|-------------|
| | | <i>Trend</i> | <i>Mean</i> | <i>SD</i> | <i>CV</i> |
| | | <i>[2014]</i> | | | |
| EBITDA | <i>[revert to mean]</i> | | | | |
| - | 19.0% | 16.0% | 19.1% | 5.4% | 0.28 |
| D&A | <i>[static]</i> | | | | |
| - | -7.5% | -7.9% | -7.1% | 0.8% | 0.11 |
| Inventory | <i>[static]</i> | | | | |
| - | 0.0% | 0.0% | 0.0% | 0.0% | |
| Acc. Receivable | <i>[revert to mean]</i> | | | | |
| - | 20.0% | 9.8% | 20.8% | 6.3% | 0.30 |
| Acc. Payable | <i>[static]</i> | | | | |
| - | 13.0% | 13.0% | 12.5% | 1.9% | 0.16 |
| CAPEX | <i>[revert to mean]</i> | | | | |
| - | 15.0% | 20.6% | 14.4% | 3.5% | 0.25 |

Table 1 - To-Sales Ratio Analysis and Selection

GROWTH PROJECTIONS

Revenues show an upward trend with a compound annual growth rate (CAGR) of 2.7%. The statistics display a somewhat intermittent behavior during recent years – reflected in a standard deviation of 8.8% on the year-over-year relative change with a mean of 2.6% – mainly influenced by an uncharacteristic year of 2012 when the effects of the domestic economic distress originated the first downward move in a steadily expanding history of Vortal’s sales.

Adjusting our measurements by removing the above mentioned outlier we obtain different and considerably more accurate figures: an average annual revenue growth rate of 6.9% accompanied by a 1.9% standard deviation.

Given our conservative goal on the implementation of the chosen DCF methodologies, and in order to accommodate eventual downward movements

that may occur again in the next few years in the domestic market, we opt to use the last year change rate of 5% to extend through the explicit period of our forecast.

As for the perpetual component (continuing period) of our prediction, we take in consideration macroeconomic outlooks for the countries and industries the firm is serving and establish a compatible revenue growth rate.

Considering the dependency of the firm's revenues on the investment in infrastructure that impact both on the public procurement and private activities for which the services of Vortal are vital, we refer to a report published by the McKinsey Global Institute which suggests that growth in infrastructure investment must, at least, be the same as GDP's in the long-term future. (Dobbs et al., 2013)

It is incontestable that, in the long-term, one of the most certain policies to be adopted by the majority of the central banks is to maintain a controlled level of inflation in the surroundings of a 2% annual rate. Hence, the growth of revenues obtained from our company in a model based in current prices (in the long term) shall be at least the expected level of inflation.

Moreover, the outlook medium-term projections for the global economy (International Monetary Fund, 2013), suggests for the period between 2015 and 2018 a World Real GDP Growth in the Euro Area of 1.6%. This figure, for usefulness, is adjusted for inflation - since our estimates are calculated in current prices. Hence, our best estimate based on the above mentioned data would be a nominal terminal growth rate of $(1.02 \times 1.016 - 1) = 3.63\%$; capturing the combined effect to simulate current prices.

Nevertheless, in a conservative approach, we must focus on the fact that in the Portuguese market lays the majority of Vortal's influence and historically the domestic growth trails behind the rest of the world advanced economies. Furthermore, we are looking into an estimate of growth for the medium-term as

a proxy for our long-term projections. Hence, we settle for a more modest growth rate of 3.5% reflecting the current circumstances.

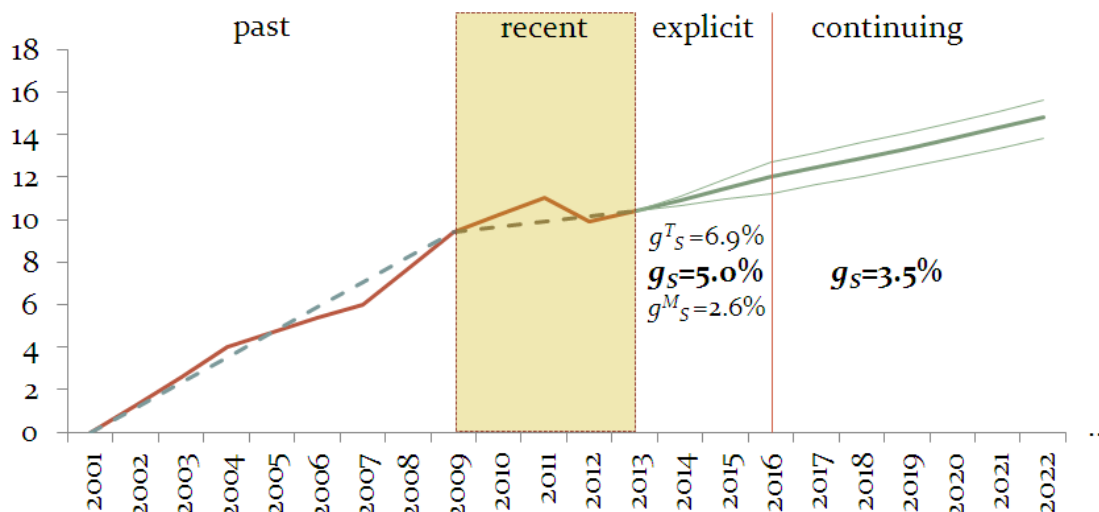


Figure 7 - Sales Growth Forecast

The above graph highlights the chosen path and discussed boundaries.

4.1.3. INCOME STATEMENT FORECAST

Expenses due to interest bearing debt have a regular pattern in the books of Vortal. They account to a little more than 6% of the previous year long-term borrowing responsibilities of the firm. At this stage we could implement the mentioned rate in our model but this is not the best practice. The theoretically expected Cost of Debt (detailed ahead in this document) is recommended and we adopt the rate of 5.4% instead.

Taxes payable annually to the Government of Portugal are based on the geographical rates that must apply to a local surcharge increased by a state surtax; identified as “derramas”. The resulting rate amounts to 27.5%. (PricewaterhouseCoopers Portugal, 2014)

Both Interest Income and Minority Interests, due to their irrelevancy, are assumed to maintain a constant absolute value ad infinitum.

| $\text{€} \cdot 10^3$ | <i>period</i> | Historical | Explicit Forecast Period | | Continuing | |
|-----------------------------------|---------------|--------------|--------------------------|-------------|-------------|------------|
| Income Statement [extract] | | 2013 | 2014 | 2015 | 2016 | Period |
| Revenues (Sales) | | 10,425 | 10,947 | 11,494 | 12,069 | 12,491 |
| ... | | ... | ... | ... | ... | ... |
| EBITDA | | 2,157 | 2,080 | 2,184 | 2,293 | 2,373 |
| Depreciation & Amortization | | (878) | (821) | (862) | (905) | (937) |
| EBIT | | 1,279 | 1,259 | 1,322 | 1,388 | 1,436 |
| Interest Expense | | (133) | (91) | (139) | (143) | (147) |
| Interest Income | | 15 | 15 | 15 | 15 | 15 |
| Profit before Income Tax | | 1,162 | 1,183 | 1,198 | 1,260 | 1,305 |
| Income Tax | | 891 | (325) | (329) | (347) | (359) |
| Minority Interests | | (38) | (38) | (38) | (38) | (38) |
| Net Income | | 2,015 | 820 | 830 | 875 | 908 |

Table 2 - Income Statement Forecast

4.1.4. BALANCE SHEET FORECAST

Intangible Assets account, as mentioned before, is the core of the business in our study. Computation of the future exercises' relevant figures in this account his accomplished by taking the previous year record and adding (the negative value) of the current year Depreciation & Amortization line from the Income Statement plus the homologous Capital Expenditure value.

Remaining Assets – including Cash & Equivalents and Tangibles – are assumed to remain constant and equal to the latest annual record; 2013.

Estimation of Shareholders' Equity results from the previous year amount added to the same year Net Income; as a measure of Retained Earnings.

Remaining Liabilities – and Minority Interests but not Total Debt – are constant and equal to the latest annual record; 2013.

We refer at this point to the elementary balance sheet equation:

$$(2) \quad \text{Assets} = \text{Liabilities} + \text{Equity}$$

In order to obtain the outstanding Total Debt account we apply equation (2) and iterative calculations. In this way, we are able to project Total Debt through the years as result of all previously mentioned results.

| $\text{€} \cdot 10^3$ | | Historical | Explicit Forecast Period | | Continuing | |
|---------------------------------------|---------------|---------------|--------------------------|---------------|---------------|---------------|
| | <i>period</i> | | | | | |
| Balance Sheet [extract] | | 2013 | 2014 | 2015 | 2016 | Period |
| Tangible | | 467 | 467 | 467 | 467 | 467 |
| Intangible | | 5,494 | 6,315 | 7,177 | 8,082 | 9,019 |
| Inventory | | - | - | - | - | - |
| Accounts Receivable | | 1,392 | 2,189 | 2,299 | 2,414 | 2,498 |
| Cash & Equivalents | | 2,588 | 2,588 | 2,588 | 2,588 | 2,588 |
| Other Assets | | 4,377 | 4,377 | 4,377 | 4,377 | 4,377 |
| Total Assets | | 14,318 | 15,937 | 16,909 | 17,929 | 18,950 |
| Shareholders' | | 7,163 | 7,163 | 7,983 | 8,813 | 9,688 |
| Net Income | | - | 820 | 830 | 875 | 908 |
| Minority Interests | | 13 | 13 | 13 | 13 | 13 |
| Total Debt | | 1,690 | 2,583 | 2,653 | 2,723 | 2,781 |
| Accounts Payable | | 1,517 | 1,423 | 1,494 | 1,569 | 1,624 |
| Other Liabilities | | 3,936 | 3,936 | 3,936 | 3,936 | 3,936 |
| Total Liabilities & Equity | | 14,318 | 15,937 | 16,909 | 17,929 | 18,950 |

| | <i>period</i> | Historical | Explicit Forecast Period | | Continuing | |
|-----------------------------|---------------|-------------|--------------------------|-------------|-------------|--------|
| | | | | | | |
| Other Operating Info | | 2013 | 2014 | 2015 | 2016 | Period |
| CAPEX | | 2,008 | 1,642 | 1,724 | 1,810 | 1,874 |
| Current Assets | | 10,768 | 11,565 | 11,675 | 11,790 | 11,874 |
| Current Liabilities | | 6,887 | 7,686 | 7,827 | 7,972 | 8,085 |

Table 3 - Balance Sheet Forecast

It is important to note that we traced during this analysis a slightly degrading trend in the Working Capital of the firm which has been consistently decreasing throughout the last 5 years culminating with a negative figure during the year of 2013 exercise. It is an outcome of the decaying efficiency registered in the recent past due to increasingly extended periods of collection from customers.

We associate this condition to the recent reducing management ability to overcome the economic emergency experienced in Portugal in the period of our

historical analysis. On the other hand, Vortal is poised to operate on a multinational frame in a more consolidated fashion and will take advantage of operating in more balanced foreign economies. Therefore, and without compromising the goals of our overall assessments, we assume a stabilization of operating conditions in our future projections of Working Capital reverting to the mean at a manageable level.

4.1.5. COST OF CAPITAL

As mentioned previously, the cost of capital includes a crucial set of parameters in the exercise of the DCF methodology. It represents the time-value of money and appears in the form of annualized rates which affect the computation of the desired Present Values, discounting the above revealed projected cash-flows.

In our study, we require two different (although interrelated) rates to implement in the different models: APV and EDCF. These are the Unlevered Cost of Equity and the Weighted Average Cost of Capital, respectively.

RISK-FREE RATE

A measure of the opportunity cost, prevailing in the market, for which there is a zero probability of default embodies the reference and the basis of all the methodologies applied herein.

Presently, the concept of the availability of an investment instrument exempt of the possibility of failing to see its capital entirely refunded at maturity is a rather theoretical one – given the prospect of default even by the most solid of states issuing debt. The recent global financial crisis as presented us with some palpable examples of sovereign responsibilities in the brink of not being met or requiring transnational support in order to be honored – namely in the European countries of Greece, Ireland and Portugal.

Nevertheless, some of the reviewed literature offer guidelines in choosing the appropriate vehicle of investment for the model and timing being developed. (Damodaran, 2002) (Koller et al., 2010)

Thus, we chose a government bond: with the higher possible degree of credibility, issued in the currency with which the firm reports its taxes and trading with sufficient liquidity to simulate the risk-free environment we want to model.

The above mentioned financial instrument, given the required traits and market constraints, is the 10-year German *Bund*. Currently trading at an annual rate of 1.17%, which is the figure we adopt. (Bloomberg, n.d.)

MARKET RISK PREMIUM

A local historical statistic of the difference between the expected return on a market portfolio and the risk-free rate, on a yearly basis, is used as the projection of an important component of the postulate commonly referred to as Capital Asset Pricing Model. This hypothesis, CAPM, establishes a relationship between risk and expected return on an individual asset by accommodating a risk measure named beta (β) and providing anticipated results for the return on the security we are investigating. (Koller et al., 2010)

It is equated as follows:

$$(3) \quad r_i = r_f + \beta_i(r_M - r_f)$$

Where,

r_i is the expected return on the chosen security, and

β_i is the beta as a measure of risk of the chosen security

For the purpose of our study, this formulation is very useful to derive other important results.

Relying on the research available from the records updated at the New York University Stern School of Business, we look for the value listed for our country of reference – Germany – and adopt an annual rate of 5%. (Damodaran, 2014)

COST OF DEBT

As mentioned earlier in the document this cost may be estimated, although in many instances returning weak results, by collecting historical data from the company. Vortal has not issued any debt in the past and it is not expected to do so in the future. The company's means of financing of its operations, apart from the excess cash collected through the years and subscribed equity in its foundation, is by borrowing from commercial banks a small fraction of its necessities.

The recommended alternative is by means of the Synthetic Ratings Approach adjusted to the domestic reality as a function of the relevant country default risk. (Damodaran, 2002)

In the present case, the country to which we must refer to regarding borrowing costs to be supported by Vortal is Portugal. Currently the Portuguese crisis, originated by difficulties in meeting responsibilities attached to issued sovereign debt, has driven the fear of default to unimaginable heights. Hence, the present rating associated with the country - which has had a systemic impact on the financial activities of all the economic agents – must be taken into consideration when evaluating the costs related to debt contracted by Portuguese companies.

So, our implementation of the Synthetic Ratings Approach – adjusting for a country with unusually high Default Risk premium – assigns the theoretical Cost of Debt for Vortal as follows:

$$(4) \quad r_f + \text{Company Default Spread} + \frac{2}{3} \text{Country Default Spread}_{\text{Portugal}}$$

Again, trusting the research accessible from the records updated at the Stern School of Business, we look for the listed country of fiscal reporting of Vortal (Portugal) and adopt a Country Default Spread of 5.36%. (Damodaran, 2014)

We are in a position to obtain the Company Default Spread based on the latest Interest Cover Ratio obtained from the analysis of historical operations of Vortal. Making use of the data collected in the above mentioned records of NYU Stern, we verify that for a figure of 9.6 during the year of 2013 we are lead towards a Aa2/AA rating and a spread of 0.7%. (Damodaran, 2014)

The use of equation (4) with the extracted values results in an estimated Cost of Debt for the firm of 5.4%.

UNLEVERED BETA, UNLEVERED COST OF EQUITY

In order to proceed with the implementation of the APV model we need an estimation of the cost of capital the firm would support if no debt is present to use as the appropriate discount rate.

The Unlevered Cost of Equity may be obtained using the following formulation:

$$(5) \quad r_u = r_f + \beta_u(r_M - r_f)$$

This last parameter - Unlevered Beta - ideally, considering that it represents the risk associated with the assets of the firm independently of the financial structure supporting the operations, should be a characteristic of the industry where the company operates. Since the assets and the business are the same for a selected group of companies offering the same services, there should be a common measure of risk separating the mentioned group from the others in the market.

It is understood that in order to compute the desired Unlevered Cost of Equity we may take advantage of aggregated data organized by industry to extract the value for the Unlevered Beta. (Damodaran, 2014)

Currently, in the case of the Internet Software and Services industry, Unlevered Beta levels at 1.01 – thus, a fraction riskier than the market.

Consequently, the adopted value for the Unlevered Cost of Equity is 6.2%.

This concludes the necessary set of inputs to successfully implement the Adjusted Present Value model.

TARGET LEVERAGE RATIO

The alternative approach to the Adjusted Present Value model is the Enterprise Discounted Cash-Flow model. This formulation, although deemed to return a similar valuation to the APV as a consequence of Modigliani-Miller theorems (Koller et al., 2010), is of interest for us as a means of validation and calibration of our study. Nevertheless, the caveat of following the EDCF path lies on the imposition of a target leverage ratio for the firm during projected years.

In order to establish such requirement we must refer to industry statistics which allows us to define a legitimate capital structure for the business in analysis.

Hence, we begin by selecting from the already mentioned NYU Stern Industry references the appropriate D/E ratio of 4.16%. (Damodaran, 2014)

This assumption contrasts with the historical and forecasted patterns where we are able to verify a considerably different proportion in the financing capital of Vortal's business. In fact, although the trend shows a path to a positive leverage ratio, the current position regarding the firm's excess cash turns the sign of the mentioned ratio to negative - a consequence of a systematic negative Net Debt value.

Nonetheless, for the purpose of the present exercise there is no incongruence in modeling a diverse capital structure applied as a target for future undertakings.

COST OF EQUITY

As a consequence of our assumption of the firm's capital structure for the future, together with results from the Cost of Debt assessment and Unlevered Cost of Equity investigation, we may now use a combination of the Capital Asset Pricing Model theory and Modigliani and Miller's equations to estimate Cost of Equity. (Koller et al., 2010)

$$(6) \quad r_e = r_u + \frac{D}{E}(r_u - r_d)$$

The ensuing result is the adoption of an annual rate of 6.25% for this particular parameter.

WEIGHTED AVERAGE COST OF CAPITAL

Distinctively to the APV computation, the EDCF approach calls for a discount rate based on the WACC formulation in order to capture the capital structure discussed above:

$$(7) \quad r_{wacc} = \frac{D}{D+E}r_d(1 - T_m) + \frac{E}{D+E}r_e$$

The result of the above calculation is a WACC annual rate of 6.16%.

This shows a very similar rate to the Cost of Equity computed before and is a consequence of the extremely low leverage ratio in the industry reflected in our projections for the firm in evaluation in the context of the EDCF model.

| | | <i>Adopted</i> | <i>Lower Limit</i> | <i>Upper Limit</i> | <i>Reference</i> | <i>Comment</i> |
|----------------|-------------|----------------|------------------------|------------------------|------------------|-------------------------|
| Risk-Free | r_f | 1.17% | | | 1.17% | 10-year Yield Ger. Bund |
| Market Premium | $r_m - r_f$ | 5.0% | 4.5% | 5.5% | 5.00% | Damodaran 2014 |
| Cost of Debt | r_d | 5.4% | 5.4% [estimated] | 6.0% [historical] | 5.36% | add 2/3 country risk |
| Unlevered Beta | β_u | 101.0% | | | 101.00% | Damodaran 2014 |
| Unlevered Cost | r_u | 6.2% | [APV] | | | |
| WACC | r_{wacc} | 6.16% | [EDCF] | | | |

Table 4 - Summary of Cost of Capital Projected Rates

4.1.6. APV VALUATION

Our deterministic approach to the value of the firm begins by establishing a reasonable forecast for the Net Operating Profit Less Adjusted Taxes (NOPLAT) as a starting point for the Free Cash Flow available to all investors. We then compute the Present Value of the Enterprise as if the Company was All-Equity Financed – considering our estimate for the Unlevered Cost of Equity – and, finally, we add to the result the Present Value of Tax Shield benefits generated by debt contracted through the years. (Koller et al., 2010)

Free Cash Flow forecasted for next three years (on an explicit basis) and for the fourth year (to simulate a continuing condition) are calculated. Taking in consideration the fact that we are using historical data of the company's last five annual exercises our explicit forecast must not extend beyond the time frame of the original data. Moreover, and in order to capture the material flows we are

seeking to predict, we use an adjusted version of NOPLAT (or after-tax EBIT) as well as the necessary deductions of Net Investments from the result.

The chronological change in the Operating Working Capital is instrumental to achieve the overall deductions of the above mentioned Net Investments. It is obtained from our forecasted Balance Sheets.

Note the particularity, in the context of the continuing forecasted period to achieve what is usually referred to as Terminal Value, of omitting the contribution of D&A and CAPEX to the computation of Free Cash-Flow as it is presumed that in perpetuity these two accounts cancel each other out.

Interest Expenses throughout the years of projection is computed in order to establish the Interest Tax Shield – the annual savings deducted from the Net Income to be added in adjustment of our discounted cash-flow sums. These expenses are calculated as a fraction of Total Debt running in the previous year at the estimated rate for the Cost of Debt clarified above.

The present value of FCF from Operations has two components. One given by the sum of discounted cash-flows computed by using equation (1), the other given by the Gordon Growth Model resulting in the Terminal Value. (Damodaran, 2002)

$$(8) \quad PV_{CF} = \sum_{i=1}^3 \frac{CF_i}{(1+r_u)^i} + \frac{[CF_4/(r_u - g_s^{continuing})]}{(1+r_u)^3}$$

Analogously, the Present value of Interest Tax Shields is computed in two steps.

$$(9) \quad PV_{ITS} = \sum_{i=1}^3 \frac{ITS_i}{(1+r_d)^i} + \frac{[ITS_4/(r_d - g_D)]}{(1+r_d)^3}$$

Total Debt Growth Rate, g_D , for the continuing period is assumed to be equal to the growth value obtained directly from the building of our Forecasted Balance Sheet – in this instance, accordingly, both values are a result of our previous calculations and assume an annual rate of 1.8%.

Moreover, we are hence able to compute our estimate for the Adjusted Present Value as follows. (Koller et al., 2010)

$$(10) \quad APV = PV_{CF} + PV_{ITS}$$

Since the described model returns a valuation of the operations of the firm, in other words the economic benefit obtained from the use of the operating assets against the loss incurred from the use of the operating liabilities, we add Cash and other Assets and deduct other Liabilities accounts to the Adjusted Present Value in order to obtain the desired Enterprise Value.

| €^*10^3 | | | | | | |
|---------------------------------------|-------------------|----------------------|--------------|-------------|-------------|--------------|
| <i>period</i> | Historical | | Explicit | | | Cont. |
| Cash Flows | <u>31-12-2012</u> | <u>31-12-2013</u> | <u>2014</u> | <u>2015</u> | <u>2016</u> | <u>2017</u> |
| EBIT x (1-T _m) | <i>NOPLAT</i> | | | | | |
| | | 928 | 913 | 958 | 1,006 | 1,041 |
| Depreciation and Amortization | | 878 | 821 | 862 | 905 | |
| Change in Operating Working Capital | | (879) | 892 | 38 | 40 | 30 |
| CAPEX | | 2,008 | 1,642 | 1,724 | 1,810 | |
| Free Cash-Flow | | <u>676</u> | <u>(800)</u> | <u>58</u> | <u>61</u> | <u>1,012</u> |
| Inventory | | - | - | - | - | - |
| Acc. Receivable | 1,688 | 1,392 | 2,189 | 2,299 | 2,414 | 2,498 |
| Acc. Payable | 935 | 1,517 | 1,423 | 1,494 | 1,569 | 1,624 |
| Operating Net Working Capital | <u>754</u> | <u>(125)</u> | <u>766</u> | <u>805</u> | <u>845</u> | <u>874</u> |
| Change in Operating Working Capital | | <u>(879)</u> | <u>892</u> | <u>38</u> | <u>40</u> | <u>30</u> |
| Interest Expense | | | (91) | (139) | (143) | (147) |
| Interest Tax Shield | | | <u>25</u> | <u>38</u> | <u>39</u> | <u>40</u> |
| | <i>period</i> | 0 | 1 | 2 | 3 | 4 |
| Present value of FCF from Operations | <i>Explicit</i> | (651) | (753) | 51 | 51 | |
| Terminal Value from Operations | <i>Cont.</i> | 31,041 | | | 844 | |
| Present value of Interest Tax Shields | <i>Explicit</i> | 92 | 24 | 35 | 34 | |
| Terminal Value of ITS | <i>Cont.</i> | 953 | | | 35 | |
| Cash & Equivalents | | 2,588 | | | | |
| Other Assets | | 4,377 | | | | |
| Other Liabilities | | (3,936) | | | | |
| Enterprise Value | | <u>34,464</u> | | | | |

Table 5 - APV Valuation

4.1.7.EDCF VALUATION

EDCF follows the same principles applied in the APV approach.

This approach is also based in the above mentioned Net Operating Profit Less Adjusted Taxes (NOPLAT) as a starting point for the Free Cash Flow available to all investors. Nevertheless, the Present Value of the Enterprise is obtained considering, in this instance, our estimate for the WACC alone. (Koller et al., 2010)

Free Cash Flows are calculated in the same way for the relevant periods taking advantage of an adjusted version of NOPLAT (or after-tax EBIT) as well as the necessary deductions of Net Investments from the result.

The present value of FCF from Operations has again two components. One given by the sum of discounted cash/flows computed by using equation (1), the other given by the Gordon Growth Model resulting in the Terminal Value. This approach requires a different discount rate, as explained, which is an average allowing for the adopted capital structure – the weighted average cost of capital. (Damodaran, 2002)

$$(11) \quad PV_{CF} = \sum_{i=1}^3 \frac{CF_i}{(1 + r_{wacc})^i} + \frac{[CF_4 / (r_{wacc} - g_S^{continuing})]}{(1 + r_{wacc})^3}$$

Our estimate for the Enterprise Discounted Cash-Flow is subsequently the resulting value for PV_{CF} which is added to the current value in Cash & Equivalents, Other Assets and Other Liabilities accounts to project the desired Enterprise Value of the firm.

| $\text{€} \cdot 10^3$ | | | | | | | |
|--------------------------------------|-----------------|-------------------|-------------------|-------------|-------------|-------------|------------|
| | <i>period</i> | Historical | | Explicit | | Cont. | |
| Cash Flows | | 31-12-2012 | 31-12-2013 | 2014 | 2015 | 2016 | |
| EBIT x (1-T _m) | <i>NOPLAT</i> | | 928 | 913 | 958 | 1,006 | 1,041 |
| Depreciation and Amortization | | | 878 | 821 | 862 | 905 | |
| Change in Operating Working Capital | | | (879) | 892 | 38 | 40 | 30 |
| CAPEX | | | 2,008 | 1,642 | 1,724 | 1,810 | |
| Free Cash-Flow | | | 676 | (800) | 58 | 61 | 1,012 |
| Inventory | | | - | - | - | - | - |
| Acc. Receivable | | 1,688 | 1,392 | 2,189 | 2,299 | 2,414 | 2,498 |
| Acc. Payable | | 935 | 1,517 | 1,423 | 1,494 | 1,569 | 1,624 |
| Operating Net Working Capital | | 754 | (125) | 766 | 805 | 845 | 874 |
| Change in Operating Working Capital | | | (879) | 892 | 38 | 40 | 30 |
| | <i>period</i> | | 0 | 1 | 2 | 3 | 4 |
| Present value of FCF from Operations | <i>Explicit</i> | | (651) | (753) | 51 | 51 | |
| Terminal Value from Operations | <i>Cont.</i> | | 31,786 | | | 846 | |
| Cash & Equivalents | | | 2,588 | | | | |
| Other Assets | | | 4,377 | | | | |
| Other Liabilities | | | (3,936) | | | | |
| Enterprise Value | | | 34,165 | | | | ★ |

Table 6 - EDCF Valuation

As expected, and already discussed herein, similar results are obtained by the use of the two methods.

4.2. RELATIVE VALUATION

Relative valuation requires a certain degree of criteria and available information. Although this approach is in practice the preferred and the most utilized although rather subjective, in order to successfully perform the desired valuation the analyst must choose comparable firms carefully and enjoy the chance of being able to compile enough information to support his choices. (Damodaran, 2002)

Recently, there have been a few acquisitions (**Ariba**, **SciQuest** and **CombineNet**) from which we are capable of gathering sufficient data to employ in our study.

Moreover, we are able to identify - through the already mentioned report on the top e-sourcing firms where Vortal has been included - a couple of competitors currently trading in the US stock exchange from which it is possible to register relevant data. (Gartner, 2013)

Furthermore, we rely on aggregated sectorial data compiled by two firms dedicated to the United States and European markets and particularly the industry sector in which Vortal operates; **SEG** and **PERL** respectively. (Software Equity Group, L.L.C., 2014) (Progressive Equity Research Limited, 2013)

Ideally we should consider at least three different multiples to include in our work: one user-based and two related to the Enterprise Value, either referred to Revenues or EBITDA.

We are unable to use the suggested user-based approach (Cauwels & Sornette, 2011) due to the lack of information regarding most of the analyzed firms.

Also, and given the highly erratic nature of all of the businesses' earnings historical values, we are forced to leave the EBITDA multiple behind limiting our study to the Revenue side of our comparison.

The above mentioned limitations reinforced our focus on compiling as much valid information as possible regarding the selected EV/Revenues multiple.

Considering the recent acquisitions of Ariba by SAP and current stock prices of SciQuest and CombineNet, we would be inclined to adopt a figure in the neighborhood of 6 times Revenues achieved in the latest exercise.

On the other hand, the results reported by SEG from companies of similar levels of Revenue Growth, aim toward a lower multiple of 2.5 times Revenues.

A summary of the collected data is illustrated in the following diagram, showing also the multiple derived from the PERL sectorial report.

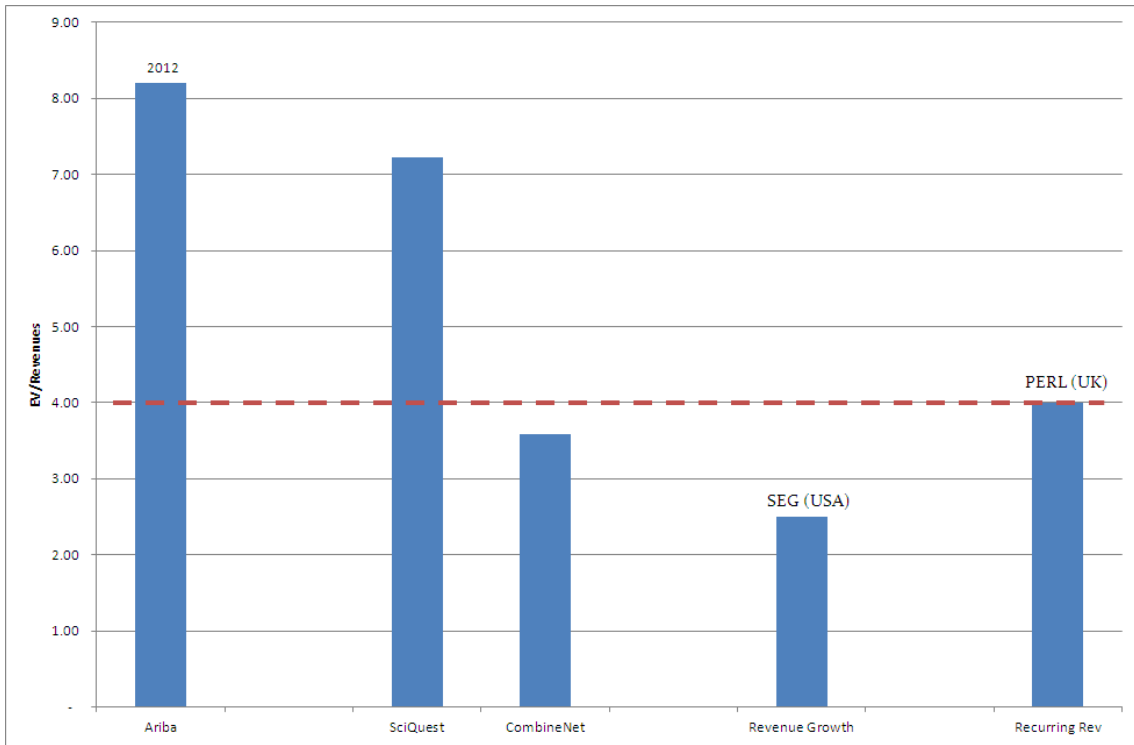


Figure 8 - EV/Revenue Data Collection

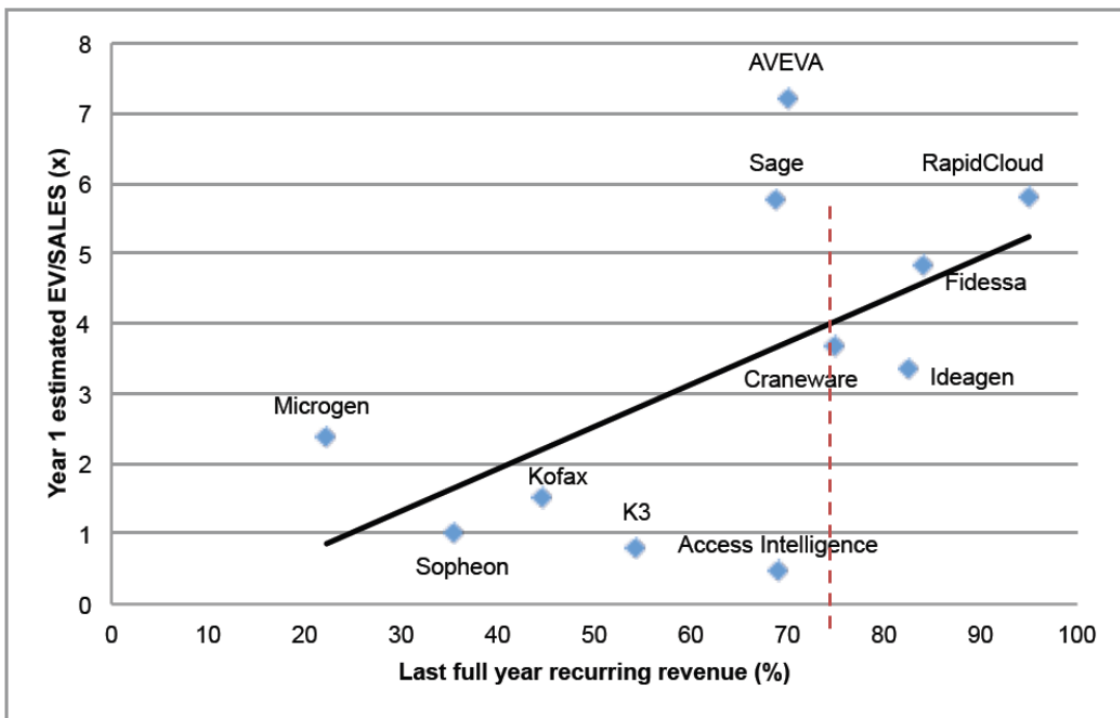


Figure 9 - PERL EV/Revenues v. Recurring Sales Research [Source: PERL, 2013]

Based on Vortal's last annual report we estimate that recurring revenues add up to approximately 73% of revenues realized by Vortal during the year 2013; mainly from Suppliers wishing to engage in Vortal's network and Corporate Buyers who take advantage of its services on a regular basis. By taking this value in *Figure 9* and crossing the line produced by the PERL team we are able to identify a conservative value of 4 which we consider to be the market valuation at this stage for a company like Vortal.

Thus, the market value of Vortal is the last reported figure regarding Revenues (or Sales) which is $10,425 \text{ €} \cdot 10^3$ times 4 resulting in a valuation of $41,701 \text{ €} \cdot 10^3$.

$$41.701 \text{ M€} = 4 \times 10.425 \text{ M€}$$

4.3. CONTINGENT CLAIM MODELS

If we agree that the market value of Vortal is given by our Relative Valuation of the company and that the DCF approach is not able to materialize all of the value of a company of this type – as a corollary of the arguments and results we describe in the first chapters of this work – we must also consent with the necessity to identify another source of value to fill in the gap.

We understand now that value is driven by revenues (and maybe also by the number of active users) and eventually the stableness implied by the DCF approach does not accommodate or project dramatic rises in sales as well as spectacular decreases in that particular side of the business.

The valuation of modern companies like Vortal with the help of non-traditional methods that try to go beyond is well documented and a few successful examples emerge. One of those cases addresses the problem of projecting R&D investments into the future within large scale enterprises and constitutes a comprehensive analysis of the empirical evidence. (Tsui, 2005) Another model, in 2000 and tested 8 years later, is a discrete application to a time-continuous postulation

which has rendered acceptable results in the explanation of higher than expected market values for a few IT companies. (Schwartz & Moon, 2000) (Baek et al., 2008)

4.3.1.A STOCHASTIC PROCESS

Influenced by these novel approaches, we adapt our spreadsheets - created to obtain the DCF valuation - and perform simulations in order to achieve the necessary results leading to the implementation of real option pricing models.

In our work, we develop a means to obtain a measure of the desired volatility by simulating several results from our selected deterministic valuation model (APV) through the conversion of one of the most sensitive parameters in a randomly-based variable – Revenue Growth. (Refer to Appendix 5: Sensitivity Analysis)

From the historical data we assume a normal distribution with known mean and standard deviation – in our exercise: 2.6% and 8.8% respectively. Then, we substitute the deterministic baseline value by a function that generates the desired random figures based on the mentioned distribution.

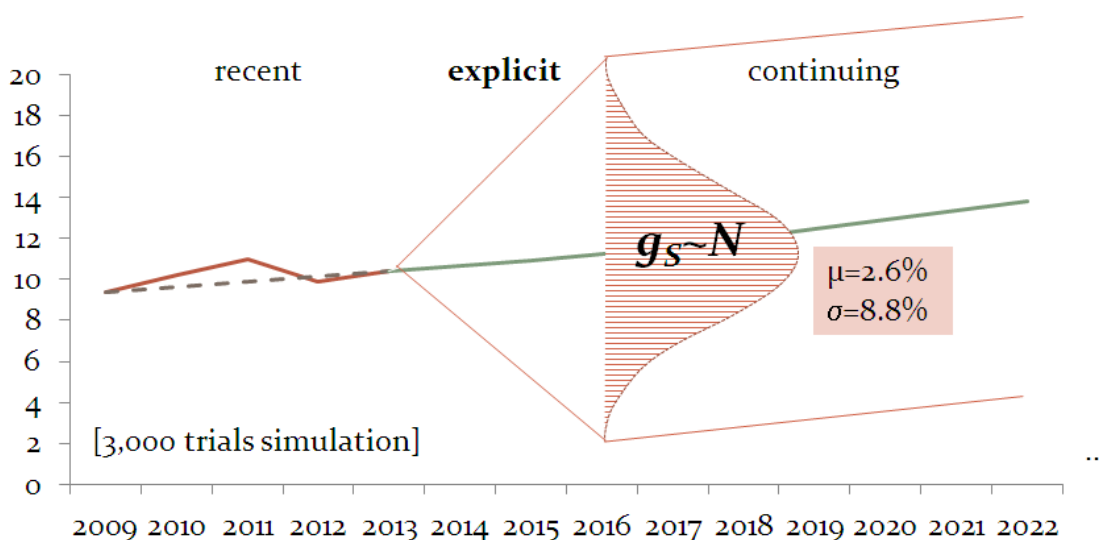


Figure 10 - Stochastic Model Concept

The number of trials chosen (3,000) imparts, considering a 95% confidence interval, an acceptable error in our estimation of the Enterprise Value which has a value of approximately ± 0.3 M€ given the standard deviation of around 7.6 M€; expressed by the formula:

$$\pm 1.96 \times \frac{7.6M\text{€}}{\sqrt{3,000}}$$

The outcome of this procedure is patent in the following graph and consistently returns a Coefficient of Variation of 23%.

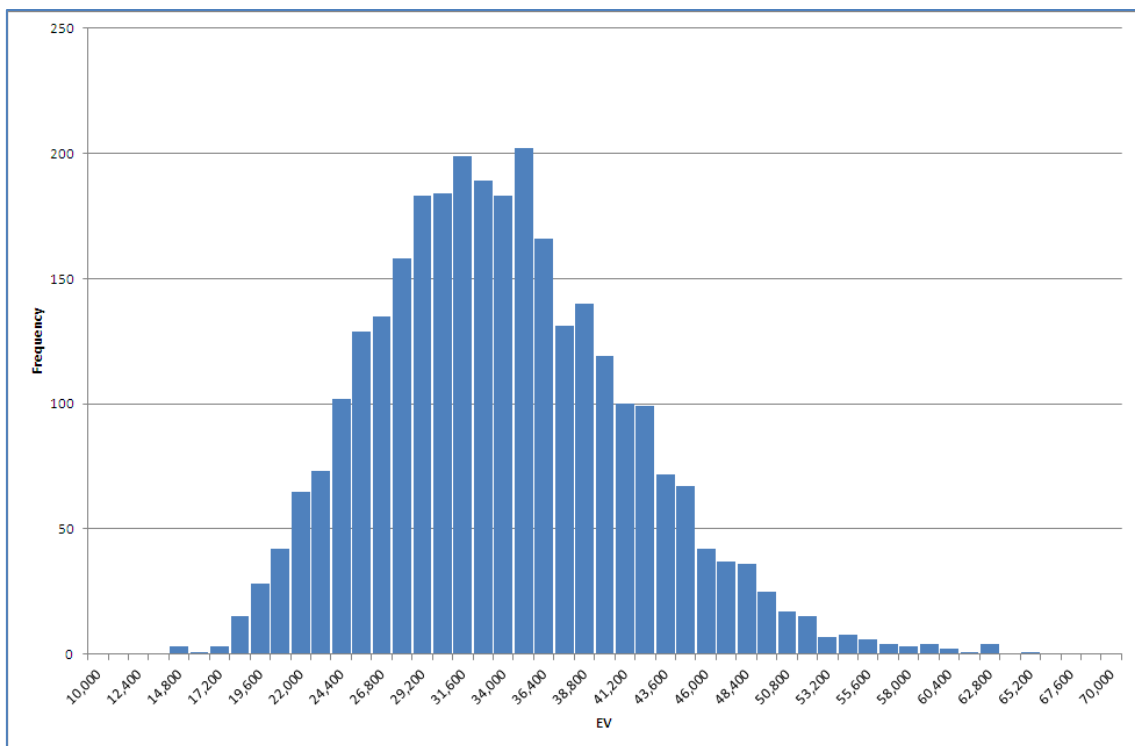


Figure 11 - Histogram of the APV Stochastic Process

4.3.2. A BINOMIAL APPROXIMATION

The possibility of finding in Vortal's operation and assets the option to expand is tested by idealizing a consistent frame of problem formulation in the context of the real option applications.

For this purpose we take advantage of a simplistic but attractive approach which obtains an estimate of the desired valuation by means of the proven methodologies used in the financial option pricing techniques. (Serradas, 2011)

We perceive the origin of the extra value we are assessing as a call option susceptible of being exercised during the lifetime of a common R&D project if circumstances allow the intangible asset to be fully exploited as a consequence of an advantageous expansion in demand for the scalable services provided.

As a starting point, we presume the underlying asset is the firm we are valuing. Next, we assume the current price of this underlying asset is, from the point of view of the investors, the value obtained by our conservative APV approach. Sequentially, the exercise price shall be the perceived market price obtained from the relative valuation methodologies.

| $\text{€} \cdot 10^3$ | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | |
|-----------------------|-------------|--------|--------|--------|--------|--------|---------|--------|
| S_0 | 34,464 | 0 | 1 | 2 | 3 | 4 | 5 | prob |
| K | 41,701 | | | | | | | |
| r_f | 1.17% | | | | | | 108,845 | 2.25% |
| T | 5 | | | | | 86,481 | 67,144 | |
| n | 5 | | | | 68,712 | 45,265 | 68,712 | 12.77% |
| dt | 1 | | | 54,594 | 27,976 | 54,594 | 27,011 | |
| σ | 23.0% | | 43,377 | 16,412 | 43,377 | 13,378 | 43,377 | 29.02% |
| u | 1.25860001 | 34,464 | 9,297 | 34,464 | 6,597 | 34,464 | 1,676 | |
| d | 0.794533603 | 5,136 | 27,383 | 3,241 | 27,383 | 775 | 27,383 | 32.97% |
| p | 0.468112121 | 39,600 | 1,587 | 21,757 | 359 | 21,757 | - | |
| 1-p | 0.531887879 | | | 166 | 17,287 | - | 17,287 | 18.73% |
| $E[S_T]$ | 36,541 | | | | - | 13,735 | - | 4.26% |
| $E[f_T]$ | 5,445 | | | | | | - | |
| f_0 | 5,136 | | | | | | | |

Figure 12 - Option Pricing from a Binomial Model

Where,

$$u = e^{\sigma\sqrt{\delta t}}, d = e^{-\sigma\sqrt{\delta t}}, p = \frac{e^{rf\delta t} - d}{u - d}$$

The above description comprehends the pricing of an American Call Option with the characteristics presented below borrowing from the riskless rate calculated before, assuming a 5 year time span for the life of this type of investments implicitly stated in the last Vortal report by expressing a period of amortization that varies between 4 and 6 years and omitting dividend concerns due to recent policy of the firm.

The volatility associated with the underlying asset is the result of our stochastic process described above and is given by the coefficient of variation of the trials outputs as a normalized measure of volatility.

Since the underlying asset does not devalue throughout the years, the analyzed call option as the same value (5,136 €*10³) regardless of the possibility of being exercised early than its maturity.

4.3.3. A CLOSED-FORM SOLUTION

As expected, the application of the same framework to the Black-Scholes postulate (below) results in a value which does not distinguish itself from the previously computed volatility and pricing.

$$(12) \quad \text{Value of Call Option} = S \times e^{-qt} \times N(d_1) - K \times e^{-rt} \times N(d_2)$$

Where,

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r - q + \frac{\sigma^2}{2}\right)t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}.$$

The implementation of the above described model culminates in the following set of results (pricing the call premium at **5,294 €*10³**) and is useful to assess the correctness of the binomial model.

| | |
|---------------------------------|---|
| €*10 ³ | |
| Horizon | 5 years |
| S_0 | 34,464 <i>value from df valuation</i> |
| K | 41,701 <i>market value based on multiples</i> |
| t | 1825 <i>days (1 year=365 days)</i> |
| r_f | 1.17% <i>risk-free rate</i> |
| q | 0% <i>assuming recent policy</i> |
| σ | 23.0% <i>from simulations</i> |
| Theoretical Call Premium | 5,294 €*10³ |
| d_1 | 0.000300482 |
| d_2 | -0.513995153 |
| $N(d_1)$ | 0.500119875 |
| $N(d_2)$ | 0.30362769 |
| $N(-d_1)$ | 0.499880125 |
| $N(-d_2)$ | 0.69637231 |
| $N'(d_1)$ | 0.398942262 |

Figure 13 - Option Pricing based on Black-Scholes Formulation

5. CONCLUSION

In our quest for the fair value of Vortal we test the hypothesis that traditional methodologies might not constitute enough evidence for the explanation of the price investors are willing to pay for technological companies of the sort.

We make our valuations both from a DCF-based perspective and a market-oriented comparison procedure.

The discrepancy obtained from the selected approaches is confirmed by our implementation of real options theory and practice.

Hence, we are able to confidently assess the Enterprise Value of Vortal in a range between 39.8 and 41.7 million€ as a result of a combination of a baseline value obtained by conventional models and the premium embedded in the potential for growth estimated against the perceived value similar companies currently enjoy in the market.

The following summary offers a target price for the equity of the firm.

| | 31-12-2013 | combined <i>APV&B-S</i> | multiples <i>EV/Rev</i> | DCF | | options | |
|-----------------------------|------------|--------------------------------|----------------------------|------------|-------------|------------|---------------|
| | | | | <i>APV</i> | <i>EDCF</i> | <i>B-S</i> | <i>Binom.</i> |
| Baseline Value | | 34,464 | | 34,464 | 34,165 | | |
| Options Value | | 5,294 | | | | 5,294 | 5,136 |
| + Enterprise Value | | 39,759 | 41,701 | | | | |
| - Total Debt | | 1,690 | | | | | |
| + Cash | | 2,588 | | | | | |
| - Minority Interests | | 13 | | | | | |
| Equity Value | | 40,644 | | | | | |
| Multiple | | | 4.0 | | | | |
| Denominator | | | 10,425 | | | | |
| # Issued Shares | | 10,795,000 | | | | | |
| Price per Share in € | | 3.77 | | | | | |

Table 7 - Summary of Results

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The author currently serves as a member of the non-executive board of Vortal and is an employee of Soares da Costa which is one of its shareholders. This project combines the need for a better understanding of the firm with the present functions of the author within the organization of his employer.

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APPENDICES

Appendix 1 - Historical Balance Sheets

| €*10 ³ | | | | | |
|--------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Balance Sheet | | | | | |
| | <i>31/12/2009</i> | <i>31/12/2010</i> | <i>31/12/2011</i> | <i>31/12/2012</i> | <i>31/12/2013</i> |
| Non-Current Assets | | | | | |
| Tangible Assets | 482 | 701 | 662 | 559 | 467 |
| Goodwill | | | 24 | 24 | 49 |
| Intangible Assets | 2,061 | 2,638 | 3,363 | 4,363 | 5,494 |
| Financial Investments & Others | 1,132 | 1,355 | 167 | 3 | 1 |
| Deferred Tax | 467 | 879 | 1,425 | 1,415 | 2,361 |
| Total Non-Current Assets | 4,140 | 5,573 | 5,642 | 6,363 | 8,371 |
| Current Assets | | | | | |
| Accounts Receivable | 2,809 | 2,336 | 2,264 | 1,688 | 1,392 |
| Inventory | - | - | - | - | - |
| Prepaid Expenses | 6 | 77 | 61 | 55 | 25 |
| Operating Taxes | 50 | - | 390 | 205 | 500 |
| Other Receivables | 121 | 88 | 350 | 614 | 1,018 |
| Cash & Equivalents | 4,108 | 3,380 | 2,765 | 2,675 | 2,588 |
| Accrued Income | 184 | 373 | 364 | 328 | 425 |
| Total Current Assets | 7,277 | 6,254 | 6,195 | 5,565 | 5,947 |
| Total Assets | 11,418 | 11,827 | 11,837 | 11,928 | 14,318 |
| Equity | | | | | |
| Issued Capital & Reserves | 5,026 | 4,648 | 5,470 | 3,740 | 3,867 |
| Retained Earnings | (27) | 321 | - | 757 | 1,281 |
| Minority Interests | - | - | (38) | 2 | 13 |
| Net Income | 1,560 | 2,036 | 787 | 1,012 | 2,015 |
| Total Equity | 6,559 | 7,005 | 6,219 | 5,511 | 7,176 |
| Non-Current Liabilities | | | | | |
| Loans and Borrowings | 1,000 | 714 | 643 | 1,562 | 1,050 |
| Other Payables | 117 | 225 | 126 | 231 | 256 |
| Total Non-Current Liabilities | 1,117 | 939 | 769 | 1,793 | 1,306 |
| Current Liabilities | | | | | |
| Accounts Payable | 1,120 | 1,331 | 1,467 | 935 | 1,517 |
| Loans and Borrowings | - | - | 286 | 648 | 640 |
| Prepaid Income | 19 | 44 | 43 | 50 | 26 |
| Operating Taxes | 345 | 171 | 304 | 298 | 512 |
| Other Payables | 116 | 146 | 1,715 | 1,991 | 2,448 |
| Accrued Expenses | 2,141 | 2,191 | 1,013 | 620 | 576 |
| Shareholders | - | - | 20 | 82 | 118 |
| Total Current Liabilities | 3,742 | 3,884 | 4,849 | 4,624 | 5,837 |
| Total Liabilities | 4,859 | 4,823 | 5,618 | 6,417 | 7,143 |
| Total Liabilities and Equity | 11,418 | 11,827 | 11,837 | 11,928 | 14,318 |

Appendix 2 - Historical Income Statements

| €*10³ | | | | | |
|---------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Income Statement | | | | | |
| | 31/12/2009 | 31/12/2010 | 31/12/2011 | 31/12/2012 | 31/12/2013 |
| Revenue | 8,895 | 9,853 | 10,429 | 9,305 | 9,783 |
| Subsidies | 47 | 30 | 31 | 29 | 33 |
| Subsidiaries P&L | (101) | (333) | (36) | - | - |
| Self Revenue | 544 | 609 | 596 | 606 | 609 |
| Services Paid | (4,183) | (4,616) | (5,609) | (4,506) | (4,585) |
| Salaries and Wages | (3,195) | (3,067) | (4,028) | (3,821) | (3,788) |
| Receivables Impairments | (37) | (55) | (124) | (11) | (154) |
| Provisions | 65 | (15) | - | - | 3 |
| Other Profits | 248 | 402 | 181 | 273 | 540 |
| Other Losses | (169) | (330) | (256) | (174) | (284) |
| EBITDA | 2,115 | 2,479 | 1,185 | 1,702 | 2,157 |
| Depreciation and Amortization | (654) | (677) | (729) | (657) | (878) |
| EBIT | 1,460 | 1,802 | 456 | 1,045 | 1,279 |
| Interest Income | 59 | - | 106 | 29 | 15 |
| Interest Expense | (38) | (19) | (44) | (60) | (133) |
| Profit before Income Tax | 1,481 | 1,783 | 518 | 1,015 | 1,162 |
| Income Tax | 79 | 253 | 207 | (96) | 891 |
| Minority Interests | - | - | 61 | 93 | (38) |
| Net Income | 1,560 | 2,036 | 787 | 1,012 | 2,015 |
| Capex | | | 1,224 | 1,532 | 1,885 |

source: Annual Report Notes

Appendix 3 - Rearranged Financial Statements

| €*10 ³ | | | | | | trend | | to-sales ratio | | | | | | | |
|---------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------|----------------|-------|-------|--------|-------|-------|------|--|
| Rearr. Income Statement | 31-12-2009 | 31-12-2010 | 31-12-2011 | 31-12-2012 | 31-12-2013 | 31-12-2014 | g ratio | 2009 | 2010 | 2011 | 2012 | 2013 | mean | sd | |
| Sales/Revenue | 9,386 | 10,160 | 11,020 | 9,940 | 10,425 | 10,743 | 2.7% cagr | y-o-year | 7.9% | 8.1% | -10.3% | 4.8% | 2.6% | 8.8% | |
| Expenses | (7,271) | (7,680) | (9,836) | (8,238) | (8,268) | | | TTM | | | | | | | |
| EBITDA | 2,115 | 2,479 | 1,185 | 1,702 | 2,157 | 1,720 | 16.0% | 22.5% | 24.4% | 10.8% | 17.1% | 20.7% | 19.1% | 5.4% | |
| Depreciation & Amortization | (654) | (677) | (729) | (657) | (878) | (847) | -7.9% | -7.0% | -6.7% | -6.6% | -6.6% | -8.4% | -7.1% | 0.8% | |
| EBIT | 1,460 | 1,802 | 456 | 1,045 | 1,279 | | | | | | | | | | |
| Interest Expense | (38) | (19) | (44) | (60) | (133) | | | | | | | | | | |
| Interest Income | 59 | - | 106 | 29 | 15 | | | | | | | | | | |
| Profit before Income Tax | 1,481 | 1,783 | 518 | 1,015 | 1,162 | | | | | | | | | | |
| Income Tax | 79 | 253 | 207 | (96) | 891 | | | | | | | | | | |
| Minority Interests | - | - | 61 | 93 | (38) | | | | | | | | | | |
| Net Income | 1,560 | 2,036 | 787 | 1,012 | 2,015 | | | | | | | | | | |
| Rearr. Balance Sheet | 31-12-2009 | 31-12-2010 | 31-12-2011 | 31-12-2012 | 31-12-2013 | 31-12-2014 | ratio | 2009 | 2010 | 2011 | 2012 | 2013 | mean | sd | |
| Tangible | 482 | 701 | 662 | 559 | 467 | fixed assets | | | | | | | | | |
| Intangible | 2,061 | 2,638 | 3,363 | 4,363 | 5,494 | software, R&D | | | | | | | | | |
| Others | 1,598 | 2,234 | 1,617 | 1,442 | 2,410 | | | | | | | | | | |
| Non-Current Assets | 4,140 | 5,573 | 5,642 | 6,363 | 8,371 | | | | | | | | | | |
| Accounts Receivable | 2,809 | 2,336 | 2,264 | 1,688 | 1,392 | 1,054 | 9.8% | 29.9% | 23.0% | 20.5% | 17.0% | 13.3% | 20.8% | 6.3% | |
| Inventory | - | - | - | - | - | - | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | |
| Cash & Equivalents | 4,108 | 3,380 | 2,765 | 2,675 | 2,588 | | | | | | | | | | |
| Others | 360 | 538 | 1,165 | 1,201 | 1,967 | | | | | | | | | | |
| Current Assets | 7,277 | 6,254 | 6,195 | 5,565 | 5,947 | | | | | | | | | | |
| Total Assets | 11,418 | 11,827 | 11,837 | 11,928 | 14,318 | | | | | | | | | | |
| Shareholders' | 6,559 | 7,005 | 6,257 | 5,508 | 7,163 | | | | | | | | | | |
| Minority Interests | - | - | (38) | 2 | 13 | | | | | | | | | | |
| Total Equity | 6,559 | 7,005 | 6,219 | 5,511 | 7,176 | | | | | | | | | | |
| Long-Term Loans | 1,000 | 714 | 643 | 1,562 | 1,050 | | | | | | | | | | |
| Others | 117 | 225 | 126 | 231 | 256 | | | | | | | | | | |
| Non-Current Liabilities | 1,117 | 939 | 769 | 1,793 | 1,306 | | | | | | | | | | |
| Accounts Payable | 1,120 | 1,331 | 1,467 | 935 | 1,517 | 1,393 | 13.0% | 11.9% | 13.1% | 13.3% | 9.4% | 14.6% | 12.5% | 1.9% | |
| Short-Term Loans | - | - | 286 | 648 | 640 | | | | | | | | | | |
| Others | 2,621 | 2,553 | 3,096 | 3,042 | 3,680 | | | | | | | | | | |
| Current Liabilities | 3,742 | 3,884 | 4,849 | 4,624 | 5,837 | | | | | | | | | | |
| Total Liabilities & Equity | 11,418 | 11,827 | 11,837 | 11,928 | 14,318 | | | | | | | | | | |

Appendix 4 - Fundamentals derived from Rearranged Financial Statements

| €*10 ³ | | | | | | trend | | | to-sales ratio | | | | | | | |
|---------------------------------|------------|------------|------------|------------|------------|------------------------------|--------|-------|----------------|--------|-------|-------|--------|-------|--------|-------|
| | 31-12-2009 | 31-12-2010 | 31-12-2011 | 31-12-2012 | 31-12-2013 | 31-12-2014 | g | ratio | 2009 | 2010 | 2011 | 2012 | 2013 | mean | sd | |
| Investment & Funding | | | | | | | | | | | | | | | | |
| Estimated CAPEX | 978 | 1,255 | 1,454 | 1,656 | 2,008 | 2,208 | | 20.6% | 10.4% | 12.4% | 13.2% | 16.7% | 19.3% | 14.4% | 3.5% | |
| Total Debt | 1,000 | 714 | 929 | 2,209 | 1,690 | 2,171 | 14.0% | cagr | y-o-year | -33.7% | 26.3% | 86.7% | -26.8% | 13.1% | 55.9% | |
| Net Debt | (3,108) | (2,666) | (1,837) | (466) | (898) | debt-cash | | | | | | | | | | |
| Op. Net Working Capital | 1,689 | 1,005 | 797 | 754 | (125) | inventory+receivable-payable | | | | | | | | | | |
| Risk Assessment | | | | | | | | | | | | | | | | |
| Estimated Interest Rate | | 1.9% | 6.2% | 6.4% | 6.0% | to previous year Total Debt | | | | | | | | | | |
| Interest Cover Ratio | 38.7 | 92.5 | 10.3 | 17.6 | 9.6 | | | | | | | | | | | |
| Rating | Aaa/AAA | Aaa/AAA | Aa2/AA | Aaa/AAA | Aa2/AA | | | | | | | | | | | |
| Spread | 0.4% | 0.4% | 0.7% | 0.4% | 0.7% | | | | | | | | | | | |
| Capital Structure | | | | | | | | | | | | | | | | |
| D+E | 3,451 | 4,339 | 4,382 | 5,045 | 6,277 | | | | | | | | | | | |
| E/(D+E) | 1.90 | 1.61 | 1.42 | 1.09 | 1.14 | | | | | | | | | | | |
| D/(D+E) | (0.90) | (0.61) | (0.42) | (0.09) | (0.14) | | | | | | | | | | | |
| [E/(D+E)]+[D/(D+E)] | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | | | | |
| D/E | -47.4% | -38.1% | -29.5% | -8.5% | -12.5% | 2.6% | | | | | | | | | -27.2% | 16.6% |
| Efficiency Information | | | | | | | | | | | | | | | | |
| Average Collection Period | 107.73 | 82.77 | 73.97 | 61.15 | 48.06 | 32.46 | -18.3% | cagr | | | | | | | | |
| Average Payment Period | 42.96 | 47.16 | 47.94 | 33.85 | 52.38 | 46.51 | 5.1% | cagr | | | | | | | | |
| Performance | | | | | | | | | | | | | | | | |
| Return on Assets | 13.7% | 17.2% | 6.6% | 8.5% | 14.1% | 9.6% | 0.7% | cagr | | | | | | | | |

APPENDIX 5: SENSITIVITY ANALYSIS

All the different model parameters described in this work have different impacts on final value which is obtained by the implementation of the two chosen DCF models.

For that reason, it is informative to produce an analysis of the above mentioned impacts through the simulation of individual changes in the value of the inputs of our computation.

With this in mind, we prepare a register with relevant variations in the baseline values for each of the above mentioned parameters. These registers capture the resulting valuation (in M€ shown in the next diagrams) from an imposed change in the original input values. In this way we are able to verify the magnitude of the changes in the output values derived from the deviations we wish to test.

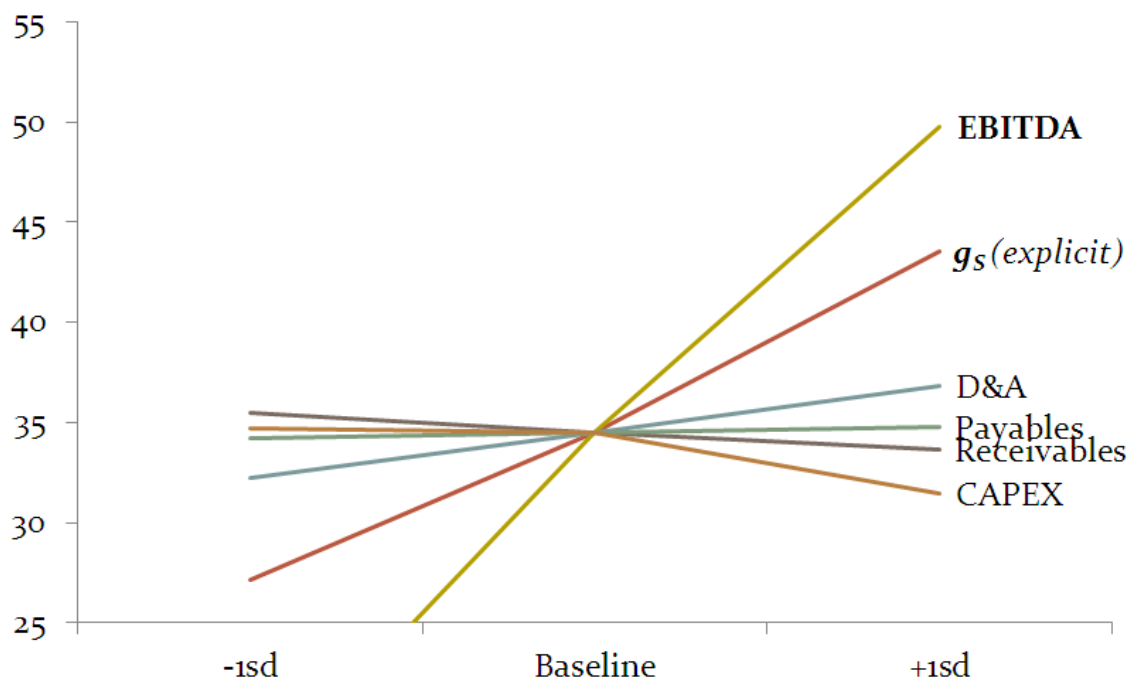


Figure 14 - Historical Data Sensitivity

We use intervals of variation either with a radius of a Standard Deviation or a percentage point from the central adopted value. Above, we consider standard deviations given the statistical nature of the parameters. On the other hand, in the following graph, we are reporting mainly on discount rates and measures of risk so we find the percentage point variation better suited to the analysis.

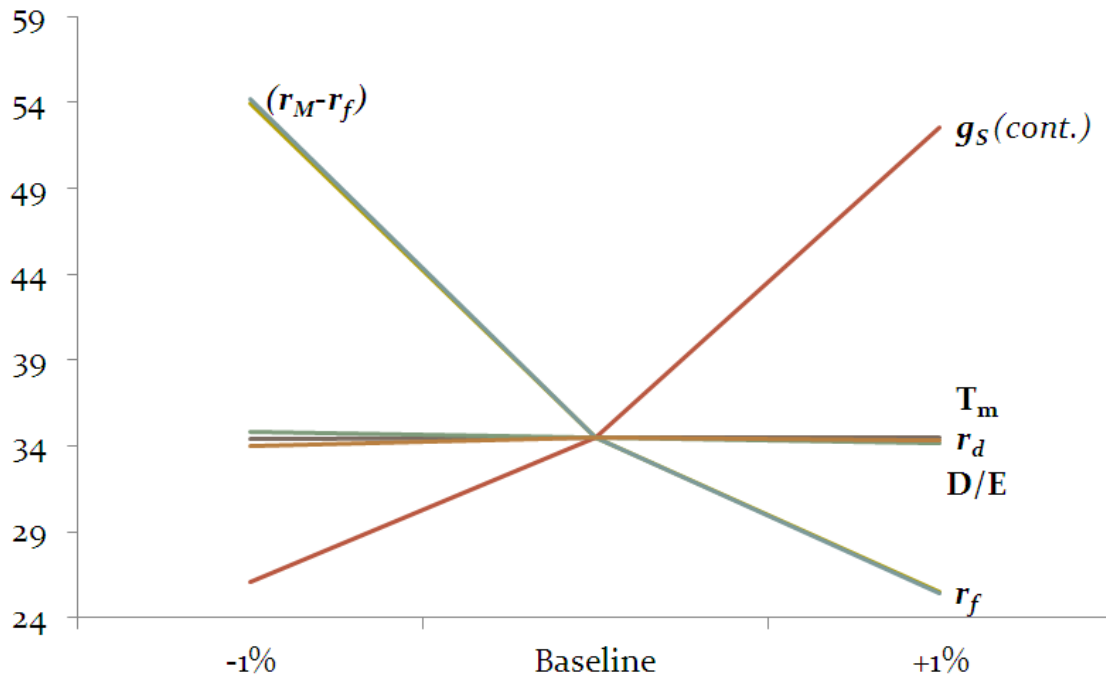


Figure 15 - Cost of Capital, Taxes & Growth Sensitivity

Overall, we are driven to declare that the two most sensitive and difficult to estimate parameters of our study are Sales Growth Rates and EBITDA to-sales Ratio. We may also verify that the Risk-Free rate assumption has an important impact on final results.