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How different valuation methods and theories influence a company's intrinsic value
The importance of APV

Intel Case Study

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There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world

John Maynard Keynes

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General Introduction

«*There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world*».

Keynes' quotation has been specifically chosen as the introductory phrase because it best summarizes the content and the objective of this final dissertation.
Although we may possess a solid knowledge in terms of valuation techniques to such an extent that we could be considered rational investors, we may never be certain about the rationality of the rest of the world. And, it could be added that, even if we were in the presence of rational investors only, the logic behind some of their results could be challenged because of its inapplicability under specific circumstances. The aim of this thesis is to analyze how different valuation methods and theories can influence a company's intrinsic value by underlining the importance of a specific firm valuation method: the Adjusted Present Value (APV). The connection between the title of this dissertation and Keynes' quotation lies in the fact that, despite using a generally accepted valuation method, you may still obtain a wrong result because of the inconsistency of your applied assumptions and theories. According to Professor Fernández, whose theories will be intensively adopted in the third chapter and later applied in the fourth chapter, all valuation methods should lead to the same result provided consistent assumptions are used and the iteration is done correctly. Because of the inability of meeting Fernández's prerequisites, most of the time practitioners fail to obtain the same result.

This final dissertation is divided into four different chapters.
The first two chapters provide the reader with a full explanation of how to proceed when it comes to valuing a company.

The first chapter aims to analyze different ways to properly estimate the cost of equity and the cost of debt to be able to compute the cost of capital (also known as WACC, the weighted average cost of capital) since it is a function of both costs. Moreover, hybrid instruments such as preferred shares will be included in the computation of the WACC. Although this chapter does not include the main topic of this thesis, it is of great importance because computing correctly the discount rates is a prerequisite for the discounted cash flow methods to be implemented properly.

The second chapter gives the reader an overview of the most used valuation methods by making a distinction between the "Discounted Cash Flow" (DCF) valuation methods and the "Multiples-based valuation". The former category gathers the well-known "Dividend Discount Model" (DDM), the

“Free Cash Flow to Equity” (FCFE) and the “Free Cash Flow to the Firm” (FCFF). The DCF is the category providing a company’s intrinsic value; however, this thesis’ author believes it is important to also cover the multiples since they are even better known among investors: they are easier to understand and interpret. Moreover, the multiples can potentially be found within the discounted cash flow valuation as well because the terminal value could be computed as the EV/EBITDA multiple of the benchmark industry multiplied by the company’s EBITDA. More specifically, the DDM and the FCFE belong to the equity valuation models since their cash flows are discounted at the cost of equity, while the FCFF belongs to the firm valuation models since its cash flows are discounted at the WACC. The chapter also presents the Residual Income Model and the EVA which could theoretically be considered as part of the firm valuation models, however, due to their peculiarity, they can also be seen as a different category and are known as “Value Creation Models”. Both the first and second chapter have a common denominator which consists in relying intensively on one of the major experts in the field as far as corporate finance is concerned: Aswath Damodaran. The Dean of Valuation’s techniques and assumptions will be adopted in the fourth chapter as it will be later explained.

After these two introductory chapters, we finally arrive at the third chapter which is the core topic of this final dissertation: it discusses the advantages brought by the usage of the APV as a better tool compared to the WACC.

In 1974 Myers introduced the Adjusted Present Value to be used as an alternative valuation method, by demonstrating that it is none other than a general version of the model proposed by Modigliani and Miller: Modigliani and Miller’s theories had started being criticized because of their strong assumptions that would ultimately make it impossible for them to be applied in many circumstances. Before the APV was developed, the only valuation approach used among professionals was the WACC approach despite its limitations and disadvantages that are explained in the third chapter.

After Myers’ paper was published, the long-standing debate characterizing the computation of the tax shield (one of the key elements in computing APV) started. Economists differ on how to compute the tax shields according to what debt policy the company has decided to follow, and the third chapter will take into consideration some among the most used debt policies.

Furthermore, it should be stated that a firm’s debt policy is the element influencing the relation between levered and unlevered betas. While Myers stated that the interest tax shields should be discounted at the cost of debt assuming them to be as risky as the debt is, some other experts believe that interest tax shields, whenever a constant leverage policy is followed, should be discounted at the unlevered cost of capital, thus assuming them to be as risky as the cash flows are. In the end, others would claim that the interest tax shields should be discounted at a rate which is higher than the cost of debt but lower than the cost of unlevered equity.

After years of debating on which discount rate to use, the real innovation was brought by Professor Fernández who claimed that the value of the tax shields is not equal to the present value of the tax shields: it is the difference between the present value of the taxes paid by the unlevered firm and the present value of the taxes paid by the levered firm.
Fernández's numerous analyzed papers present two different macro-scenarios: companies in the form of a constant perpetuity (thus implying a growth rate equal to 0%) and companies in the form of a growing perpetuity. Such scenarios are the ones adopted by Fernández and reported in this thesis: they are meant to support his theories; they also demonstrate the inconsistency and acceptability of other theories. The theories taken into consideration in our analysis are the ones proposed by: Fernández (with and without cost of leverage), Miles & Ezzel, Modigliani & Miller, Myers, Miller, Harris & Pringle - Ruback, Damodaran (1994), Practitioners.

In the fourth chapter what has been discussed throughout the whole thesis is put into practice.
First, after a brief overview and outlook of the private equity industry and LBOs, the APV valuation method is applied to one of the major LBOs in history: RJR Nabisco acquisition by KKR. Such application has been put forward to demonstrate the importance of the APV in contexts where, since there is a frequent change in the capital structure, the usage of the WACC approach would result in being a tedious process.
Then, we start discussing the core case study which basically gathers all methods and theories seen in the previous chapter. The company that has been analyzed is Intel Corp., it is one of the key players in the semiconductor industry, which has now become a fundamental industry in an extremely interconnected and digitalized world. Two separate valuations will be conducted:

- The first valuation is the one that professionals would do, and it consists in estimating the risk-free rate, the cost of equity, the cost of debt, the ERP (and the WACC consequently) according to Damodaran's way of proceeding; when it comes to implementing the DCF model, the WACC approach has been chosen by assuming a constant leverage policy (thus allowing not to iterate since there is no change in the capital structure)

- The second valuation gathers all theories mentioned by Fernández together with Fernández's theories; as far as the risk-free rate, the cost of debt and ERP are concerned, they have been assumed to be equal to the ones estimated in the abovementioned analysis; the nine different theories mentioned above will be used together with four different valuation methods - the APV, the ECF, the FCF and the CCF

Intel has been chosen as the subject of our analysis to demonstrate that, unlike what the market values the company, in this thesis author's opinion it is undervalued. The whole valuation process has been put into practice to see how different results are obtained by applying different valuation methods and theories. More specifically, despite being theoretically inconsistent, it is worth implementing the professionals-like valuation because it is the kind of valuation that is applied on an everyday basis in working environments such as consulting firms and investment banks. Then, it is worth analyzing the more theoretical valuation process because it shows exactly how consistent valuations should be carried. In the end, the various results will be compared to underline the differences.

CHAPTER I

Estimating Discount Rates

1.1 Introduction

In the first chapter of this final dissertation, we aim to analyze different ways to properly estimate the "Cost of Equity" (hereinafter may be referred as COE or R_e) and the "Cost of Debt" (hereinafter may be referred as COD or R_d) to be able to compute the "Weighted Average Cost of Capital" (hereinafter may be referred as WACC), since it is a function of both costs. More specifically, for the correct estimation of the WACC to be implemented, hybrid instruments (such as "preferred stocks" and "convertible bonds") will be taken into consideration.
Regarding the COE estimation process, two main procedures will be compared: the "Capital Asset Pricing Model" (hereinafter CAPM) introduced by William Sharpe in 1964 and the four most famous multifactor models in the whole finance literature.

The multifactor models that will be commented on are the following ones:

- "Arbitrage Pricing Model" by Stephen A. Ross in 1976
- "Fama-French three-factor model" by Eugene F. Fama and Kenneth R. French in 1992
- "Carhart four-factor model" by Mark M. Carhart in 1997
- "Fama-French five-factor model" by Eugene F. Fama and Kenneth R. French in 2014

The section concludes by stating the supremacy of the CAPM model over the various multifactor models because of both its simplicity and approximately good estimates, which, by no surprise, make it the most common COE estimation method among practitioners.
As regards the COD, according to Damodaran's work, two main scenarios will be presented during an investor's investment decision: the first one is the so-called "Bond rating approach" in case there were rankings concerning the firm's bond (as an alternative to the "Yield-To-Maturity estimate); while the second scenario portrays a much more realistic situation in which we are not provided with ratings. In the second case two main COD estimation methods can be applied: the "Analysis of the firm's recent borrowing history" or the "Synthetic rating approach".
In the end, after carefully considering all the fundamental valuation perspectives when estimating the COE and COD, we can finally compute the WACC.

“Estimating Discount Rates”, despite not being the core topic of this final dissertation, is of great importance since it lays the foundation for the next chapters by estimating the discount rates which will be intensively adopted in the various valuation methods; they are indeed one of the essential elements when it comes to dealing with valuation.

1.2 Cost of Equity

“The Cost of Equity is the rate of return that investors require to make an equity investment in a firm”[1]. This rate is strongly in9fluenced by the riskiness of the investment to be supported. If a company decides to finance itself through equity and debt, the cost of equity, as Modigliani and Miller have shown[2], has a positive correlation with financial debt, since what shareholders are entitled to receive, is what has been left over after the needs of the company and other capital providers have been met.

This section will compare the single-factor model par excellence, the CAPM, with the abovementioned multifactor models.

1.2.1 Capital Asset Pricing Model (CAPM)

As far as the origins of the Capital Asset Pricing Model (CAPM) are concerned, Jack Treynor[3], William Sharpe[4], John Lintner[5], and Mossin[6] were able to create such a multi-use model thanks to the previous studies led by Harry Markowitz on modern portfolio theory and diversification[7].

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[1] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, p. 35.

[2] Modigliani, F. and Miller, M. H. (1958) ‘The Cost of Capital, Corporation Finance and the Theory of Investment’, *The American Economic Review*, 48 (3), pp. 261-297 and Modigliani, F. and Miller, M. H. (1963) ‘Corporate Income Taxes and the Cost of Capital: A Correction’, *The American Economic Review*, 53 (3), pp. 433-443.

[3] Treynor, J. L. (1962) ‘Toward a Theory of Market Value of Risky Assets’, *Social Science Research Network (SSRN)*, pp. 1-20.

[4] Sharpe, W. F. (1964) ‘Capital Asset Prices: a Theory of Market Equilibrium under Conditions of Risk’, *The Journal of Finance*, 19 (3), pp. 425-442.

[5] Lintner, J. (1965) ‘The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets’, *The Review of Economics and Statistics*, 47 (1), pp. 13-37 and Lintner, J. (1965) ‘Security Prices, Risk and Maximal Gains from Diversification’, *Journal of Finance*, 20 (4), pp. 587-615.

[6] Mossin, J. (1966) ‘Equilibrium in a Capital Asset Market’, *Econometrica*, 34 (4), pp. 768-783.

[7] Markowitz, H. (1952) ‘Portfolio Selection’, *The Journal of Finance*, 7 (1), pp. 77-91 and Markowitz, H. (1959) *Portfolio Selection: Efficient Diversifications of Investments.* New York: John Wiley & Sons.

The CAPM, as its name implies, is a model used in finance to calculate the price of assets, but it is also very useful when it is necessary to measure their riskiness. In valuation, on the other hand, the CAPM is used to calculate the return expected by risk capital providers. Whoever invests in a company, or a project wants to be remunerated, and the greater the risk of the project, the higher the return demanded.

The formula underlying the CAPM is very simple and consists of three parameters which are the risk-free rate, the beta of the business, and the equity risk premium:

$$E(R) = R_f + \beta(R_m - R_f) \tag{1.1}$$

$R_f = Risk - Free\ Rate$
$\beta = Systematic\ Risk$
$R_m - R_f = Equity\ Risk\ Premium\ (ERP)$
$R_m = expected\ return\ from\ a\ portfolio\ consisting\ of\ all\ risky\ securities\ on\ the\ market$

For us to understand how the CAPM formula was developed, it is fundamental to analyze André Perold's 2004 paper[8]. André Perold is HighVista's founder, a Boston-based investment firm.
The CAPM lays its foundation on the fact that asset prices should not be influenced by all kinds of risks. Specifically speaking, when we are dealing with a diversifiable risk, provided it is kept together with other investments in a portfolio, we must remember that this is not to be considered a risk.
It should be mentioned the fact that, before the CAPM was introduced, the problem of how to properly find the relation between expected returns and risk had still to be solved.
In 1952 Markowitz's work was able to state that, since many economic factors can have a significant impact, asset risks were correlated with one another to a certain level. Thus, the risk could be partially but not entirely canceled by the investors by building a diversified portfolio. According to Markowitz, diversification benefits are correlation dependent.
Correlation coefficients[9] are comprised between -1.0 and 1.0. In the first case, the assets are said to be perfectly negatively correlated, by following a fixed proportion, the assets go in opposite directions; this leads to the fact that the two assets are meant to insure one another. While in the second case, the assets are perfectly positively correlated: which signifies that they follow the same direction and are in fixed proportion; this implies that the two assets are substitutes for one another

[8] Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), pp. 3-24.

[9] «The correlation coefficients between the returns of two assets measure the degree to which they fluctuate together», Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 6.

in the first case only. Finally, whenever the correlation is equal to 0, then the return of one asset will not be useful to determine the other asset's return.

Investing in two risky assets (A and B respectively) should be considered, for us to be able to see the way correlation can impact portfolio risk among individual security returns. We should then assume that the asset's return standard deviation (σ_A, and σ_B respectively) is a relatively good risk estimate. Then we use: ρ to identify the correlation between the returns on assets, x to indicate the amount invested in A, and y the amount invested in B.

In case of perfectly positively correlated asset returns (ρ = 1), the portfolio risk is the weighted average of the risks of the assets in the portfolio, which can be written in the following formula:

$$\sigma_P = x\sigma_A + yx\sigma_B$$

While in case of not perfectly correlated assets (ρ < 1), part of the risk of one asset is compensated by the other asset, which implies that the portfolio standard deviation will always be less than the weighted average of σ_A and σ_B. Furthermore, the further away that the correlation is from 1, the higher the diversification benefits will be. As it can be seen by the following formula, a non-linear relationship between the risk of the portfolio and the risks of underlying assets can be found.

$$\sigma_P^2 = x^2\sigma_A^2 + y^2\sigma_B^2 + 2xy\rho\sigma_A\sigma_B$$

In Markowitz's view, two statements can be used to best describe his research[10]:

a) "Diversification does not rely on individual risks being uncorrelated, just that they be imperfectly correlated"
b) "Risk reduction from diversification is limited by the extent to which individual asset returns are correlated"

The way imperfect correlation among returns on asset influences the investor's decision between risk and return must be carefully analyzed to correctly arrive at the CAPM. On one hand, as it has been previously stated, risks have a non-linear relationship, on the other hand, expected returns combine linearly: the portfolio expected return can be seen as the weighted average of the expected returns of the underlying assets; as a consequence of that diversification can bring a risk reduction without having to compromise the expected return. By adopting techniques of optimization, Markowitz's

[10] Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 7.

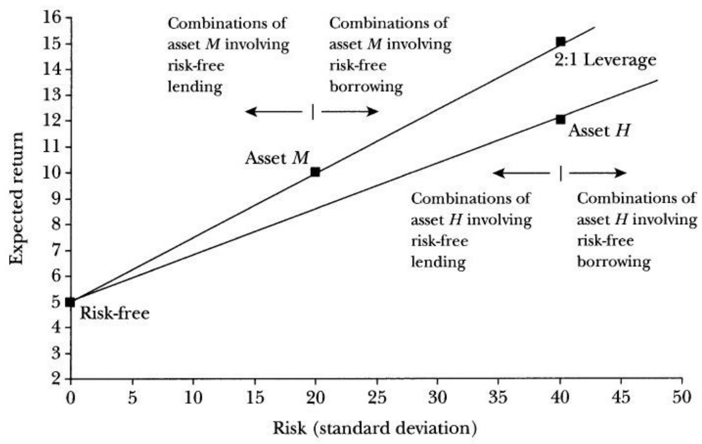
"Efficient Frontier" can be calculated. Given a certain expected return level, we can solve for the portfolio assets combination vaunting the lowest risk, alternatively given a risk level, we can solve for the portfolio assets combination offering the highest expected returns. The efficient frontier is an ensemble of optimal portfolios investors can decide which to invest in according to their risk aversion. An interesting modification was brought by James Tobin in 1958 to the original portfolio theory according to which all assets are risky[11]. Tobin's work demonstrated how the efficient frontier simplifies whenever investors can borrow and lend at a risk-free rate[12]. For capturing the impact of the risk-free rate on investors, the following instruments must be used: risky assets M and H, and a riskless asset. Assuming that we initially had to opt for allocating all our money to a single asset, we would choose according to our risk aversion. Then we should assume to be able to borrow and lend at the risk-free rate, supposing that part of our wealth will be invested in such a riskless asset and the remaining part in the risky asset. If x is the amount invested in the risky asset, then 1-x is the amount allocated to the riskless asset (with $x < 1$ meaning that we are lending at the risk-free rate, and with if $x > 1$ stating that we are borrowing at the risk-free rate). The expected return of such a portfolio (assuming we are using H risky asset) is $r_f + x (E_H – r_f)$, and the portfolio risk is $x\sigma_H$. Because Asset H is the only risk source, we can easily affirm that the portfolio risk is proportional to the risk of Asset H. Risk and return present a linear combination; every point on the line in the figure below linking the risk-free asset to Asset H represents a specific allocation (x). The slope of this line is called the Sharpe Ratio: the difference between the return of Asset H and the risk-free rate (risk premium) divided by the standard deviation of Asset H:

$$Sharpe\ Ratio = \frac{(E_H - R_f)}{\sigma_H}$$

[11] Tobin, J. (1958) 'Liquidity Preference as Behavior towards Risk', *The Review of Economic Studies*, 25 (2), pp. 65-86.

[12] More detailed explanations will be provided on the risk-free rate in the following paragraph.

Figure 1.1 - Combining a Risky Asset with Risk-Free Lending and Borrowing

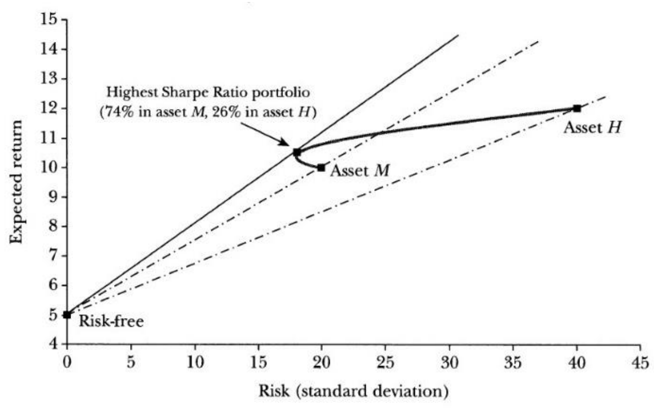


Source: Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 11.

As it can be clearly understood, lending and borrowing at a risk-free rate have a significant impact on our investment decisions. If we can only choose one risky asset, we would select the one with the highest Sharpe Ratio. Then, a second choice must be made concerning the amount to invest in such a risky asset that should be kept in our portfolio: risk aversion will be the leading factor in determining our choice.

The following figure (Figure 1.2) shows the method in the case in which we could invest in both risky assets together with the riskless asset as well, assuming no correlation between the two risky assets. All expected return and standard deviation pairs that we can obtain by combining M and H assets are shown by the curve linking the two of them.

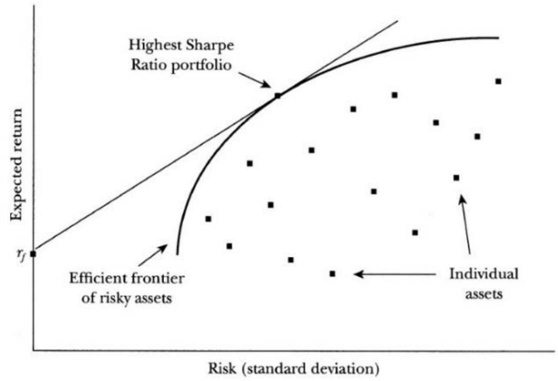
Figure 1.2 - Efficient Frontier with Two Risky Assets



Source: Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 12.

Figure 1.3 shows a general example; by using Markowitz's formulas to find the efficient frontier risky assets portfolios, we then find the highest Sharpe Ratio portfolio that will be the spot in which the line starting from the risk-free asset is tangent to the efficient frontier. In the end, according to our risk aversion, we will designate part of our wealth between the portfolio offering the highest Sharpe Ratio and the risk-free asset: this set of choices is known as "fund separation".

Figure 1.3 - Efficient Frontier with Many Risky Assets



Source: Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 12.

It is important to report the rule used to determine whether a certain stock should be added to our risky assets portfolio because this will allow us to reach the CAPM equilibrium risk-return relationship. Generally speaking, stocks are added whenever their presence increases the portfolio's Sharpe Ratio.

Specifically speaking, three different scenarios can be detected:

1) we would add an uncorrelated stock to our portfolio if its risk premium $E_S - R_f$ were positive;
2) a perfectly correlated stock would be chosen when $E_S - R_f > \beta\ (E_P - R_f)$ implying that beta times the portfolio risk premium must be surpassed by the stock's risk premium;
3) when it comes to an imperfectly correlated stock, we get to the conclusion that an additional stock to our portfolio will benefit our Sharpe Ratio provided the alpha of the stock is positive, which can be translated into the following formula $E_S - R_f > \beta\ (E_P - R_f)$

As to derive the CAPM, first and foremost we must make four essential assumptions for the model to hold[13]:

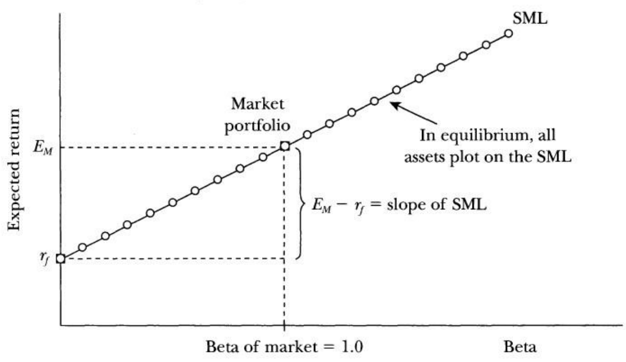
a) Investors are not risk takers and value their portfolios of investments only in terms of expected return and standard deviation computed over the same single holding period

[13] Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), pp. 15,16.

b) Capital markets are perfect in multiple ways since assets can be infinitely divided, transaction costs, short selling limitations, and taxes are not present; information is available and free for everybody; the risk-free rate is the rate at which the money can be lent and borrowed
c) The same investment opportunities are open to all investors
d) The same valuations concerning standard deviations, expected returns, and asset correlations are made by all investors

As it can be seen, we are facing very strong assumptions that would probably never take place at the same time in the real world, nevertheless, we cannot help proceeding with such strong assumptions otherwise we would not be able to get the CAPM. Following these four assumptions, the same highest Sharpe Ratio portfolio will be computed by the investors, according to whose risk aversion they will select a part of their wealth addressed to this optimal portfolio and the remaining part will be given to the risk-free asset. In order to reach market equilibrium, the price, or rather the expected return, of all assets should allow investors to possess exactly the quantity of the asset. Provided risky assets are owned in the same proportions by all investors, then those proportions must be respected in the market portfolio (the portfolio gathering all available shares of all risky assets). When we are in equilibrium the market portfolio must be the highest Sharpe Ratio portfolio of risky assets. Moreover, if we apply the rule for improving the portfolio, then each asset's risk premium must satisfy $E_S - R_f = \beta (E_M - R_f)$ with E_S and E_M being the asset expected return and the market portfolio expected return respectively, and with β being the asset's return sensitivity to the market portfolio return. We have finally established the Capital Asset Pricing Model whose formula is $E_S = R_f + \beta (E_M - R_f)$ indeed. In the case this formula was not to hold, then investors could profit out from this situation by obtaining a higher Sharpe Ratio; however as soon as this profit opportunity is spotted by the investor's community, then stock prices will change until the CAPM can be applied once again. It must be underlined that the CAPM's expected return does not depend on the stand-alone risk of a given stock, also known as specific risk, diversifiable risk, or unsystematic risk. It depends on the beta, which allows us to measure the risk of an asset that cannot be diversified, it is known as systematic risk, market risk, or non-diversifiable risk. Furthermore, the capitalization-weighted average of the betas of the market of all stocks is the market beta versus itself, as a consequence that the average stock has a market beta equal to 1.0. It is important to define what the Securities Market Line (SML) is: it is a graph in which the asset risk is measured by beta and lies on the horizontal axis, while the expected return lies on the vertical one. Every asset, provided we are in equilibrium, should be lying on the SML; were it not to be like so, investors would be able to obtain higher Sharpe Ratios before the equilibrium is restored.

Figure 1.4 - The Securities Market Line (SML)



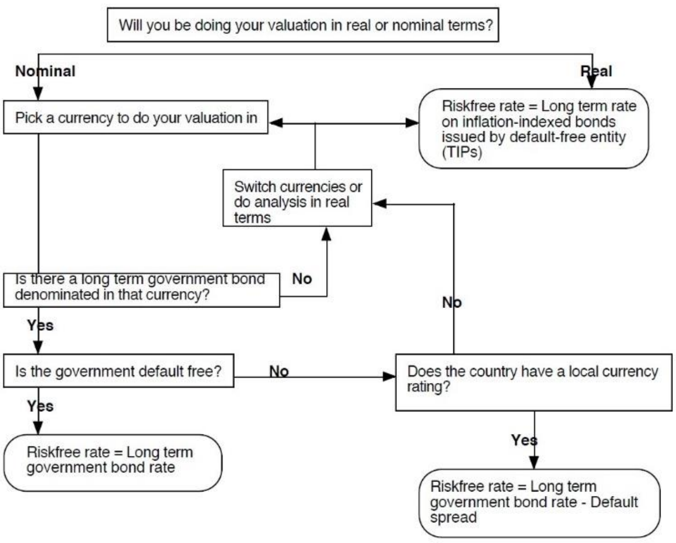
Source: Perold, A. F. (2004) 'The Capital Asset Pricing Model', *The Journal of Economic Perspectives*, 18 (3), p. 18.

Now that we have established how CAPM was developed, it is important to spend more time on the three components of the formula: the risk-free rate, the beta, and the equity risk premium.

1.2.1.1 Risk-free rates

To properly estimate the risk-free rate, which, as we have seen above, is a fundamental element for the estimation of the CAPM, we will now proceed with analyzing Damodaran's paper concerning this specific topic that is, in his opinion, often overlooked when valuing a company[14]. In this paragraph, we will follow the main steps suggested by Damodaran, which we can find summarized in Figure 1.5 below.

Figure 1.5 - A Framework for Estimating Risk-Free Rates



Source: Damodaran, A. (2008) 'What is the Risk-Free Rate? A Search for the Basic Building Block', *Stern School of Business*, p. 30.

[14] Damodaran, A. (2008) 'What is the Risk-Free Rate? A Search for the Basic Building Block', *Stern School of Business*, pp. 1-33.

In the author’s view, three rules need to be respected when we are dealing with risk-free rates:

1) A risk-free rate should embrace its name completely, implying that in the case a certain rate was to face some inner risks like the risk of default, then it should not be considered as a risk-free rate. For this very reason, several emerging economies’ local currency government bond rates simply cannot be adopted as risk-free rates.
2) The risk-free rate should be constantly aligned with the cash flows, meaning that in the case the risk-free rate is real, then so must be the cash flows (this often occurs when there is high and unstable inflation, in such circumstances we would be using long-term inflation-indexed treasury securities, also known as TIPs). Following the same logic, the risk-free rate must be in the same currency as the one selected for the cash flows.
3) Even though we could have strong evidence on what could be the interest rates in the future, it is recommended not to influence the company’s valuation process through our expectations.

An investment is said to be riskless provided it satisfies two conditions: there must be no default risk linked to the cash flows, and the second rule states there can be no reinvestment risk. If we had to apply such rules in the strictest way possible, we would be using a zero-coupon that is connected to the time in which the cash flows would take place (e.g. for a cash flow happening in two years, we would be using two years zero coupon rate, and so forth). Nevertheless, what happens on a practical basis is that the cash flows’ duration is the one connected to the risk-free asset duration; this leads us to use long-term government bond rates as risk-free assets (typically a 10-year Treasury Bond in the United States is more appropriate than the 3 months Treasury Bill) when it comes to corporate finance and valuation. Damodaran presents three main problems in his paper: the first issue regards the likelihood of not finding traded government bond in a certain currency, whose solution would be to either select a different currency (fastest option) or estimate the risk-free rate from the forward markets; the second problem happens if the long-term government bond rate is likely to face default risk, in such case it should be default spread netted; and last but not least we may be challenged with an unusual risk-free rates pattern compared to its historical data, in this case, it would be much more prudent to take our views on interest rates from the company valuation process.

1.2.1.2 Beta estimation

By assuming that the market portfolio is efficient, then shocks in its value could have the relative economy significantly and systematically affected (the US economy in case of shocks recorded by the S&P 500). As we have previously seen, a security’s systematic risk can be measured by computing the sensitivity of the security’s excess return over the risk-free rate to the excess returns of the market portfolio; such measure is known as Beta (β). Specifically, «the beta of a security is the expected % change in its return given a 1% change in the return of the market portfolio»[15].

There are several ways to calculate β, however, before listing them it is important to make a distinction between the kind of firms we desire to analyze. If we are dealing with public companies, (companies listed on the stock market) then we can proceed with the statistical approach which can be summarized in the following formula:

$$\beta_i = \frac{Cov(R_i, R_{m,i})}{Var(R_{m,i})} \tag{1.2}$$

$\beta_i =$
$Beta\ coefficient\ of\ company\ i$
$Cov(R_i, R_m) = Covariance\ between\ company\ i's\ returns\ and\ its\ stock\ market\ index's\ returns$
$Var(R_{m,i}) = Historical\ volatility\ of\ company\ i's\ stock\ market\ index\ return$

This formula says that the beta is given by the ratio of the covariance of stock and market returns over the variance of market returns. As it can be understood, this formula is only looking at past data and provides no information about the future whatsoever. To have a coefficient able to give us some forecast, the finance literature has developed several formulas that allow us to find the so-called "Adjusted" starting from the beta previously calculated known as "Raw Beta".

The most used techniques to rectify raw beta are:

- 1975 Blume's technique[16] (also used by Bloomberg), is based on the fact that in the medium to long term the beta coefficients of each company tend to converge towards the market average of betas, the beta coefficient is determined as a weighted average between the specific beta of the stock and the average market beta, with weighting weights of 2/3 and 1/3.

[15] Berk, J. and DeMarzo, P. (2016) *Corporate Finance*. 4th edn. United Kingdom: Pearson Education, p. 375.

[16] Blume, M. E. (1975) 'Betas and Their Regression Tendencies', *The Journal of Finance,* 30 (3), pp. 785-795 and Di Marcantonio, M. (2017) *La Stima del Costo del Capitale: dalla Teoria al Processo Valutativo*. Torino: G. Giappichelli Editore.

Since by definition the average market beta is equal to 1, Blume's formula is:

$$Adjusted\ \beta_i = \frac{2}{3}\,\beta_i + \frac{1}{3}\,\beta_m \qquad (1.3)$$

$Adjusted\ \beta_i = Blume's\ Adjusted\ Beta$
$\beta_i = Company\ i's\ Raw\ Beta$
$\beta_m = The\ average\ market\ value\ of\ the\ beta\ coefficients\ assumed\ to\ be\ equal\ to\ 1$

Although this formula may seem easy to use, it should be said that it is based on parameters of a fixed magnitude assuming that both its weights will not change over time and do not depend on the economic context the company works in.

- Vasicek's technique (1973)[17] adjusts the raw beta as a function of the ratio between the volatility of the beta of security i and the volatility of the betas of companies comparable to the target company considered for estimation purposes, where volatility is measured in terms of historical variance. It is based on the concept that it is appropriate to give a higher weight to the least volatile beta. The weighting weights of the two betas are inversely proportional to their respective standard deviations.

  Vasicek's formula is:

$$Adjusted\ \beta_i = \frac{\sigma^2_{\beta m}}{\sigma^2_{\beta m} + \sigma^2_{\beta i}}\,\beta_i + \frac{\sigma^2_{\beta i}}{\sigma^2_{\beta m} + \sigma^2_{\beta i}}\,\beta_m$$

$\beta_i = Company\ i's\ Raw\ Beta$
$\beta_m = the\ average\ market\ value\ of\ the\ beta\ coefficients, assumed\ to\ be\ equal\ to\ 1$
$\sigma^2_{\beta i} = variance\ of\ \beta_i$
$\sigma^2_{\beta m} = variance\ of\ \beta_m$

Despite this technique being more complex, it defines a standard formula that makes it possible to solve the problem of the invariance of the beta adjustment coefficients, according

[17] Vasicek, O. A. (1973) 'A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas', *The Journal of Finance*, 28 (5), pp. 1233-1239.

to a criterion of inverse proportionality between the volatility of β_i and β_m coefficients and their weighting weights.

Sometimes, however, we may be faced with the problem of not being able to adopt the method based on the statistical approach and, as a consequence of that, the adjusted formulas cannot be implemented either. This occurs because many companies, especially in markets outside the US, are not listed: the lack of publicly available data hinders the possibility of using these approaches. If beta coefficient estimates are not freely available in the market or are completely absent, one can circumvent the problem by studying the beta value from a sample of comparable companies[18].

A firm's beta is influenced by three factors:

- The business or businesses the firm is involved in
- The degree of operating leverage
- The degree of financial leverage

Due to the fact that betas measure a company's risk respect to its stock market index, the higher the business sensitivity is, the higher the beta and, as a matter of fact, cyclical firms (such as the semiconductor industry which will be analyzed in the last chapter) typically have higher betas than non-cyclical firms. The degree of operating leverage depends on the firm's cost structure and is described as the relationship between fixed costs and total costs: the higher the fixed costs the higher the degree of operating leverage and since companies with a high operating leverage present higher variability in operating income this result in having higher betas. Despite being a fundamental determinant of betas, operating leverage is very difficult to be estimated just by consulting a company's financial statements since there is no clear separation between fixed and variable costs; as a consequence of that a good approximation is given by the following formula:

$$Degree\ of\ oprating\ leverage = \frac{\%\ change\ in\ operating\ profit}{\%\ change\ in\ sales}$$

For highly operating leveraged companies, the operating income should change more than proportionately whenever sales change.

[18] Damodaran, A. (2011) *The Little Book on Valuation: How to Value a Company, Pick a Stock, and Profit*. United States of America: John Wiley & Sons, p. 38 and Damodaran, A. (2012) *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*. 3rd edn. United States of America: John Wiley & Sons, pp. 199-207.

As far as the financial leverage is concerned, it comes naturally to think that a higher financial leverage will increase the equity beta; thus, the higher the leverage the higher the risk borne by investors.

The formula that can be used for implementing such a process was introduced by Hamada in 1972[19]:

$$\beta_L = \beta_u \left[1 + (1 - T) \frac{D}{E} \right] \tag{1.4}$$

$\beta_L = \beta_E = Beta\ Levered, also\ known\ as\ Beta\ Equity$

$\beta_U = \beta_A = Beta\ Unlevered, also\ known\ as\ Beta\ Asset$

$\frac{D}{E} = Debt - To - Equity\ of\ the\ company\ analyzed$

$T = It\ represents\ the\ Marginal\ Tax\ Rate\ computed\ as$

Although it may be wrongly believed that Hamada's formula can be always used, it should be underlined that this equation is valid if and only if these three assumptions are true:

- The formula lays its foundation on Modigliani and Miller's formulation of the tax shield values for constant debt
- The debt beta β_D is equal to zero, implying that interest and principal payments will be conducted properly
- The cost of debt is assumed to be the discount rate when computing the tax shield, meaning that the Tax Shield = T * D

It can be easily realized that many alternative formulas have been proposed through time, however, this chapter is not meant to stress such a topic, whose main theories will be discussed later.
The unlevered beta of a firm is affected by its cyclicality and operating leverage; it is also known as asset beta because it is determined by the company's assts, while the levered beta is known as equity beta because it reflects equity investments in the firm and is the result of how dangerous a business is, and the amount of leverage undertaken by the firm. The alternative approach we will be dealing is known as "Bottom-Up Betas" and clearly allows us to separate business risk related betas from their financial leverage. It is important to know that a firm's beta is a weighted average of the betas of all businesses it operates in.

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[19] Hamada, R. S. (1972) 'The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks', *The Journal of Finance*, 27 (2), pp. 435-452.

Five steps must be followed when using this method:

I. Identification of the firm's business or businesses
II. Search for listed comparable firms and computation of their regression betas
III. Finding the unlevered beta for our target company by computing the average (or median) of the regression betas that had been computed previously; otherwise, the unlevered beta for each company could be computed and then the average (or median) value would be assumed to be the target company's unlevered beta. The first method is, according to Damodaran, supposed to be more reliable since the "unlevering process" of wrong regression betas is more likely to compound the error in the following steps
IV. Then, to properly estimate the unlevered beta, a weighted average of the unlevered betas for all the target company's businesses must be computed (with the value of each business being the weight, otherwise revenues could be used as well):

$$Unlevered\ beta_{firm} = \sum_{j=1}^{j=k}(Unlevered\ beta_j * Value\ weight_j)$$

$k = the\ number\ of\ businesses\ the\ target\ company\ is\ involved\ in$

Although this formula could be theoretically adopted due to the fact that the target company (Intel Corporation), as it is shown in its financial filings sent to the SEC (Security Exchange Commission), splits its revenues among the various segments it operates in, for the purpose of our case study, however, this formula will not be used: Intel mainly operates in the semiconductor business indeed.

V. In the end, the levered beta can be computed through Hamada's formula (or one of its variants that will be discussed in the third chapter) by estimating the firm's current market values of debt and equity.

1.2.1.3 Equity Risk Premium (ERP) estimation

«The equity risk premium is the price of risk in equity markets, and it is not a key input in estimating costs of equity and capital in both corporate finance and valuation, but it is also a key metric in assessing the overall market. Given its importance, it surprising how haphazard the estimation of equity risk premium remains in practice»[20].

[20] Damodaran, A. (2022) 'Equity Risk Premium (ERP): Determinants, Estimation, and Implications - The 2022 Edition', *Stern School of Business*, p. 1.

If we think about the concept of risk, it is logical to understand that the riskier the investments the expected returns compared to the returns offered by safer investments for both investments to be seen as the right investments. Therefore, an investment's expected returns can be seen as the sum of the risk-free rate and a certain premium able to compensate for the higher risk taken. The long-standing debate regards how to properly estimate the premium required for investing in equities as a class: the equity risk premium.

According to Damodaran, the equity risk premium is influenced by several determinants that be included in the following domains[21]:

- Risk aversion and consumption preferences,
- Economic risk
- Inflation and interest rates
- Information
- Liquidity and fund flows
- Catastrophic risk
- Government Policy and Politics
- Monetary policy
- The behavioral/irrational component

Three main estimation approaches can be identified to compute the equity risk premium:

A) <u>Survey premiums approach</u> which is finalized to obtain the investors', managers', and academics' opinions on what could be the expected returns in the future
B) <u>Historical premiums approach</u> is the most widely used approach, in the survey premium approach interviewees make their predictions on returns earned in the past, thus by using a historical base
C) <u>Implied premiums approach</u>, involves the process to estimate a forward-looking premium based on the market rates or prices

Given the higher importance of the historical premiums and implied premiums approach, we will be ignoring the survey premiums approach for us to focus on the most correct ways to estimate the equity risk premium.

[21] Damodaran, A. (2022) 'Equity Risk Premium (ERP): Determinants, Estimation, and Implications - The 2022 Edition', *Stern School of Business*, pp. 10-21.

As far as the historical premiums approach is concerned, which is believed by many to be the most reliable method to predict the equity risk premium, even though we are all provided with the same historical data, it is quite surprising to see how divergent the estimates can result to be because of the different assumption that is put forward[22]:

- different time periods – although some experts believe that choosing a shorter period would provide us with a more updated estimate since the average investor's risk tolerance changes as time goes by, this school of thought is not compensated by the standard error of such estimates which is much higher than the standard error obtained if we decided to use longer periods; at the same time taking into consideration too many years could not be appropriate for our valuation either (in 1871 the US market was more of an emerging market than the current mature market that it has become)
- different risk-free rates and market indices – as far as using the proper risk-free rate is concerned, as we have seen before, implies having to choose between short-term government securities and long-term government securities (T-Bills and T-Bonds in the US respectively). Because in the US we have had an upward sloping for most of the time, it is clear that the T-Bills would give us higher risk premium estimates than the T-Bonds would. Astonishingly, several academics and practitioners deem that using the Treasury Bill as a risk-free rate is a better alternative since T-Bills, unlike bonds with longer maturities, are not interest rates affected. Such an argument has a point if and only if we are interested to know the risk premium for a single year (e.g. the next year); however, if it is not the case, then treasury bonds would be a much better fit (with the 10 years T-Bond being the best choice).

  As regards the market indices, the idea of adopting a stock index with a long history behind them may seem the most appropriate way of proceeding, such as the Dow 30. Nevertheless, it may not be appropriate since theoretically, we would need a market-weighted index and returns should not have survivor bias, meaning that stock returns should take into account those equity investments that are no longer present because they were either acquired or went into bankruptcy. The very last concern is about whether stock returns should be calculated using nominal or real returns. This can be solved quite quickly because subtracting inflation from both stock and bond returns should give us nearly the same equity risk premium.
- different ways of computing average returns – The uncertainty concerns whether to use the arithmetic average or the geometric average to compute the returns of stocks and bonds. There is much evidence supporting either method, with the arithmetic average yielding higher risk

[22] Damodaran, A. (2022) 'Equity Risk Premium (ERP): Determinants, Estimation, and Implications – The 2022 Edition', *Stern School of Business*, pp. 31-33.

premiums. However, in our second case study, the arithmetic average approach will be followed.

Another important factor that is worth mentioning is the "Country Risk", which must be accounted in case it was not diversifiable, especially when it comes to investing in emerging markets[23].
Three different approaches will be analyzed to compute the country risk premium, all of which start from the historical risk premiums estimates.
The basic proposition from which our considerations will begin is the following one:

$$ERP = Base\ Premium\ for\ Mature\ Equity\ Market + Country\ Risk\ Premium$$

For the "Base Premium for Mature Equity Market" to be estimated correctly, the most common way to find a reasonable number is to look at the US historical risk premium, assuming to be the mature market by definition.
There are three main approaches to calculate the country risk premium, and each and every of them presents different ways of proceeding. Owing to the fact that for a proper explanation of such a topic many pages would be required, and because it goes beyond the final aim of this dissertation, the approaches will be merely listed without entering into many details.

1. *Default spreads* - this is the easiest and most frequently used approach, it is the default spread investors are willing to pay for buying the issuing country's bonds; it can be estimated in three different ways: a) Current Default Spread on Sovereign Bond or CDS market (the difference between a country's bond yield denominated in US dollars and a US Treasury bond with the same maturity, b) Average (Normalized) spread on bond (implying the usage of the average spread over a longer period of time instead of focusing on a single year only), c) Imputed or Synthetic Spread (to be used in absence of US dollars denominated bonds or absence of sovereign ratings)

2. *Relative Equity Market Standard Deviations* – Since standard deviation is conventionally accepted risk measure for equity, we can start by computing the relative standard deviation of our country of interest and only then we will be able to calculate the equity risk premium:

$$Relative\ Standard\ Devaition_{Country\ X} = \frac{Standard\ Deviation_{Country\ X}}{Standard\ Deviation\ _{US}}$$

[23] Damodaran, A. (2022) 'Country Risk: Determinants, Measures and Implications - The 2022 Edition', *Stern School of Business*, pp. 68-78.

$$Equity\ Risk\ Premium_{Country\ X} = \ Risk\ Premium_{US} * \ Relative\ Standard\ Deviation_{Country\ X}$$

3. *Default Spreads + Relative Standard Deviations* – The third approach tries to unify the previous approaches in the following formula:

$$Country\ Risk\ Premium = Country\ Default\ Spread * (\frac{\sigma_{Equity}}{\sigma_{Country\ Bond}})$$

$$\sigma_{Equity} = \ Country_X's\ Equity\ Index\ Standard\ Deviation$$
$$\sigma_{Country\ Bond} = \ Country_X's\ Dollar\ Denominated\ 10 - year\ bond\ Standard\ Deviation$$

After having estimated the Country Risk Premium (CRP), we must understand how such premium can have an impact on the firm’s cost of equity; three main approaches can be identified[24]:

- *Country of Incorporation ERP* – It involves making the big assumption that the companies incorporated in a certain country are equally subject to country risk in such country, this statement can be represented by the following formula:

  $$Cost\ of\ Equity = Risk - Free\ Rate + Beta\ (Mature\ Market\ Premium) + CRP$$

  Sometimes, however, analysts believe it is more appropriate to scale CRP by beta and the formula becomes:

  $$Cost\ of\ Equity = Risk - Free\ Rate + Beta\ (Mature\ Market\ Premium\ + CRP)$$

  By using these formulas, we are assuming that a certain company is only exposed to the country where it is incorporated

- *Operation-weighted ERP* – This approach assumes weighs a company’s country risk premium according to its operating exposure (signifying that if the company’s business is equally derived from Brazil and Argentina, the CRP will be the average of the two countries’ CRP). Generally speaking, the revenues by country or any other geographic area are used as weight

[24] Damodaran, A. (2022) ‘Country Risk: Determinants, Measures and Implications - The 2022 Edition’, *Stern School of Business*, pp. 88-97.

- *Lambdas* – This approach makes it possible for a firm to vaunt a country risk exposure different from the way it is exposed to other market risk. Such measure is named lambda (λ) and it can be interpreted in a similar way just as we did for beta: a lambda higher than one means that the company has an above average exposure to country risk, while if it is lower than one the company vaunts a below average exposure.

  The cost of equity then can be expressed as:

$$Cost\ of\ Equity = R_f + Beta\ (Mature\ Market\ Equity\ Risk\ Premium) + \lambda\ (CRP)$$

  Being Lambda the country risk exposure, it is important to understand the determinants of such exposure which can be identified in the following categories: Revenue Source (the most used one), the Production Facilities and the Risk Management Products.

  By using revenue source as our benchmark category, we can compute lambda in the following way to see how a company is exposed to a certain country risk:

$$Lambda = \frac{\%\ of\ Revenue\ in\ country_{Company}}{\%\ of\ Revenue\ in\ country_{Average\ company\ in\ market}}$$

  It seems clear to realize that such approach is no longer feasible when the company in question is exposed to several country risks, which otherwise would imply having to compute a lambda for each of them.

Finally, as a more precise equity risk premium estimation, we have the implied risk premium which allows not to rely on historical data nor on country risk premiums, by assuming a fairly priced market though; as a consequence of these advantages, this is the approach that will be adopted in our case study[25].

Assuming that all companies will pay their remaining cash flows in dividends and that there is a stable growth situation, then the formula that we need to apply for computing the implied risk premium is derived from the Gordon Growth Model[26]:

$$Value = \frac{Expected\ Dividends\ Next\ Period}{(Required\ Return\ on\ Equity - Expected\ Growth\ Rate)} \tag{1.5}$$

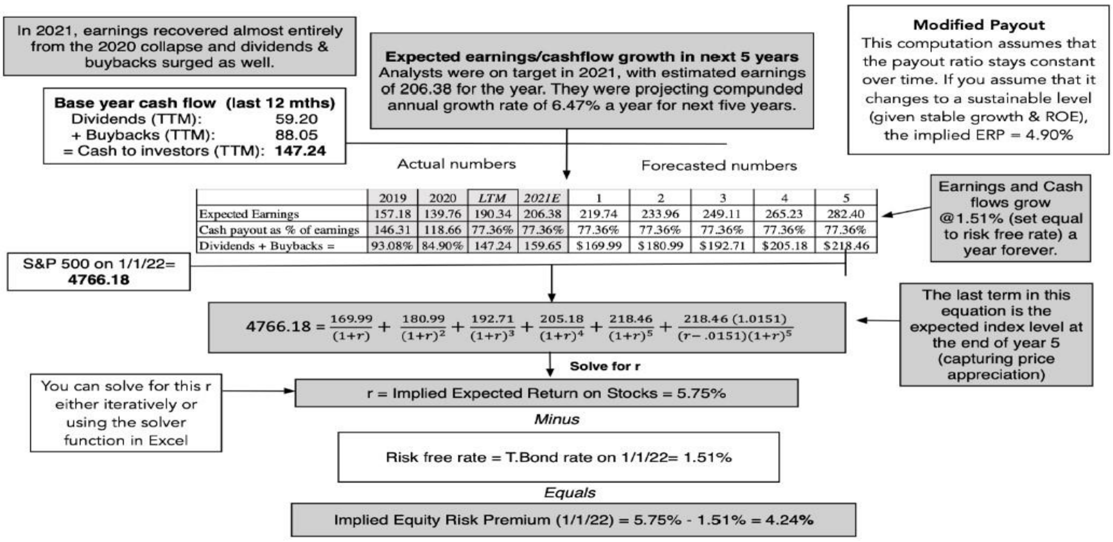
[25] Damodaran, A. (2022) 'Equity Risk Premium (ERP): Determinants, Estimation, and Implications - The 2022 Edition', *Stern School of Business*, pp. 82-87.

[26] Gordon, M. J. and Shapiro, E. (1956) 'Capital Equipment Analysis: The Required Rate of Profit', *Management Science*, 3 (1), pp. 102-110.

We are basically dealing with the present value of dividends[27] growing at a constant rate, where the only unknown value is the required return on equity which can be easily obtained since we can be given access to the other three values from external sources. Once the return on equity is found, by subtracting the risk-free rate from it, the equity risk premium has been found.
Naturally, given the strong assumptions concerning the model, we can better our approach by solving for the required return on equity either by adding "stock buybacks" to the above-mentioned Dividend Discount Model (DDM), or by expanding it and use the Free Cash Flow to Equity model (FCFE), or adopting the residual earnings model. However, these valuation approaches which can be used to properly value a company and not just as intermediate means for the calculation of the equity risk premium, will not be analyzed now since they will be object of a deep explanation in the following chapter. As a matter of fact, the S&P (a good proxy of the US economy), because of its long history, appears to be the most logical stock market index to be used as a benchmark in order to compute the implied equity risk premium. By assuming a certain growth rate for the period analyzed (typically a historical time interval of five years), then assuming a lower growth rate (generally equal to the treasury bond rate) it is possible to produce a relatively good estimate.

By using the Dividend Discount Model adjusted for Stock Buybacks (which is exactly the same approach that will be adopted in the fourth chapter), Damodaran has come up with the following implied equity risk premium at the beginning of 2022 (Figure 1.6):

Figure 1.6 - Implied Equity Risk Premium estimate (01/01/2022)

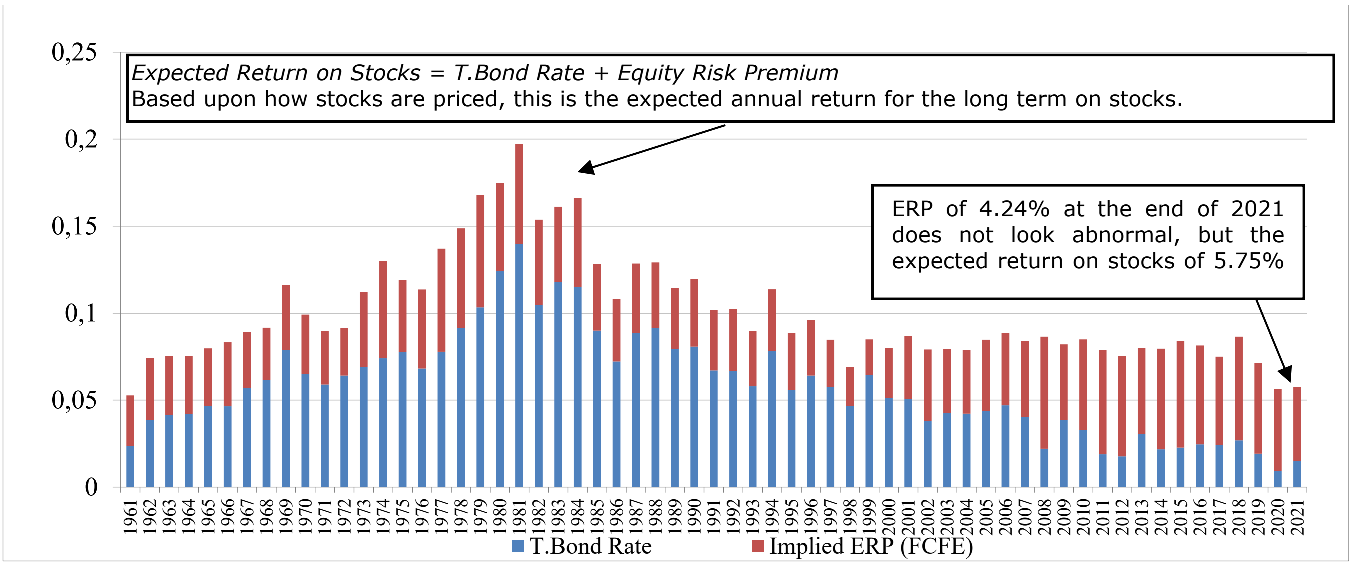


Source: Damodaran, A. (2022) 'Equity Risk Premium (ERP): Determinants, Estimation, and Implications - The 2022 Edition', *Stern School of Business*, p. 101.

[27] Burr Williams, J. (1938) *The Theory of Investment Value*. Netherlands: North-Holland Publishing Company, pp. 55-96.

The following figure represents Damodaran's estimate of the implied equity risk premium from 1961 to 2021 and the relative comparison with the ten year treasury bond.

Figure 1.7 - Implied ERP and Risk-free rates (1961-2021)



Source: https://pages.stern.nyu.edu (Accessed: 15 October 2022)

1.2.2 Multifactor models

So far, we have seen different ways for estimating the cost of equity according to the assumptions we make in the first place; however, we have always been dealing with single factor models (with the only exception of the inclusion of the country risk premium computed via the lambda approach).
After the introduction of the CAPM, as time went by many economists and other experts in the field started to criticize the model for several reasons, describing its inability to truly find the proper cost of equity because it did not take into consideration all the affecting factors when valuing a company, aside from the market risk represented by beta. All the following authors developed their models using the CAPM as a starting point.

1.2.2.1 Arbitrage Pricing Theory (APT)

Arbitrage Pricing Theory, introduced by Ross in 1976, assumes as a basic assumption that returns on financial assets can be explained by a factor model, in which there several factors, each of which represents a component of systematic risk[28]. These factors are mainly related to macroeconomic

[28] Ross, S. A. (1976) 'The Arbitrage Theory of Capital Asset Pricing', *Journal of Economic Theory*, 13 (3), pp. 341-360.

variables, such as the price of oil or GDP, and other financial variables. The equation describing a multifactor model as follows:

$$E\ (R_i) = R_f + \beta_{i1} * RP_1 + \beta_{i2} * RP_2 + \beta_{i3} * RP_3 + \cdots + \beta_{kn} * RP_n + \varepsilon_i$$

$\alpha_i = the\ intercept\ of\ the\ equation, which\ is\ assumed\ to\ be\ 0\ in\ the\ CAPM$
$R_f = risk - free\ rate$
$\beta = the\ asset\ sensitivity\ respect\ to\ a\ certain\ factor, each\ of\ them\ is\ distributed\ with\ 0\ mean$[29]
$RP = Risk\ Premium\ of\ the\ facotr\ in\ question$
$\varepsilon_i = specific\ risk, companies' specific\ risk\ will\ have\ average = zero\ in\ a\ diversified\ portfolio$

The determination of the expected return (R_i) of the generic risky asset (i) is the objective of the APT, according to which the equilibrium relationship between expected return and asset risk is achieved through a market rebalancing mechanism based on arbitrage. The APT does not make any bidding assumptions about the risk appetite of the investors (who are assumed to be generically risk-averse); the model, unlike the CAPM, does not make use of the mean-variance principle of Markowitz. The model, however, assumes that: short selling of securities is possible, no transaction costs exist, investors have equal information, there is a one-period time horizon, the correlation between the returns of two securities is determined solely by their dependence on the various factors and E (ε) = 0. The equation above is a starting point, and the finish line is the following equation which indicates the values to be taken by the expected returns of almost all risky assets:

$$E(R_i) = \lambda_0 + \beta_{i1}\lambda_1 + \beta_{i2}\lambda_2 + \cdots + \beta_{in}\lambda_n$$

$\lambda_0 = a\ constant\ and\ that\ is\ the\ return\ of\ the\ zero - beta\ portfolio$
$\lambda_1, \lambda_2, \dots, \lambda_n = are\ the\ risk\ premiums\ associated\ with\ each\ factor$
$\beta_{i1}, \beta_{i2}, \dots, \beta_{i3} = are\ the\ security's\ betas\ respect\ to\ the\ various\ factors$

In addition to the abovementioned basic assumptions, which are in any case less stringent than those of the CAPM, the APT is in fact described as an "incomplete theory": it is difficult to identify factors of systematic risk. The use of the wrong factor or the failure to consider a relevant factor can lead to insignificant estimates of asset returns. A further limitation of APT is related to the fact that investment choices are made by evaluating a one-period time horizon.

[29] Implying that if the variables do not deviate from expectations, the actual return will coincide with the return expected.

1.2.2.2 Fama-French three-factor model

The fundamental problem of APT, as we have seen is to determine systematic risk factors. Among the authors who have put forward hypothesis in this regard are Fama and French[30].

By means of a regression analysis of the average returns of US equities, the scholars investigated a number of alternative variables to Beta, which were not analyzed in previous tests and capable to better explaining company returns. They identified how stocks with low capitalization (the so-called small cap firms) and with a high Book-to-Market ratio tend to have better returns than those of the market as a whole. The size factor is defined as the share price multiplied by the number of stocks on the market. BE/ME is calculated by dividing the book value of the equity (BE) with the market value of equity (ME); it aims to identify securities that are undervalued (if the index is greater than 1) and overvalued (if the index is less than 1).

To reflect the exposure of stock returns to these two factors Fama and French have therefore extended the CAPM in the following formula:

$$E(R_i) = R_f + \alpha_i + \beta_{mrkt} * \left[E(R_m) - R_f\right] + \beta_{SMB} * SMB + \beta_{HML} * HML$$

$E(R_m) - R_f = \text{the equity risk premium, as observed in the CAPM}$

$SMB\ (Small\ Minus\ Big) = Size = small\ cap\ stocks'excess\ returns\ over\ large\ cap\ stocks$

$HML\ (High\ Minus\ Low) = high\frac{BE}{ME}ratio\ stocks'excess\ return\ over\ low\frac{BE}{ME}\ ratio\ stocks$

$Betas = deriving\ from\ time - series\ regression\ of\ their\ relative\ portoflios$

In order to test their results on a practical level, Fama and French constructed 25 portfolios, including NYSE and NASDAQ stocks divided according to size and value factors[31].

They discover that stocks of smaller companies are associated with higher returns than those of larger companies, while value stocks are associated with better performance than growth stocks. The HML factor shows the extent to which investors rely on the premium associated with investing in value stocks, whether or not they invest in stocks with a high BE/ME index to achieve higher than expected returns.

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[30] Fama, E. F. and French, K. R. (1992) 'Common Risk Factors in the Returns on Stocks and Bonds', *Journal of Financial Economics*, 33 (1), pp. 3-56.

[31] Value stock means stocks characterized by high BE/ME index values, for which the market price is, relative to its book value, very low.

1.2.2.3 Carhart four-factor model

With the aim of analyzing the persistence in pension fund returns, Carhart introduced a four-factor model of equity pricing. Carhart's work is motivated by the fact that Fama and French's three-factor model is incapable of explaining the short-term persistence of stock returns[32]. Carhart developed a model including the (annual) momentum factor. "Momentum" is described as the tendency of the price of a stock to continue rising if it is going up (and vice versa to continue falling if it is going down). In this specific case, a stock is characterized by the momentum factor if the average of its returns over the previous twelve months is positive.

Carhart's model predicts the existence of a return premium linked to the choice of assets that have performed best in the past:

$$E(R_i) = R_f + \alpha_i + \beta_{mrkt} * \left[E(R_m) - R_f\right] + \beta_{SMB} * SMB + \beta_{HML} * HML + \beta_{PR1YR} * PR1YR$$

$PR1YR = represents\ stocks'excess\ returns\ characterised\ by\ a\ positive\ annual\ momentum$

1.2.2.4 Fama-French five-factor model

Over time, other studies have shown that much of the variation in average returns is not explained by the Fama-French 3-factor model. The two scholars therefore introduced the two additional factors in 2015 after a series of empirical tests[33]. It is possible to explain why profitability and investment are linked to average stock returns by using the Dividend Discount Model. This model states that the market value of stocks is given by the discounted value of the expected dividends for the same stocks:

$$m_t = \sum_{\tau=1}^{\infty} \frac{E(d_{t+\tau})}{(1+r)^{\tau}}$$

$E(d_{t+\tau}) = expected\ value\ of\ the\ dividend\ for\ the\ stock\ in\ question\ at\ the\ period\ t+\tau$
$r = the\ internal\ rate\ of\ return\ on\ expected\ dividends$

[32] Carhart, M. M. (1997) 'On Persistence in Mutual Fund Performance', *The Journal of Finance*, 52 (1), pp. 57-82.

[33] Fama, E. F. and French, K. R. (2015) 'A Five-Factor Asset Pricing Model', *Journal of Financial Economics*, 116 (1), pp. 1-22.

It is essential to consider the proposal of Modigliani and Miller, who, developing the DDM, have demonstrated how the market value of a firm's shares at time t is given by:

$$M_t = \sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}}$$

$Y_{t+\tau} = total\ equity\ eanrings\ for\ period\ t+\tau$
$dB_{t+\tau} = change\ in\ total\ book\ equity$

If we divide the equation by time t book equity gives:

$$\frac{M_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}}}{B_t}$$

The equation shows that the B_t/M_t ratio is a very good approximation of expected returns, because the factor M_t (market capitalization) also takes into account earnings forecasts (profitability) and investments. The choice of the two factors profitability and investment originates, as we have seen, from the DDM, of which they are natural consequences. The decomposition of cash flows, included in the DDM equation, in fact implies that the expected return of each stock is determined by its book-to-market ratio and expectations of its future profitability and investments. If variables not explicitly linked to this decomposition, such as size and momentum, favor predictable returns, they do so by implicitly increasing expectations of profitability and investment.

The model is represented by the following formula:

$$E(R_i) = R_f + \alpha_i + \beta_{mrkt} * [E(R_m) - R_f] + \beta_{SMB} * SMB + \beta_{HML} * HML + \beta_{RMW} * RMW + \beta_{CMA} * CMA + \varepsilon_i$$

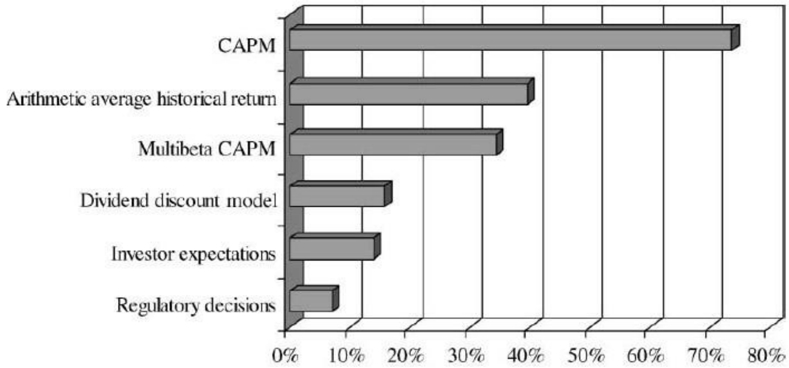
$RMW = Robust\ Minus\ Weak$
$The\ difference\ between\ stocks' portfolio\ returns\ with\ high\ and\ low\ profitability$

$CMA = Conservative\ Minus\ Aggressive$
$The\ difference\ between\ high\ and\ low\ investments\ firms' stocks'\ portfolio\ returns$

1.2.3 CAPM vs multifactor models

After having analyzed the four main multifactor models that have been developed, it is important to state which method among the abovementioned ones, is used more frequently on daily basis in working environments. Thanks to the survey collected by John R. Graham and Campell R. Harvey, we can easily observe how the CAPM model is the most used cost of equity estimation method by far[34].

Figure 1.8 - Cost of equity capital method, percent of CFOs who always or almost always use a given method



Source: Graham, J. R. and Harvey, C. R. (2001) 'The Theory and Practice of Corporate Finance: Evidence from the Field', *Journal of Financial Economics*, p. 203.

As it can be observed, 73.5% of respondents always or almost always adopt the CAPM model. The multi-beta CAPM models despite being ranked as the third most used cost of equity estimation method, are only used by slightly more than 30% of respondents at most, which is a huge gap compared to the CAPM model. In the light of the above, the CAPM model, despite its very strong assumptions, given its spread usage in the common practice, will be the cost equity estimation model that will be used in our last chapter when it comes to applying theories to practice.

1.3 Cost of Debt

After having deeply observed how to properly estimate a company's cost of equity, now the main methods to estimate the cost of debt will be presented following Damodaran's suggestions on the best way to proceed with.

«The cost of debt measures the current cost of the firm of borrowing funds to finance projects»[35].

[34] Graham, J. R. and Harvey, C. R. (2001) 'The Theory and Practice of Corporate Finance: Evidence from the Field', *Journal of Financial Economics*, pp. 187-243.

[35] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 137.

Generally speaking, it depends on the following factors:

- The current level of interest rates - if they rates rise, so will the cost of debt for all companies
- The default risk of the company – if the company in question is navigating through difficult times, its risk of default will rise and its lenders will ask for higher interest rates (a default spread) because it is more likely for the firm not to be able to pay in such a situation, thus causing higher risks to the lenders
- The tax advantage associated with debt – due to the fact that interests are tax-deductible, the after-tax cost of debt will be lower than the pretax and, as it can be seen from the formula below, the higher the tax rate, the higher the deductibility:

$$After - tax\ cost\ of\ debt = \left(R_f + Default\ spread\right) * (1 - Marginal\ tax\ rate) \quad (1.6)$$

The real difficulty in computing the cost of debt is trying to find the default spread.

1.3.1 Bond Rating Approach as alternative to the Yield-To-Maturity (YTM) estimate

The bond rating approach is applied only if the following conditions are not respected. It must be known that the base-case scenario in which the cost of debt can be estimated happens when a company has long-term bonds that are publicly traded and do not have any peculiar characteristics. At this point, the bond's yield-to-maturity (YTM) is found by using the bond's coupon rate and market price and it is assumed to be equal to the company's cost of debt. However, it must be said that such approach is appropriate when it comes to valuing firms whose bonds are highly liquid and that are traded on a regular basis. In case of not frequently traded bonds, the bond rating approach is adopted and, as the name suggests, since companies, whose bonds are traded, typically are provided with ratings by the major rating agencies (e.g. Standard & Poor's, Moody's, Fitch Ratings): these ratings present associated default spreads that will be added to the risk-free rates in the formula. The general logic of looking at a company's traded bond comes with a big disadvantage though: we are assuming that the cost of debt can be identified with its issued bond, without taking into consideration any kinds of borrowing coming from financial institutions like banks. Apart from such limiting assumption, we may find ourselves in the event of not being able to apply the above-mentioned approach, if we are supposed to value private companies or companies coming from emerging market, in either situation there are no rating agencies able to give us any reliable default spreads.

1.3.2 Measurement of Default Risk in the absence of a rating

Two alternatives are proposed by Damodaran in the case of absence of a bond rating, which consist in either analyzing deeply the *borrowing history* of a company or proceeding with a *synthetic rating* approach. The first option, on which we will not dedicate an ad hoc paragraph because of the highly subjective approach, as the name suggests, requires the careful investor to look at the most recent borrowings the firm has contracted with the various financial institutions and according to the interests charged to the company, the cost of debt can be deducted.

1.3.2.1 Synthetic rating approach

This very last approach gives the investor the possibility to play the part of a rating agency and thus assign a rating to a company according to its financial ratios. The ratio that will be used to determine a company’s default spread is the so-called “Interest Coverage Ratio (ICR)”:

$$Interest\ Coverage\ Ratio = \frac{Operating\ Income}{Interest\ Expense} \tag{1.7}$$

This ratio shows us how well a company can sustain its financial expenses through its EBIT (Earnings Before Interests and Taxes) or Operating Income, where the higher the ratio the lower will be the default spread applied to the firm. It should be highlighted the fact that Damodaran makes a distinction of the characteristics of the analyzed company; in fact, according to the type of firm, different default spreads are adopted: large manufacturing firm (a market cap higher than $ 5 bln), small manufacturing firm (a market cap lower than $ 5 bln) and a financial service firm.

Table 1.1 - Ratings, Interest Coverage Ratios and Default Spreads for non-financial firms only as of January 2022

If Interest Coverage Ratio is			
greater than	**≤ to**	**Rating is**	**Spread is**
-100000	0,499999	D2/D	14,34%
0,5	0,799999	C2/C	10,76%
0,8	1,249999	Ca2/CC	8,80%
1,3	1,499990	Caa/CCC	7,78%
1,5	1,999999	B3/B-	4,62%
2,0	2,499999	B2/B	3,78%
2,5	2,999999	B1/B+	3,15%
3,0	3,499999	Ba2/BB	2,15%
3,5	3,9999999	Ba1/BB+	1,93%
4,0	4,499999	Baa2/BBB	1,59%
4,5	5,999999	A3/A-	1,29%
6,0	7,499999	A2/A	1,14%
7,5	9,499999	A1/A+	1,03%
9,5	12,499999	Aa2/AA	0,82%
12,5	1000000	Aaa/AAA	0,67%

Source: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.html (Accessed: 15 October 2022)

We decided to report such table since it is the one that will be implemented in our valuation case.

The formula (1.7) could be modified with the addition of a further default spread, which is applied in case we were dealing with an emerging market firm the formula would become[36]:

$$Cost\ of\ debt_{emerging\ mkt\ company} = R_f + Default\ spread_{synthetic\ rating} + \ Default\ spread_{em}$$

$$Default\ spread_{em} = \ Country\ Defualt\ Spread_{emerging\ market}$$

As it can be thought without much effort, most listed firms have several borrowings including short-term and long-term bonds as well as bank borrowings which all possess their own terms and interest rates and as a consequence of that many analysts elaborate multiple cost of debts accordingly. However, this method can take a very long time and not necessarily lead to the best estimate, a good solution would require combining all debt and attach its cost to the 10 years risk-free rate.

Operating leases and other fixed commitments must also be taken into consideration since they generate tax-deductible interests and, just like financial debt, in case they were not paid, they could lead to bankruptcy. For valuation purposes, lease payments must be considered as financial expenses and the present value of their future payments must be added to the conventional debt[37].

1.4 Hybrid Instruments

Two main hybrid instruments will be mentioned as far as estimating their impact on the cost of capital: preferred stocks and convertible bonds. However, for the purpose of our case studies, there will be no hybrid securities, thus not much time will be spent on such topic.

1.4.1 Preferred Stocks

Preferred stocks have some characteristics in common with both debt (preferred dividends are determined in advance at issuing time and are distributed before common dividends) and equity

[36] Damodaran, A. (2012) *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*. 3rd edn. United States of America: John Wiley & Sons, p. 217.

[37] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, p. 72.

(preferred dividends are do not offer any tax shields). Provided that preferred stocks have no special features such as convertibility and is perpetual, then the cost of preferred stocks can be estimated[38]:

$$k_{ps} = \frac{Preferred\ dividend\ per\ share}{Market\ price\ per\ preferred\ share} \quad (1.8)$$

1.4.2 Convertible Bonds

A convertible bond can be seen as the union of a straight bond (the debt component) and a conversion option (the equity component). The easiest way to compute this hybrid instrument's cost is to consider each component individually. The option to convert the bond into equity can be valued through an option-pricing model and the remaining value is assumed to be debt. Alternatively, provided we are valuing a traded bond, the hybrid security can be valued as if it were a straight bond using the pre-tax cost of debt (the rate the company must pay for borrowing) as the interest rate; the value of the conversion option would be equal to the difference between the price of the hybrid security and the value of the straight bond.

1.5 Weighted Average Cost of Capital (WACC)

After having estimated the cost for all the capital sources, we need to compute their weights to finally obtain the cost of capital, also known as "Weighted Average Cost of Capital (WACC)"[39].
Despite the fact that some analysts the accounting estimates for computing the weights, the general rule would require a wise investor to utilize the market values since the aim of the cost of capital is to be forward-looking and thus, it should reflect market changes. As far as estimating the market value of equity, also known as market capitalization, the common approach consists of multiplying the current stock price by the number of outstanding shares. As it regards the market value of debt, it is a much more difficult task to estimate such number because most firms do not have all their debts in the form of outstanding debt (e.g. corporate bonds), but a large amount of it could consist of bank debt. Although Damodaran proposes a very precise and sophisticated way to convert the book value into market, for the purpose of this final dissertation I am going to use such method for the target company only; while for the many comparable firms, we are going to use the very same assumption

[38] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 144.

[39] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, p. 78.

that most analysts make: market value of debt is equal to the book value of debt. So, according to Damodaran the market value of debt is computed in the following way:

$$Interest\ Expenses * \left[\frac{1-\frac{1}{(1+Pre\ Tax\ Cost\ of\ Debt)^{Weighted\ Maturity}}}{Pre\ Tax\ Cost\ of\ Debt}\right] + \frac{Face\ Value\ of\ Debt}{(1+Pre\ Tax\ Cost\ of\ Debt)^{Weighted\ Maturity}}$$

Then, the present value of operating leases must be added to the previous result, and this will provide us with the correct estimate of the market value of debt. However, in our valuation case study, the present value of lease obligations will be incorporated into the market value of debt; with the market value of debt assumed to be equal to its book value.

Another problem when using debt is whether to use gross debt or net debt[40].

$$Net\ Debt = Gross\ Debt - Cash\ \&\ Marketable\ Securities \tag{1.9}$$

The logic behind this formula is that netting cash decreases the firm's debt burden. In order to skip the cash adjustments, in the fourth chapter the net approach will be followed according to which, estimating the unlevered beta (starting from the comparable companies' levered beta) will be done by using the net debt-to-equity ratio of the target company.

In conclusion, the formula for computing the WACC can be synthesized in the following expression:

$$WACC = K_E\left[\frac{E}{D+E+PS}\right] + K_D\left[\frac{D}{D+E+PS}\right] + K_{PS}\left[\frac{PS}{D+E+PS}\right] \tag{1.10}$$

$E = Market\ Value\ of\ Equity$

$K_E = Cost\ of\ Equity$

$D = Market\ Value\ of\ Debt$

$K_D = Cost\ of\ Debt$

$PS = Preferred\ Stock$

$K_{PS} = Cost\ of\ Preferred\ Stock$

[40] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 128.

CHAPTER II

Main Valuation Models

2.1 Introduction

In the second chapter of this final dissertation, as it has already been mentioned in the previous section, we aim to analyze the main valuation models which will be used in the following two chapters. After having carefully seen several ways for the discount rates estimation in chapter I, now it is possible to apply such methods to the main valuation models; more specifically to the so-called "Absolute Valuation Models", which are also identified as the "Discounted Cash Flow Valuation": as the name implies, these valuation methods require the usage of discount rates indeed.
Due to the fact that there is a close link between the first chapter and the DCF valuation methods and because such valuation methods family is the one that will be further deepened in the last two chapters, it has been decided to discuss them first.

The absolute valuation models can be divided into two main categories:

- the equity valuation models - the Dividend Discount Model (hereinafter it may be referred to as DDM) and the Free Cash Flow to Equity (hereinafter it may be referred to as FCFE or LFCF, standing for Levered Free Cash Flow, or FTE, standing for Flow-To-Equity method) will be taken into consideration
- the asset or firm valuation models - the Free Cash Flow to the Firm (hereinafter it may be referred to as FCFF or as UFCF, standing for the Unlevered Free Cash Flow, or as FCF, standing for Free Cash Flow); sometimes the FCFF is also known as the WACC approach since the WACC is the discount rate to be used

Within the firm valuation models, the "Adjusted Present Value" (APV) is one of the most famous ones, however, given its strategic importance, for the purpose of this dissertation it will be discussed deeply in a dedicated chapter (Chapter III).

Finally, the Residual Income together with the Economic Value Added (hereinafter it may be referred to as RI and EVA) despite being cash flow-based models, because of the fact that they are both "Excess Return Models" or, alternatively, "Value Creation Models", they will be analyzed separately.

The chapter proceeds with the introduction of a different valuation form, the well-known "Relative Valuation", which is also known as "Multiples Valuation". Multiples are obtained by dividing one financial metric by another financial metric. This kind of valuation, as its name suggests, consists of comparing the target company to a sample of comparable companies (that can be selected according to different factors) through the usage of certain multiples whose average or median by multiple may be assumed to be equal to that specific target company's multiple. The multiples can be adopted for the "Comparable Company Analysis" (also known as "CCA") and also for the "Precedent Transactions Analysis" (also known as "M&A Comps", "Comparable Transactions" or "Deal Comps"). As far as the professionals' way of analyzing companies is concerned, the good practice would normally require the usage of all the three analyses when it comes to valuing an M&A target company: the CCA, the precedent transactions analysis and the discounted cash flow analysis. The underlying idea is that, by adopting all these methods, it would be possible to reach a more precise range of values among which the target company's real value is comprised. Despite this being the generally accepted approach, it should be stated that we are not going to discuss the first two analyses because, since they are going to be neither mentioned in the third chapter nor applied in the fourth chapter, it would go beyond the purpose of this final dissertation. However, the main distinction between "Equity Multiples" and "Asset Multiples" is being put forward.

2.2 Discounted Cash Flow Valuation or Absolute Valuation

Two main approaches can be identified as the discounted cash flow valuation: the first method consists in valuing the equity side of the firm, whilst the second one regards the whole company valuation which comprises both equity and any other claims in the firm. What makes the two approaches differ most significantly is the choice of cash flows and discount rates[41].
According to the first approach the value of equity can be found through the following formula:

$$Value\ of\ equity = \sum_{t=1}^{n} \frac{CF\ to\ equity_t}{(1+k_e)^t} \tag{2.1}$$

As it can be logically observed, we are discounting the expected cash flow to equity at the COE.
As far as the asset valuation is concerned, the formula applied is:

$$Value\ of\ the\ firm = \sum_{t=1}^{n} \frac{CF\ to\ the\ firm_t}{(1+WACC)^t} \tag{2.2}$$

[41] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 516.

Regardless of the valuation method, whether we are dealing with equity valuation or asset valuation, provided the same set of assumptions is used, we will always obtain consistent results. However, it should be stated that, since FCFE concerns cash flows after the issues or payments of debt, in the case the financial structure had to change multiple times, then it would become much more difficult to estimate FCFE than FCFF which are, instead, pre-debt cash flows. As it can be observed from the below mentioned formulas, the FCFF will always be greater than or equal to FCFE.

2.2.1 Equity Valuation Models

In this paragraph, as it has been repeatedly said, two equity valuation models will be analyzed: the DDM and the FCFE model respectively.

2.2.1.1 Dividend Discount Model (DDM)

The choice between valuing a company's equity through a DDM rather than adopting a FCFE will provide us, according to Damodaran's opinion, with the most conservative result since the great majority of firms «pay less in dividends than they can afford to»[42]. The Free Cash Flow to Equity is the cash flow available after all investments and debt payments have been made; in other words, it is the potential cash flow that could be allocated to dividend payments.

The DDM base-case scenario is easily represented by this formula:

$$Value\ per\ share\ of\ stock = \sum_{t=1}^{\infty} \frac{Expected\ dividends\ in\ period_t}{(1 + Cost\ of\ Equity)^t} \tag{2.3}$$

Owing to the fact that dividend payments cannot be foreseen indefinitely, after having decided the dividends extraordinary growth rates for the estimated period, we can then proceed to compute what is known as the stable growth rate that is assumed to be maintained by the analyzed company in perpetuity[43]. Broadly speaking, the stable growth rate is assumed to be lower than the extraordinary growth rates since the company is not expected to be able to sustain such incredible growth performances for all its life.

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[42] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 517.

[43] Ibid., p. 520.

This particular DDM case is called the Gordon growth model[44]:

$$P_0 = \sum_{t=1}^{t=n} \frac{DPS_t}{(1+r)^t} + \frac{P_n}{(1+r)^n} \ with\ P_n = \frac{DPS_{n+1}}{(r-g_n)} \quad (2.4)$$

The formula clearly shows the four inputs needing to be estimated carefully for the model to be considered reliable:

I. the length of the high-growth period
II. the expected dividends in such period
III. the cost of equity
IV. the terminal value (the expected stock price at the end of the high-growth period)

Many aspects should be taken into account when it comes to estimating the high-growth period, among these, according to Damodaran's work, three main factors can be found: size of the firm in relation to the market, existing growth rate and excess returns, magnitude and sustainability of competitive advantages[45].
Damodaran briefly affirms that high growth is what makes a firm bigger and the bigger they become, the harder it is for them to maintain such abnormal growth rates; as a consequence of that it is seen as not cautious enough to predict a firm's growth for a time period longer than ten years. Moving on to computing the expected dividends in the high growth period, the expected earnings estimation is the first thing that must be done; two alternative ways are proposed: we can either find an expected growth rate to be applied to the company's current earnings, or yearly net profit margins can be estimated only after having computed the expected revenues – despite the first method being easier, the second one is much more flexible in the case of changing margins. Then expected earnings must be assigned with payout ratios (potentially subject to variation throughout the high growth period.
Damodaran identifies three different ways to estimate future earnings:

- the first way consists in analyzing the historical growth rate in earnings; the two challenges presented by this method are the length of the analyzed historical period and whether to proceed with the geometric average or the arithmetical one (generally speaking, the geometric average can provide more meaningful data)

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[44] Gordon, M. J. and Shapiro, E. (1956) 'Capital Equipment Analysis: The Required Rate of Profit', *Management Science*, 3 (1), pp. 102-110 and Gordon, M. J. (1959) 'Dividends, Earnings, and Stock Prices', *The Review of Economics and Statistics*, 41 (2), pp. 99-105.

[45] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 521.

- the second way consists in relying on other people's estimates
- the third approach focuses on the fundamentals and on the company's investment policy; specifically, a firm's earnings per share (EPS) growth can be computed as:

$$Expected\ growth\ rate = Retention\ ratio * Return\ on\ Equity \tag{2.5}$$

$Retention\ ratio = the\ percentage\ of\ net\ income\ retained\ in\ the\ firm\ to\ generate\ future\ growth$
$Retention\ ratio\ or\ Plowback\ ratio = 1 - Payout\ ratio$
$Payout\ ratio = the\ percentage\ of\ net\ income\ distributed\ to\ shareholders\ as\ dividends$

Damodaran concludes that, since the historical approach is not applicable because the future growth pattern may change even dramatically compared to the estimated average and, due to the fact that relying on other analysts' estimates is not the most prudent way of proceeding, the fundamentals approach is the one that should provide the most accurate results[46].
Because the cost of equity estimation has been largely discussed in the previous chapter, we are now going to see the terminal value estimation procedure.

Owing to the fact that cash flows cannot be estimated forever, generally speaking we should put an end to our DCF model by stopping the cash flow estimation somewhere in the future and then calculating the terminal value, which reflects the value of the firm at that point. Three different ways can be used to compute the terminal value (hereinafter it may be referred to as TV)[47] with the first one assuming a liquidation value of the firm's assets and the other two methods valuing the firm as a going concern[48] at the time of the TV estimation.

- Liquidation value – in some valuations it can be assumed that the firm will cease its operations at a given time in the future and sell the assets it has accumulated to the best bidders, such estimate is called liquidation value. It can be estimated in two different ways; we either use the book value of the assets by adjusting it for the inflation during the time interval or we estimate the value according to the earning power of the assets. Now, we are going to see two quick numerical examples provided by Damodaran.

[46] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 523.

[47] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/valquestions/termvalapproaches.htm (10/11/2022).

[48] «Going concern is an accounting term for a company that has the resources needed to continue operating indefinitely until it provides evidence to the contrary» by Investopedia.

Liquidation value – first approach

Book value of assets ten years from now = $ 2 bln
Average age of the assets at ten years from now = 5 years
Expected inflation rate = 3%

$$Liquidation\ value = Book\ Value\ of\ Assets_{Term\ yr} * (1 + inflation\ rate)^{Average\ life\ of\ assets}$$

In this case it would be equal to $ 2,319 bln.

Liquidation value – second approach

Such approach is aimed at reflecting the earning power of the assets; to make such estimates we first need to compute the expected cash flow from assets and then discount them with the appropriate discount rate

If we assume that the assets are expected to generate $ 400 mln in after-tax cash flow for 15 years (after the terminal year) and the cost of capital is 10%, then our liquidation value would be:

$$Liquidation\ value = After - tax\ cash\ flows_{Term\ yr} * \frac{\left(1 - \frac{1}{(1 + Cost\ of\ capital)^{n}}\right)}{Cost\ of\ capital}$$

In this case it would be equal to $ 3,042 bln.

- The multiples approach – it consists in using multiples to earnings, revenues or book value to estimate the value in the terminal year (as it will be shown in the Multiples section, the EV/EBITDA multiple is the most used one)
- The perpetual growth model – it assumes the cash flows will grow at a constant rate forever at a stable growth rate and this is exactly the approach that will be adopted throughout this chapter and implemented in the fourth one

As far as the terminal value is concerned, the following formula must be applied in the DDM:

$$Value\ of\ equity\ in\ year\ n = \frac{Expected\ dividends_{n+1}}{r_n - g_n} \quad (2.6)$$

By looking at the abovementioned formula, we can see that we are dealing with a two-staged formula that has some evident limitations since, after assuming a higher growth rate in the first period, we then assume a lower perpetual growth rate to change abruptly (in real life this change occurs more gradually over time). By assuming a fixed growth rate and payout ratio in the extraordinary growth period, then the dividends present value can be computed as:

$$PV\ of\ high-growth\ dividends_0 = \frac{Dividends_0 * (1+g) * (1 - \frac{(1+g)^n}{(1+r)^n})}{r-g} \quad (2.7)$$

The dividend payout ratio in stable growth becomes:

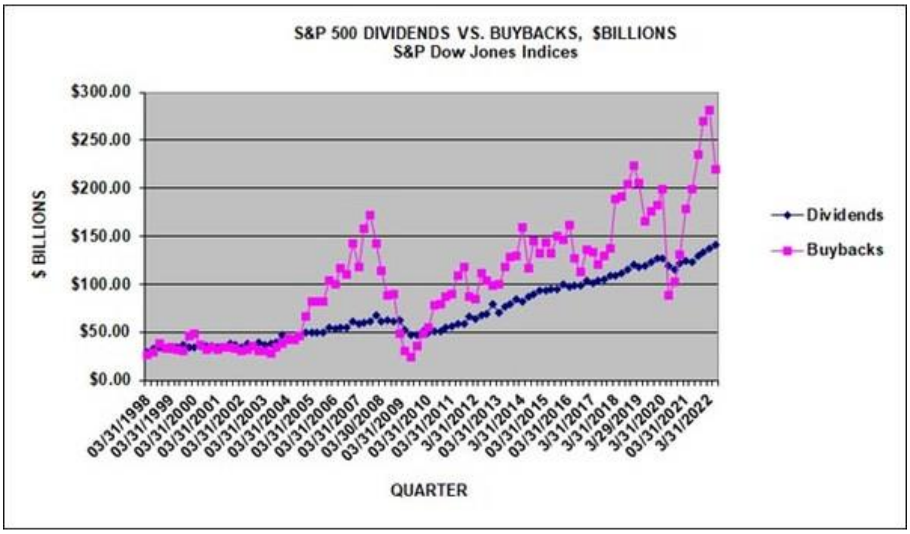
$$Dividend\ payout\ ratio = 1 - Retention\ ratio = 1 - \frac{g_{Stable}}{ROE_{Stable}} \quad (2.8)$$

Although most practitioners think of the DDM as an outdated model, in Damodaran's opinion it is still an extremely useful tool when it is hard to properly estimate a company's free cash flows (e.g. financial services companies). Generally, the DDM uses per share values meaning that the final present value is going to represent the firm's intrinsic share price, however, we could opt for the usage of the total dividends paid, thus would provide us with the equity value[49].

Although it is not going to be implemented in the case study section, it is important to remember that the proportion of FCFE that companies have decided to distribute to their stockholders in the form of stock buybacks (also knowns as stock repurchases) has incredibly risen through time, as it can be easily demonstrated in the figure below. The amount paid in stock buybacks has only been lower than the amount paid in dividends in crisis times, which is exactly what could happen in the near future. Despite all this, the line graph clearly shows the firms' preference towards a stock repurchase policy rather than a dividend one.

[49] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 527.

Figure 2.1 - S&P 500 Dividends vs Buybacks



Source: "S&P 500 Buybacks Decline 21,8% as Financials Pull Back; 12-Months Buybacks Pass $1 Trillion for the First Time", https://press.spglobal.com/, 20/09/2022

This is worth mentioning since, as it can be easily imagined, we could implement stock repurchases to our previously discussed Dividend Discount Model.

The dividend payout ratio and growth rate would become the modified dividend payout ratio and modified growth rate respectively[50]:

$$Modified\ dividend\ payout\ ratio = \frac{Dividends + Stock\ Buybacks}{Net\ income}$$

It is important to mention the fact that some firms increase the stock repurchases as a way to have a higher financial leverage; in case this had to be considered an issue, the newly issued debt could be simply subtracted from the previous formula:

$$Modified\ dividend\ payout\ ratio = \frac{Dividends + Stock\ Buybacks - Long\ term\ debt\ issues}{Net\ income}$$

$$Modified\ growth\ rate = (1 - Modified\ dividend\ payout\ ratio) * Return\ on\ Equity$$

All other things being equal, the fact of increasing the numerator in the modified dividend payout ratio formula by adding the stock buybacks would result in a higher value provided by the DDM.

[50] Damodaran, A. (2012) *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*. 3rd edn. United States of America: John Wiley & Sons, p. 328.

For the sake of completeness, at this point of the chapter it would be interesting to explain the so called "Net Present Value of Growth Opportunities" (PVGO)[51].

First and foremost, the difference between present value and net present value should be outlined.

«The Present Value (PV) is the value of the investment today, while the Net Present Value (NPV) is the addition that investment makes to your wealth[52]» which can be represented by the following formula:

$$NPV = C_0 + PV$$

$$NPV = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} \text{ with } C_0 \text{ being the cash flow at time } 0 \text{ (today) which is typically negative}$$

PVGO formula can help firms to understand whether they should opt for paying dividends or reinvesting their earnings:

- PVGO > 0 → means that it is more convenient for the company to reinvest its earnings than distributing them as dividends (it creates more value for the shareholders to reinvest the earnings since ROE > Cost of Equity)
- PVGO < 0 → implies that it is more convenient for the company to distribute earnings as dividends

The stock price could be also seen as the sum of the present value of no-growth earnings (as if the company were entirely distributing its earnings as dividends) and the present value of growth opportunities (the present value of earnings with growth):

$$P_0 = \frac{EPS_1}{Cost\ of\ Equity} + PVGO$$

$$PVGO = P_0 - \frac{EPS_1}{Cost\ of\ Equity} = \frac{NPV_1}{Cost\ of\ Equity - g}$$

[51] Brealey, R. A., Myers, S. C. and Allen, F. (2017) *Principles of Corporate Finance*. 12th edn. New York: McGraw-Hill Education, pp. 90-93.

[52] Ibid., p. 52.

2.2.1.2 Free Cash Flow to Equity (FCFE) Model

«The FCFE is the residual cash flow left over after meeting interest and principal payments and providing for reinvestment to maintain existing assets and create new assets for future growth[53]». The FCFE can be obtained through the following formulas:

$$FCFE = EBIT - Interests - Taxes + D\&A - \Delta NWC - Capex + Net\ Borrowing \quad (2.9)$$
$$FCFE = NI + D\&A - \Delta NWC - Capex + Net\ Borrowing$$
$$FCFE = CFO - Capex + Net\ Borrowing$$
$$FCFE = FCFF - Int * (1 - Tax\ rate) + Net\ Borrowing$$

$$Capex = Net\ Increase\ in\ Fixed\ Assets + D\&A \quad (2.10)$$
$$\Delta NWC = NWC_t - NWC_{t-1} \quad (2.11)$$
$$NWC = Accounts\ Receivable + Inventory - Accounts\ Payable$$
$$Net\ Borrowing = New\ Debt\ Issues - Principal\ Repayments \quad (2.12)$$
$$Net\ Borrowing = Debt_{t1} - Debt_{t0}$$

Although working capital is generally computed as the difference between current assets and current liabilities, for valuation purposes we are using non-cash working capital as it can be seen in the abovementioned formula. This must be done because, as Damodaran highlights, cash in typically invested in risk-free assets (e.g. T-Bills, short-term government investments or commercial paper). As a matter of fact, the return on these investments is lower than the return the company could obtain by investing in riskier assets. Differently from inventory and accounts receivable, cash earns a fair return and should not be included in the working capital computation[54].

Furthermore, there is a particular case in which working capital and the capital expenditures (hereinafter it may be referred to as capex) are financed at a target (fixed) debt ratio (δ) and principal payments are made from new debt issues:

$$FCFE = NI - (1 - \delta) * (Capex - D\&A) - (1 - \delta) * \Delta NWC \quad (2.13)$$

[53] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 531.

[54] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/valquestions/noncashwc.htm (Accessed: 10/11/2022).

Another way of representing the FCFE can be found: the FCFE can be expressed as a function of the equity reinvestment rate, which is the percentage of net income that equity investors are willing to reinvest in the company:

$$Equity\ reinvestment\ rate = \frac{(Capex - D\&A + \Delta NWC) * (1-\delta)}{Net\ income} \tag{2.14}$$

$$FCFE = Net\ income * (1 - Equity\ Reinvestment\ Rate) \tag{2.15}$$

After estimating the FCFE, we are going to notice that the equity value formula starting from the FCFE is very similar to the DDM:

$$Value_0 = \sum_{t=1}^{n} \frac{E(FCFE)_t}{(1+r)^t} + \frac{Terminal\ value_n}{(1+r)^n}\ where\ Terminal\ value_n = \frac{E(FCFE)_{n+1}}{(r_n - g_n)} \tag{2.16}$$

Just like in DDM, FCFEs are estimated in the high-growth period and g_n is the stable growth rate. Nevertheless, DDM and FCFE models present a significant difference, which is that while dividends cannot be less than zero, FCFEs can be negative (this can happen despite the company's positive earnings because of the high working capital and expenditure needs). The FCFE has basically the same four inputs of the DDM: the length of the high-growth period, FCFEs computation in the high-growth period, the cost of equity and the terminal value of equity by adopting a stable growth rate. Of the four inputs, estimating the FCFEs and the terminal value needs some time to be spent on, since it slightly differs from what is required in the proper DDM estimation.

We first start, just like in the DDM, by estimating the expected earnings growth with the only difference laying on the fundamental growth: while in the DDM we decided to use the retention ratio (also known as the plowback ratio) and the return on equity, for the FCFE it would be more appropriate to use the return on equity together with the equity reinvestment rate.

$$Expected\ growth\ in\ net\ income = Equity\ reinvestment\ rate * Return\ on\ equity \tag{2.17}$$

It should be marked the fact that the retention ratio cannot be more than 100% or less than 0%, while the equity reinvestment rate can be greater than 100% or negative (in the case capex were lower than D&A). If the company had to present a negative equity reinvestment rate and were this to be also the case in the future, then the expected earnings growth would be a negative one; whilst if the equity reinvestment rate is higher than 100%, as a consequence of that the net income will grow at higher rate than ROE[55], the company having to issue new shares to fund the reinvestment though.

After that, capex, working capital and debt must be considered to obtain the FCFE. It must be remembered that both capex and working capital needs should reflect the changes in the growth rate.

In conclusion, Damodaran states that the equity reinvestment rate is typically higher in high growth (high growth firms require higher capex and working capital needs, they do not use much leverage to sustain their investments, unless they start experiencing a declining growth phase, implying higher debt ratios) and will decrease as the growth rate declines[56].

Then we must proceed with the terminal value estimation which essentially the same formula used in the DDM, with the only difference of the cash flows to be used:

$$Terminal\ value\ of\ equity_n = \frac{FCFE_{n+1}}{r-g_n}$$

And the equity reinvestment rate is the very same formula used in the DDM:

$$Equity\ reinvestment\ rate = 1 - \frac{g_{Stable}}{ROE_{Stable}} \quad (2.18)$$

Damodaran states that the FCFE could be seen as an alternative model to the DDM, however, since the two approaches provide us with different results, it is important to stress why this happens. Two circumstances can be found in which both approaches give us the same result: the first scenario is when the FCFE and the dividends are the same and the second one happens when FCFE is greater than dividends, but the excess cash (FCFE – Dividends) is invested in projects whose NPV is equal to 0. Nevertheless, most of the time the two methods will yield different estimates: when the FCFE is greater than the dividend and the excess cash either results in earning below market returns or is invested in projects with negative NPVs, then the value from FCFE model will be higher than the value from DDM (the value loss in the DDM is due to poor corporate governance).

[55] It can be computed in several ways: ROE = Net Income / (Equity – Net Income) or ROE = ROI + D/E * (ROI – Rd after-tax).

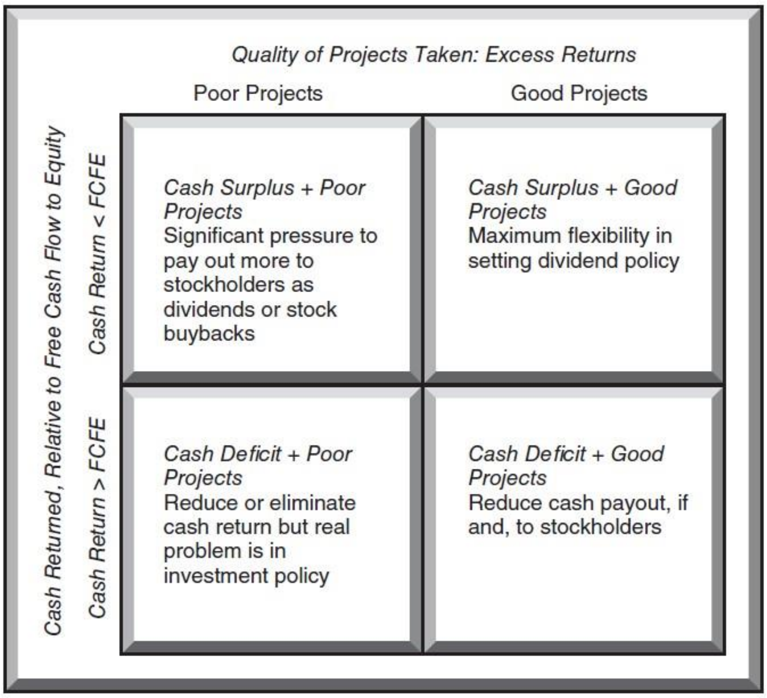
[56] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 534.

In the case dividends were higher than FCFE, the company will need to either issue new shares or borrow money to sustain the dividend payments which will, one way or another, conduct to three different negative outcomes:

- Flotation costs become unbearable (especially for equity issues)
- If the firm borrows too much debt, it may easily become overleveraged (value loss expected)
- Capital rationing constraints, making the firm unable even to start good projects (loss of wealth)

A few more lines should be spent on understating the meaning of the difference in value between the two models and which is the best fit when estimating a firm's value. Most of the time the FCFE will provide a higher valuation and the difference in value with the DDM can be seen as one component of the value of exercising control over a company (basically the value of dividend policy control). Whenever hostile takeovers occur, the buyer could aim at controlling the firm and modify the dividend policy, thus reflecting the FCFE, in order to obtain the higher FCFE value. In the opposite scenario, which is much rarer, the DDM value is higher than the FCFE value. It may be considered as a warning sign, indicating the unfeasibility of such policy in the long run. Damodaran states that the FCFE approach is a more reliable tool whenever there is a very high probability for the firm to be subject to a buyout or a change in the management structure; while the DDM becomes more appropriate where no such change is likely to happen.

Figure 2.2 - Analyzing dividend policy



Source: Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 493.

The table above provided by Damodaran summarizes four different scenarios that can happen when it comes to analyzing a firm's dividend policy:

- The firm has good projects and is paying out more than its FCFE → the company is destroying value by both having to issue more securities in order to counterbalance the cash deficit caused by paying too much in dividends (or buybacks) and by having to ration its capital which could have been alternatively invested in good projects
- The firm has good projects and is paying out less than its FCFE → this would result in the firm accumulating a large of cash claiming to be doing so to preserve it for the time when better investment opportunities will arise, however stockholders may argue why the company did not invest the money in the current projects
- The firm has poor projects and is paying out less than FCFE → in this case the firm is able to accumulate cash, nevertheless it will feel the pressure coming from the stockholders who are eager to receive more remuneration since they fear that otherwise the money could be spent on poor projects
- The firm has poor projects and is paying out more than FCFE → since the firm has poor projects, it will be forced to abandon those ones with a hurdle rate higher than its return. Thus, reducing the CapEx may eventually solve the problem; however, were this not to be the case, then the company would be obliged to cut the dividends as well

In order to properly estimate a firm's dividend policy, we can use two major ratios: the well-known and previously mentioned dividend payout ratio and a more precise one, which measures the total cash returned to stockholders as a proportion of FCFE:

$$Dividend\ payout\ ratio = \frac{Dividends}{Earnings}$$

$$Cash\ to\ Stockholders\ to\ FCFE\ ratio = \frac{Dividends + Equity\ Repurchases}{FCFE}$$

As it can be clearly figured from the second formula, the following considerations can be made[57]:

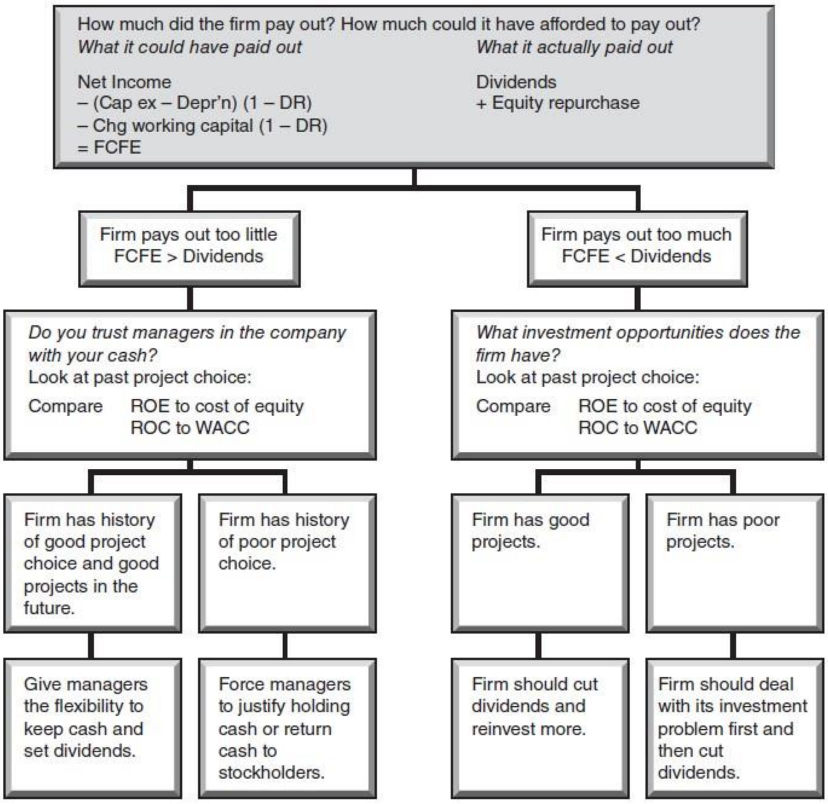
- If the ratio is close or equal to 100%, this means the company is paying all it has to its stockholders

[57] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 486.

- If the ratio is significantly lower than 100%, this implies the company is paying much less than it can afford and it using the excess cash to increase its cash balance or invest in profitable projects
- If the ratio is much higher than 100%, then the firm is paying much more than it can afford to its shareholders, and for the company to be able to do that, it is either relying on existing cash accumulated in the previous years, or issuing new securities

Furthermore, it should be said that the firm's financing policy is strictly connected to its shareholders' remuneration policy because the higher the amount paid to stockholders either in dividends or stock buybacks, the higher the financial leverage will be (and vice versa). As a matter of fact, a low-levered firm would be able to pay more compared to a highly levered firm.
Moreover, Damodaran provides another table that is sort of self-explanatory, since it gives us the inputs to be considered when it comes to understanding whether the dividend/cash policy is an appropriate one. The table suggests what actions should be taken in terms of both the management of the company and investment opportunities: to arrive at these conclusions, the amount of cash distributed to the shareholders must be analyzed (whether the FCFE is greater than dividends or not) and then the ROE and the ROC must be compared to the Cost of Equity and WACC respectively.

Figure 2.3 - A Framework for Assessing Dividend/Cash Return Policy



Source: Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 498.

2.2.2 Free Cash Flow to the Firm (FCFF) Model or the WACC Approach

As it has been repeatedly mentioned, the DDM and the FCFE are methods which value a firm's equity directly. Now we are going to analyze a different method which aims at obtaining a firm's business value from which the equity value can be computed. The focus is now on operating assets and the cash flow that they produce[58]. There are two main different approaches when it comes to estimating the FCFF: we can either add the cash flows to equity investors (in the form of dividends or buybacks) to the cash flows to debt holders (interests and net debt payments), or we could estimate the cash flows before debt payments are made but after reinvestment needs are satisfied.

Formula following the first method:

$$FCFF = FCFE + Int * (1 - Tax\ rate) - Net\ Borrowing$$

Alternative formulas for FCFF following the second method:

$$FCFF = EBIT * (1 - Tax\ rate) + D\&A - Capex - \Delta NWC \qquad (2.19)$$

$$FCFF = NI + D\&A + Int * (1 - Tax\ rate) - Capex - \Delta NWC$$

$$FCFF = CFO + Int * (1 - Tax\ rate) - Capex$$

The difference between Capex and D&A is known as Net Capital Expenditure and the change in non-cash working capital represents the reinvestment made by the firm to sustain growth in the future. The second method FCFF formula can be also written as a function of the reinvestment rate:

$$Reinvestment\ rate = \frac{(Capex - D\&A + \Delta NWC)}{EBIT * (1 - Tax\ rate)} \qquad (2.20)$$

$$FCFF = EBIT * (1 - Tax\ rate) * (1 - Reinvestment\ rate) \qquad (2.21)$$

If the reinvestment rate is greater than 100%, then the company needs to fund itself through external financing (debt or equity); when such scenario happens the FCFF will show a negative value.

[58] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 539.

As mentioned earlier, the FCFF is also called the unlevered cash flow because it is, unlike the FCFE, not affected by debt payments and the tax benefits connected to the interest payments generated.

$$Value_0 = \sum_{t=1}^{n} \frac{E(FCFF)_t}{(1+r)^t} + \frac{Terminal\ value_n}{(1+r)^n}\ where\ Terminal\ value_n = \frac{E(FCFF)_{n+1}}{(r_n - g_n)} \quad (2.22)$$

As it has been for the DDM and FCFE, four main inputs must be estimated in order to arrive at the value of the operating assets properly: high-growth period, the high-growth FCFFs, the cost of capital (WACC) and the terminal value. After doing so, there are more calculations to be made to arrive at the equity value: the value of non-operating assets must be added (e.g. “Cash & Cash equivalents), while the value of non-equity claims must be subtracted. The most common non-equity claims are: debt, operating leases, finance leases (both leases are often included into the debt), contingent liabilities, preferred stock, minority interests and net operating losses carried forward (sometimes unfunded pensions are included as well in the formula).

This leads us to the well-known formula:

$$Equity\ Value = EV + Non\ Op.Assets - Debt - Preferred\ stock - Minority\ interests \quad (2.23)$$

In addition to that, the effect of other equity claims should be considered as well, such as outstanding warrants, options, and convertible securities whose exercise has a dilutive effect on the firm’s equity. In order to find the right number of fully diluted shares outstanding, the “Treasury Stock Method” (TSM) must be followed for both options and warrants, while the “If-converted method (or the Net Share Settlement)” is the one adopted for convertible and equity-linked securities[59].

[59] Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p. 46.

Figure 2.4 - Calculation of Fully Diluted Shares Outstanding using the Treasury Stock Method (TSM)

($ in mln, except per share data, shares in millions)	
Assumptions	$ 20,00
Basic Shares Outstanding	100,00
In-the-Money Options	5,00
Weighted Average Exercise Price	$ 18,00

Calculation of Fully Diluted Shares Using the TSM		
Option Proceeds	$ 90,00	= in the Money Options * Exercise Price = 5 mln * $ 18,00
/ Current Share Price	$ 20,00	
Shares Repurchased from Option Proceeds	**4,50**	= Option Proceeds / Current Share Price = 90 mln / $ 20,00
Shares from In-the-Money Options	5,00	= Current Share Price (20) > Exercise Price (18)
Less: Shares Repurchased from Option Proceeds	-4,50	
Net New Shares from Options	**0,50**	= In-The-Money Options – Shares Repurchased = 5 mln – 4,5 mln
Plus: Basic Shares Outstanding	100,00	
Fully Diluted Shares Outstanding	**100,50**	Net New Shares from Options + Basic Shares Oustanding = 0,5 mln + 100 mln

Source: Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p. 46.

According to the TSM model, it is assumed that the proceeds obtained from the sale of options are in turn used to buy the shares at the current price. As a matter of fact, since the options were bought by the investors in the first place because they were in-the-money, it is clear that the firm will use the same total amount of money to repurchase the shares: but since the shares are listed at a price higher than the one paid by the investors, the firm will be able to afford fewer of them, thus implying more shares outstanding anyway and a dilution effect.

Figure 2.5 - Calculation of Fully Diluted Shares Outstanding using the If-Converted Method

($ in mln, except per share data, shares in millions)	
Company	
Current Share Price	$ 20,00
Basic Shares Outstanding	100,00
Convertible	
Amount Outstanding	$ 150,00
Conversion Price	$ 15,00

If-Converted	
Amount Outstanding	$ 150,00
/ Conversion Price	$ 15,00
Incremental Shares	**10,00**
Plus: Net New Shares from Options	0,50
Plus: Basic Shares Outstanding	100,00
Fully Diluted Shares Outstanding	**110,50**

= Amount Outstanding / Conversion Price
= $150 mln / $15

= Calculated before

= New Shares from Conversion + Net New Shares from Options + Basic Shares Oustdanding = 10 mln + 0,5 mln + 100 mln

Source: Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p. 48.

In the “If-Converted Method” we must remember that the conversion price is the exercise price at which the bondholder will buy the security provided the share price is higher. After assessing the number of convertible securities that are in-the money, then such amount is simply divided by the conversion price: the result obtained is the number of incremental shares.

Due to the complexity of the topic, it would be worth spending more lines on the dilution effect (by explaining the NSS method for instance), however, since it is not going to be part of the following chapters, it goes beyond the purpose of this dissertation, thus we are not going to discuss it any further.

Now, two different scenarios will be seen when it comes to estimating the FCFFs in the high-growth period: operating margins and return on capital are expected to stay stable in the high-growth period, whilst the second scenario is the one where margins and returns on capital change as time goes by.

After establishing that the firm will maintain its current ROC, then:

$$Expected\ growth_{EBIT} = Reinvestment\ rate * Return\ on\ capital$$

$$Reinvestment\ rate = \frac{Capex - D\&A + \Delta NWC}{EBIT * (1 - Tax\ rate)}$$

$$Return\ on\ capital = \frac{EBIT * (1 - Tax\ rate)}{(BV\ of\ equity + BV\ of\ debt - Cash)} \quad (2.24)$$

It must be stated that the two measures should be forward-looking. The reinvestment rate is often computed on historical reinvestment data; despite this being a promising beginning, it is not always the best way to proceed with. Moreover, the firm's current ROC should always be compared to the industry data: if the company's ROC is significantly higher than the industry average, then the forecasted ROC should be lower than the current value which will inevitably happen because of the rising competition. A firm vaunting a ROC higher than its WACC implied that such firm has a strong competitive advantage.

In the case of changing margins and ROC, there is no other choice but to begin estimating revenues and work down through the rest of the financial statements[60].

Since the cost of capital estimation has been largely discussed in the previous chapter, we are now going to see the terminal value estimation.

By using the relationship between growth and reinvestment rates, we can say that:

$$Reinvestment\ rate\ in\ stable\ growth = \frac{Stable\ growth\ rate}{ROC_n} \quad (2.25)$$

$$Terminal\ Value = \frac{EBIT_{n+1} * (1 - Tax\ rate) * (1 - \frac{g_n}{ROC_n})}{(Cost\ of\ capital_n - g_n)} \quad (2.26)$$

On one hand, it is much more convenient to use the FCFF method since the debt cash flows do not need to be taken into consideration, the FCFF being a pre-debt cash flow. Had leverage to change dramatically, the FCFF is extremely useful because of how complex estimating the net borrowing would become the further in time we go. Nevertheless, such approach require data concerning debt ratios and interests for computing the WACC[61].

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[60] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 542.

[61] Ibid., p. 551.

«The value for equity obtained from the firm valuation and equity valuation approaches will be the same if you make consistent assumptions about financial leverage»[62], states Damodaran by adding that it is much more difficult in the daily practice.

2.2.3 Residual Income and Economic Value Added (EVA) Valuation Methods

The origins of the method which is about to be explained can be found in the work of Edwards & Bell (1961), Peasnell (1982)[63] and Ohlson (1995)[64].
This very interesting absolute valuation method in the accounting literature is the so-called Residual Income method[65]. A firm's residual income can be defined by the following formula:

$$Residual\ Income_t = Net\ Income_t - r_e * Book\ Value\ of\ Equity_{t-1}$$

$$Residual\ Income_t = (ROE_t - r_e) * Book\ Value\ of\ Equity_{t-1}$$

$$r_e * Book\ Value\ of\ Equity_{t-1} = Equity\ charge$$

The residual income can be seen as the company's excess profit of its ROE; the residual income will show positive numbers if and only if the ROE will be higher than the COE. According to the residual income method, the firm's market value of equity should be equal to its book value plus the present value of its expected residual income:

$$E_0 = BE_0 + PV(Residual\ Income) = BE_0 + \sum_{t=1}^{\infty} \frac{RI_t}{(1+r_e)^t} \qquad (2.27)$$

The residual income method is the same as the abovementioned FCFE; since the book value increases by the net income minus the payout given to the shareholders (FCFE), then:

$$BE_t = BE_{t-1} + NI_t - FCFE_t$$

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62 Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 551.

63 Peasnell, K. V. (1982) 'Some Formal Connections between Economic Values and Yields and Accounting Numbers', *Journal of Business Finance & Accounting*, 9 (3), pp. 361-381.

64 Ohlson, J. A. (1995) 'Earnings, Book Values, and Dividends in Equity Valuation', *Contemporary Accounting Research*, 11 (2), pp. 661-687.

65 Berk, J. and DeMarzo, P. (2016) *Corporate Finance*. 4th edn. United Kingdom: Pearson Education, p. 721.

As a matter of fact, FCFE can be written as:

$$FCFE_t = NI_t + BE_{t-1} - BE_t = RI_t + (1 + r_e) * BE_{t-1} - BE_t$$

In terms of present values, we can see that:

$$E_0 = PV(FCFE) = PV(RI) + BE_0$$

It is important to notice that in the previously mentioned formulas, the cost of equity is assumed to be constant which is only possible if we assumed the firm has a target leverage ratio, otherwise it must be computed for each and every year as long as the capital structure changes.

Now a very similar approach will be presented: the Economic Value Added. It is a relatively new approach that aims at measuring the economic performance of a company, it was developed in 1995 by Stern Stewart & Company, a global consulting firm[66].
A very similar logic can be applied for the EVA measure which is computed as the firm's NOPAT minus the total invested capital's charge[67]:

$$Economic\ Value\ Added_t = EBIT_t * (1 - T_c) - (r_{WACC} * Book\ Enterprise\ Value_{t-1})$$

$$Economic\ Value\ Added_t = (ROIC_t - r_{WACC}) * Book\ Enterprise\ Value_{t-1}$$

The EVA will be positive if and only if the firm's ROIC will be higher than its WACC because:

$$BEV_t = BEV_{t-1} + EBIT_t * (1 - Tc) - FCFF_t$$

Just like we did for the FCFE, we can easily show that the WACC method is equivalent to the firm's current market enterprise value (V_0) being equal to its book enterprise value (BEV_0) plus the present value of expected EVA:

$$V_0 = BEV_0 + PV\ (EVA) = BEV_0 + \sum_{t=1}^{\infty} \frac{EVA_t}{(1+r_{WACC})^t} \quad (2.28)$$

[66] Stern, J., Stewart, G. B. and Chew, D. (1995), 'The EVA Financial Management System', *Journal of Applied Corporate Finance*, 8 (1), pp. 32-46.

[67] Berk, J. and DeMarzo, P. (2016) *Corporate Finance*. 4th edn. United Kingdom: Pearson Education, p. 722.

As it has been said for the Residual Income method, here the WACC is assumed to be the same given the firm's constant target leverage debt policy, were it to change, then the WACC should be computed for each year.

2.3 Multiples Valuation or Relative Valuation: Equity Multiples and Asset Multiples

In relative valuations, unlike what occurs in absolute valuation where we are meant to value assets according to their cash flows, growth, and risk peculiarities, the objective is to value an asset by comparing it to similar ones[68]. It is very typical for analysts to compare companies belonging to the same industry or sector.
Three main steps are identified by Damodaran in performing such valuation:

- Finding comparable assets that are priced by the market
- Scaling the market prices to a common variable
- Adjusting for differences across assets when comparing their standardized values

As it is suggested by evidence, there are several circumstances in which multiples valuation are used[69]:

- most equity research reports are multiples-based
- acquisitions and corporate finance are the domains where discounted cash flow analyses are typically used more often, nevertheless we should be aware of the fact that the value paid in acquisitions is also determined by a multiple since the terminal value can be also computed through the usage of a multiple and not only via the "Perpetual Growth Rate" as we have seen in the previous paragraphs:

$$Terminal\ Value = \frac{Enterprise\ Value}{EBITDA} * EBITDA_{firm}$$

- In the end, because of their simplicity, some multiples are most investors' rule of thumb: for instance, companies trading at P/E ratios lower than the expected growth rates are considered to be cheap

[68] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, p. 233.

[69] Ibid., pp. 234, 235.

Furthermore, it should be said that there are several reasons why multiples valuation is so widely appreciated: it is less time and resource consuming than intrinsic valuation; it is much easier for analysts and salespeople to sell multiples based valuations rather than absolute valuations; it is easier to sustain your valuations compared to the high number of assumptions that must be made when dealing with DCF analysis; last but not least relative valuation is supposed to mirror the market's current expectations[70].

However, there are as many weaknesses characterizing the relative valuation:

- on one hand it has been claimed that part of the advantage of using such approach is due to the easiness of putting together a group of comparable firms, on the other hand if the comparable companies are not properly selected, inconsistent results will arise
- since multiples are meant to reflect the market's view, the valuation will present either higher values or lower values whenever the market is overvaluing or undervaluing the comparable firms
- the valuation can be easily manipulated in the case the analysts performing it were allowed to choose both the multiples and the sample of comparable firms, they would be always able to justify their numbers
- sometimes finding comparable companies can be extremely hard since multiples do not consider the many aspects such as the difference in regulation
- last but not least, multiples are static measures, implying that they reflect the value in a specific point in time without considering the dynamics behind the business (this is the reason why in most cases for the very same multiple analysts try to compute the last twelve months and forward-looking multiple)

All the advantages and disadvantages of multiples valuation can be applied to both CCA and PTA. However, a point should be mentioned about precedent transactions analysis, which that, generally speaking, multiples in PTA are higher than multiples in CCA because they are affected by the premium paid by the buyer.
Owing to the fact that comparing different firms can be extremely hard, prices need to be converted so that values are standardized scaling them to a common variable (relative to earnings, book values or replacement costs, revenues or other sector-specific measures).

[70] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, pp. 235, 236.

Every multiple is composed of a numerator and a denominator which can be either an equity or an asset value. In order to understand if the multiples have been computed consistently, we should remember what Damodaran says: «If the numerator for a multiple is an equity value, then the denominator should be an equity value as well. If the numerator is a firm value, then the denominator should be a firm value as well[71]». If we take the Enterprise Value / EBITDA as example, we see that such multiple is a consistent one because the EV indicates the market value of the operating assets and the cash flow created by the operating assets is represented by the EBITDA. EV is the value of operations to all capital providers and due to the fact that it comprises both debt and equity, it is not affected by the capital structure (this topic will be deepened in the next chapter). As a consequence of that, if we decided to use it as our numerator, we should remember to put metrics in the denominator that are capital structure neutral such as revenues, EBITDA or EBIT. These very metrics are not affected by the capital structure since they are all measures before interests are subtracted. The same logic can be applied to the most famous equity multiple, which is the P/E ratio, since both the numerator and the denominator depend on the firm's capital structure.
A clear example of inconsistent ratio would be the price-to-EBITDA for instance because in the case we had both firms with no debt and firms with a lot of debt, then the latter would seem cheap while in reality it could either be overvalued or correctly priced.

When it comes to choosing which exact companies should be included in as our comparable companies, two main comparing distinction must be made: the business profile and the financial profile[72]. The business profile analyzes the firms' following elements: the sector, the products and services, the customers and end markets, the distribution channels, and the geography. While, the financial profile takes into account the following information: the firm's size (market valuation: equity value and enterprise value; and key financial data: sales, gross profit, EBITDA, EBIT and net income), the profitability (gross profit, EBITDA, EBIT and net income margins), the growth profile (historical and forecast growth rates), the return on investment (ROIC, ROE, ROA, and dividends yield) and the credit profile (leverage ratios, coverage ratios, and credit ratings)[73].
In the two following figure some among the most used equity and asset multiples are shown.

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[71] Damodaran, A. (2006) *Damodaran on Valuation*. 2nd edn. United States of America: John Wiley & Sons, p. 239.

[72] Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p. 35.

[73] Ibid., p. 45.

Figure 2.6 - Enterprise Value and Equity Value Multiples

Multiple	Basic formula
EV / sales	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T) \times M$
EV / EBITDA	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T) \times (1 - D)$
EV / EBIT	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T)$
EV / NOPLAT	$\frac{ROIC - g}{ROIC \times (WACC - g)}$
EV / invested capital	$\left(\frac{ROIC - g}{ROIC \times (WACC - g)} \times ROIC\right)$ *or* $\frac{ROIC - g}{WACC - g}$
EV / capacity unit	$\frac{EV}{Unit} = \frac{ROIC - g}{ROIC \times (WACC - g)} \times \frac{NOPLAT}{Unit}$
Price to earnings	$\frac{ROE - g}{ROE \times (COE - g)}$
Price to book value	$\left(\frac{ROE - g}{ROE \times (COE - g)} \times ROE\right)$ *or* $\frac{ROE - g}{COE - g}$
PE to earnings growth	$\frac{ROE - g}{100 \times g \times ROE \times (COE - g)}$

Source: UBS Global Equity Research (2001) *Valuation Multiples: A Primer*, p. 15.

CHAPTER III

The Advantages of APV: The Long-Standing Debate over Debt Policy and VTS

3.1 Introduction

In the third chapter of this final dissertation our aim is to analyze one of the most famous firm valuation models: the Adjusted Present Value (hereinafter it may be referred to as APV). This valuation model, despite being one of the absolute valuation models, since it is the core topic of the thesis, has been given a dedicated chapter as it has already been underlined in the introduction to the second chapter. Such model was developed by S. C. Myers in 1974[74] and, as it will be later explained in detail, the great advantage of the APV (when it comes to computing the levered value of a firm or project) over the WACC approach consists in not requiring iteration whenever the firm's capital structure changes, thanks to the way it is computed. The APV is none other than the general version of the WACC and it is a much more flexible approach to valuation since it allows to capture the effect of the financial benefit arising from the tax shields.

The APV formula, indeed, is given by the summation of the following elements:

- the present value of the unlevered firm[75], which is obtained by discounting the FCFs at the unlevered cost of capital (hereinafter it may be referred to as R_u or K_u, with u standing for unlevered or as R_a or K_a, with a standing for asset)
- the present value of the tax shields (hereinafter it may be referred to as VTS) which is obtained by discounting the interest tax shields (computed as the interest expenses at time t multiplied by the tax rate, with the interest expenses as the result of the pre-tax cost of debt multiplied by the debt at time t-1) at the pre-tax cost of debt

[74] Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), pp. 1-25.

[75] The value of the unlevered firm, as it will be later underlined, is the value of the firm as if it were debt-free, as if it were entirely financed by equity capital; implying that the WACC would be equal to the unlevered cost of equity. Based on the CAPM formula seen in chapter I, the unlevered cost of equity = $R_f + \beta_u$*ERP whose approximation can be given by the pre-tax WACC in the case the firm decided to keep a target leverage ratio (either a debt-to-equity or interest coverage ratio policy).

As far as the computation of the first element is concerned, the financial literature converges to the formula adopted by Myers, however, the same thing cannot be stated for the value of the tax shields at all. In Myers' opinion, the present value of the tax shield should be discounted at the pre-tax cost of debt assuming that the tax shield is as risky as the debt is. This statement has been largely debated and it is going to be covered throughout the whole chapter by seeing how economists' views on the matter differ from each other: this will eventually lead us to realize that there is no common ground on how to properly compute the value of the tax shield.
One more fundamental point should be made, which is that economists differ on how to compute the tax shields according to what debt policy the company has decided to follow.

The various opinions have been classified on such criteria in this very chapter. Among the various debt policies, the most relevant ones in the finance literature will be covered in the next paragraphs:

- Predetermined debt levels - meaning that the debt repayment schedule has been set in advance (more specifically, the debt is either in the form of a constant perpetuity or it follows a different pattern which is not connected to the equity value)
- Constant market leverage policy - implying that the firm targets a certain market value-based debt-to-value ratio that must be respected
- Fixed book-value leverage policy - implying that the firm targets a certain book value-based debt-to-value ratio that must be respected
- Constant interest coverage policy - implying that the firm sets its interest payments equal to a constant proportion of its FCFs

Moreover, it should be stated that a firm's debt policy is the element influencing the relation between levered and unlevered betas. It must be remembered that, for the purpose of this thesis, the book value of debt is always assumed to be equal to the market value of debt as far as historical data are concerned.
Furthermore, for the purpose of this final dissertation, despite knowing how significant the impact of personal taxes could be, such considerations will not be covered: our analysis will be limited on corporate taxes only.
Even if it has been claimed that the only doubt concerning the computation of the value of the tax shields consists in identifying the correct discount rate, which is in turn based upon the firm's debt policy, professor Fernández, whose considerations will be intensively used in this chapter, has developed alternative ways of calculating them.

He then says that (assuming we are in the presence of constant growth companies in a world with no leverage costs) the VTS is given by the difference between the present value of taxes paid by the unlevered firm and the present value of taxes paid by the levered firm[76]:

$$VTS = G_U - G_L \qquad (3.1)$$

The professor argues that the VTS depends only upon the nature of the stochastic process of the net increase in debt and today's value of the expected increase in debt in turn depends on the financing strategy (i.e. debt policy):

$$VTS_0 = T * D_0 + T * PV_0[\Delta D_t] \qquad (3.2)$$

Moreover, the professor will claim that the VTS does not depend upon the nature of the stochastic process of the free cash flow.

The real difficulty is trying to figure the proper discount rate for the present value of the net increase in debt.

Fernández demonstrates that in the specific case of perpetuities, the VTS is equal to the tax rate times the current value of debt; the abovementioned formula clearly confirms the professor's words since, whenever the debt is perpetual, then the debt variation is equal to zero, thus implying PV to be equal to zero as well, leaving the VTS equal to tax rate multiplied by the current value of debt.

$$VTS_0 = T * D_0 \qquad (3.3)$$

Always assuming constant growth companies in a world without leverage costs and that the net debt increases are as risky as the FCFs are (and that the firms is adopting a fixed book-value leverage policy), the VTS is equal to the present value of debt times the tax rate times the required return to the unlevered equity discounted at the unlevered cost of equity.

[76] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), pp. 145-165.

As Fernández highlights, this process is much different from discounting the tax shields at R_u, since the amount being discounted is higher than the tax shield: the numerator sees the multiplication of the unlevered cost of equity instead of using the pre-tax cost of debt (we are not dealing with the interest tax shields):

$$VTS = \frac{DTK_u}{K_u - g} \tag{3.4}$$

However, as it will be discussed more deeply, there are other circumstances in which different theories, approaches and formulas are applied.

As regards different valuation methods that will be adopted throughout this chapter, the so-called "Capital Cash Flow" (CCF) which, despite being potentially mentioned in the previous chapter among the firm valuation methods, since it is also known as the "Compressed Adjusted Present Value" (CAPV), will be used in the next paragraphs. Among the DCF models, there would also be the Debt Cash Flow which, once again, since it is functional to the computation of the CCF, will be mentioned in this chapter for the first time following the logic of the CCF.

The formula of the APV could be further adjusted by including a third element to the abovementioned formula, which will be mentioned in the chapter as "the expected costs of financial distress". To be more precise, more costs could potentially be added (of which the present value should be calculated), such as the debt issuance costs, agency costs, other debt financing considerations and other market imperfections; nevertheless, the financial distress costs, being the most relevant ones, will be the only ones discussed by mentioning one of the most used model to assess a company's default risk: the Altman Model (also known as the Z-Score). Such model will be discussed for sake of completeness; the expected costs of financial distress will not be computed since Intel shows no risk of financial distress and, because of that, the APV formula applied in the case study in the fourth chapter will include the value of the unlevered firm and the value of the tax shields only[77].

The APV formula will also be applied to the RJR Nabisco case study as a demonstration of its usefulness whenever the capital structure changes and the company has not set a target leverage ratio (were it to be the latter, the WACC approach could be used easily as well). The APV, as it will be later explained, is highly adopted in LBO valuation since, because of the intrinsic nature of such acquisitions, we already know in advance the debt schedule that will be followed and we know that it will decrease as time passes, making it more complicated to adopt the WACC approach because of the change in the capital structure.

[77] The fact of not including the "costs of financial distress" is referred to the "professionals' valuation", since Fernández's theory with cost of leverage will be applied in the fourth chapter.

3.2 Fixed Debt Policy

Among the many authors whose theories are based upon the assumption of debt being fixed over time, the economists that will be analyzed are the following ones: Modigliani and Miller, Myers and Luehrman.

3.2.1 Modigliani and Miller's contribution to Corporate Finance

Modigliani and Miller's work (hereinafter the two economists may be referred to as MM or M&M) represents a milestone in modern finance theory. Their contribution was in fact the first attempt to explain the relation between a company's financial structure and its value. The theorem was born with the aim of developing what are the key principles that must be adopted to be able to make rational decisions when evaluating investment opportunities and making decisions regarding financial policy, in a world where returns on securities or future cash flows present a degree of uncertainty. The final goal is to maximize profits or the market value of the company.

3.2.1.1 Modigliani and Miller's propositions in a world without taxes

M&M's first theorem concerns the irrelevance of the financial structure given the fundamental assumption of no taxation. In the first part of their work, the two authors show that the value of a company is independent of the debt-equity ratio the company intends to have (i.e. whether it intends to finance itself using debt or equity). The overall value of a company is exclusively linked to the profitability and risk characteristics of its real assets, and therefore the value cannot change because of changes in the financial structure[78].

M&M' first proposition thus states that the value of a levered firm is equal to the value of an unlevered firm and is defined as follows:

$$V_U = V_L$$
$$V_U = E_U$$
$$V_L = E_L + D_L$$

[78] Modigliani, F. and Miller, M. H. (1958) 'The Cost of Capital, Corporation Finance and the Theory of Investment', *The American Economic Review*, 48 (3), pp. 261-297.

This first proposition is well-known as the "pie" model: regardless of the size of the slices (representing the proportion of debt and equity) obtained by cutting the pie, its value will not change[79].

As it has been seen in chapter I (this time the formula will not take into consideration the preferred shares and taxes), WACC is the discount rate to be used to find the value of the overall assets, and, as consequence of that, it could be identified with the symbol R_a.

$$R_a = WACC = \frac{E}{V} * R_e + \frac{D}{V} * R_d \tag{3.5}$$

If we rearranged the previous equation to solve for the cost of equity, we would obtain[80]:

$$R_e = R_a + \frac{D}{E} * (R_a - R_d) \tag{3.6}$$

This is the very famous MM's second proposition which states that the cost of equity depends on three elements: the firm's required rate on return on assets, the cost of debt and the debt-to-equity ratio.

As it will be shown in the picture below, MM proposition II states that as the company raises its debt-to-equity ratio, we experience an increase in the risk of equity and, as consequence of that, in the cost of equity. The WACC does not depend on the debt-to-equity ratio, as it has already been confirmed by the first proposition: this is because the change in the capital structure weights is offset by the change in R_e, thus making it possible for the WACC to be the same.

The first element composing the second proposition is R_a which, since it is the required return on the firm's assets, depends on the company's operating activities indeed. The risk associated with R_a is known as the business risk of the firm's equity. And the business risk depends on the systematic risk of the company's assets: the higher the business risk, the higher R_a will be and, all things being equal, the cost of equity will increase. The second component (R_a – R_d) * D/E, instead, depends on the financial structure; as it can be imagined, in the presence of an all equity financed firm, such component is equal to zero, thus resulting in $R_e = R_a =$ WACC.

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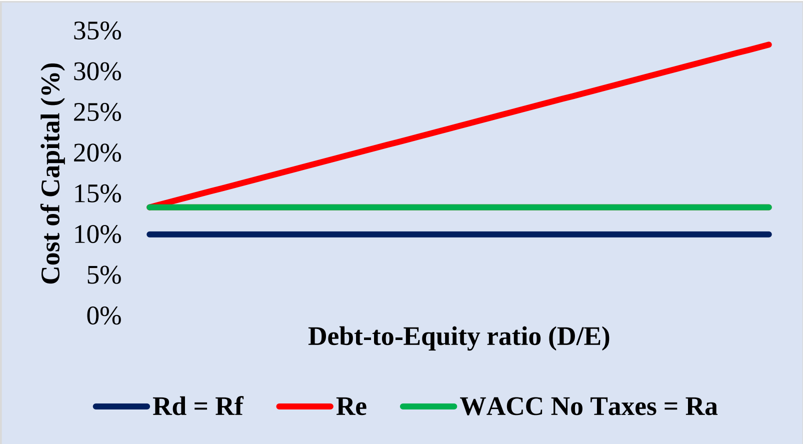
[79] Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 516.

[80] We should always remember that MM's theorem assumes R_d to be risk-free, thus implying $R_d = R_f$.

However, as the debt component rises, R_e starts increasing as well because the debt increases the risk sustained by the shareholders: this new risk is known as the financial risk of the firm's equity. In conclusion, the company's systematic risk depends on both the business risk and financial risk[81].

Figure 3.1 - MM's I and II propositions without taxes



Source: Own construction based on Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 517.

Clearly, the assumption of irrelevance of the financial structure is only correct under a set of assumptions that are quite stringent. The model assumes, in addition to the assumption of no taxation, that we are in a world of perfect capital markets, that is a scenario characterized by the absence of information asymmetries, bankruptcy costs and transaction costs; furthermore, there is a complete absence of constraints to borrow or lend without limit at the interest rate including the firm's risk premium, which coincides with the discount for future cash flows; essentially everyone can make the same transactions as the firm and at the same price (absence of the opportunity for arbitrage).
In the end, it must be remembered that cash flows and debt are in the form of constant perpetuity.

So, by recalling some of the formulas introduced in the second chapter, we can easily understand that the value of the firm (i.e. the enterprise value) can be found in this way:

$$V_U = \frac{FCF}{R_a} \; for\ an\ unlevered\ firm$$

$$V_L = \frac{FCF}{WACC} \; for\ a\ levered\ firm$$

[81] Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 519.

However, since according to MM I $V_U = V_L$, then:

$$V_U = V_L = \frac{FCF}{R_a} = \frac{FCF}{WACC}$$

If the firm were unlevered the previous equation could be expanded:

$$V_U = V_L = \frac{FCF}{R_a} = \frac{FCF}{WACC} = \frac{FCF}{R_e}$$

After listing all the assumptions of the model and explaining the two propositions, assuming the CAPM holds, we can easily understand which is the relation between the levered and unlevered beta:

$$\beta_U = \beta_e * \frac{E}{E+D} + \beta_d * \frac{D}{E+D}$$

«This equation says that the beta of a firm's assets is revealed by the beta of a portfolio of all of the firm's outstanding debt and equity securities. An investor who bought such a portfolio would own the assets free and clear and absorb only business risks»[82].

Or alternatively:

$$\beta_L = \beta_U * \left(1 + \frac{D}{E}\right) - \beta_d * \frac{D}{E}$$

However, since the debt is assumed to be risk-free, then the formula simplifies to the following one:

$$\beta_L = \beta_U * \left(1 + \frac{D}{E}\right)$$

[82] Brealey, R. A., Myers, S. C. and Allen, F. (2017) *Principles of Corporate Finance*. 12th edn. New York: McGraw-Hill Education, p. 505.

3.2.1.2 Modigliani and Miller's propositions in the presence of taxes

Modigliani and Miller, aware that the financial structure affects the value of the firm and that the presence of taxation in the model could not be excluded, dropped the no-taxation hypothesis, and developed propositions I and II in the presence of taxation[83]. The two authors demonstrated, in fact, that the value of a company is positively correlated to its amount of debt. This assumption stems from the tax advantage enjoyed by a levered firm. The benefit is given by the tax deductibility of the interests on the debt, from which derives a reduction in taxes to be paid exactly equal to the value of the tax shield:

$$VTS = R_d * T_c * D$$

Since, as it has been previously said, the debt (just like the cash flows) is a constant perpetuity, then we need to discount this as well:

$$VTS = \frac{R_d * T_c * D}{R_d} = T_c * D$$

The first proposition then becomes:

$$V_L = V_U + T_c * D$$

The value of a levered firm is obtained by the sum of the value of the unlevered firm with the present value of the tax shield. As it can be observed, the higher the amount of debt, the higher the tax shield: a firm could then decide to substitute equity with debt to increase its value (provided there are no side effects, such as the increase of potential distress costs which, in the real world, do happen).

The second proposition becomes:

$$R_e = R_a + \frac{D}{E} * (R_a - R_d) * (1 - T_c)$$

[83] Modigliani, F. and Miller, M. H. (1963) 'Corporate Income Taxes and the Cost of Capital: A Correction', *The American Economic Review*, 53 (3), pp. 433-443.

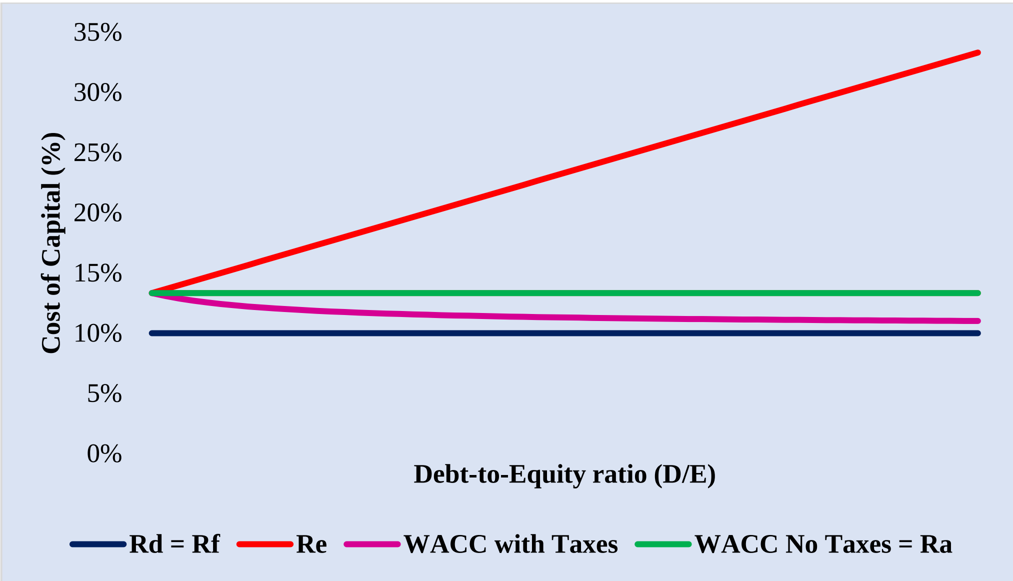
As in the no-taxation scenario, the financial leverage increases the cost of equity for the very same reason[84].

The WACC then becomes:

$$WACC = \frac{E}{V} * R_e + \frac{D}{V} * R_d * (1 - T_c)$$

By doing so, as we can understand, the WACC is no longer equal to R_a, it is lower thanks to the tax advantage provided by the interest payments.

Figure 3.2 - MM's proposition II with taxes



Source: Own construction based on Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 522.

We can easily understand which is the relation between the levered and unlevered beta with the addition of taxes:

$$\beta_L = \beta_U * \left(1 + (1 - T_c)\frac{D}{E}\right)$$

What seems to emerge from the work of the two authors is that a company must finance itself entirely with debt to maximize its value, in fact, as the tax shield formula shows, the more debt increases, the

[84] Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 520-522.

more the firm's value increases. This deduction can be considered quite unreasonable, it should be remembered, in fact, that debt has, by its intrinsic nature, a certain degree of riskiness which grows as its level increases, causing a tightening of the firm's financial structure. Furthermore, the assumptions underlying the theorem include the absence of transaction and agency costs, so the risky component is not considered within the model, whereas it is in the real life. Having demonstrated that the use of debt has advantages anyway, each company must understand what is its optimal level of debt that allows it to maximize its value. It must be remembered that the tax shield provides an incentive to take on debt, nevertheless it increases a company's overall risk. Excessive leverage is often the cause of financial disruptions or tensions that do not benefit the company's well-being and even less the value perceived by the markets. In facts, the danger of incurring huge costs may counterbalance the benefits of the tax shield.
The work of MM highlighted early on the importance of the tax shield in the valuation process of a company. The reported formulas marked how interest on debt is deducted from profit to obtain a corporate tax reduction in the amount of R_d*T_c*D. Since the model assumes that the flows are perpetuities, the same treatment is applied to the tax shield, which is discounted at the pre-tax cost of debt R_d. In the valuation process, the risk profile and the context that qualifies a business are fundamental in defining the discount rate. The assumption implicitly made is therefore that the riskiness of the flows associated with the tax shield is the same as the company's debt. Assumptions on the riskiness of flows are still subject of much debate today, and over the years, numerous other theories on the valuation of the tax shield have been added, which we will analyze in the following paragraphs.

3.2.2 Myer's contribution to firm valuation: the Adjusted Present Value (APV)

After Modigliani and Miller laid the foundations for the study of the interactions between the financial structure and the enterprise value, many others have devoted themselves to the subject, contributing their ideas and their studies. One of the best-known works after M&M was done by Stewart C. Myers, who in addition to his many theoretical insights, also provided a series of practical approaches and tools to address real world problems.
The model presented by Myers, universally known by the acronym APV (Adjsuted Present Value) is also static like the previous theories, but unlike these it presents certain characteristics that give it an advantageous position such that it has become one of the most accredited methods for the valuation of investment opportunities. The great advantages of the APV, as it has been said in the introduction, lie in its ability to be flexible (implying that it can be easily used regardless of the countless changes in the capital structure) and to show not only the final value of an asset (or of a firm as in our case)

but also what are the sources of the creation of this value, highlighting what entails benefits and what, instead, entails costs. In the process of capital budgeting and company valuation, one of the issues that continues to be a source of debate among analysts and economists, as it has been repeatedly said, is the search for the correct method to capture the tax benefit of debt. Such benefit is one of the most important sources of value creation and plays a key role in the APV approach as demonstrated in 1974 Myers' paper[85].

Myers presents what he considers the general approach for analyzing the interactions between corporate financing and investment decisions, defining a kind of general rule to be used to assess investment opportunities.

Myers underlines that his paper has some limitations though: it does not gather all existing interactions of financing and investment decisions and his model, as already mentioned, is a static one, meaning that it does not consider how future financial decisions might change because of changes in the market, but suggests an optimal financial plan given the realization of current expectations. What the author aims for is precisely the outlining of a general approach (of which the WACC is a particular case) to analyzing interactions and a specific study of the most relevant ones.

Before looking at the formula developed by Myers, it is important to truly understand the WACC when the firm decides to change its capital structure (i.e. possibly due to a change in the entire financing policy) in order to understand the convenience in using Myers' APV.

In the previous paragraphs, it has been stated that, according to M&M's theories, the financial leverage has an impact on the WACC making it differ from the unlevered cost of capital if and only if we are in the presence of taxes, because of the fiscal benefit generated from the interest payments. In their propositions (both in the no taxation and taxation scenario), the higher the financial leverage the higher the cost of equity, however, the pre-tax cost of debt, which is risk-free, is constant despite of how dramatic the increase in the financial leverage may be. This is an important factor that in real life practice should be considered, whenever we are computing the new WACC. As it can be grasped from the previously explained MM's propositions, the pre-tax cost of debt is constant because of the assumption concerning the debt (which is in the form of a constant perpetuity just like the cash flows) and there is no risk for expected distress costs or any other costs arising from the increase in leverage (the debt is risk-free). In a real case scenario, it must be remembered that as the leverage increases, so does the cost of equity (because of the aforementioned reasons) and so potentially does the cost of debt after a certain threshold of debt has been reached (this is easily understandable since, as we can imagine, it is not the same thing to have two identical firms with their only difference being the

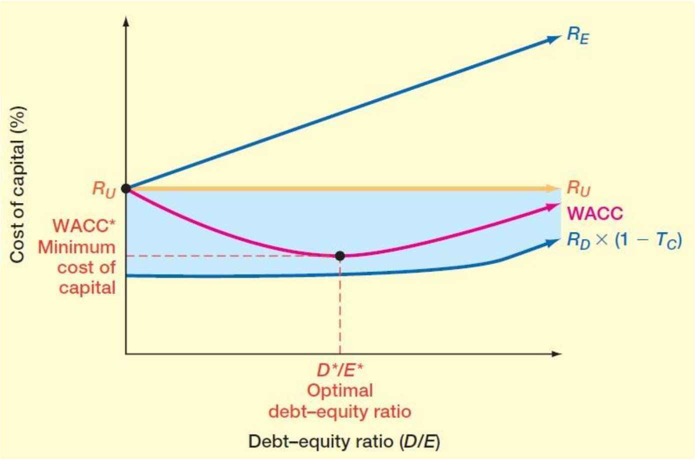
[85] Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), pp. 1-25.

amount of debt and expecting the much more levered one to have the same pre-tax cost of debt, expecting the more levered company to pay the same interests). We can then realize that it is not true that the increase in debt may be only beneficial to the firm's value, such increase may not vaunt enough benefits deriving from the tax shields to cover all the side effects connected to the presence of an excessive leverage.

The static theory of capital structure (also known as the trade-off theory) indeed states that «a firm borrows up to the point where the tax benefit from an extra dollar in debt is exactly equal to the cost that comes from the increased probability of financial distress»[86]. It is called the static theory because the only thing changing is the Debt-to-Equity ratio, while assets and operations are assumed to be fixed. From this theory it can be deduced that there is an optimal Debt-to-Equity ratio which maximizes the value of the firm by minimizing the WACC. After such threshold, an increase in the financial leverage would result in an increase in the cost of debt and WACC.

All such considerations can be summarized in the following figure:

Figure 3.3 - The Static Theory of Capital Structure



Source: Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 529.

86 Ross, S. A., Westerfield, R. W. and Bradford, J. (2012) *Fundamentals of Corporate Finance*. 9th edn. Boston: McGraw-Hill Education, p. 526 and Kraus, A. and Litzenberger, R. H. (1973) 'A State-Preference Model of Optimal Financial Leverage', Journal of Finance, 28 (4), pp. 911-922.

However, there is another important theory first developed by Donaldson[87] in 1961 and later modified by Myers[88] himself in 1984 (who based his work upon the very famous paper by Black[89]), this theory is known as the "Pecking Order Theory" (POT). Such theory is based upon the concept of information asymmetries assuming them to be the main cause of the increase in financing costs. Such theory states that[90]: companies prefer internal financing to external financing and whenever they need external financing, they first start issuing safer securities: they start with debt-like instruments and then they will proceed with the issuing of equity as a last resort. This is because when managers, who are assumed to know more about the company in question than the investors, decide to issue new equity investors believe that managers are trying to take advantage of the firm's potential over-valuation and, as a consequence of that, investors bid a lower value to the firm's newly issued shares. According to the Pecking Order Theory, there is no optimal Debt-to-Equity ratio that would maximize the company's value: this happens because there are two kinds of equity financing: the internal equity financing and the external equity financing which are at the top and at the bottom of this capital structure theory respectively.

The POT is able to demonstrate why the most profitable companies typically borrow less, this occurs not because of their low target debt ratios, but because they do not need external financing sources. In the POT, the interest tax shield is assumed to be less relevant than it is in the trade-off theory. Both the trade-off theory and POT can be adopted within certain limits since, as it has been agreed by the financial literature there is still no existing theory that is able to produce a formula to perfectly capture the optimal Debt-to-Equity ratio in every possible scenario and circumstance.

3.2.2.1 The Value of the Unlevered Firm and the Value of the Tax Shield (VTS)

This final dissertation wants to show how different valuation methods can provide different results when it comes to finding the firm's intrinsic value, however, it must be said that such valuation methods could also be adopted to value the convenience of single projects taken by the firm; among the many project valuation approaches, the following valuation methods are the most frequently used: the WACC method, the APV method and the FTE method.

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[87] Donaldson, G. (1961) 'Corporate Debt Capacity: A Study of Corporate Debt Policy and the Determination of Corporate Debt Capacity', *Division of Research Graduate School of Business Administration,* Harvard University.

[88] Myers, S. C. (1984) 'The Capital Structure Puzzle', *The Journal of Finance*, 39 (3), pp. 575-592.

[89] Black, F. (1976) 'The Dividend Puzzle', *The Journal of Portfolio Management*, 2 (2), pp. 5-8.

[90] Brealey, R. A., Myers, S. C. and Allen, F. (2017) *Principles of Corporate Finance*. 12th edn. New York: McGraw-Hill Education, p. 510.

All these three methods can lead to the very same result, provided some assumptions are made (as it will be shown by Fernández in chapter IV).
It must be said that the unlevered cost of capital for a project that the company wants to start may present a very different value compared to the unlevered cost of capital of the existing firm: this is because the firm's R_a is based upon its main business (which could be the result of several different businesses, each belonging to a different division with their relative beta as it has been shown in chapter I) and the launching of a new project could consist in diversifying its business by creating a whole new division, thus implying a specific unlevered cost of capital for the project. Such new R_a would be normally found assuming it to be equal to the comparable firm's (or average of the comparable firms') unlevered cost of capital. Once the project has been completed, we must remember that, in the case of a significant change in the business of the company, the firm's unlevered cost of capital should be computed again (as there may be one or more divisions/businesses it now deals with).

All this should have already made it quite clear how important the correct computation of the WACC is for the results obtained from such approach to be used. The steps required for the computation of the new WACC after a significant change in the capital structure can be summarized[91]:

- Computing the unlevered cost of capital (which, as it has already been said, may differ from the existing company's unlevered cost of capital)
- Estimating the new cost of debt because of the new Debt-to-Equity ratio
- Estimating the new cost of equity
- In the end, estimating the WACC by including the impact of taxation

The computation of the new cost of equity would be also functional for the application of the FCFE approach, whose discount rate is the cost of equity indeed.

We must bear in mind that, because of the time and effort taken to compute the new WACC, most analysts assume the company to keep its current Debt-to-Equity ratio, thus assuming a constant WACC for the forecasted period. The assumption of a constant WACC (meaning that the firm targets a constant leverage ratio, most of the time such debt policy is referred to the market leverage ratio; such process is known as "rebalancing") allows to compute the unlevered cost of capital simply by

[91] Brealey, R. A., Myers, S. C. and Allen, F. (2017) *Principles of Corporate Finance*. 12th edn. New York: McGraw-Hill Education, p. 504.

using a pre-tax WACC, as already mentioned in the introduction, instead of following the previously mentioned step starting from the computation of the new unlevered cost of capital:

$$R_a = R_f + \beta_a * ERP$$

Nevertheless, it seems logical to realize how difficult it is for a firm to constantly rebalance its capital sources for the Debt-to-Equity ratio to be the same, especially if we are dealing with market values. In fact, in the real life such process does not happen continuously.

All these considerations should make the reader realize how important Myers' APV is in order not to have to constantly compute the new WACC, regardless of the firm's adopted debt policy.

We are now going through the assumptions and considerations made by Myers which led him to develop its firm valuation model; more specifically sections II and V will be analyzed.
According to Myers' general formulation, the firm in question must decide the project to undertake among different options and wants to arrive at a financing plan (it consists of specifying the amount of debt outstanding, the cash dividends paid and net proceeds from newly issued shares for the period t)[92].

x_j = proportion of project j accepted
y_t = stock of debt outstanding in t
D_t = total cash dividends in t
E_t = net proceeds from equity issued in t
C_t = expected net after-tax cash inflation to the firm in t with net outflow (i.e. investment) represented by $C_t \leq 0$
Z_t = Debt capacity in t, defined as the limit on y_t
Z_t depends on the firm's investment decision

$\psi = \Delta V$, the change in the current market value of the firm (evaluated cum dividend at the start of period t = 0). ψ is a function of x, y, D and E.

[92] Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 2, 3.

Myers' idea is to maximize ψ which is subject to:

$\Phi_j = x_j - 1 \leq 0$ $\quad j = 1, 2, ..., J.$

$\Phi^F_t = y_t - Z_t \leq 0$ $\quad t = 1, 2, ..., T.$

$\Phi^C_t = -C_t - [y_t - y_{t-1} (1 + (1 - \tau) r] + D_t - E_t = 0$ $\quad t = 1, 2, ..., T.$

$x_j, y_t, D_t, E_t \geq 0$

r = the borrowing rate is assumed to be constant

τ = the corporate tax rate is assumed to be constant

Myers provides no details about the maturity structure of the planned stock of debt, and he states that stock repurchases are not allowed since such information is not critical to his paper.

The nature of the interactions between the firm's financing policy and investment decisions are described by the previously mentioned equations. To fully understand the effects of such interactions, the conditions for the optimal solution should be analyzed[93].

Myers defines:

$A_j \equiv \delta\psi/\delta x_j$, $F_t \equiv \delta\psi/\delta y_t$, $Z_{jt} \equiv \delta Z_t/\delta x_j$, and $C_{jt} \equiv \delta C_t/\delta x_j$

$\delta\varphi_j/\delta x_j$, $\delta\varphi^F_t/\delta y_t$ and $-\delta\varphi^C_t/\delta y_t = 1$

$\delta\varphi^C_t/\delta x_j = -C_{jt}$

The shadow prices are: λ_j for φ_j, λ^F_t for φ^F_t and λ^C_t for φ^C_t

93 Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 4.

Such simplifications lead us to the following necessary optimum conditions.

For each project:

$$A_j + \sum_{t=0}^{T} \left[\lambda_t^F Z_{jt} + \lambda_t^C C_{jt}\right] - \lambda \ \leq 0$$

For debt in each period,
$F_t - \lambda^F{}_t + \lambda^C{}_t - [1 + (1 - \tau)\ r]\ \lambda^C{}_{t+1} \leq 0$

For dividends in each period,
$\delta\psi/\delta D_t - \lambda^C{}_t \leq 0$

For equity issued in each period,
$\delta\psi/\delta E_t - \lambda^C{}_t \leq 0$

According to Myers, a marginal investment is justified if project j's APV is positive[94]:

$$APV_j \equiv A_j + \sum_{t=0}^{T} \left[\lambda_t^F Z_{jt} + \lambda_t^C C_{jt}\right] > 0$$

In the optimal scenario $APV_j = \lambda_j$ if the project is accepted ($x_j = 1$); if the project is rejected ($x_j = 0$) then APV_j is negative and $\lambda_j = 0$ and if it is partially accepted, then $APV_j = \lambda_j = 0$.

It is known as the Adjusted Present Value, since in the optimal solution A_j, which is the project's direct contribution to the objective, is "adjusted for" the project's side effects on other investment and financing options. The side effects occur because of the project's effects on the debt capacity and sources/uses constraints.
In the case the dividend policy was irrelevant[95] (in the same way as Modigliani and Miller) and that $\delta\psi/\delta y_t$ is positive (regardless of MM's considerations being right or wrong), then the constraint $\varphi^F{}_t$ will always be binding.

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94 Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 4.

95 «Given x_j's and y_t's, a marginal change in D_t and an offsetting change in E_t will not affect shareholder's wealth» Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 5.

Because of that:

$$APV_j = A_j + \sum_{t=0}^{T} Z_{jt}F_t$$

Such equation shows that the contribution of a marginal investment in j to the company's value is given by A_j together with the present value of the additional debt the project supports.

In a world with no taxes and perfect capital markets, both debt policy and dividend policy are not relevant, thus making investment and financing decisions independent which implies that:

$$APV_j = A_j$$

Such independence policy is the one present in a pure MM world; the economic interpretation of A_j is that A_j «is the contribution to firm value of marginal investment in project j, assuming all equity financing and irrelevance of dividend policy»[96].

Indeed, the APV finds the value of the project in its unlevered form and only then adjustments are made (e.g. when debt and/or dividend policy are relevant).

After computing the project's base case, given the year-by-year debt capacity (ΔZ_t) and after-tax cash flow (ΔC_t) the formula becomes[97]:

$$APV_j = A_j + \sum_{t=0}^{T} \left[\lambda_t^F Z_{jt} + \lambda_t^C C_{jt}\right] > 0$$

As it can be observed from the formula, this time we are dealing with discrete amounts instead of partial derivatives: the discrete form is used for the accept-reject choice (when the project scale is known), while the continuous form is meaningful when it comes to choosing the optimal scale. The APV will provide the same results if and only if the various partial derivatives are constants.

In section III Myers derives the WACC rules as a special case of a more general analysis and in section IV he detects the mistakes which can emerge if those rules are adopted in real-case scenarios

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[96] Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 5.

[97] Ibid., p. 6.

by testing their robustness. However, since it would go beyond the purpose of this dissertation, such sections are not examined.

In section V Myers provides us with the APV as an alternative in the case one or more assumptions of the WACC were severely violated and, as it has been already stated, every project with APV > 0 should be accepted.

To best summarize the way APV is computed[98]:

- A_j (the project's base case value) must be calculated first by using the NPV formula with the discount rate being R_u
- The project's contribution to firm debt capacity whose value will be added to A_j (in an MM world such amount would be equal to the present value of tax shields; however, the APV rule does not assume MM are right)
- In the end, it must be understood if the marginal source of equity financing is composed of retained earnings, additional stock issues or a decrease in stock buybacks. In the case there were costs or benefits associated with such source (vs. the base case of irrelevance of dividend policy), then they will be included in the λ^C_t and the project value adjusted by adding ΣC_{jt}

The second step, calculating Z_{jt}'s, is the most difficult one whenever it is based upon market values instead of using book debt ratios (indeed in the latter case Z_{jt} would then be fixed in advance and independent of project profitability or value).
According to Myers' view, as it has been stated in the introduction, the tax shield should be discounted at the pre-tax cost of debt.
Myers was able to find a general way to compute the firm's levered value despite finite and uneven operating cash flows (while MM only works if a constant perpetuity is assumed).

[98] Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 20.

Myers concludes by stating that the APV is the manager's perfect guide through multiple real-life problems among which we can find[99]:

- Analysis of the lease vs buy, or lease vs borrow decision
- APV can take into consideration the impact of dividend policy without making awkward distinctions between the cost of retained earnings vs the cost of stock issue (there would also be the possibility of considering transaction costs in financing)
- In the case subsidized borrowing were available for some investments (e.g. pollution control facilities), the APV framework could show the impact on the investment's value

In most textbooks, Myers' formula is simply written:

$$APV = base\ case\ NPV + sum\ of\ PVs\ of\ financing\ side\ effects \quad (3.7)$$

However, for the purpose of this dissertation, the PVTS, as it has already been mentioned, is the only component of the second part of the formula that will be considered.
Despite not being the part of the analysis in the fourth chapter, the next paragraph will briefly cover one of the most important models which help the financial situation of a firm: the Altman model.

3.2.2.2 Probability of Default and the Value of the Costs of Financial Distress

The finance literature has been characterized by many different models trying to perfectly capture firms' credit worthiness.

A company's credit worthiness is strictly associated with its probability of default: as matter of fact, the lower its credit worthiness, the higher its probability of default (PoD). When we use the word default, we are referring to a specific circumstance in which the firm in question has declared that it will delay or miss some of its payments. As it can be easily imagined, the higher the probability of default, the more difficult it could be for the company to conduct its business activities since capital providers will be concerned about the possibility of not being entirely or even at all repaid. Because of such possibility, interest rates on all forms of debt required by debt holders will start growing making it even more difficult for the highly levered company to pay all the sums due. In terms of valuation, we can understand that such problem will trigger a series of negative effects: indeed, the

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99 Myers, S. C. (1974) 'Interactions of Corporate Financing and Investment Decisions - Implications for Capital Budgeting', *The Journal of Finance*, 29 (1), p. 23.

higher the interest payments, the higher the cost of debt, the higher the WACC and the lower the intrinsic value of equity.
Since data on default is not always available, most theories use bankruptcy[100] as the subject of their analyses.

Damodaran provides us with the following formula which could be added in the APV[101]:

$$PV\ of\ expected\ bankrupcty\ cost = \pi_{\alpha} BC$$

$$\pi_{\alpha} = Probability\ of\ default\ after\ the\ additional\ debt$$
$$BC = Present\ value\ of\ the\ bankruptcy\ costs$$

Damodaran states that such part of the equation is often removed because of the impossibility in directly estimating the probability of bankruptcy and the bankruptcy costs. In the case of companies with high probability of default, such approach would overvalue their values. According to Damodaran's experience, bankruptcy costs should range between 10% and 40% (for firms with low and high indirect bankruptcy costs respectively; thus, an average of 25% could be considered as a relatively good estimate) of the firm's market value.

In Damodaran' view, the general formulation of APV could be summarized in the following formula:

$$Value\ of\ levered\ firm = \frac{FCFF_n}{R_u - g} + T_c * D - \pi_{\alpha} BC$$

As it can be seen, the professor calculates the tax shield in this way, thus assuming the debt to be a constant perpetuity (as it was assumed by MM)[102].

[100] Bankruptcy is a legal proceeding initiated when a person or a business is unable to repay outstanding debt or obligations. The entity involved files for either liquidation (Chapter 7) or reorganization (Chapter 11) according to the United States Bankruptcy Code, by www.investopedia.com.

[101] Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 555.

[102] Ibid., p. 378.

The cost of bankruptcy can be divided into direct costs and indirect costs[103]. Direct costs are the ones associated with the actual filing such as court costs, lawyers' fees, and administrative fees; while indirect costs are all those costs associated with lost opportunities (the decrease in sales and profits generated by customers who no longer want to deal with a distressed firm) and as mentioned earlier, the increase in cost of borrowing.

Apart from relying on rating agencies to discover the credit worthiness of a company such as Moody's, Standard & Poor's, and Fitch (whose judgment has been long debated after the Subprime Crisis), many different theories could be analyzed.
It must be said that the estimated probability of default is functional to estimating the creditor's expected loss:

$$E(L) = PoD * E(LGD) * E(EAD)$$

$PoD = Probability\ of\ Default$
$LGD = Loss\ Given\ Default, the\ amount\ lost\ at\ time\ of\ default$
$EAD = Exposure\ at\ Default, the\ amount\ the\ creditor\ is\ exposed\ to\ at\ time\ of\ default$

However, among the many existing theories (including the O-Score developed by Ohlson in 1980[104] and the hazard-based model proposed by Campbell, Hilscher and Szilagyi in 2011), it is imperative to mention the well-known Z-Score developed by Altman in 1968[105].
The model does not directly produce a probability of default, nevertheless by taking the Altman's Z-Score we could map it to a credit rating and translate that credit rating into a probability of default (adopting the same logic used to compute the Interest Coverage Ratio in chapter I by following Damodaran's approach). However, since, as it has already been anticipated, there will be no default risk in our case study, a probability of default will not be found.

[103] Wruck, k. H. (1990) 'Financial Distress, Reorganization, and Organizational Efficiency', *The Journal of Financial Economics*, 27 (2), pp. 419-444.

[104] Ohlson, J. A. (1980) 'Financial Ratios and the Probabilistic Prediction of Bankruptcy', *Journal of Accounting Research*, 18 (1), pp. 109-131.

[105] Altman, E. I. (1968) 'Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy', *The Journal of Finance*, 23 (4), pp. 589-609.

The original model developed by Altman was only possible through the MDA technique[106]. Altman was able to conclude that there are five most relevant variables which are the best bankruptcy predictors:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

$$X_1 = \frac{Working\ capital}{Total\ assets}$$

$$X_2 = \frac{Retained\ earnings}{Total\ assets}$$

$$X_3 = \frac{EBIT}{Total\ assets}$$

$$X_4 = \frac{Market\ value\ of\ equity}{Book\ value\ of\ total\ debt}$$

$$X_5 = \frac{Sales}{Total\ assets}$$

The logic of the model is that the lower the Z-Score, the more likely it is for the company in question to face bankruptcy. More specifically, Altman stated that his model was quite precise (72% accuracy) in forecasting bankruptcy up to two years, however, as time passes, the reliability of the model starts decreasing.

The model must be interpreted in the following way:

- Z-Score > 2,99 → no risk for bankruptcy
- Z-Score < 1,81 → risk for bankruptcy
- 1,81 < Z-Score < 2,99 → gray area (further analyses should be put forward to determine the risk of bankruptcy)

Throughout the years Altman was able to enhance its model and the final formula he developed, which is also the formula that will be used to assess Intel's credit worthiness, is:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5 \qquad (3.8)$$

[106] Multiple Discriminant Analysis is a statistical technique which allows to screen for several variables

It must be remembered that his model was created for publicly traded manufacturing firms. As time went by Altman derive adjusted models for non-manufacturers and emerging markets (they will not be the subject of any analysis though).

3.2.3 Luehrman: APV as a better Tool for Valuing Operations

Luehrman clearly shows the superiority of the Adjusted Present Value over the WACC which is, using his own words «obsolete»[107]. He states that APV always works, while the same thing cannot be said about WACC because APV needs fewer assumptions. Furthermore, Luehrman claims that the APV is less likely to lead the valuation towards many mistakes that would arise when using the WACC approach. In the end APV can provide managers some very useful information about the origin of the value, as well as telling them how much the project/business/asset is worth.

« APV unbundles components of value and analyzes each one separately. In contrast, WACC bundles all financing side effects into the discount rates»[108].

The true advantage of the WACC, which is what made it so appealing in the history of corporate finance, lies in the fact that it only requires one discounting operation. APV, on the hand, can vaunt an incomparable flexibility.

Luehrman provides us with a numerical example where APV is applied: such firm valuation method is applied for valuing a company which has become the acquisition target of another company.

The first step consists in computing the value of the firm as if it were entirely equity financed by discounting the FCFs together with the terminal value at the unlevered cost of equity. Although there are many side effects connected to debt financing, Luehrman says that it will only mention the value of the tax shields.

The author states that the value of the tax shield is to be computed as the present value of the interest tax shield discounted at an appropriate rate; he then adds that there is no consensus on which discount rate should be adopted:

- the pre-tax cost of debt could be used, thus assuming the tax shields to be as risky as the principal and interest payments

[107] Luehrman, T. (1997) ‘Using APV: A Better Tool for Valuing Operations’, *Harvard Business Review*, p. 1.

[108] Ibid., p. 2.

- since there are some circumstances in which interest payments are paid but the tax shield cannot be used, a higher discount rate should be found which could reflect the higher uncertainty of the tax shield
- others believe that an even higher discount rate which is none other than the unlevered cost of equity by assuming interest payments and tax shields to be as risky as the cash flows

In the end, Luehrman says that it will follow the most common approach by using a discount rate higher than the average cost of debt and lower than the unlevered cost of equity[109].
After computing the VTS, we add it to the unlevered value of the firm, and we obtain the acquisition target's intrinsic value. In this numerical example, since the minimum acceptable offer price (in this case it is equal to the company's book value) is lower than the result provided by the APV, we can then conclude that the potential buyer would increase his investor's wealth by the difference of the two amounts. Another reason why the APV is a better valuation approach is provided by the fact that the base-case cash flow forecasts can be divided into separate cash flows associated with the buyer's value creation proposals. The base-line cash flows come from the current operating results and together with the various incremental initiatives give us the base-case value (the unlevered value of the firm)[110]. Two main limitations can be found when it comes to apply APV (without considering the difficulties arising from the technicalities):

- stocks taxation may be different (compared to bonds) when the investors must pay their own taxes and, because of that, there would be the risk of overestimating the tax shield benefits in terms of corporate borrowing
- most of the time costs of financial distress are not considered, implying that the APV value obtained has been overestimated.

Despite these problems, Luehrman highlights that «the most common formulations of WACC suffer from all these limitations and more»[111].

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[109] Luehrman, T. (1997) 'Using APV: A Better Tool for Valuing Operations', *Harvard Business Review*, p. 9.

[110] Ibid., p. 11.

[111] Ibid., p. 14.

3.3 Constant Leverage Policy

3.3.1 Constant Market Leverage Policy

In this section the constant market leverage policy will be analyzed, more specifically, the authors that will be covered are Miles & Ezzel and Harris & Pringle.

3.3.1.1 Miles & Ezzel: a comparison between WACC and APV

Managers, to make choices that maximize the value of the company, necessarily must use a model that allows them to correctly assess and estimate the market value of the company or a possible project. James Miles and John Ezzel (hereinafter they may be referred to as ME) also emphasize that a capital budgeting model should not only consider the effects of the investment decision but also the effects of how the financing of the operation occur and how the two decisions influence each other.
The problem addressed by Modigliani and Miller had by then captured the interest of many, and numerous other interpretations and modifications of the valuation model they had created were developed. The approach presented by Myers, the Adjusted Present Value, was also the subject of the analysis by experts and scholars in the field because it was then recognized as a general extension of MM's model.
In two of their papers Miles and Ezzel analyze, from a business valuation perspective, how and under which assumptions the two approaches work, then focusing on the choices concerning the valuation of the tax shield[112]. It is universally acknowledged, in fact, that under the assumption of perfect capital markets the market value of the firm is given by the sum of two components: the present value of the unlevered cash flows and the present value of the tax shields, respectively discounted at the rate expressing the cost of capital on account of riskiness. Thus, one part captures the effect of the investment decision and the other the financial effect. ME use the theories developed by MM, also focusing on the analysis and evaluation of the tax shield, as a representative element of the financial effects of a management decision, but in the first paper (1980) a preference emerges (in contrast to what had been proposed in the APV) for the use of a single discounted present value calculation at a rate that thus reflects both the investment and financing decision.

[112] Miles, J. A. and Ezzel, J. R. (1980) 'The Weighted Average Cost of Capital, Perfect Capital Markets, and Project Life: A Clarification', *The Journal of Financial and Quantitative Analysis,* 15 (3), pp. 719-730 and Miles, J. A. and Ezzel, J. R. (1983) 'Capital Project Analysis and The Debt Transaction Plan', *The Journal of Financial Research,* 6 (1), pp. 25-31.

However, it seems that this approach was also popular in normal capital budgeting, which in practice consisted of discounting future unlevered cash flows at the weighted average cost of capital. The WACC had become very popular mainly due to its simplicity; in fact, by grouping aspects of the valuation of a project or business into a single rate, it lent itself to use even by less experienced managers[113]; the WACC, then, thanks to its simplicity of application, lent itself to being used in projects where the riskiness is the same as that of the existing business or where a company has a risk that may fall within the average market risk; finally, observing directly firms that had a financial structure composed only of equity was somewhat complicated, if not impossible in some cases.

The approach, however, (in the years when ME wrote their article) was receiving much controversy, especially concerning its validity in the case of projects of a certain duration. It had in fact only proved to be correct for two valuation cases: one-year cash flows or perpetual cash flows. The two authors, on the other hand, want to demonstrate the validity of the application of the WACC also in the case of non-regular and finite cash flows in a context of perfect capital markets. If the unlevered cost of capital, the cost of debt, the tax rate and the market value leverage ratio are assumed constant, then the value of the levered firm can be obtained by discounting the unlevered cash flows at the WACC. The application takes place regardless of the trend of the flows and the duration of the analysis, thus demonstrating that the WACC approach is a special case of the results obtained by Modigliani and Miller and Myers' APV. In the model they presented, the financing decision is of key importance since the Debt-to-Value ratio is assumed to be constant. Since the trend and duration of the flows is no longer a critical aspect, what involves a certain degree of risk is the choice of investment type and the effect of the tax shield. The impact, in fact, is not known in advance, as keeping the Debt-to-Value ratio constant means adjusting the debt level every time changes altering the ratio occur. Thus, since the exact amount of debt is unknown, the amount of the tax shield is also unknown. The objective of the two authors in their paper written in 1980 is to establish the correct link between the riskiness of the investment (embedded in the unlevered cost of capital) and the riskiness of future tax savings under the assumption that the Debt-to-Value ratio is constant, to attest the validity of using the WACC.

[113] Miles, J. A. and Ezzel, J. R. (1980) 'The Weighted Average Cost of Capital, Perfect Capital Markets, and Project Life: A Clarification', *The Journal of Financial and Quantitative Analysis*, 15 (3), pp. 719-730.

The assumptions made in the model are as follows[114]:

- Perfect capital markets – the levered value of the cash flows is equal to the sum of the unlevered cash flows and the market value of the tax shields
  The value of the tax shield is expressed by the following formula:

$$V_k^L = \sum_{i=k+1}^{T} \frac{\bar{X}_i}{\underset{j=k+1}{\overset{i}{\pi}} (1+d_{ij}^u)} + \sum_{i=k+1}^{T} \frac{\tau r B_{i-1}}{\underset{j=k+1}{\overset{i}{\pi}} (1+d_{ij}^\tau)}$$

$where\ 0 \leq k\ \leq j\ \leq i\ \leq T$
$k =\ the\ point\ in\ time\ at\ which\ market\ value\ is\ realized$
$i = the\ point\ in\ time\ following\ k\ at\ which\ cash\ flows\ are\ realized$
$with\ j = k+1 = the\ period\ between\ k\ and\ each\ i$
$\bar{X}_i = expected\ unlevered\ cash\ flow\ at\ time\ i$
$B_{i-1} = outstanding\ debt\ at\ time\ i-1$
$r = the\ cost\ of\ debt$
$\tau = the\ firm's\ income\ tax\ rate$
$d_{ij}^u = the\ appropriate\ discount\ rate\ for\ the\ unlevered\ cash\ flows$
$d_{ij}^\tau = the\ appropriate\ discount\ rate\ for\ the\ expected\ tax\ savings$

- Constant market leverage ratio (hereinafter it may be referred to as L)
- The appropriate discount rate for the interest tax shields to be used is the cost of debt

ME's objective through their analysis is to find a discount rate which allows to obtain the levered market value V_L by discounting the unlevered cash flows at just one rate which could represent the whole risk of the project. The formula that must be satisfied is the following one:

$$V_0^L = \sum_{i=1}^{T} \frac{\bar{X}_i}{\underset{j=1}{\overset{i}{\pi}} (1+\rho_{ij}^*)}$$

$$\rho_j^* = composite\ set\ of\ rates$$

ME have demonstrated that in the case of constant leverage, such rate is equal to the WACC.

[114] Miles, J. A. and Ezzel, J. R. (1980) 'The Weighted Average Cost of Capital, Perfect Capital Markets, and Project Life: A Clarification', *The Journal of Financial and Quantitative Analysis*, 15 (3), p. 722.

The model assumes a constant debt ratio, which occurs through the adjustment of the amount of debt in each period. The assumption is easily supported in the case where the project life is one year long, but for all cash flows longer than that, it is reasonable to assume that changes in market values may force the management to carefully rebalance the debt-to-equity ratios through appropriate financial transactions. The elaboration of their thoughts thus leads to the argument that the failure of the literature in realizing correct valuations for finite and irregular cash flows with the WACC approach is not an issue related to the duration of the project, but rather to the possibility of varying the leverage ratio.

The choice between the WACC and the APV approach in the case of capital budgeting analysis may depend, for instance, on the debt repayment schedule or the leverage ratio[115]. Under the assumption of perfect capital markets, the APV model is neutral with respect to the financing policy of the company but requires the explicit evaluation of tax benefits. The WACC approach, on the other hand, is seen as a special case of the general Myers model when the level of debt is exogenous, and the firm can estimate the tax benefits implicitly by discounting the unlevered cash flows at the WACC rate. Nevertheless, the approach assumes a constant leverage ratio and any other financing policy will lead the leverage ratio not to be constant except by pure chance. Due to the fact that the cost of equity is a function of the year's leverage, without knowing the leverage in advance the COE estimation would be impossible and the leverage ratio cannot be computed if we do not know the levered market value (which is ME's objective of the analysis). As a consequence of that, unless we are provided with the leverage ratio and the cost of equity, the textbook WACC is not the proper discount rate to be used in the capital budgeting analyses. In the end, Miles & Ezzel state that whenever the debt transaction schedule is exogenous (and not the Debt-to-Value ratio), then the general MM-APV approach should be adopted.

Miles & Ezzel later re-addressed the topic of valuation and estimation of the benefit of the tax shield in a subsequent paper in 1983[116] where the conflict between WACC and APV is discussed. In general, the two approaches lead to different valuation results, as it was apparent from both Myers' work and ME's paper written in 1980. The relevant element, which emerged from the earlier analysis of the two scholars, was that the two methods had the same basic assumptions regarding the value of the unlevered cash flows. Since the present value of the levered cash flows is the sum of the present value of the unlevered cash flows and the present value of the tax shields, it follows that the substantial difference between the two models lies in the different considerations regarding the valuation of the

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[115] Miles, J. A. and Ezzel, J. R. (1980) 'The Weighted Average Cost of Capital, Perfect Capital Markets, and Project Life: A Clarification', *The Journal of Financial and Quantitative Analysis*, 15 (3), p. 728.

[116] Miles, J. A. and Ezzel, J. R. (1983) 'Capital Project Analysis and The Debt Transaction Plan', *The Journal of Financial Research*, 6 (1), pp. 25-31.

present value of the tax shield. The key factor determining the changes in the tax shield are the decisions relevant to the financial structure of the company to be valued. ME had already shown that in the WACC approach it was necessary to rebalance the amount of debt appropriately in order to keep the leverage ratio constant in terms of market value. For the APV model, on the other hand, it is necessary to know the future debt levels in order to express valuations that are as correct as possible. Since using one requires to keep the debt-to-value ratio constant while the other to know exactly the amount of future debt, the choice of one model excludes the other. It follows that any choice of the method to be applied will be conditioned by the company's financial management policies. Regarding the WACC approach, the content of the previous article is reconfirmed. The levered market value of the firm is obtained by summing the market value of the debt and equity or by discounting the unlevered future cash flows at the WACC.

Miles & Ezzel develop new interpretations of the APV model with respect to how it was originally presented, assuming that the formula is modified by substituting the discount rate of the tax shield. The two scholars propose to exchange the discount rate R_d (Cost of Debt) with R_u (Cost of Unlevered Capital). The choice would in fact depend on the riskiness associated with the tax shields generated by deductibility of interests on debt. If we assume to know with certainty all future movements of the debt and thus also the exact amount of the value of the tax shield, we can reasonably discount the latter at the cost of debt since the riskiness of the debt and the tax shield is the same.

While the APV assumes that the level of debt is predetermined and never changed over the time span of the valuation, ME, on the other hand, consider the existence of the constant leverage ratio, therefore, the exact level of debt is only known in the first period while in subsequent periods it can be increased or decreased, in order to keep the debt-to-value ratio constant, depending on the market value assumed by the company. Through these considerations, it can be deduced that the future level of debt depends on the levered market value of the company and consequently the riskiness of debt is assimilated to the riskiness of the operating activity, reflected in the unlevered discount rate (R_u). Since the tax shield by its nature undergoes the same influence as debt, it should also be discounted at R_u. The point in fact is that when the firm maintains a constant leverage ratio in terms of market values, the discount rate that equals the present value of the unlevered cash flow to its levered market value is constant each period. The standard APV approach fails to result in a constant weighted average discount rate because it does not assume that the company's financial plan maintains a constant leverage ratio in terms of market values. The paper also outlines the source of the conflict between the two approaches. Both methods make the same assumptions for the valuation of the unlevered component of a project's cash flows but define different assumptions for the valuation of the tax shield. According to the APV approach, the latter should be discounted at the cost of debt. The approach outlined by ME, on the contrary, discounts the tax shield in the initial period at the cost

of debt, while in the remaining periods it uses the risk-adjusted rate of the unlevered cost of capital, depending on the riskiness associated with the different components. Underlying these two assumptions on the discount rate there are management's decisions on the financing policy the company intends to adopt.
In the end, it should be clarified that, as it is for Myers' model, both ME's and HP's equations hold in the case of uneven cash flows streams and perpetuities.

In another paper published in 1985[117] the two authors provide us with their relation between the levered and unlevered beta underlying the differences between their formula and the one developed by Hamada in 1972 (see equation in chapter I). On one hand Hamada assumed the debt to be constant over time (and he also assumed MM to be true and beta debt to be equal to zero), while ME assume a constant leverage ratio.

By assuming debt beta to be equal to zero, ME's relation between levered beta and unlevered beta can be represented in the following formula:

$$\beta_u = \beta_e \left[\frac{1 - L}{1 - \frac{\tau r L}{1 + r}} \right]$$

$$L = leverage\ ratio$$

3.3.1.2 Harris & Pringle: a new way of valuing VTS

Harris & Pringle in their 1985 paper deal with risk adjusted discount rates, where starting from the standard model of the WACC, they try to find a general model to develop risk adjusted rates[118].
One of the major limitations of the WACC is its applicability only to projects with an average risk or at least very similar to the riskiness of the activities of the company being evaluated. Therefore, its inadequacy to deal with valuations for projects with high volatility has led to the search for alternative ways of including risk in discount rates. We have already seen the models of Miles & Ezzel and Myers' APV, which have made an important contribution to the literature on the subject.

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117 Miles, J. A. and Ezzel, J. R. (1985) 'Reformulating Tax Shield Valuation: A Note', *The Journal of Finance*, 40 (5), pp. 1485-1492.

118 Harris, R. S. and Pringle, J. J. (1985) 'Risk-Adjusted Discount Rates – Extension from the Average Risk Case', *The Journal of Financial Research*, 8 (3), pp. 237-244.

The approach developed by Harris & Pringle to deal with projects and analyses with very different risks aims to develop a clear model that, starting from the WACC, comes to define a general case of interest rates varying with the risk.

Starting from the well-known WACC formula, we can obtain the following equation:

$$WACC = \left(\frac{E}{V}K_e + \frac{D}{V} * K_d\right) - t_c k_d \frac{D}{V}$$

The first part of the equation is weighted average reflecting the returns required by the shareholders and debt holders, while the second part is the interest tax shield. The simplicity of such representation also allows to give a financial interpretation of the two parts of the equation:

- the first part can be seen as the rate required to compensate the operational risk coming from the firm's business (it none other than the unlevered cost of capital); investors who owns debt and equity in the very same proportion the firm does, they will eventually obtain R_u. The two authors underline that the effects of the financial leverage are eliminated, and R_u represents the return rate of the unlevered cash flows, thus capturing the operational effect only (and not the financial one)
- the second part of the equation is the financial benefit of the tax shield

Because of that, the WACC can be written as:

$$WACC = R_u - t_c R_d \frac{D}{V}$$

The disadvantage of this representation is that it does not explicitly show, as in the case with many other approaches, what the optimal level of debt is. What emerges is that for the same R_u, as the debt increases, the WACC decreases, but it is not shown explicitly how the cost of debt and financial benefits offset each other. The basic assumptions always include the requirement of a constant leverage ratio. Furthermore, the effects of excessive borrowing are not taken into account in any way; on the contrary, from the previous formula it appears to be a source of benefits only. This view is clearly (as it has already been shown in the previous sections of this chapter) not reasonable given the negative effects of excessive debt in the real world. An increase in debt, in fact, increases the risks for the shareholders who, for this reason, should ask for higher returns (R_e), consequently R_u should rise, thus undermining the interpretation that sees it as the discount rate for unlevered cash flows.

Although there may be some disadvantages (e.g. knowing R_u and the financing policy of the project since the beginning), the previously mentioned formula can also have a practical usage. Indeed, if we ever needed to value a new project j which differs from the average risk of the firm's business, then the formula could be written in the following way:

$$R_j = R_{ju} - t_c k_d \frac{D_j}{V_j}$$

The formula therefore fits the assumptions about riskiness and any other decisions concerning the project. Applying this procedure results in a WACC specific to project j. The model follows ME's logic but uses the R_u rate to discount the tax shield from the first period.

3.3.2 Constant Interest Coverage Policy

In this paragraph a different target leverage policy will be briefly discussed: the Constant Interest Coverage policy. Such policy implies that the firm sets its interest payments as a target fraction (k) of its FCFs[119]:

$$Interest\ paid\ in\ Year\ t = k * FCF_t$$

When it comes to implementing the APV, the present value of the tax shield should be discounted at the unlevered cost of capital (R_u) since, as it can be seen, the interest payments are as risky as firm's cash flows are. Since the present value of the FCFs discounted at R_u is the unlevered value of the firm, then:

$$PV(ITS) = PV(\tau_c k * FCF) = \tau_c k * PV(FCF) = \tau_c k * V^U$$

And the firm's levered value with such debt policy becomes:

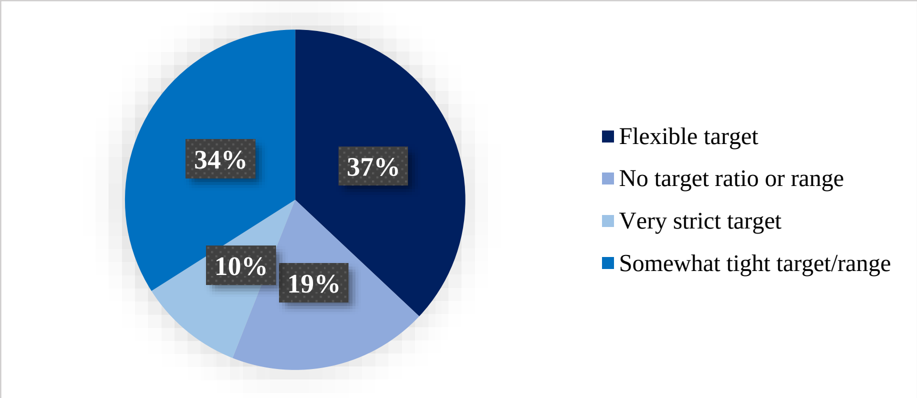
$$V^L = V^U + PV(ITS) = V^U + \tau_c k * V^U = (1 + \tau_c k) * V^U$$

[119] Berk, J. and DeMarzo, P. (2016) *Corporate Finance*. 4th edn. United Kingdom: Pearson Education, p. 692.

To properly conclude this paragraph, it is interesting to look at the data gathered by J. R. Graham and C. Harvey in 2001 concerning the most used firms' leverage policies[120].

As it can also be summarized from the pie chart below, the two authors' own words on their gathered data say that «we asked directly whether firms have and optimal or "target" debt-equity ratio. Nineteen percent of the firms do not have a target debt ratio or target range. Another 37% have a flexible target, and 34% have a somewhat tight target or range. The remaining 10% have a strict target debt ratio. These overall numbers provide mixed support for the notion that companies trade off costs and benefits to derive an optimal debt ratio»[121].

Figure 3.4 - Interviewed firms' debt policies



Source: Own construction based on Graham, J. R. and Harvey, C. R. (2001) 'The Theory and Practice of Corporate Finance: Evidence from the Field', *Journal of Financial Economics*, p. 218.

3.4 Other Theories making different assumptions

In this last section of chapter III, different theories and views will be analyzed; the most relevant for the purpose of our case study is the one proposed by Professor Fernández.

3.4.1 Ruback: Compressed Adjusted Present Value

An alternative model for evaluating risky cash flows has also been proposed by Ruback. The criterion was called the Capital Cash Flows (CCF, also known as CAPV standing for the Compressed Adjusted Present Value) and involves putting together all the cash flows available to capital providers including those given by the tax shield. The latter in fact decreases taxable income, the amount of taxation and consequently increases the after-tax cash flows. In other words, CCFs are equal to FCFs plus the tax

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120 Graham, J. R. and Harvey, C. R. (2001) 'The Theory and Practice of Corporate Finance: Evidence from the Field', *Journal of Financial Economics*, pp. 187-243.

121 Ibid., p. 211.

benefits deriving from interest payments. Since the benefit is included in the cash flows, the appropriate discount rate depends on the riskiness of the firm's assets[122].

The two approaches are, therefore, algebraically equivalent and use the same assumptions but treat the tax shield differently. The great advantage of the CCF lies on its simplicity. If a certain future amount of debt is expected or if the capital structure changes over time, the CAPV[123] method is much easier to use because the tax shields on interests are included in the cash flow. The expected return on the firm's assets, moreover, depends on the business risk, which does not change with changes in the financial structure of the capital. This implies that the cost of capital does not have to be re-estimated every period, contrary to the WACC. The CCF method can be used to value cash flows that present some risk including the tax shield into the cash flows or within the discount rate.

Debt is proportional to the firm value, so the higher the value of the company, the higher will be the debt used in the financial structure. Consequently, the greater the debt, the greater the tax benefit will be. Ruback, even if the debt is riskless, argues that riskiness of the tax shield is equal to business risk provided the leverage ratio is constant. The model discounts CCFs at R_u, which expresses the operational risk. CCFs include all cash flows that are paid or could be paid to any capital provider, so they measure all the after-tax income generated by the assets. The present value of these cash flows is equal to the enterprise value. The appropriate discount rate, instead, is a pre-tax rate because the tax benefits are included in the flows. The pre-tax rate should correspond to the riskiness of the CCFs.

Such discount rate is none other than the pre-tax WACC:

$$Pre - tax\ WACC = \frac{D}{V} * R_d + \frac{E}{V} * R_e$$

[122] Ruback, R. S. (2002) 'Capital Cash Flows: A Simple Approach to Valuing Risky Cash Flows', *Financial Management*, 31 (2), pp. 85-103 and Kaplan, S. N. and Ruback, R. S. (1995) 'The Valuation of Cash Flow Forecasts: An Empirical Analysis', *The Journal of Finance*, 50 (4), pp. 1059-1093.

[123] It was called CAPV by Myers himself because the APV is the same as the CCF when ITS are discounted at the unlevered cost of equity

Such formula could further be simplified by considering COD and COE separately following the CAPM logic:

$$R_d = R_f + \beta_d * R_P \tag{3.9}$$

$$R_e = R_f + \beta_e * R_P$$

$$R_f = risk - free\ rate;\ \beta_e = Equity\ beta;\ \beta_d = Debt\ beta$$

If we substitute these formulas in the pre-tax WACC formula, after some adjustments we obtain:

$$Pre - tax\ WACC = R_f + \left(\frac{D}{V} * \beta_d + \frac{E}{V} * \beta_e\right) * R_P$$

As it can be spotted, the part of the equation in the parentheses is none other than the unlevered beta (β_U). By substituting the unlevered beta symbol in the pre-tax WACC (which is our R_u), we obtain:

$$R_u = Pre - tax\ WACC = R_f + \beta_U * R_P$$

We have thus obtained a discount rate that does not depend on the structure of debt and equity, but only on the operational risk of the company's assets (business risk), the market risk premium and the risk-free rate. Since both the equity risk premium and the risk-free rate can be easily observed in the market, it is only necessary to estimate the asset beta. The author has shown that the method is equivalent to the FCF method since they have the same basic assumptions and provide identical results if applied correctly using the same information and assumptions. The choice between the two methods, therefore, is motivated by the ease of use that depends on the complexity of application of the method and the probability of making errors.

Sometimes, especially depending on cash flow projections, it is easier to use the FCF method than the CCF; the former is more suitable for simple valuation exercises where cash flows do not include the interest tax shields and the financing strategy is constructed according to specific ratios; the latter is more convenient when the cash flow projections include detailed information on the financing plan. In addition, the CCF model also has similarities with Myers' APV; the key difference between the two is that the CCF discounts the tax shield at R_u, while the APV uses R_d; this results in a higher value than Ruback's method because it treats the tax shield as less risky than the company. However, it should be said that Ruback underlines the importance of debt policy when computing the ITS, indeed he states that in the case of a fixed amount of debt, then the cost of debt should be used as discount rate when it comes to computing the ITS.

3.4.2 Fernández's unique contribution to valuation

In this part of the III chapter, we are going to see Professor Fernández's unique contribution to corporate finance by observing his considerations which led him to compute the value of the tax shields is an alternative way compared to the existing theories on the matter. Then, his response to several criticisms moved by other economists will be seen, where he demonstrates the accuracy of his results. Moreover, his considerations about why the Adjusted Present Value is the most practical valuation approach and why firms should purse a constant book leverage policy will be discussed. In the end Fernández's views on the tax shields will be compared to other economists' theories by applying the same four valuation methods: the adjusted present value, the equity cash flow, the free cash flow, and the capital cash flow. Fernández will demonstrate that, if computed correctly (iteration is done properly) then the different valuation methods will provide the same result for each author. The difference in value is only the result of the different assumptions and considerations put forward by the various economists (whose opinions differ when it comes to computing the VTS).

3.4.2.1 The Value of Tax Shields is NOT equal to the Present Value of Tax Shields

Among the most recent works Pablo Fernández's papers can be found. Many of them, presenting interesting interpretations, focus on the study of the value of the tax shield and company valuation methods. The general lack of consensus as to what the value of the tax shield is, exists because all studies have focused on finding what the correct present value of the tax shield is. In 2002, Fernández wrote a paper "The value of the tax shields is not equal to the present value of the tax shields" where he showed that the increase in the value of the firm generated by debt is not the present value of the tax shield on interest payments[124]. The increase in value would, indeed, be determined by the difference between the present value of two different cash flows: taxes for the unlevered firm and taxes for the levered firm.

[124] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), pp. 145-165.

Accepting this new interpretation makes it more difficult to understand the riskiness of the tax shield since its value depends on two different cash flows, in a world without leverage costs, it is equal to the product of the of the tax rate and the amount of current debt.

The result is the same as Modigliani & Miller, but the way Fernández has obtained it is completely different. The following shows the procedure followed by the author.

The value of a levered company is given by the sum of the market value of debt (D) and equity (E), but it has been shown that it can also be calculated by summing the value of the company as if it were financed entirely through equity and the value of the tax shield:

$$V_L = E + D = V_U + VTS \tag{3.10}$$

By assuming that there are no other costs in the market, the formula could be written as follows:

$$V_U + G_U = E + D + G_L + Leverage\ Cost > E + D + G_L \tag{3.11}$$

Where G_u is the unlevered firm's present value of the taxes, while G_L represents the levered firm's present value of taxes. The equation clearly shows that the value of the firm entirely financed by equity is equal to the value of the levered firm. It has been stated, though, that the value can also be computed by summing the value of the unlevered firm and the value of the tax shield, therefore, by adjusting the two formulas the VTS can be written as follows[125]:

$$VTS = G_U - G_L$$

This is exactly, as repeatedly stated, the difference between the present value of the taxes paid by the unlevered firm and the present value of the taxes paid by the levered firm. If we assume perpetual cash flows, then the levered firm's profit after-tax (PAT_L) is equal to the Equity Cash Flow (ECF):

$$PAT_L = ECF$$

In the case of perpetuity, «the allowed depreciation deduction is exactly equal to the cash spent to replace capital equipment that wears out»[126].

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[125] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), p. 147.

[126] Ibid.

The FCF equals the unlevered firm's profit before taxes times one minus the effective tax rate:

$$FCF = PBT_u * (1 - T)$$

And in the case the company had to pay no taxes, then the equation would simplify and become (with FCF_0 representing the firm's free cash flow in the absence of taxes):

$$FCF_0 = PBT_u$$

The relation between the two different cash flows is then:

$$FCF = FCF_0 * (1 - T)$$

The unlevered firm' taxes are represented by the following equation[127]:

$$Taxes_U = T\ PBT_u = T\ FCF_0 = \frac{T\ FCF}{(1 - T)}$$

K_{TU} is the unlevered firm's required return to tax and K_{TL} is the levered firm's required return to tax. The unlevered firm pays an amount in taxes that is proportional to FCF_0 and FCF. Because of that, the unlevered firm's taxes are as risky as FCF_0 and FCF, thus the unlevered cost of equity (K_u) should be used. Only in the case of perpetuities, the unlevered firm's required return to tax (K_{TU}) is equal to the required return of unlevered equity (K_u).

$$K_{TU} = K_u$$

We know that the present value of the yearly paid taxes ($Taxes_U$) is the present value of the taxes paid by the unlevered firm (G_U) discounted at K_u. Since we also know that V_u = FCF / K_u, then:

$$G_u = \frac{Taxes_U}{K_{TU}} = \frac{T\ FCF}{[(1-T)K_u]} = \frac{T\ V_u}{(1-T)} \qquad (3.12)$$

[127] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), p. 148.

As for the levered firm (since we know that the profit after tax of the levered firm equals the ECF), the yearly paid taxes ($Taxes_L$) are proportional to the ECF:

$$Taxes_L = TPBT_L = \frac{TPAT_L}{(1-T)} = \frac{T\ ECF}{(1-T)}$$

PBT_L and PAT_L represent the levered firm's profit before taxes and after taxes respectively. Following the same logic applied to the unlevered firm, we can say that since $Taxes_L$ are proportional to ECF, they should be discounted at the same rate (K_e, the cost of levered equity). Once again, in the case of perpetuities only, the tax risk is equal to the risk of ECF and the required return to tax in the levered firm (K_{TL}) is equal to K_e:

$$K_{TL} = K_e$$

As it has been shown, if we subtract the taxes from the PBT we obtain the PAT; thus, the present value of taxes paid by the levered firm is equal:

$$G_L = \frac{Taxes_L}{K_{TL}} = \frac{T\ ECF}{[(1-T)K_e]} = \frac{T\ E}{(1-T)} \qquad (3.13)$$

As it can be figured, the increase in the firm's value is not given by the present value of the interest tax shields, but by the difference between the present value of taxes paid by the unlevered firm and the present value of the taxes paid by the levered firm.

$$VTS = G_u - G_L = \left[\frac{T}{(1-T)}\right] * (V_u - E)$$

This is because

$$V_u - E = D - VTS$$

Then we have[128]

$$VTS = DT$$

[128] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), p. 149.

Such result had already been obtained by many other economists before, however, Fernández's process is entirely new. Multiple authors who arrived at the same conclusions claim that the VTS should be computed by multiplying DT by the cost of borrowing and such cost would be also the discount rate to be applied. As we have seen in the previous paragraphs, MM would use the risk-free rate (R_f), while Myers believes it should be the cost of debt (K_d).
The previous equation could be written as:

$$VTS = PV[K_u; Taxes_U] - PV[K_e; Taxes_L]$$

Such difference is equal to the interest tax shield:

$$Taxes_U - Taxes_L = DK_dT$$

In the specific case of perpetuities, K_d can be claimed to be the risk of such difference. As a matter of fact:

$$\frac{DK_dT}{K_d} = DT$$

However, it must be stated that as far as growing companies are concerned, the risk of the ITS is neither K_d nor K_u as will be later shown.
After explaining his considerations in the case of perpetuities, Fernández derives the relation between K_u and K_e[129]:

$$K_e = K_u + \frac{D}{E}(K_u - K_d)(1 - T)$$

Which could be also written in terms of systematic risk:

$$K_e = R_f + \beta_L P_M$$
$$K_u = R_f + \beta_u P_M$$
$$K_d = R_f + \beta_d P_M$$

[129] Fernández, P. (2004) 'The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 73 (1), pp. 149, 150.

Because of that, we can write the relation between the unlevered beta and the levered beta as follows:

$$\beta_L = \beta_u + \frac{D}{E}(\beta_u - \beta_d)(1 - T)$$

In the end, Fernández derives the formula to be applied in the case of growing perpetuities[130]:

$$VTS = G_u - G_L = \left[\frac{Taxes_U}{K_{TU} - g}\right] - \left[\frac{Taxes_L}{K_{TL} - g}\right] \quad (3.14)$$

$$VTS = \frac{DTK_u}{(K_u - g)}$$

The VTS is not the present value of the ITS, but the difference between two different present values with different risks each. «The appropriate way to do an adjusted present value analysis with a growing perpetuity is to calculate the VTS as the present value of DTK_u (not the interest tax shield) discounted at the unlevered cost of equity (K_u) »[131]:

$$VTS = PV[K_u; DTK_u] \quad (3.15)$$

As it has been already stated, there is a vast financial literature on this topic and all the other authors have one thing in common: they all believe that the VTS is the presented value of the ITS discounted at the appropriate rate (such rate changes according to the theory we are applying). Fernández has, instead, provided us with an alternative method and shows how all other theories are incorrect because they either produce inconsistent valuations of the tax shield or inconsistent relation between the cost of capital of the unlevered and levered company. MM’s conclusions about the tax shield are the same as Fernández’s, but they arrive at the same result following a different path and they believe the cost of debt to be equal to the risk-free rate and this implies that:

$$VTS = PV\left[R_f; DTR_f\right] \quad (3.16)$$

MM’s formula only works in the case of perpetuities, but it is not correct in the case of growing perpetuities. MM assume the cost of bankruptcy to be equal to zero.

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[130] Fernández, P. (2004) ‘The Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields’, *Journal of Financial Economics*, 73 (1), p. 151.

[131] Ibid.

Myers' APV approach, assuming the tax savings to be as risky as the debt is, requires the VTS to be computed in the following way:

$$VTS = PV[K_d; DTK_d] \tag{3.17}$$

Such approach has also been shared by Luehrman in 1997 (more specifically, he mentioned the two most used approaches consisted in either using K_d or K_u as discount rates, this is way he applied a discount rate in between the two of them in his numerical example).

In 1985 Harris & Pringle suggest discounting the interest tax shield at the unlevered cost of equity (K_u), they assumed that ITS are as risky as the firm's cash flows are:

$$VTS = PV[K_u; DK_dT] \tag{3.18}$$

Harris & Pringle's conclusions have been reached by many other authors among whom Ruback can be found. Ruback's peculiarity consists in the introduction of the Capital Cash Flow[132] which is the one measure that must be discounted at K_u which, according to Ruback, can be computed as the pre-tax WACC (he assumed a constant debt-to-value ratio indeed).

His assumptions lead Ruback's results to be equal to the one advanced by Harris & Pringle because:

$$E + D = PV[K_u; CCF] = PV[K_u; FCF] + PV[K_u; DK_dT] \tag{3.19}$$
$$= V_u + PV[K_u; DK_dT]$$

Many economists support the idea that the VTS should be computed according to a firm's debt policy: a firm that has a predetermined amount of debt must be valued differently from a firm targeting a constant leverage ratio. Miles & Ezzel believe that firms targeting a constant market leverage ratio should discount the tax shield at the cost of debt the first year and the cost of unlevered equity for the following years. The VTS can be represented by the following formula:

$$VTS = PV[K_u; DTK_d](1 + K_u)/(1 + K_d) \tag{3.20}$$

[132] CCF = ECF + DCF = FCF + ITS; DCF = Interests - ΔD; ITS = $Interests_{t1}$*D_{t0}*Tax rate; ΔD = $Debt_{t1}$ – $Debt_{t0}$.

Inselbag and Kaufold[133] and Ruback say that if the company targets the dollar values of debt outstanding, then the VTS should be computed according to Myers' formula, while if it targets a constant debt-to-value ratio, ME should be applied. In the end, Taggart[134] thinks that ME should be used in the case the firm decided to rebalance its debt-to-value ratio every year, while HP should be adopted if the company constantly rebalances its debt-to-value ratio.

In a previous version of "Damodaran on Valuation" published in 1994 Damodaran, assuming that all the company's risk is borne by the shareholders (thus implying a debt beta = 0), provided us with the following relation between the unlevered and levered betas[135]:

$$\beta_L = \beta_u + \frac{D}{E}\beta_u(1-T)$$

In Fernández's opinion, sometimes it is appropriate to assume debt beta to be equal to zero, but at that point the cost of debt should be assumed to be risk-free (as it was assumed by MM). Such relation is used in many finance textbooks and adopted by several consultants and investment bankers with the objective of introducing the cost of leverage when it comes to valuing firms: given a certain unlevered beta, its levered beta will be higher, thus the COE will be higher implying a lower value of equity.

Fernández deduces the Damodaran's relation between K_e and K_u and how to compute the VTS:

$$K_e = K_u + \frac{D}{E}(1-T)(K_u - R_f) \tag{3.21}$$

$$VTS = PV\left[K_u; DTK_u - D(K_d - R_f)(1-T)\right] \tag{3.22}$$

Finally, another widespread way of computing the levered beta (especially by consultants and investment bankers) and the related VTS is the following:

$$\beta_L = \beta_u\left(1 + \frac{D}{E}\right) \tag{3.23}$$

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133 Inselbag, I. and Kaufold, H. (1997) 'Two DCF Approaches for Valuing Companies Under Alternative Financing Strategies (and How to Choose Between Them)', *Journal of Applied Corporate Finance*, 10 (1), pp. 114-122.

134 Taggart, R. A. (1991) 'Consistent Valuation and Cost of Capital Expressions with Corporate and Personal Taxes', *Financial Management*, 20 (3), pp. 8-20.

135 This is the well-known Hamada's equation (developed in 1972) that has already been mentioned in Chapter I; it can only be applied if the debt is constant, beta debt = 0 and the tax shield is as risky as debt is (thus implying ITS = TD).

$$VTS = PV\left[K_u; DTK_d - D(K_d - R_f\right] \tag{3.24}$$

Such approach is called the Practitioners' method by Fernández.

Because of the countless theories concerning the tax shield computation, according to Copeland et al. «the finance literature does not provide a clear answer about which discount rate for the tax benefit of interest is theoretically correct» and then they add «We leave it to the reader's judgment to decide which approach best fits his or her situation»[136].

In the end, Fernández, by providing numerical example, demonstrates that:

- in the case of perpetuity, only Modigliani & Miller, Myers and his own theory give the correct VTS which is equal to D*T, since all the other theories result in a VTS that is too low
- in the case of growing perpetuity MM and Myers provide us with VTS that is too high (even higher than the debt value itself) and consequently an equity value that is too high compared to the correct value obtained by Fernández; moreover, MM and Myers methods conclude that the levered beta is lower than the unlevered beta which is not plausible

Fernández's work was instantly criticized in a paper by Cooper and Nyborg[137]written in 2004 and by Wonder et al.[138] to whom the professor answered in two different papers.
In the paper answering to Cooper and Nyborg Fernández[139] proves that the results he obtained in 2004 are correct in many scenarios; he then shows the mistakes made in the formulas proposed by Cooper and Nyborg, since they attribute to ME formulas that were developed by Harris & Pringle and Ruback. Furthermore, some of their formulas only work in the case of perpetuities and not in the case of growth. Finally, he shows that the value of the tax shield depends only upon the nature of the stochastic process of the net increase of debt.

[136] Copeland, T. E., Koller, T., Murrin, J. (2000) *Valuation: Measuring and Managing the Value of Companies*. 3rd edn. Wiley, New York, p. 482.

[137] Cooper, I. A. and Nyborg, K. G. (2006) 'The Value of Tax Shield IS Equal to the Present Value of Tax Shields', *Journal of Financial Economics*, 81 (1), pp. 215-225.

[138] Wonder, N. X., Tham, J. and Vélez-Pereja, I. (2003) 'Comment on the Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *Social Science Research Network (SSRN)*, pp. 1-30.

[139] Fernández, P. (2004) 'Reply to The Value of Tax Shields Is Equal to the Present Value of Tax Shields', *IESE Business School*, pp. 1-16.

In the paper answering to Wonder et al. Fernández[140] demonstrates how their results are wrong because of the multiple scenarios in which Fernández's formulas can be used. In both answering papers Fernández shows that, as it has already been stated in the introduction of this chapter, VTS only depends upon the nature of the stochastic increase of debt. Such statement can be represented (in a world with no leverage) by the following formula:

$$VTS_0 = T * D_0 + T * PV_0[\Delta D_t]$$

The only problem is the calculation of the present value of the increase of debt because of the appropriate discount rate needed. In another paper[141] Fernández corrects some of his previous formulas and confirms the previously mentioned formula as the general rule for the computation of VTS (of which DTK_u / (K_u - g) is a special case, as it will be later shown). He also adds that, as already mentioned in the introduction, VTS does not depend upon the stochastic process of the free cash flow.

Now different special scenarios whose VTS can be computed will be seen[142]:

- *Perpetual debt*

  As already seen in Fernández's first mentioned paper, in such case, being the $PV_0[\Delta D_t] = 0$,

$$VTS_0 = T * D_0$$

- *Debt of one-year maturity but perpetually rolled-over*

  As in the previous example $E\{D_t\} = D_0$, however, the debt is yearly rolled over and the discount rate that should be used for the existing debt is K_d and K_{ND} for the new debt, then the PV of obtaining new debt every year = D_0 / K_{ND} and the PV of the principal repayments at the end of every year = $D_0 (1+K_{ND}) / [(1+Kd) K_{ND}]$.

[140] Fernández, P. (2005) 'Reply to Comment on the Value of Tax Shields Is NOT Equal to the Present Value of Tax Shields', *The Quarterly Review of Economics and Finance,* 14 (1), pp. 188-192.

[141] Fernández, P. (2005) 'The Value of Tax Shields Is Not Equal to the Present Value of Tax Shields: A Correction', *IESE Business School*, pp. 1-8.

[142] Fernández, P. (2004) 'Reply to The Value of Tax Shields Is Equal to the Present Value of Tax Shields', *IESE Business School*, pp. 4-6.

Consequently, $PV_0[\Delta D_t] = -D_0(K_{ND} - K_d) / [(1+K_d) K_{ND}]$

In the case of $K_{ND} = K_d$, then $PV_0[\Delta D_t] = 0$ → this is common in the case of a constant perpetuity, which implies that, being the future amount of debt the same, the risk of the current debt and interest is the same as the risk of the repayment of debt and interest for the following year

- *Debt increases are as risky as the free cash flows*

In this circumstance the proper discount rate to be used is the cost of unlevered equity (Ku); in the case of a constant growing perpetuity then Fernández's formula is used

$PV_0[\Delta D_t] = g*D_0 / (K_u - g)$

$$VTS_0 = \frac{TK_uD_0}{(K_u - g)}$$

- *The company is expected to repay the current debt without issuing new debt*

In this scenario, as it can be deduced by the title, we are in the presence of negative ΔD_t and K_d is the appropriate discount rate. In such context, Myer's conditions are applied

$PV_0[\Delta D_t] = PV_0[E\{\Delta D_t\}; K_d]$

$VTS_0 = D_0*T + T*PV_0[E\{\Delta D_t\}; K_d]$

It is interesting to notice that in the case of perpetuities, the previously mentioned formula, the VTS formula in the case of debt increases as risky as cash flows and the MM's formula would provide the same result.

As far as a firm deciding to repay its debt without issuing new debt is concerned, then

$D_0 = PV_0[E\{D_{t-1}\} * K_d - E\{\Delta D_t\}; K_d]$ and by substituting this formula in the previously mentioned one we would obtain Myers' formula

$VTS_0 = PV_0[T*E\{D_{t-1}\} * K_d; K_d]$

$$VTS_0 = \frac{TD_{t-1}K_d}{K_d}$$

- *Debt is proportional to the Equity value*

Such assumption was proposed by Miles & Ezzel in 1980 and they believe that in the case of growing perpetuities, being $D_t = L * E_t$

$$VTS_0 = \frac{D_0 K_d T}{(K_u - g)} \frac{(1 + K_u)}{(1 + K_d)}$$

And if we substituted this formula in the general one proposed by Fernández[143] we would obtain

$$PV_0[\Delta D_t] = D_0 \frac{(K_d - K_u) + g(1 + K_d)}{(K_u - g)(1 + K_d)}$$

In the case g = 0, we can easily see how $PV_0[\Delta D_t] = D (K_d - K_u) / [K_u (1 + K_d)] < 0$
And if we compare $PV_0[\Delta D_t] = -D_0 (K_{ND} – K_d) / [(1+K_d) K_{ND}]$ with the previous expression, we can understand that $K_{ND} = K_u$.
$PV_0[\Delta D_t] = 0$ when $g = (K_u – K_d) / (1 + K_d)$ and it is negative for growth rates lower than that. In Fernández's opinion, not much economic significance can be found in such expression.

In addition to that, Fernández firmly believes that ME's debt policy is not a good one for and a constant book leverage policy should be followed for several reasons[144]:

- The firm following a fixed book-value leverage policy is more valuable than one following a fixed market-value leverage policy since VTS measured by Fernández is higher than VTS measured by ME
- Rating agencies rely on the book-based values when it comes produce ratings
- The amount of debt is not linked to the stock market
- The fixed book-value leverage policy is much easier to be implemented by non-listed firms and the empirical evidence clearly supports Fernández's debt policy

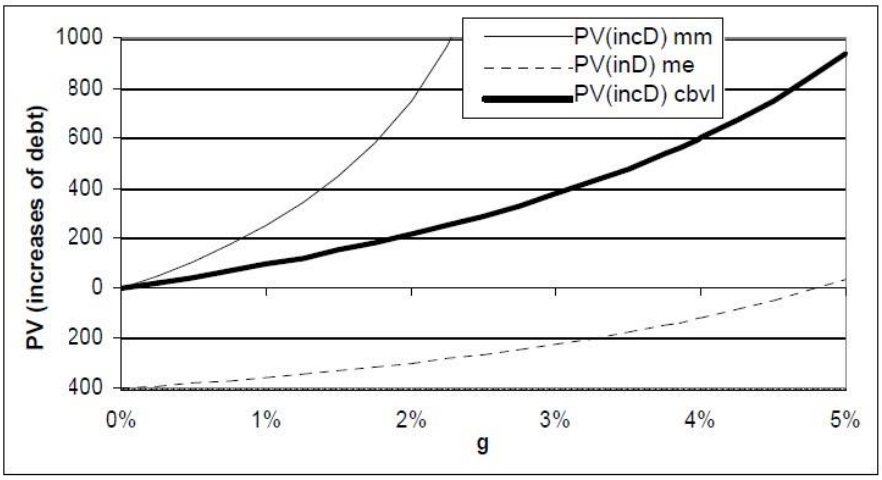
[143] $VTS_0 = T * D_0 + T * PV_0[\Delta D_t]$.

[144] Fernández, P. (2007) 'A More Realistic Valuation: APV and WACC with Constant Book Leverage Ratio', *IESE Business School – International Center for Financial Research*, p. 4.

Fernández debt policy provides a value which is in between ME and MM. Modigliani and Miller should be implemented if the debt is predetermined, while ME should be adopted if the company strictly follows a constant market leverage ratio.

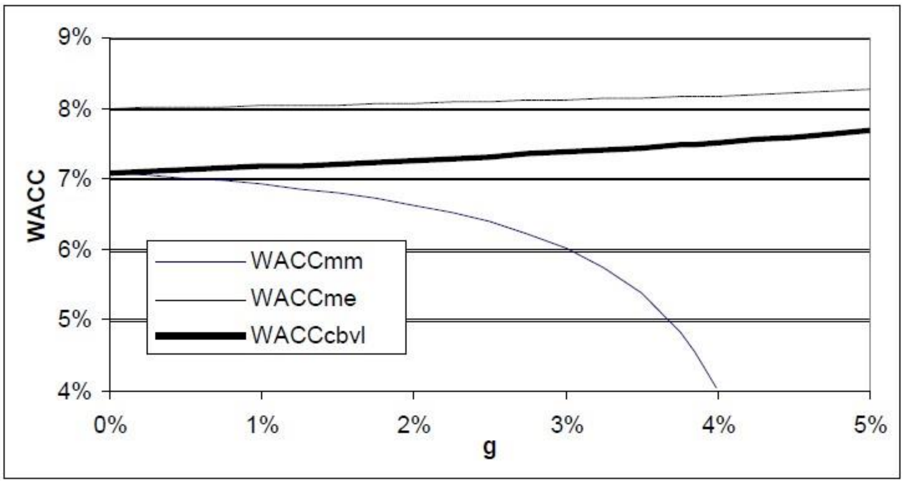
The two pictures below give a clear representation of the three theories as far as the PV increases of debt and WACC are concerned.

Figure 3.5 - PV (increases of debt) according to MM, ME, and Fernández



Source: Fernández, P. (2007) 'A More Realistic Valuation: APV and WACC with Constant Book Leverage Ratio', *IESE Business School – International Center for Financial Research*, p. 7.

Figure 3.6 - WACC according to MM, ME, and Fernández



Source: Fernández, P. (2007) 'A More Realistic Valuation: APV and WACC with Constant Book Leverage Ratio', *IESE Business School – International Center for Financial Research*, p. 8.

The value of net debt increases implied by alternative theories taken into consideration by Fernández will now be summarized[145].

The substantial difference between Fernández's formulas and all major theories on VTS is that according to the professor the VTS is the difference between the present value of taxes paid by the unlevered firm and the present value of taxes paid by the levered firm.

As it has already been said, MM's theory in the case of constant perpetuity and no bankruptcy risk implies that we are in the presence of R_f debt, thus

$VTS = PV[E\{D*T*R_f\}; R_f] = D*T$

Such formula, as stated before, provide us with the same result as $VTS_0 = T*D_0 + T*PV_0[\Delta D_t]$ in the case of perpetuities (just like the formulas provided by Myers and Fernández), however, it is neither correct nor applicable as it regards growing perpetuities.

Myer's formula is:

$VTS = PV[E\{D*T*K_d\}; K_d]$

This is correct if and only if the company pays its debt without issuing any new debt (Luehrman agrees on the usage of Myers' formula). It must always be remembered that the MM's and Myers' formulas can be used only if the debt is predetermined, and the cost of debt is used as discount rate (which is equal to the risk-free rate according to MM).

In 1977 Miller stated that there no financial benefits associated with debt financing and said: «I argue that even in a world in which interest payments are fully deductible in computing corporate income taxes, the value of the firm, in equilibrium will still be independent of its capital structure»[146].

This implies that in Miller's opinion:

$VTS = 0$

Harris & Pringle believe that MM is too extreme since it would imply that ITS are not riskier than the interest payments and state that:

$VTS = PV[E\{D*T*K_d\}; K_u]$

Ruback arrives at the same formula proposed by HP with the only difference that he uses CCFs (instead of using FCFs) discounted at the pre-tax WACC which is assumed to be equal to K_u.

[145] Fernández, P. (2020) 'Valuing Companies by Cash Flow Discounting: Only APV Does Not Require Iteration', *IESE Business School*, pp. 7-10.

[146] Miller, M. H. (1977) 'Debt and Taxes', *The Journal of Finance*, 32 (2), p. 262.

In the case of a constant market leverage policy most authors believe ME's formulas should be used, according to their opinion the ITS should be discounted at K_d for the first year and at K_u for the following years (because of the previously mentioned reasons):

$VTS = PV[E\{D*T*K_d\}; K_u] (1 + K_u) / (1 + K_d)$

Inselbag & Kaufold and Ruback agree on the usage of Myers' formula if the company targeted the dollar value of debt outstanding, while ME's formula should be used if the firm decided to adopt a constant leverage policy. Taggart, instead, claims that ME should be used if the company adjusted its leverage policy once a year, while HP should be used if that leverage were constantly adjusted.

Damodaran, assuming that the risk is entirely borne by the shareholders (debt beta = 0) presents a different formula for the relation between the levered beta and unlevered beta (and of course between the unlevered cost of equity and the levered cost of equity); thus, despite not being explicitly mentioned by Damodaran, Fernández derives that the VTS can be computed as:

$VTS = PV [K_u; DTK_u – D (K_d – R_f) * (1-T)]$

Then, there would also be, as already mentioned, the Practitioners' method which, since it requires a different relation between the unlevered and levered beta (it basically removes 1-T from Damodaran's relation, thus obtaining an even higher levered beta and K_e and, as a matter of fact, a lower equity value), requires a different way of computing the value of the tax shields, which is:

$VTS = PV [K_u; DTK_d – D (K_d – R_f)]$

The Practitioners' method way of computing the VTS will always provide a lower value than Damodaran's. In the end, Fernández shows what the value of the tax shields would be in the case we were in the presence of costs of leverage (leverage costs are assumed to be proportional to debt and to the difference between K_d and R_f) [147], thus:

$VTS = PV [K_u; DK_uT – D (K_d – R_f)]$.

As it can be spotted, the VTS with costs of leverage are lower than the tax computed by Fernández whose proposed formula is:

$VTS = PV [K_u; DTK_u]$

It must be used if the firm targets a fixed book-value leverage policy and if the appropriate discount rate is K_u (when $\Delta D_t = K * FCF_t$).

[147] Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 11.

Modigliani & Miller theory will always provide the highest value of equity, while Miller will result in obtaining the lowest value of equity because of the absence of the VTS. MM and Myers theories are the only ones whose equity value are higher than the one provided by Fernández in the absence of costs of leverage. It must be added that such results are inconsistent since there may be some circumstances (a certain growth rate) where MM and Myers provide a K_e that is lower than K_u and this clearly makes no economic sense:

For Myers, if $DTK_d / (K_d - g) > D \rightarrow VTS > D$ and $E > Vu$

For MM when $VTS > D\,[K_u - K_d * (1 - Tc)] / (K_u - g) \rightarrow$ such conditions occur when either leverage, tax rate, K_d or MRP are particularly high.

ME, HP, and Ruback are not to be considered valid since the provide a VTS that is too low. In terms of equity value, Fernández's equity value results in being the third largest after MM and Myers.

All major alternative formulas used in the computation of the VTS will be summarized in the following tables. These formulas are extremely important since they will all be applied to the Intel case study in chapter IV.

Table 3.1 - Value of Tax Shields according to the 9 theories in perpetuity

Theories	**VTS**
Fernandez	DT
Miles-Ezzell	TDKd(1+Ku)/[(1+Kd)Ku]
Modigliani-Miller	DT
Myers	DT
Miller	0
Harris-Pringle	T D Kd/Ku
Damodaran	DT-[D(Kd-R_F)(1-T)]/Ku
Practitioners	D[R_F-Kd(1-T)]/Ku
With-Costs-Of-Leverage	D(KuT+R_F- Kd)/Ku

Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 11.

Table 3.2 - Value of Tax Shields according to the 9 theories in growing perpetuity

	Fernandez (2007)	**Damodaran (1994)**
Ke	$Ke = Ku + \frac{D(1-T)}{E}(Ku - Kd)$	$Ke = Ku + \frac{D(1-T)}{E}(Ku - R_F)$
Ke - Ku	$D\frac{(Ku - Kd)(1-T)}{Vu + VTS - D}$	$D\frac{(Ku - R_F)(1-T)}{Vu + VTS - D}$
β_L	$\beta_L = \beta u + \frac{D(1-T)}{E}(\beta u - \beta d)$	$\beta_L = \beta u + \frac{D(1-T)}{E}\beta u$
WACC	$Ku\left(1 - \frac{DT}{E+D}\right)$	$Ku\left(1 - \frac{DT}{E+D}\right) + D\frac{(Kd - R_F)(1-T)}{E+D}$
$WACC_{BT}$	$Ku - \frac{DT(Ku - Kd)}{E+D}$	$Ku - D\frac{T(Ku - R_F) - (Kd - R_F)}{E+D}$
VTS	PV[Ku; DTKu]	PV[Ku; DTKu - D (Kd- R_F) (1-T)]
ECF_t\\Ku	$ECF_t - D_{t-1}(Ku_t - Kd_t)(1-T)$	$ECF_t - D_{t-1}(Ku - R_F)(1-T)$
FCF_t\\Ku	$FCF_t + D_{t-1} Ku_t T$	$FCF_t + D_{t-1} Ku T - D_{t-1}(Kd - R_F)(1-T)$
ECF_t\\R_F	$ECF_t - D_{t-1}(Ku_t - Kd_t)(1-T) -$ $- E_{t-1}(Ku_t - R_{F\,t})$	$ECF_t - D_{t-1}(Ku - R_F)(1-T) -$ $- E_{t-1}(Ku_t - R_{F\,t})$
FCF_t\\R_F	$FCF_t + D_{t-1} Ku_t T -$ $- (E_{t-1} + D_{t-1})(Ku_t - R_{F\,t})$	$FCF_t + D_{t-1} Ku T - D_{t-1}(Kd - R_F)(1-T) -$ $(E_{t-1} + D_{t-1})(Ku_t - R_{F\,t})$

Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 12.

Table 3.3 - Value of Tax Shields according to the 9 theories in growing perpetuity

	Harris-Pringle (1985) Ruback (1995)	**Myers (1974)**	**Miles-Ezzell (1980)**
Ke	$Ke = Ku + \frac{D}{E}(Ku - Kd)$	$Ke = Ku + \frac{Vu - E}{E}(Ku - Kd)$	$Ke = Ku + \frac{D}{E}(Ku - Kd)\left[1 - \frac{TKd}{1+Kd}\right]$
Ke - Ku	$D\frac{(Ku - Kd)}{Vu + VTS - D}$	$(D - VTS)\frac{(Ku - Kd)}{Vu + VTS - D}$	$D\frac{(Ku - Kd)}{Vu + VTS - D}\left[1 - \frac{TKd}{1+Kd}\right]$
β_L	$\beta_L = \beta u + \frac{D}{E}(\beta u - \beta d)$	$\beta_L = \beta u + \frac{Vu - E}{E}(\beta u - \beta d)$	$\beta_L = \beta u + \frac{D}{E}(\beta u - \beta d)\left[1 - \frac{TKd}{1+Kd}\right]$
WACC	$Ku - \frac{DKdT}{E+D}$	$Ku - \frac{VTS(Ku - Kd) + DKdT}{E+D}$	$Ku - \frac{DKdT}{E+D}\frac{1+Ku}{1+Kd_0}$
$WACC_{BT}$	Ku	$Ku - \frac{VTS(Ku - Kd)}{E+D}$	$Ku - \frac{DKdT}{E+D}\frac{(Ku - Kd)}{(1+Kd_0)}$
VTS	PV[Ku; T D Kd]	PV[Kd; T D Kd]	PV[Ku; T D Kd] (1+Ku)/(1+Kd)
ECF_t\\Ku	$ECF_t - D_{t-1}(Ku_t - Kd_t)$	$ECF_t - (Vu - E)(Ku_t - Kd_t)$	$ECF - D(Ku - Kd)\frac{1 + Kd(1-T)}{(1+Kd_0)}$
FCF_t\\Ku	$FCF_t + T D_{t-1} Kd_t$	$FCF_t + T D Kd + VTS(Ku - Kd)$	$FCF + T D Kd (1+Ku) / (1+Kd)$
ECF_t\\R_F	$ECF_t - D_{t-1}(Ku_t - Kd_t) -$ $- E_{t-1}(Ku_t - R_{F\,t})$	$ECF_t - (Vu - E)(Ku_t - Kd_t) -$ $- E_{t-1}(Ku_t - R_{F\,t})$	$ECF - D(Ku - Kd)\frac{1 + Kd(1-T)}{(1+Kd_0)} -$ $- E_{t-1}(Ku_t - R_{F\,t})$
FCF_t\\R_F	$FCF_t + T D_{t-1} Kd_t -$ $- (E_{t-1} + D_{t-1})(Ku_t - R_{F\,t})$	$FCF_t + T D Kd + VTS(Ku - Kd)$ $- (E_{t-1} + D_{t-1})(Ku_t - R_{F\,t})$	$FCF + T D Kd (1+Ku) / (1+Kd) -$ $- (E_{t-1} + D_{t-1})(Ku_t - R_{F\,t})$

Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 12.

Table 3.4 - Value of Tax Shields according to the 9 theories in growing perpetuity

	Miller	With-cost-of-leverage
Ke	$Ke = Ku + \frac{D}{E}[Ku - Kd(1-T)]$	$Ke = Ku + \frac{D}{E}[Ku(1-T) + KdT - R_F]$
Ke-Ku	$D\frac{Ku - Kd(1-T)}{Vu + VTS - D}$	$D\frac{Ku(1-T) + KdT - R_F}{Vu + VTS - D}$
ßL	$\beta_L = \beta u + \frac{D}{E}(\beta u - \beta d) + \frac{D}{E}\frac{TKd}{P_M}$	$\beta_L = \beta u + \frac{D}{E}[\beta u(1-T) + \beta dT]$
WACC	Ku	$Ku - \frac{D(KuT - Kd + R_F)}{E+D}$
WACCBT	$Ku + \frac{DKdT}{E+D}$	$Ku - \frac{D[(Ku - Kd)T + R_F - Kd)]}{E+D}$
VTS	0	$PV[Ku;\ D\,(KuT + R_F - Kd)]$
$ECF_t\backslash\backslash Ku$	$ECF_t - D_{t-1}[Ku_t - Kd_t(1-T)]$	$ECF_t - D_{t-1}[Ku_t(1-T) + Kd_tT - R_{Ft}]$
$FCF_t\backslash\backslash Ku$	FCF_t	$FCF_t + D_{t-1}[Ku_t T - Kd_t + R_{Ft}]$
$ECF_t\backslash\backslash R_F$	$ECF_t - D_{t-1}[Ku_t - Kd_t(1-T)] - - E_{t-1}(Ku_t - R_{Ft})$	$ECF_t - D_{t-1}[Ku_t(1-T) + Kd_tT - R_{Ft}] - E_{t-1}(Ku_t - R_{Ft})$
$FCF_t\backslash\backslash R_F$	$FCF_t - (E_{t-1} + D_{t-1})(Ku_t - R_{Ft})$	$FCF_t + D_{t-1}[Ku_t T - Kd_t + R_{Ft}] - - (E_{t-1} + D_{t-1})(Ku_t - R_{Ft})$

Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 13.

Table 3.5 - Value of Tax Shields according to the 9 theories in growing perpetuity

	Modigliani-Miller	Practitioners
Ke	$Ke = Ku + \frac{D}{E}[Ku - Kd(1-T) - (Ku-g)\frac{VTS}{D}]$ *	$Ke = Ku + \frac{D}{E}(Ku - R_F)$
Ke-Ku	$\frac{D[Ku - Kd(1-T)] - VTS(Ku - g)}{Vu + VTS - D}$ *	$D\frac{(Ku - R_F)}{Vu + VTS - D}$
ßL	$\beta_L = \beta u + \frac{D}{E}[\beta u - \beta d + \frac{TKd}{P_M} - \frac{VTS(Ku-g)}{D\,P_M}]$ *	$\beta_L = \beta u + \frac{D}{E}\beta u$
WACC	$\frac{D\,Ku - (Ku - g)\,VTS}{(E + D)}$ *	$Ku - D\frac{R_F - Kd(1-T)}{E+D}$
WACCBT	$\frac{DKu - (Ku-g)VTS + DTKd}{E+D}$ *	$Ku + D\frac{Kd - R_F}{E+D}$
VTS	$PV[R_F;\ T\,D\,R_F]$	$PV[Ku;\ T\,D\,Kd - D(Kd - R_F)]$
$ECF_t\backslash\backslash Ku$	$ECF_t - D_{t-1}[Ku_t - Kd_t(1-T) - (Ku-g)VTS/D]$*	$ECF_t - D_{t-1}(Ku_t - R_{Ft})$
$FCF_t\backslash\backslash Ku$	$FCF_t + E_{t-1}Ku + (Ku-g)VTS$ *	$FCF_t + D_{t-1}[R_{Ft} - Kd_t(1-T)]$
$ECF_t\backslash\backslash R_F$	$ECF_t - D_{t-1}[Ku_t - Kd_t(1-T) - (Ku-g)VTS/D] - - E_{t-1}(Ku_t - R_{Ft})$*	$ECF_t - (E_{t-1} + D_{t-1})(Ku_t - R_{Ft})$
$FCF_t\backslash\backslash R_F$	$FCF_t + E_{t-1}Ku + (Ku-g)VTS - - (E_{t-1} + D_{t-1})(Ku_t - R_{Ft})$*	$FCF_t + D_{t-1}[R_{Ft} - Kd_t(1-T)] - - (E_{t-1} + D_{t-1})(Ku_t - R_{Ft})$

* Valid only for growing perpetuities

Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 13.

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CHAPTER IV

Practical application

4.1 Introduction

This is the last chapter of the final dissertation, and the reader could, not surprisingly, find it the most interesting part so far. Such feeling would be justified by the scope of the following paragraphs: the chapter aims at summarizing and putting into practice all methods and theories that have been analyzed in the previous three chapters.

The first section puts emphasis on the importance of the Adjusted Present Value as a firm valuation method when it comes to determining the LBO target company's intrinsic value: as it has been already mentioned in chapter III, APV becomes particularly useful when the debt repayment schedule has been set in advance and the capital structure is not made to follow any target ratios (e.g. debt-to-equity ratio). Since private equity firms are the firms which typically pursue an M&A deal through the implementation of LBOs, a brief overview and outlook of such industry will be discussed. Moreover, to truly see how valuations work in such domain, a simplified APV valuation of the most famous LBO acquisition in history will be shown: KKR and RJR Nabisco deal.

The second section provides the reader with this thesis author's analysis: the company being valued is Intel Corp, one of the major players in the semiconductor industry. The reason why this company has been chosen is linked to the increasing importance of the semiconductor industry in these past years, without whose products many other industries could barely keep their business alive:

- Artificial intelligence
- Clean energy
- Communication
- Computing
- Energy
- Healthcare
- IoT
- Military

More specifically, Intel has been chosen to demonstrate that on the date of the valuation its stock price was undervalued by the market. It will be demonstrated that its price should be higher by presenting two different analyses: the first analysis gathers all the assumptions, considerations and procedures that are commonly followed in professional environments such as consulting firms and investments banks; the second analysis is none other than the ensemble of theories seen in the third chapter which all differ on how to properly compute the VTS. It must be remembered that, as Fernández stated multiple times, professionals often apply valuation methods by using different theories at the same time (a very easy example is brought by the usage of Hamada's equation by assuming a constant leverage policy at the same time). However, despite their inconsistency, it is worth applying the professionals' way of valuing a company because it is the one followed on an everyday basis in most finance-related working environments.

First it is shown how professionals would value the company, thus assuming a constant market leverage debt policy for the forecast period and adopting the WACC approach. The relation between the unlevered beta and the levered beta is the one proposed by Hamada, despite its inconsistent usage due to the previously mentioned debt policy (Hamada, as it has been repeatedly said, can be applied in the case MM hold, implying that the debt should be in the form of a constant perpetuity). Intel's levered beta is estimated by computing the unlevered betas of all comparable firms, whose average is assumed to be Intel's asset beta; in the end such unlevered beta is converted into Intel's equity beta following Hamada equation.

Then it is shown how economists and their theories would value the company; the nine different theories analyzed are the ones summarized in the tables at the end of chapter III:

- Fernández
- Modigliani & Miller
- Myers
- Miller
- Miles & Ezzel
- Harris & Pringle (and Ruback)
- Damodaran (1994)
- Practitioners
- Fernández (with cost of leverage)

Each of the abovementioned theories is applied with the four main valuation methods:

- Adjusted Present Value (APV), using K_u as the discount rate for the unlevered cash flows
- Equity Cash Flow (ECF), using K_e as its discount rate
- Free Cash Flow (FCF), using WACC as its discount rate
- Capital Cash Flow (CCF), using WACC Before Taxes as discount rate

In this second analysis, three different scenarios are set[148]:

- The company perpetually grows at 2%
- The company perpetually grows at 3,5%
- The company perpetually grows at 0% (which basically means that there is no growth unlike the two previous scenarios)

4.2 The APV applied to Leveraged Buyouts: KKR and RJR Nabisco case study

This section is divided into two paragraphs: the first paragraph aims to give a short overview of how the PE firms and LBO work, while the second paragraph focuses on the valuation of RJR Nabisco, an LBO target.

4.2.1 Brief overview and outlook of Private Equity and LBOs

«An LBO is the acquisition of a target using debt to finance a large portion of the purchase price»[149]. The remaining equity financing needed is provided by the financial sponsor which is interested in acquiring the firm in question. The term "financial sponsor" term identifies with private equity firms (since they are the subjects which are more likely to start an LBO), however, it is an umbrella term which could also refer to investment banks, hedge funds and venture capital funds.
Private equity firms can invest in either private firms or public companies (with the aim of delisting them) in order making profits out of the sale of their stake after a 5-7 years' period.
Private equity (PE) firms have historically aimed at obtaining a 20% return over a 5 years' time investment, regardless of the kind of the exit opportunity.
The capital required by PE firms is raised among third parties and is organized into funds which are in the form of limited partnerships (LPs). Limited partnerships have a finite life and have a capital commitment, with the limited partners being the passive investors and the general partner (GP, i.e. the sponsor) managing the fund. The limited partners, at the time of capital raising, do not know in advance what deal their money will be invested in, however, there are certain limits fixed in advance concerning how much can be invested in a single business (generally speaking, no more than 10% to

[148] As it can be seen, we only considered the event of companies growing perpetually at the same rate; the general case (in which the company may grow or contract at different rate) has not been considered. Furthermore, as it has already been stated throughout the previous chapter, we have always assumed the book value of debt to be equal to the market value of debt. Finally, we have assumed to be in a world where the only taxes applied are the corporate taxes, personal taxation has not been considered in this final dissertation.

[149] Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p.25.

20%). What makes a substantial difference among PE firms is given by the fund size (ranging from millions to billions), focus (e.g. targeting situations such as firms in a distressed situation) and investment strategy (e.g. sometimes PE firms focus on industry sectors rather than situations such as the TMT industry; some other times they are generalists, implying that they do not focus on specific sectors only).

The key participants in an LBO are the following ones[150]:

- Financial sponsors
- Investment banks
- Bank and institutional lenders
- Bond investors
- Target management

As far as the management is concerned, an MBO (Management Buyout) is the term which is used to define an LBO where the target company's management team is the subject leading the operation.
The LBO boom that occurred in the 1980s was the result of a thinking process put forward by Jerome Kohlberg Jr. and Henry Kravis. In 1976, after working for Bear Sterns for a very long time, they decided (together with George Roberts) to found the well-known private equity firm KKR (standing for Kohlberg Kravis Roberts)[151]. Before being known as LBOs, such deals were called "the bootstrap deals".
There are some characteristics a firm must possess to be considered as a suitable LBO candidate:

- Strong cash flow generation
- Leading and defensible market positions
- Growth opportunities
- Efficiency enhancement opportunities
- Low capex requirements
- Strong asset base
- Proven management team

[150] Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p.198.

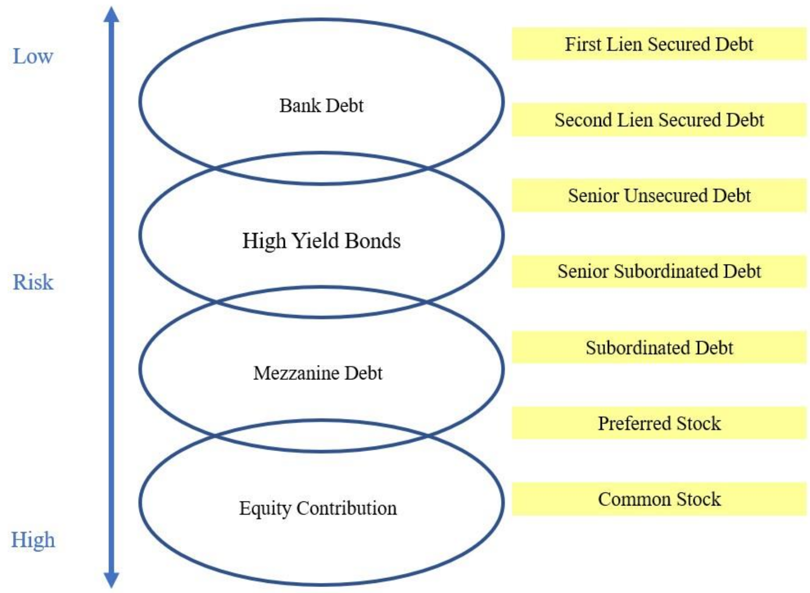
[151] Burrough, B. and Helyar, J. (2003) *Barbarians at the gate*. 1st edn. New York: HarperCollins Publishers, pp. 133-139.

There are several strategies a PE firm can adopt to monetize their investments:

- *Sale of business* – the target company could be sold to either a strategic buyer (also known as industrial buyer, it is usually the highest bidder because of the potential synergies as well as lower cost of capital) or another financial sponsor
- *Initial Public Offering (IPO)* – After the IPO the PE firm holds a large equity stake in the now publicly traded firm, this implies that the sponsor has opted for a partial monetization, and it will be able to purse follow-on equity offerings in the future in the case it decided to further monetize its investment
- *Dividend recapitalization* – In such a circumstance, which is not seen as a true exit strategy, the target company raises proceeds by issuing new debt for the shareholders to receive a special dividend
- *Below par debt repurchase* – PE firms acquire their portfolio's companies' debt at distressed levels at low prices (below par) and, as the market conditions improve, so does those firms' financial performance, thus allowing their debt to increase in price

As it has already been stated, most of the financing in an LBO deal is in the form of debt, more specifically we are in the presence of 60%-70% of debt; such percentages were even higher during the 80s. It should be said that the debt composition includes a broad array of debt instruments. The following picture will provide the reader with a very clear understanding of how risky the LBO financing sources are:

Figure 4.1 - LBO financing sources



Source: Own elaboration based on Rosenbaum, J. and Pearl, J. (2013) *Investment Banking: Valuation, Leveraged Buyouts, and Mergers & Acquisitions*. 2nd edn. Hoboken, New Jersey: John Wiley & Sons, p. 213.

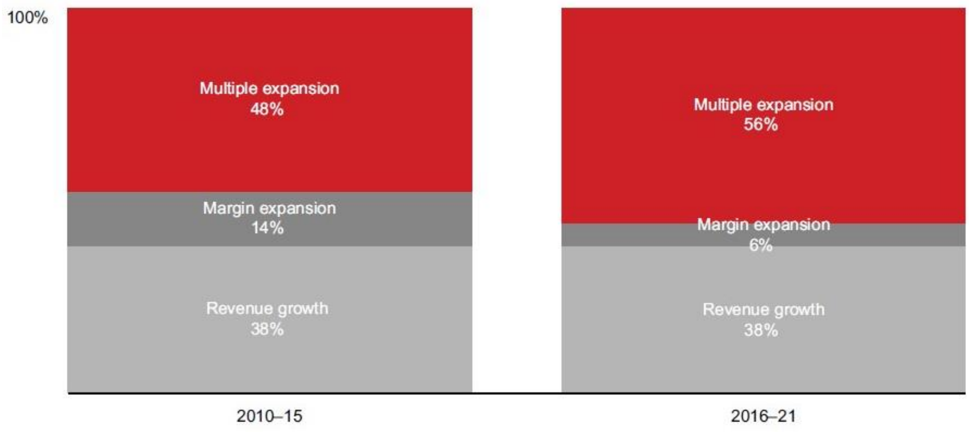
As far as the LBO outlook is concerned, a brief preamble should be made about the current M&A trend we are now experiencing. While 2021 turned out to be the year record for mergers and acquisitions (record partially reached because those deals that were suspended in the year 2020 took place the following year as soon as any lockdown restrictions were abolished), the same thing cannot be said for 2023 which will be negatively affected because of the following reasons:

- Due to the supply chain crisis generated in the South-eastern area of the world, with the subsequent increase in prices of raw materials which in turn saw the general increase in prices, thus bringing us to dramatic inflation levels
- Ukraine and Russia conflict which made the price of goods (especially food and energy) increase at unprecedented pace (inflation rising at a higher pace)
- Tightening monetary policy by the Fed and ECB to contrast the rising inflation and to decrease their balance sheets (which had reached extremely high levels after more than a decade of expansionary monetary policy)

All these factors have contributed to increase the cost of debt (which is a direct consequence of the rising interest rates) which may be very problematic when it comes to leading an LBO whose main source of financing is composed of debt-like instruments.

Moreover, it should be reported that, as it has been shown by Bain's 2022 report on private equity, PE firms have always more and more relied on multiples expansion to generate value; it has been the largest driver of buyout returns and a higher inflation and higher costs occurring in the PE's portfolio companies are putting such returns in real danger.

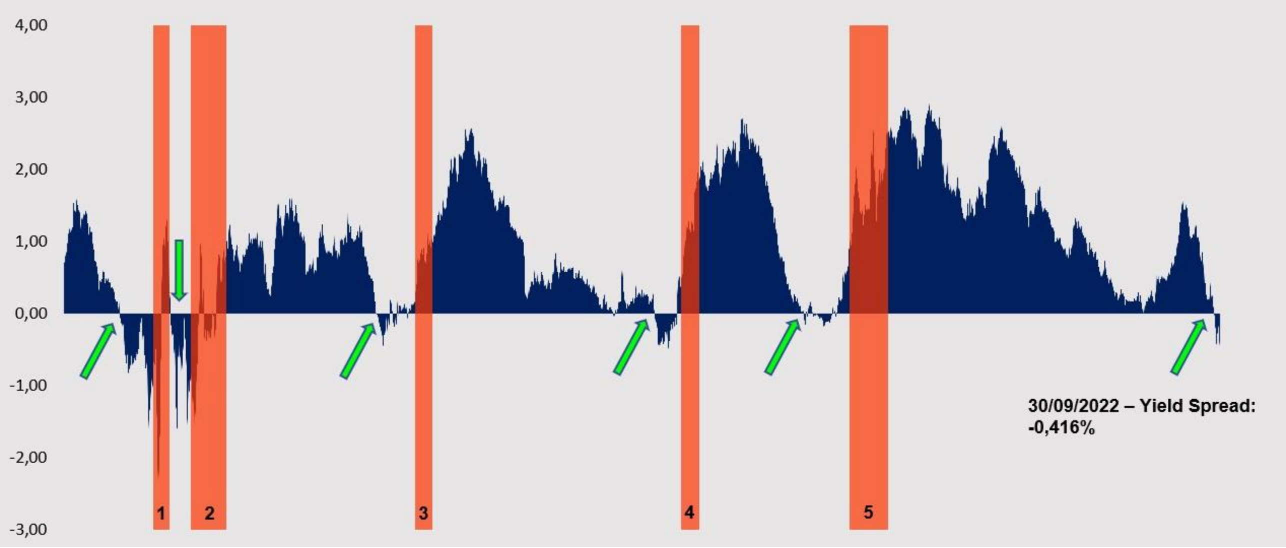
Figure 4.2 - Median value creation, by year of exit



Source: Bain & Company (2022) *Global Private Equity Report*, p. 78.

The pictures below clearly demonstrate that a potential recession is approaching due to the increase in the yield spread inversion[152] (the first manifestation appeared in April 2022). This is a further demonstration of how dramatic the decrease in multiples may become and how important it is for PE firms to adjust their strategy, especially for the most affected companies.

Figure 4.3 - Yield Spread as (between 10 and 2-year US Treasury yields) as economic recession predictor since 1976



Source: Own elaboration using data from https://fred.stlouisfed.org/ (Accessed: 10 January 2023)

Table 4.1 - Yield curve first inversion (i.e. green arrow in the previous figure) and duration of recession

	Yield Curve First Inverted	**Duration of Recession**
1	August 18, 1978	January 1980 – July 1980
2	September 12, 1980	July 1981 – November 1982
3	December 13, 1988	July 1990 – Febraury 1991
4	May 26, 1998	March 2001 – October 2001
5	December 27, 2005	December 2007 – May 2009

Source: Own elaboration using data from https://fred.stlouisfed.org/ (Accessed: 10 January 2023)

All major M&A players are now suffering the first sign of the recession and the most relevant investment banks have seen their fees on the various M&A deals drop (in certain cases the fees even halved when comparing the year record 2021 and the poorer performance in 2022).

[152] «A yield curve inverts when long-term interest rates drop below short-term rates, indicating that investors are moving money away from short-term bonds and into long-term ones. This suggests that the market is becoming more pessimistic about the economic prospects for the near future» from www.investopedia.com.

And, as it can be easily understood, in a world characterized by rising interest rates, thus implying higher cost of debt, it is fundamental to exploit the benefits provided by the tax shields. Because of that, it is important to be consistent when it comes to valuing the VTS.

4.2.2 KKR and RJR Nabisco deal: a case study application

RJR Nabisco was founded in 1875 and was involved in the tobacco business only at first. However, in 1967 after several acquisitions, RJR Foods subsidiary was created, thus allowing RJR Nabisco to enter a new market. By 1987 the firm had shown high growth patterns thanks to strong cigarettes brands (e.g. Winston and Camel) to well-known food brands (e.g. Oreo)[153].
There were all the conditions for RJR Nabisco to be considered as an appropriate LBO candidate because its operations showed no need for high capital expenditures and had a small debt, as well as presenting high growth.

Indeed, it became the object of four different bidders:

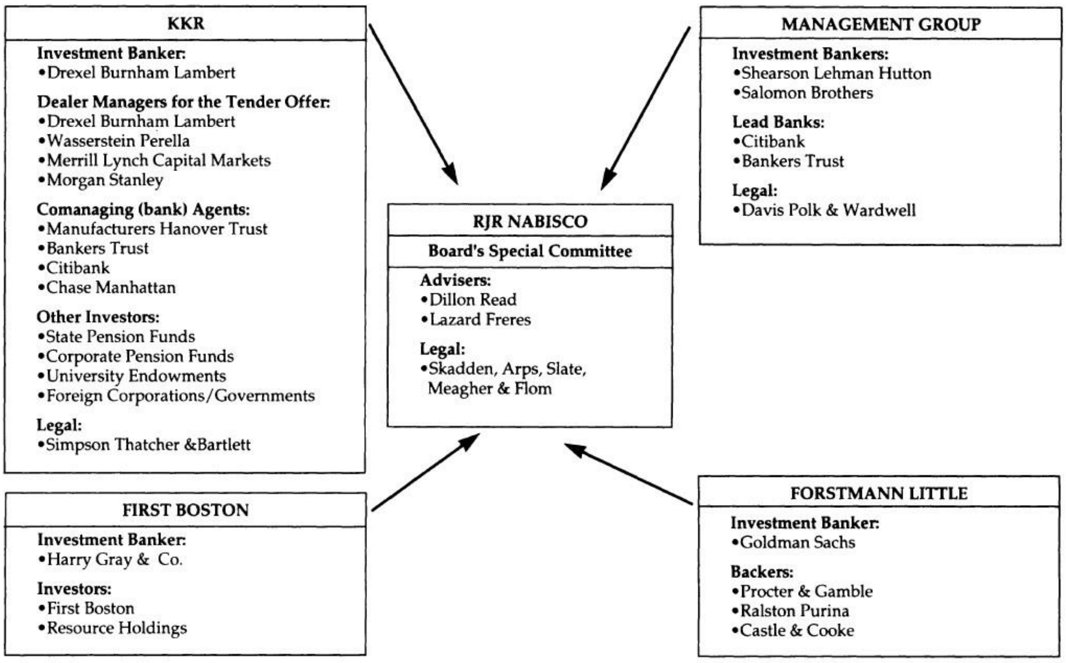
- The management of the company itself (thus making it a potential MBO)
- KKR
- Forstmann Little & Co.
- First Boston

On November 24th 1988 RJR Nabisco's board of directors accepted KKR's offer to purchase the company for $ 25 billion ($ 109 per share). The main rivalry was the one between the Management bid and the one proposed by KKR which, eventually, resulted in being the winner.
However, it is interesting to see the reasons that pushed the board of directors to accept, because unlike what most people may believe, the traditional factors did not lead the board of directors to accept KKR's offer. The Management Group's offer was higher than KKR's indeed.

Before proceeding with the explanation of the four main drivers that made KKR the successful bidder, it is interesting to look at the following two figures below which give a clear summary about the four main bidders and the evolution of their offers through time.

[153] Ruback, R. S. (2006) 'RJR Nabisco', *Harvard Business School*, pp. 1-12.

Figure 4.4 - The bidding groups



Source: Allen, M. and Israel, S. (1991) 'RJR Nabisco: A Case of a Complex Leveraged Buyout', *Financial Analyst Journal*, 47 (5), p. 23.

Figure 4.5 - The bidding dynamics

Bidder	Oct. 19	Nov. 4	Nov.25	Nov.29	Dec.1	Amount/Form of Payment
			Bidding Date (1988)			
RJR Management					$112/sh.	$84 Cash $24 Preferred Stock $ 4 Convertible Stock
				$101/sh.		$88 Cash $ 9 Preferred Stock $ 4 Other Security
			$100/sh.			$90 Cash $ 6 Preferred Stock $ 4 New Common Stock
		$92/sh.				$84 Cash $ 8 Debt Securities
	$75/sh.					Bidder did not specify form of payment
KKR Acquisition Group					$109/sh.	$81 Cash $18 Preferred Stock $10 Debentures
				$106/sh.		$80 Cash $18 Preferred Stock $ 8 Debentures
			$94/sh.			$75 Cash $11 Preferred Stock $ 8 Convertible Bond
		$90/sh.				$78 Cash $12 Securities
First Boston			$118/sh.			$110 Notes $ 3 Other Securities $ 5 Warrants

Source: Allen, M. and Israel, S. (1991) 'RJR Nabisco: A Case of a Complex Leveraged Buyout', *Financial Analyst Journal*, 47 (5), p. 24.

The main reasons why KKR managed to have its buyout approved are the following ones[154]:

1. *The break-up factor* – While the management group wanted to sell the food business, KKR promised the board that the company would be kept united as much as possible (thus by keeping both the food and tobacco businesses)
2. *The equity factor* – KKR proposed to provide the existing shareholders with 25% of the future company's equity, while the management offered 15% only; KKR had correctly interpreted the board's intention to have some of the firm's stake owned by the public
3. *The financing structure* – KKR was proposing $ 500 mln more compared to what had been offered by the management; it was in the board's interest to maximize the shareholders' wealth
4. *The employment commitment* – KKR shared the board's view in trying to minimize the negative effects on the employees by offering benefits to all those who had lost their jobs, while the management group focused on providing equity to 15.000 employees
5. *Post-LBO leadership* – The bidding war deeply affected the company and, as a consequence of that, the board was looking for an offer which would respect RJR's values; since KKR's offer proposed to have J. Paul Sticht as the new CEO, instead of Mr. Johnson who was one of the leading figures in the management bid, the board did not have a second thought about it because of the exaggerate corporate spending characterizing Mr. Johnson

Figure 4.6 - KKR's bid vs Management's bid

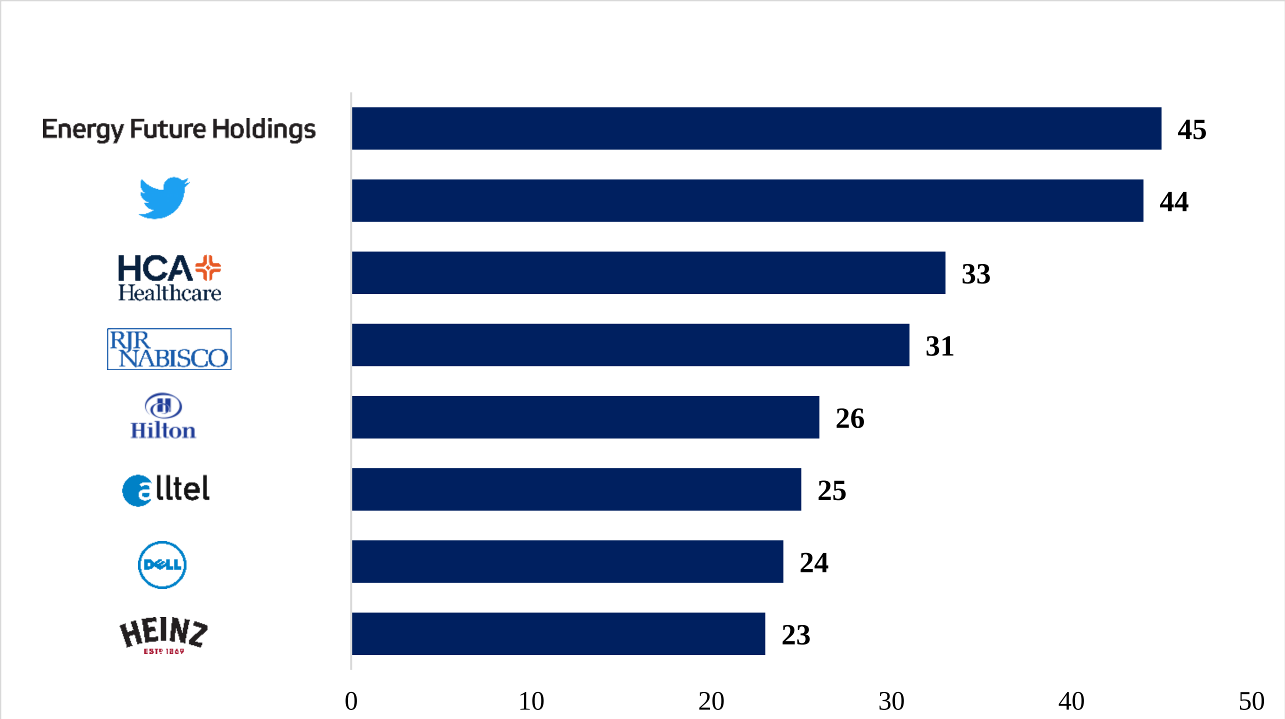
KKR's Bid	*Management's Bid*
Financial	Financial
$81 a share in cash	$84 a share in cash
$18 a share in exchangeable preferred stock	$24 a share in preferred stock
$10 a share in debentures, convertible into a total of about 25% of the new company's equity	$4 a share in additional stock, convertible into a total of 15% of the new company's stock
Total: $109 a share	Total: $112 a share
Non-Financial	Non-Financial
Keep the tobacco and much of the food business intact	Keep only the tobacco business
Guarantee severance and other benefits to employees who lose their jobs because of change in control	Give equity to 15,000 employees

Source: Source: Allen, M. and Israel, S. (1991) 'RJR Nabisco: A Case of a Complex Leveraged Buyout', *Financial Analyst Journal*, 47 (5), p. 24.

[154] Allen, M. and Israel, S. (1991) 'RJR Nabisco: A Case of a Complex Leveraged Buyout', *Financial Analyst Journal*, 47 (5), pp. 25, 26.

KKR's acquisition of RJR Nabisco paved the way for large corporate buyouts, and it is interesting to notice, as the picture below shows, how such deal is still one of the major LBO ever made by deal value. It should be added that, the major LBO deal (i.e. Energy Future Holdings, former TXU) was conducted by none other than KKR.

Figure 4.7 - Largest LBO in history by deal value as of 2022 ($, bln)



Source: Own elaboration based on www.statista.com (Accessed: 15 January 2023)

The following figure shows the APV valuation method applied to RJR Nabisco which led to the previously mentioned $ 109 price per share.

Table 4.2 - KKR and RJR Nabisco, APV application ($, mln)

KKR and RJR Nabisco

Assumptions	
Tax rate	34%
WACC	12,8%
Ru	14%
g long-term	3%
Interest Tax shield discount rate	13,5%

Year	**1989**	**1990**	**1991**	**1992**	**1993**
Operating Income	2.620	3.410	3.645	3.950	4.310
Tax on operating income	891	1.142	1.222	1.326	1.448
After-tax operating income	1.729	2.268	2.423	2.624	2.862
Add back depreciation	449	475	475	475	475
Less capital expenditures	522	512	525	538	551
Less change in working capital	(203)	(275)	200	225	250
Add proceeds from asset sales	3.545	1.805			
Unlevered cash flow (UCF)	5.404	4.311	2.173	2.336	2.536

Year	**1989**	**1990**	**1991**	**1992**	**1993**
Interest expenses	3.384	3.004	3.111	3.294	3.483
Interest tax shields	1.151	1.021	1.058	1.120	1.184

Year		**1989**	**1990**	**1991**	**1992**	**1993**
Unlevered cash flow (UCF)		5.404	4.311	2.173	2.336	2.536
Terminal value: (3% growth after 1993)						
Unlevered terminal value (UTV)						23.746
Terminal value at target debt (Levered terminal value)						26.654
Tax shield in terminal value						2.908
Interest tax shields		1.151	1.021	1.058	1.120	1.184
PV of UCF 1989-1993 at 14%	12.224					
PV of UTV at 14%	12.333					
Total unlevered value	**24.557**					
PV of tax shields 1989-1993 at 13,5%	3.834					
PV of tax shields in TV at 13,5%	1.544					
Total value of tax shields	**5.377**					
Total value	**29.935**					
Less value of assumed debt	5.000					
Value of equity	24.935					
Number of shares	229					
Value per share	**108,9**					

Source: Inselbag, I. and Kaufold, H. (1997) 'Appendix 17A - The Adjusted Present Value Approach to Valuing Leveraged Buyouts', *adapted by Inselbag and Kaufold from their unpublished manuscript titled "Analyzing the RJR Nabisco Buyout: An Adjusted Present Value Approach"*, pp. 1-5.

As we can see, the VTS has been assumed to be equal to the PVTS, which is something most analysts do but, as it was demonstrated by Professor Fernández, it is not always correct.
The terminal value has been computed with the perpetual growth rate approach, thus assuming the company will perpetually grow at a constant rate after year 5.
The tax shield of the terminal value has been calculated as the difference between the levered value of the TV and the unlevered value of the TV. Summing the PVITS with the VTS of the TV provides us with the total value of the VTS which, together with the unlevered value of the firm (computed as the sum of the present value of the unlevered cash flows and the present value of the terminal value discounted at the unlevered cost of equity) give us the enterprise value of the firm. By subtracting the assumed debt and dividing the result by the number of outstanding shares, we obtain the equity value per share equal to $ 109.
If we ever wanted to use the WACC approach, we would need to discount the FCFs at a different WACC every year since the capital structure changes; the WACC would have a growing pattern because, as the buyout proceeds, the debt is repaid, and the tax shield benefit is reduced.

4.3 The APV vs the other Valuation Methods: Intel Corp case study

As it has been repeatedly said, this section concerns the valuation of Intel Corp, one of the main market players in the semiconductor industry. It is believed that its market share price is much lower than its actual intrinsic value and such demonstration will be provided by adopting both the professionals' way of valuing firms and the approaches that different economists would follow (this second type of analysis differs in terms of results because the various theories do not have the same view on how to compute the VTS).
The true competitive advantage that can be attributed to Intel, which is the main reason why it should show a higher stock price, consists in its business structure. In the past years Intel has underperformed compared to some of its main competitors such as AMD and NVIDIA; however, the current geopolitical risks of seeing Taiwan becoming part of China, would make Intel business model much more secure than those belonging to its main competitors. Intel, indeed, produces its own chips, while many other semiconductor players rely on other Taiwanese companies (e.g. TSMC is the main chips producer in the world). Apart from a geopolitical risk, Intel's capacity of not having to entirely outsource the production, makes it possible for Intel not to stop its business in the case of a worsening of the supply chain crisis. Moreover, a further advantage presented to Intel is the fact that it will benefit from the recently approved "Chips and Science Act" which aims at bolstering US semiconductor capacity (the US decided to move in this direction due to the increasing importance of an industry whose lack of products would jeopardize a whole country's economy).

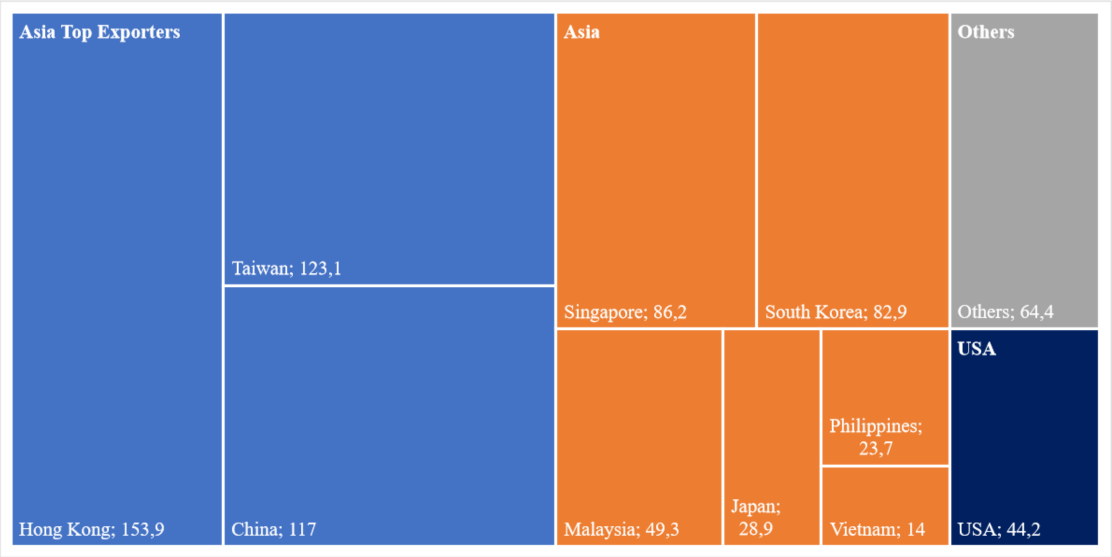
4.3.1 Brief overview and outlook of Intel Corp and the Semiconductor Industry

This paragraph is aimed at analyzing data to better understand the functioning of the semiconductor industry and how Intel business model is structured.

First, it is interesting to understand how significant the microchips shortage has been and how severe it could be, were it to occur again for an even longer period. It could be extremely detrimental if countries did not follow the US policy: according to the experts, semiconductor-dependent countries should encourage the domestic production of chips instead of having to rely on foreign nations whose government stability is debatable. Such statement is even truer if those countries on which the world rely on are all located in the same geographic area, implying that a negative event in such zone would risk compromising the whole supply system.

The supply chain crisis happened during Covid in Southeast Asia is almost over, however further logistics problems have been rising after the Russian invasion of Ukraine.

Figure 4.8 - Countries vaunting the highest exporting value of electronic integrated circuits in 2020 ($, bln)



Source: Own elaboration based on Statista, https://www.statista.com/ (Accessed: 20 January 2023)

As it can be seen, the Asian continent weighs for most of the export, more specifically, Honk Kong, Taiwan and China are the top three exporters. In other words, were Honk Kong and Taiwan to become part of China, the world would be entirely China-dependent in terms of semiconductors. These are some of the reasons which pushed the US, Japan, and the EU to act accordingly. It should be then underlined that China is one of the major producers of silicon, germanium, gallium, and arsenide which are all key materials in the semiconductor industry.

To give a proper overview of the semiconductor industry, we will intensively use Steve Blank's report on the Semiconductor Ecosystem[155].

The 21st century has been characterized by digital transformation which has occurred both in the public sector and in the private one (in all industries). Semiconductors are part of such a technological revolution because they are none other than chips that process digital information. It is now clearly demonstrated by many different analyses that the semiconductor industry will reach the first trillion dollars in sales within the next five years (such industry has recorded more than $ 600 bln in sales in 2022)[156]: this is because semiconductors are not only intensively adopted for our daily routine, but they are the foundations of new frontiers such as AI.

In the semiconductor industry there are seven different types of firms (without considering the OSAT) and each of them contribute to the whole industry value chain until a chip factory possesses all the elements to actually proceed with the manufacturing of the chip.

The industry segments are the following ones:

- Chip Intellectual Property (IP) Cores – the chip design is either owned by a single firm or some firms license their designs (e.g. ARM licenses IP Cores to Apple)
- Electronic Design Automation (EDA) Tools – thanks to the usage of such tools, engineers design chips, such designs are put on top of those IP cores they have purchased (the three main US players are Cadence, Synopsys and Mentor Graphics (now part of Siemens)
- Specialized Materials – the companies belonging to such sector produce specialized materials and chemicals without which chip factories (known as "fabs") could never produce chips physically
- Wafer Fab Equipment (WFE) – it identifies some of the most expensive machines in the world and are the ones that make the chips (the main players are Applied Materials, KLA, LAM, Tokyo Electron and ASML)
- "Fabless" Chip Companies – they create their chip designs which are then sent to foundries (that have fabs) for the physical production; within this group of companies we either find those firms that use those chips for their own products (e.g. Apple, Google, Amazon, etc.) or they sell those chips to other subjects (e.g. AMD, Nvidia, Qualcomm, Broadcom, etc.); despite not owning WFE, they use Chip IP and EDA for chip designing
- Integrated Device Manufacturers (IDMs) – they design, manufacture (they have their own fabs) and sell their own chips; Memory (e.g. Micron, SK Hynix), Logic (e.g. Intel) and Analog (TI, Analog Devices) are the three types of IDMs; although they have their own fabs, they

[155] Blank, S. (2022) in collaboration with the Gordian Knot Center for National Security Innovation, *The Semiconductor Ecosystem*, pp, pp. 1-11.

[156] https://www.gartner.com/ (Accessed: 22 January 2023).

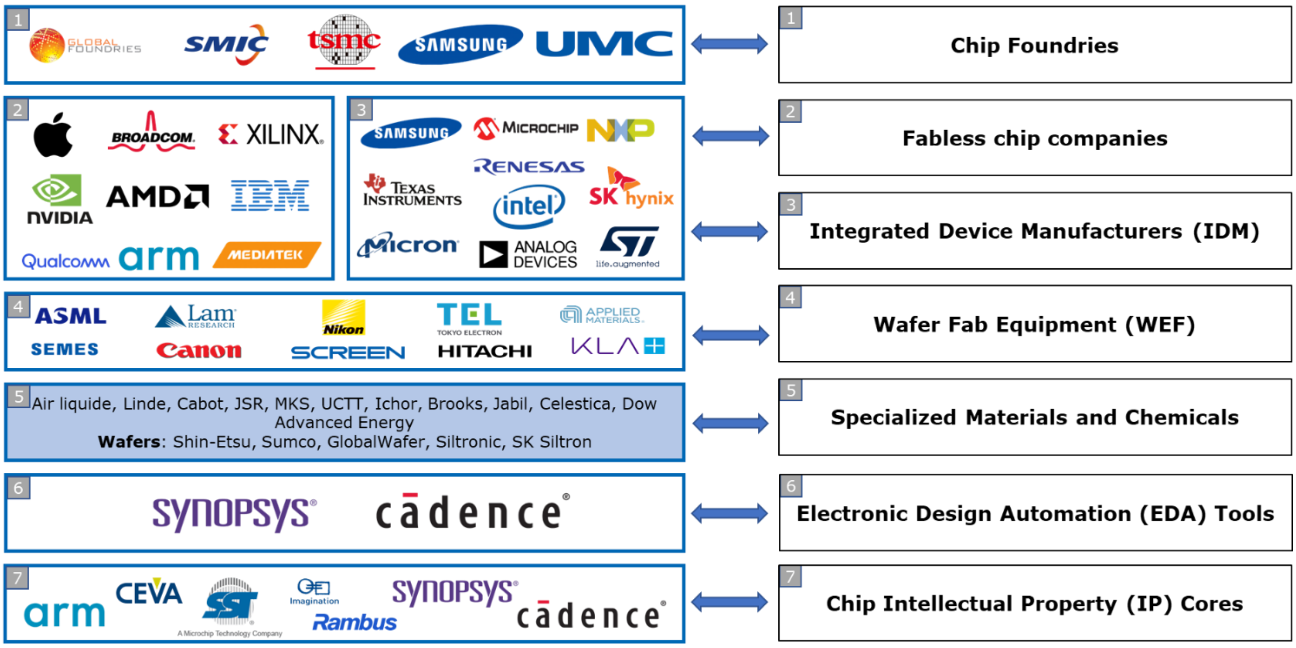
may need the use of foundries; they buy Chip IP and EDA for chip designing and purchase WFE and use specialized materials

- Chip Foundries – manufacture chips for other players in their "fabs" (in order for the chips to be produced such foundries need to purchase and combine equipment); however, it must be remembered that they do not design the chips (as far as logic is concerned, TSMC and Samsung place first and second in the world).

  It should be underlined that "Fabs" stands for fabrication plants (the making chip factory); both IDMs and Foundries have them with the only difference being if the chips are made for others to use or sell or they make chips for themselves to sell

- Outsourced Semiconductor Assembly and Test (OSAT) – they verify that chip made by IDMs and foundries work properly

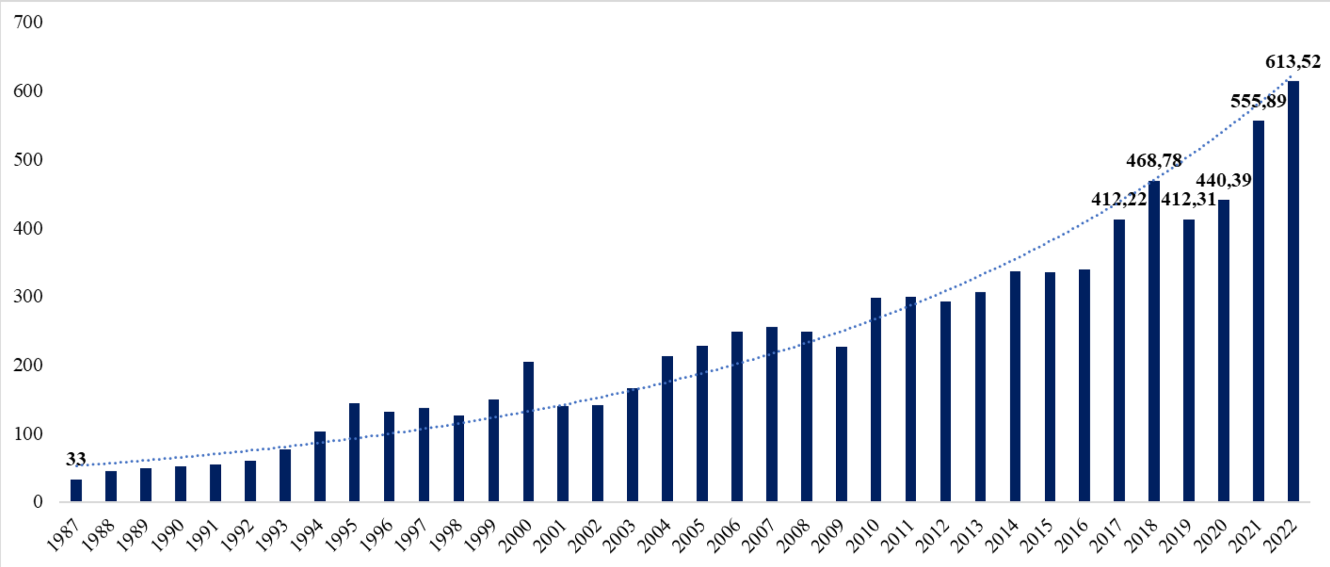
Figure 4.9 - The seven different types of companies in the semiconductor industry (without considering OSAT)



Source: Own elaboration based on Blank, S. (2022) in collaboration with the Gordian Knot Center for National Security Innovation, *The Semiconductor Ecosystem*, pp. 1-11.

To truly understand how much the semiconductor industry has grown in the past years, it is interesting to look at the bar chart below showing the worldwide sales from 1987 and 2022: we have indeed moved from just $ 33 bln in sales in 1987 to more than $ 600 bln in 2022.

Figure 4.10 - Semiconductor industry sales worldwide 1987-2022 ($, bln)



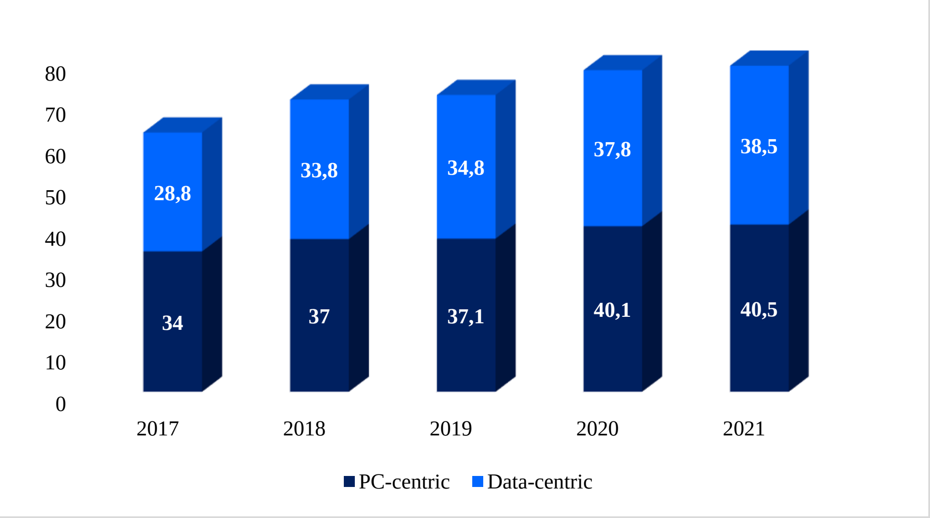
Source: Own elaboration based on Statista, https://www.statista.com/ (Accessed: 20 January 2023)

The semiconductor industry is rapidly changing, and such statement can be easily supported by ad hoc evidence. As time went by the cost of creating fabs has exponentially increased and not all companies were able to sustain such trend: in 2001 there were 17 companies making chips (i.e. Chip foundries), today basically the only ones available are Samsung in Korea and TSMC in Taiwan. Moreover, while in the past being vertically integrated was a great advantage, today such organizational system may be a disadvantage because of the lower cost incurred in the fabless foundry model (AMD has shown that moving from IDM to a fabless foundry model is economically convenient). The real advantage of foundries is that they can exploit economies of scale and standardization, they concentrate on manufacturing by adopting the innovation provided by the same ecosystem they are part of without having to invent anything.

Because of the abovementioned information, Intel has been adopting the so-called IDM 2.0 strategy: it consists of trying to follow AMD's path (behaving as if they were a fabless chip company), thus they require TSMC's services for their own chips and at the same time Intel is planning to build its own foundry. In Intel's view, this is a long-term strategy from which the company will highly benefit in the future: they are planning to invest several billions in the creation of new plants in the US and Europe. In other words, Intel wants to exploit the advantages provided by the economies of scale obtained through a foundry model, but at the same time it aims at outsourcing the production to a third party when the benefit of producing the chips on its own starts decreasing.

It should be then stated that Intel is diversifying its business by moving from a pc-centric business to a data centric business as the data below show:

Figure 4.11 - Intel's Revenues by business from 2017 to 2021 ($, bln)



Source: Own elaboration based on Securities Exchange commission (2021) *Annual Report (Form 10 k)* of Intel

Moreover, Intel's business is becoming more and more diversified: they are investing in autonomous vehicles as well as in artificial intelligence by levering the fact that both frontiers highly rely on chips of which they are one of the major producers on a global scale.
After this brief overview of the semiconductor ecosystem, which has been simplified for the purpose of this dissertation since it is a highly sophisticated and technical industry, we are now moving to the valuation part.

4.3.2 Intel Valuation according to Professionals

In this section the steps followed, and the results of our analysis will be shown according to the way professionals would proceed.

First and foremost, it must be stated that the latest available data used are the ones on 30/09/2022. Thanks to our data, the last three months to the end of 2022 have been forecasted (in terms of financial statements) and we then assumed 31/12/2022 to be our t_0. The stock market data used are the ones on 30/09/2022, assuming Intel's and the various competitors' stock price to remain almost unchanged until 31/12/2022. As far as the financial statements are concerned, Intel's 2017, 2018, 2019, 2020 and 2021 10K documents have been used as the foundation of our forecasts.

The first step consisted in the computation of Intel's beta through the usage of comparable firms.

To do this, the following data have been downloaded:

- the monthly adjusted stock prices[157] on a 5-year basis (30/09/2017 – 30/09/2022) of the publicly listed comparable firms
- the monthly adjusted prices of the stock market indices
- the monthly historical data concerning the 10-year US Treasury yield which has been assumed to be our risk-free rates

These data were used to compute the monthly stock and indices returns and their respective excess returns over the risk-free rate. The returns were simply computed as:

$$Returns_{t1} = \frac{P_{t1} - P_{t0}}{P_{t0}}$$

And the excess returns are none other than the returns of the stock market or the stock index minus the treasury yield divided by twelve (to convert it properly).

The stock excess returns, and the stock market excess returns were used as the two inputs to compute the firms' levered betas by using the covariance formula seen in chapter I.
We should remember that the risk-free rate is equal to 3,804% on 30/09/2022 and is assumed to be, just like the levered betas, almost the same on 31/12/2022 (this simplification has been made because the alternative would have been to wait for the market results and for the disclosure of Intel's financial statements for the year 2022).

It should be stated that all market data (stock prices, treasury yields) have been downloaded from Refinitiv, while Intel's historical data concerning its financial statements have been downloaded from the various 10K documents that are published online by the Security Exchange Commission (SEC).

[157] «The closing price is the raw price, which is just the cash value of the last transacted price before the market closes. The adjusted closing price factors in corporate actions, such as stock splits, dividends, and rights offerings» by Investopedia

Table 4.3 - Intel's and Comparable firms' Raw beta and Adjusted beta

Company name	Ticker symbol	Index	Raw beta
Intel Corporation	INTC	S&P 500	0,73
Advanced Micro Devices Inc.	AMD	S&P 500	2,03
Broadcom Inc.	AVGO	S&P 500	1,12
NVIDIA Corporation	NVDA	S&P 500	1,73
QUALCOMM Incorporated	QCOM	S&P 500	1,28
International Business Machines Corporation	IBM	S&P 500	0,83
Apple inc.	AAPL	S&P 500	1,26
Micron Technology Inc.	MU	S&P 500	1,29
Texas Instruments Incorporated	TXN	S&P 500	1,00
Applied Materials Inc.	AMAT	S&P 500	1,52
Microchip Technology Incorporated	MCHP	S&P 500	1,56
Analog Devices Inc.	ADI	S&P 500	1,15
NXP Semiconductors N.V.	NXPI	S&P 500	1,48
STMicroelectronics N.V.	STM.PA	CAC 40	1,20
ASML Holding N.V.	ASML.AS	AEX	1,43
Taiwan Semiconductor Manufacturing Company Limited	2330.TW	TW50	1,31
MediaTek Inc.	2454.TW	TW50	1,36
SK hynix Inc.	000660.KS	KOSPI 200	1,11
Samsung Electronics Co., Ltd.	005930.KS	KOSPI 200	1,00
Semiconductor Manufacturing International Corporation	0981.HK	(^HSCE)	0,64
Renesas Elctronics Corporation	6723.T	JPX-Nikkei 400	1,60

Source: Own calculation

Table 4.4 - Intel's and Comparable firm's additional information

Company name	Primary Sector	Industry Group	Role in the Semiconductor Industry
Intel Corporation	IT	Semiconductor	IDM
Advanced Micro Devices Inc.	IT	Semiconductor	Fabless Chip Companies
Broadcom Inc.	IT	Semiconductor	Fabless Chip Companies
NVIDIA Corporation	IT	Semiconductor	Fabless Chip Companies
QUALCOMM Incorporated	IT	Semiconductor	Fabless Chip Companies
International Business Machines Corporation	IT	Computer Services	Fabless Chip Companies
Apple inc.	IT	Computers/Peripherals	Fabless Chip Companies
Micron Technology Inc.	IT	Semiconductor	IDM
Texas Instruments Incorporated	IT	Semiconductor	IDM
Applied Materials Inc.	IT	Semiconductor Equipment	WFE
Microchip Technology Incorporated	IT	Semiconductor	IDM
Analog Devices Inc.	IT	Semiconductor	IDM
NXP Semiconductors N.V.	IT	Semiconductor	IDM
STMicroelectronics N.V.	IT	Semiconductor	IDM
ASML Holding N.V.	IT	Semiconductor Equipment	WFE
Taiwan Semiconductor Manufacturing Company Limited	IT	Semiconductor	Chip Foundries
MediaTek Inc.	IT	Semiconductor	Fabless Chip Companies
SK hynix Inc.	IT	Semiconductor	IDM
Samsung Electronics Co., Ltd.	IT	Computers/Peripherals	IDM
Semiconductor Manufacturing International Corporation	IT	Semiconductor	Chip Foundries
Renesas Elctronics Corporation	IT	Semiconductor	IDM

Source: Own calculation

The comparable companies have been selected according to different parameters: as it could be observed from the previous paragraph, we are dealing with the most relevant market players in the semiconductor and semiconductor equipment industry. As the abovementioned information about the companies show, firms belonging to the first four rectangles of figure 4.9 have been selected (those segments in which Intel is present or could potentially be present in the next years according to its long-term strategy). The comparable company analysis should include as many companies as possible to make sure the data sample is big enough not to commit any errors; this is why 20 different companies have been chosen. Moreover, the comparable companies have been chosen so that the US, EU, and Asia geographic areas could be considered.

A common tax rate = 35% has been assumed, regardless of the different country of incorporation's tax regimes.

Despite its inconsistency, since it is the most applied formula, the Hamada equation has been used to turn each company's raw beta (levered beta) into their respective unlevered beta. The average of all comparable companies' unlevered beta has been assumed to be equal to Intel's unlevered beta. Then, always using Hamada equation, Intel's levered beta has been computed: this is the beta that will be used for our next calculations.

Table 4.5 - Intel's beta calculation based on comparable companies' analysis ($, mln)

Company	Market Value of Equity	Market Value of Debt (Net Debt)
Advanced Micro Devices Inc.	102.010	(2.222)
Broadcom Inc.	179.825	27.594
NVIDIA Corporation	302.261	8.956
QUALCOMM Incorporated	126.877	8.629
International Business Machines Corporation	107.307	45.054
Apple inc.	2.220.978	90.627
Micron Technology Inc.	55.268	(1.356)
Texas Instruments Incorporated	141.424	3.110
Applied Materials Inc.	70.485	457
Microchip Technology Incorporated	33.718	7.370
Analog Devices Inc.	71.668	5.455
NXP Semiconductors N.V.	38.736	7.765
STMicroelectronics N.V.	28.384	(488)
ASML Holding N.V.	171.060	(2.502)
Taiwan Semiconductor Manufacturing Company Limited	344.075	(11.157)
MediaTek Inc.	27.570	(4.490)
SK hynix Inc.	25.358	11.862
Samsung Electronics Co., Ltd.	344.516	(17.374)
Semiconductor Manufacturing International Corporation	12.156	(1.809)
Renesas Elctronics Corporation	14.853	5.146

Source: Own calculation

Table 4.6 - Intel's beta calculation based on comparable companies' analysis

Company	D/E	Tax Rate
Advanced Micro Devices Inc.	-2,18%	35,00%
Broadcom Inc.	15,34%	35,00%
NVIDIA Corporation	2,96%	35,00%
QUALCOMM Incorporated	6,80%	35,00%
International Business Machines Corporation	41,99%	35,00%
Apple inc.	4,08%	35,00%
Micron Technology Inc.	-2,45%	35,00%
Texas Instruments Incorporated	2,20%	35,00%
Applied Materials Inc.	0,65%	35,00%
Microchip Technology Incorporated	21,86%	35,00%
Analog Devices Inc.	7,61%	35,00%
NXP Semiconductors N.V.	20,05%	35,00%
STMicroelectronics N.V.	-1,72%	35,00%
ASML Holding N.V.	-1,46%	35,00%
Taiwan Semiconductor Manufacturing Company Limited	-3,24%	35,00%
MediaTek Inc.	-16,29%	35,00%
SK hynix Inc.	46,78%	35,00%
Samsung Electronics Co., Ltd.	-5,04%	35,00%
Semiconductor Manufacturing International Corporation	-14,88%	35,00%
Renesas Elctronics Corporation	34,64%	35,00%

Source: Own calculation

Table 4.7 - Intel's beta calculation based on comparable companies' analysis

Company	Unlevered Beta (Raw Beta)
Advanced Micro Devices Inc.	2,06
Broadcom Inc.	1,02
NVIDIA Corporation	1,70
QUALCOMM Incorporated	1,23
International Business Machines Corporation	0,65
Apple inc.	1,22
Micron Technology Inc.	1,31
Texas Instruments Incorporated	0,99
Applied Materials Inc.	1,51
Microchip Technology Incorporated	1,36
Analog Devices Inc.	1,09
NXP Semiconductors N.V.	1,31
STMicroelectronics N.V.	1,22
ASML Holding N.V.	1,44
Taiwan Semiconductor Manufacturing Company Limited	1,34
MediaTek Inc.	1,52
SK hynix Inc.	0,85
Samsung Electronics Co., Ltd.	1,04
Semiconductor Manufacturing International Corporation	0,71
Renesas Elctronics Corporation	1,30
Average	**1,24**

Source: Own calculation

Table 4.8 - Intel's beta calculation based on comparable companies' analysis

Intel Corporation	
Beta Levered (Raw Beta)	0,725
Beta Levered (Adjusted)	0,817
Adjusted Close – Daily Stock price	25,77
Shares outstanding (in mln)	4.016
Market Value of Equity ($, mln)	103.492
Net Debt ($, mln)	32.972
D/E	31,86%
Tax Rate	35,00%
Unlevered Beta (avg. comparable companies' beta)	**1,24**
Levered Beta	**1,50**

Source: Own calculation

Intel's number of outstanding shares (4.016 mln) on 31/12/2022 has been assumed to be equal to the number of shares outstanding on 30/09/2022. As it has been said in chapter I, the debt amount used is always the net debt computed as all financial debt minus cash & cash equivalents. Moreover, the market value of debt has been assumed to be equal to its book value in 2022. Whenever the debt-to-equity ratio is negative, it means that the company's cash & cash equivalents are higher than the amount of debt (thus resulting in unlevered betas higher than levered betas).

We should see how the book value of debt has been calculated. After summing the short-term and long-term financial debt, the present value of all operating and finance leases has been computed and added to the previously computed summation (Intel's 2022 lease expenses have been assumed to be equal to Intel's 2021 lease expenses; moreover, Intel's lease commitments have been assumed to be the same as the ones reported in Intel's 2021 10K). The present value of such leases has been discounted at the pre-tax cost of debt. The pre-tax cost of debt has been computed through the synthetic rating approach that has been explained in the first chapter.

Table 4.9 - Converting Leases into debt ($, mln)

Operating lease expense in current year	798,00

Year	Commitment	Present Value
1	634,00	605,98
2	668,00	610,26
3	79,00	68,98
4	55,00	45,90
5	16,00	12,76
6 and beyond	27,00	20,59
Debt Value of leases		**1.364,47**

Source: Own calculation

Table 4.10 - Intel's 2022 forecasted data ($, mln)

Reported Operating Income (EBIT) in 2022	18.716,21
Reported Debt	36.440,67
Reported Interest Expenses	1.761,79

Source: Own calculation

Then, the number of years embedded in year 6 has been estimated following Damodaran's approach, which consists in using the average lease expense over the first five years (the number has been rounded up to zero because of its insignificancy).

Table 4.11 - Number of years embedded after year 5 ($, mln)

Number of years embedded in year 6 estimate	0

Source: Own calculation

Table 4.12 - Operating Lease Adjustment ($, mln)

Reported Operating income	18.716,21
+ Current year's operating lease expense	798,00
- Depreciation on leased asset = Debt Value of Leases / (5 + n° of years embedded in yr 6 estimate)	272,89
Adjusted Operating Income	19.241,31

Source: Own calculation

Table 4.13 - Final amount of debt in 2022 ($, mln)

Debt with Operating leases reclassified as debt (Reported Debt + Debt Value of Leases)	37.805,14

Source: Own calculation

Table 4.14 - Ratings, Interest Coverage Ratios and Default Spreads for non-financial firms only as of January 2022

If interest coverage ratio is			
>	*≤ to*	*Rating is*	*Spread is*
-100000	0,499999	D2/D	14,34%
0,5	0,799999	C2/C	10,76%
0,8	1,249999	Ca2/CC	8,80%
1,3	1,499999	Caa/CCC	7,78%
1,5	1,999999	B3/B-	4,62%
2	2,499999	B2/B	3,78%
2,5	2,999999	B1/B+	3,15%
3	3,499999	Ba2/BB	2,15%
3,5	3,9999999	Ba1/BB+	1,93%
4	4,499999	Baa2/BBB	1,59%
4,5	5,999999	A3/A-	1,29%
6	7,499999	A2/A	1,14%
7,5	9,499999	A1/A+	1,03%
9,5	12,499999	Aa2/AA	0,82%
12,50	100000	Aaa/AAA	0,67%

Source: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ratings.html (Accessed: 15 October 2022)

The figure above is the conversion table that we used to compute the default spread to be added to R_f and the figure below shows all the elements needed for the computation of the cost of debt.

Table 4.15 - Cost of debt estimation through the synthetic rating approach

Risk-free rate	3,804%
Interest coverage ratio	10,54
Estimated Bond Rating	Aa2/AA
Estimated Default Spread	0,82%
Estimated Pre-tax Cost of Debt	*4,62%*
Cost of Debt	*3,01%*

Source: Own calculation

The Interest Coverage Ratio has been computed as Intel's 2022 estimated EBIT adjusted by the leases divided by the estimated Intel's interest expenses plus the debt value of leases (i.e. the present value of leases discounted at the pre-tax cost of debt) multiplied by the pre-tax cost of debt:

$$ICR = \frac{Adjusted\ EBIT}{(Interest\ Expenses + Debt\ Value\ of\ Leases) * Pre\ tax\ Cost\ of\ Debt}$$

A careful reader will immediately notice that one of our outputs, the pre-tax cost of debt, has been used as if it were a given input: this was only feasible by enabling the iteration option on our excel file.

Then, the Equity Risk Premium has been computed as the Implied Risk Premium since, as it has been demonstrated by Damodaran in the first chapter, it reflects a more realistic value.

Table 4.16 - Assumptions for the estimation of the Implied ERP

Level of the index (i.e. S&P 500 as of 30/09/2022)	3.585,62
Current dividend yield	4,85%
Expected growth rate in earnings for the next 5 years	6,99%
Current long term bond rate	3,804%
Risk premium	4,82%
Expected growth rate in the long term	3,804%

Source: Own calculation

The "Current dividend yield" considers both the stock buyback and dividend yield for the previous twelve months on the S&P 500 index (the data has been provided by S&P Capital press release on 20/09/2022, the latest press release available on 30/09/2022 since such documents are published on a quarterly basis). Both the stock repurchases, and dividend yields have been taken into account, however, considering only the dividend yield could have been a simpler and acceptable alternative.

The “Expected growth rate in earnings for the next five years” has been computed as the average of analysts’ yearly growth estimates (provided by Damodaran from 2000 to 2021).
The abovementioned “Risk premium” is none other than the average of yearly historical implied equity risk premia provided by Damodaran from 2000 to 2021.
The expected dividends and the terminal value have been computed as:

$$E(Div) = Current\ dividend\ yield * Index\ level * (1 + expected\ growth\ rate\ for\ the\ next\ 5\ years)^n$$

$$TV = \frac{Exp.Div.at\ year\ 5 * (1 + risk - expected\ growth\ in\ the\ long\ run)}{(expected\ growth\ in\ the\ long\ run + risk\ premium - risk\ free\ rate)}$$

It is important to underline the fact that the current long-term bond rate has been assumed to be equal to the growth rate in the long run for the index. The discount rate that has been used is given by the sum of the risk-free rate and the risk premium. In order to find the implied risk premium, we used the “goal seek” function on excel which allowed to find that specific ERP for which the Intrinsic Value of the index is equal to the current level of the S&P 500 (as of 30/09/2022).
In the two tables below the above-mentioned results have been reported.

Table 4.17 - Intrinsic Value of Index estimation

Intrinsic Value of Index

	1	2	3	4	5
Expected Dividends	186,06	199,07	212,99	227,89	243,82
Expected Terminal Value					5.249,44
Present Value	171,29	168,71	166,18	163,68	3.632,23
Intrinsic Value of Index	4.302,09				

Table 4.18 - Implied Risk Premium calculation

Implied Risk Premium

Implied Risk Premium	5,77%

	1	2	3	4	5
Expected Dividends	186,06	199,07	212,99	227,89	243,82
Expected Terminal Value					4.384,83
Present Value	169,80	165,80	161,89	158,07	2.930,06
Intrinsic Value of Index	3.585,62				

Source: Own calculation

We have now found all the inputs needed for the calculation of the cost of equity: the risk-free rate, the levered beta, and the equity risk premium.

The CAPM formula is applied:

$$R_e = R_f + \beta * ERP$$

Table 4.19 - Cost of Equity estimation through the CAPM formula

R_f	3,804%
Intel's Raw Beta	0,73
Implied Equity Risk Premium (ERP)	5,77%
Cost of Equity	**12,21%**

Source: Own calculation

Then, by using the following formula, the WACC has been computed:

$$WACC = \frac{E}{(E+D)} * R_e + \frac{D}{(E+D)} * R_d * (1 - T_c)$$

Table 4.20 - WACC estimation through MM's formula

WACC	**10,29%**

Source: Own calculation

We must now look at the:

- Income statement
- Balance sheet
- Cash flow statement
- Net working capital calculation
- Capex & depreciation schedule
- Debt repayment schedule
- Equity schedule

It should be remembered that 2022 data, although it has been reported as historical data (i.e. t_0), are actually computed assuming a -15% growth in revenues (YOY); as it can be seen, since Intel missed its expected earnings for its second quarter in 2022, we chose the most realistic scenario for the year 2022 in terms of growing revenues, as if Intel were to suffer because of the increase in competition. Sales forecast have been assumed to grow at 9% from 2023 onwards, which is exactly the industry average growth in sales recorded by Statista for the past five years (Figure 4.10).

The COGS and OpEx have been assumed as 20% and 33% of revenues respectively.

Table 4.21 - Intel's historical and forecast income statement ($, mln)

	Historical						Forecast				
$ in mln	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Revenue	62.761	70.848	71.965	77.867	79.024	67.170	73.216	79.805	86.988	94.817	103.350
Cogs	(15.711)	(18.226)	(19.199)	(22.221)	(23.626)	(13.434)	(14.643)	(15.961)	(17.398)	(18.963)	(20.670)
Gross Profit	**47.050**	**52.622**	**52.766**	**55.646**	**55.398**	**53.736**	**58.573**	**63.844**	**69.590**	**75.853**	**82.680**
Operating expenses	(20.871)	(20.221)	(19.905)	(19.729)	(24.150)	(22.166)	(24.161)	(26.336)	(28.706)	(31.289)	(34.105)
EBITDA	**26.179**	**32.401**	**32.861**	**35.917**	**31.248**	**31.570**	**34.411**	**37.508**	**40.884**	**44.564**	**48.574**
D&A	(8.129)	(9.085)	(10.826)	(12.239)	(11.792)	(12.854)	(15.068)	(15.967)	(16.702)	(17.303)	(17.795)
EBIT	**18.050**	**23.316**	**22.035**	**23.678**	**19.456**	**18.716**	**19.343**	**21.541**	**24.182**	**27.260**	**30.780**
Interest expenses	(349)	126	484	(504)	(482)	(1.762)	(1.685)	(1.605)	(1.521)	(1.433)	(1.341)
Gains (losses)	2.651	(125)	1.539	1.904	2.729	-	2.975	3.242	3.534	3.852	4.199
EBT	**20.352**	**23.317**	**24.058**	**25.078**	**21.703**	**16.954**	**20.633**	**23.179**	**26.196**	**29.680**	**33.638**
Taxes	(10.751)	(2.264)	(3.010)	(4.179)	(1.835)	(5.934)	(7.222)	(8.113)	(9.168)	(10.388)	(11.773)
Net Income	**9.601**	**21.053**	**21.048**	**20.899**	**19.868**	**11.020**	**13.411**	**15.066**	**17.027**	**19.292**	**21.865**

Source: Own calculation

Table 4.22 - Balance sheet ($, mln)

	Historical						Forecast				
$ in mln	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Trades Receivable	5.607	6.722	7.659	6.782	9.457	6.682	7.284	7.939	8.654	9.433	10.282
Inventory	6.983	7.253	8.744	8.427	10.776	5.732	6.247	6.810	7.422	8.090	8.819
Net Fixed Assets	53.854	60.812	66.213	65.610	70.515	82.661	87.593	91.626	94.924	97.621	99.826
Cash	3.433	3.019	4.194	5.865	4.827	10.643	7.958	6.719	6.909	8.537	11.635
Other assets	53.372	50.157	49.714	66.407	72.831	61.906	67.478	73.551	80.171	87.386	95.251
Assets	**123.249**	**127.963**	**136.524**	**153.091**	**168.406**	**167.624**	**176.560**	**186.645**	**198.080**	**211.067**	**225.811**
Trades Payable	2.928	3.824	4.128	5.581	5.747	2.971	3.238	3.529	3.847	4.193	4.571
Provisions	-	-	-	-	-	-	-	-	-	-	-
Debt	26.813	26.359	29.001	36.401	38.101	36.441	34.704	32.886	30.985	28.995	26.914
Other liabilities	24.489	23.217	25.891	30.071	29.167	26.210	28.568	31.140	33.942	36.997	40.327
Equity	69.019	74.563	77.504	81.038	95.391	102.003	110.050	119.090	129.306	140.881	154.000
Liabilities & Equity	**123.249**	**127.963**	**136.524**	**153.091**	**168.406**	**167.624**	**176.560**	**186.645**	**198.080**	**211.067**	**225.811**
DSO	32,2	34,2	38,3	31,4	43,1	35,8	35,8	35,8	35,8	35,8	35,8
DIO	160,0	143,3	164,0	136,5	164,2	153,6	153,6	153,6	153,6	153,6	153,6
DPO	67,1	75,5	77,4	90,4	87,6	79,6	79,6	79,6	79,6	79,6	79,6
Other assets %	85,0%	70,8%	69,1%	85,3%	92,2%	92,2%	92,2%	92,2%	92,2%	92,2%	92,2%
Other liabilities %	39,0%	32,8%	36,0%	38,6%	36,9%	39,0%	39,0%	39,0%	39,0%	39,0%	39,0%

Source: Own calculation

The average of the Days Sales Outstanding (DSO) of the historical period has been multiplied by the revenues of the given year and divided by 360 to find the trade receivables; the same logic has been applied to the Days Inventory Outstanding (DIO) and the Days Payable Outstanding (DPO) for the inventory and trades payable respectively. While, for "other assets" and "other liabilities", the abovementioned percentage has been multiplied by the revenues of each year (the maximum of the historical years has been chosen for 2022 as the applied percentage).

Table 4.23 - Net Working Capital calculation ($, mln)

Net Working Capital	**Historical**						**Forecast**				
$ in mln	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Trades Receivable	5.607	6.722	7.659	6.782	9.457	6.682	7.284	7.939	8.654	9.433	10.282
Inventory	6.983	7.253	8.744	8.427	10.776	5.732	6.247	6.810	7.422	8.090	8.819
Trades Payable	2.928	3.824	4.128	5.581	5.747	2.971	3.238	3.529	3.847	4.193	4.571
NWC	9.662	10.151	12.275	9.628	14.486	9.443	10.293	11.220	12.229	13.330	14.530
∆NWC		489	2.124	(2.647)	4.858	(5.043)	850	926	1.010	1.101	1.200

Source: Own calculation

Table 4.24 - Fixed Assets schedule ($, mln)

Fixed Assets	**Historical**				**Forecast**				
$ in mln	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Beginning Net Fixed Assets		66.213	65.610	70.515	82.661	87.593	91.626	94.924	97.621
D&A		(12.239)	(11.792)	(12.854)	(15.068)	(15.967)	(16.702)	(17.303)	(17.795)
Capex		11.636	16.697	25.000	20.000	20.000	20.000	20.000	20.000
Ending Net Fixed Assets	**66.213**	**65.610**	**70.515**	**82.661**	**87.593**	**91.626**	**94.924**	**97.621**	**99.826**
D&A as a % of Beginning Net Fixed Assets		-18,5%	-18,0%	-18,2%	-18,2%	-18,2%	-18,2%	-18,2%	-18,2%
Capex as a % of Beginning Net Fixed Assets		17,6%	25,4%	21,5%	21,5%	21,5%	21,5%	21,5%	21,5%

Source: Own calculation

Table 4.25 - Debt Schedule ($, mln)

Debt schedule	**Historical**		**Forecast**				
$ in mln	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Beginning Debt		38.101,00	36.440,67	34.703,57	32.886,15	30.984,68	28.995,30
New debt	38.101,00	-	-	-	-	-	-
Principal repayment	-	- 1.660,33	- 1.737,10	- 1.817,43	- 1.901,46	- 1.989,39	- 2.081,38
Ending Debt	**38.101,00**	**36.440,67**	**34.703,57**	**32.886,15**	**30.984,68**	**28.995,30**	**26.913,92**

Source: Own calculation

Table 4.26 - Debt Schedule data input

Interest rate after 2022	4,62%
Repay debt in 15 years	15
Annual payment ($, mln):	**(3.422,1)**

Source: Own calculation

Table 4.27 - Equity Schedule ($, mln)

	Historical		Forecast				
$ in mln	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Beginning Equity		95.391,00	102.003,22	110.050,11	119.089,94	129.306,19	140.881,36
Increase of Capital		-	-	-	-	-	-
Net Income/(Loss)		11.020,37	13.411,48	15.066,39	17.027,08	19.291,95	21.864,56
Dividends		- 4.408,15	- 5.364,59	- 6.026,56	- 6.810,83	- 7.716,78	- 8.745,82
Ending Equity	**95.391,00**	**102.003,22**	**110.050,11**	**119.089,94**	**129.306,19**	**140.881,36**	**154.000,10**
Dividends as a % of Net Income		40,0%	40,0%	40,0%	40,0%	40,0%	40,0%

Source: Own calculation

Table 4.28 - Cash Flow Statement ($, mln)

		Forecast				
$ in mln	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Net Income	11.020	13.411	15.066	17.027	19.292	21.865
D&A	12.854	15.068	15.967	16.702	17.303	17.795
Change in Trade Receivables	2.775	(601)	(656)	(715)	(779)	(849)
Change in Inventory	5.044	(516)	(562)	(613)	(668)	(728)
Change in Trade Payables	(2.776)	267	291	318	346	377
Change in Other assets	10.925	(5.572)	(6.073)	(6.620)	(7.215)	(7.865)
Change in Other liabilities	(2.957)	2.359	2.571	2.803	3.055	3.330
Operating Cash Flow	**36.884**	**24.417**	**26.605**	**28.902**	**31.334**	**33.925**
Capex	(25.000)	(20.000)	(20.000)	(20.000)	(20.000)	(20.000)
Investing Cash Flow	**(25.000)**	**(20.000)**	**(20.000)**	**(20.000)**	**(20.000)**	**(20.000)**
Dividends	(4.408)	(5.365)	(6.027)	(6.811)	(7.717)	(8.746)
Change in Financial Liabilities	(1.660)	(1.737)	(1.817)	(1.901)	(1.989)	(2.081,4)
Change in Provisions	-	-	-	-	-	-
Change in Equity	-	-	-	(0)	(0)	-
Financing Cash Flow	**(6.068)**	**(7.102)**	**(7.844)**	**(8.712)**	**(9.706)**	**(10.827)**
Net Change in cash	**5.816**	**(2.685)**	**(1.239)**	**190**	**1.628**	**3.098**
Cash at the beginning of the year	4.827,00	10.642,66	7.957,79	6.718,94	6.909,09	8.536,98
Cash at the end of the year	10.642,66	7.957,79	6.718,94	6.909,09	8.536,98	11.634,50

Source: Own calculation

After all the previous considerations and calculations[158], Intel's intrinsic value can eventually be estimated via the implementation of the WACC approach (DCF Analysis). By assuming the firm will keep a constant market leverage ratio, the previously computed WACC will be applied as the only discount rate to all FCFs. The terminal value has been estimated via the perpetual growth rate approach (as it has already been shown in the RJR Nabisco valuation).

Table 4.29 - Discounted Cash Flow Analysis ($, mln)

Discounted Cash Flow	Entry	2023	2024	2025	2026	2027	Exit
Date	*31/12/2022*	*31/12/2023*	*31/12/2024*	*31/12/2025*	*31/12/2026*	*31/12/2027*	*31/12/2027*
Year Fraction		*1,00*	*1,00*	*1,00*	*1,00*	*1,00*	
EBIT		19.343	21.541	24.182	27.260	30.780	
Less: Cash Taxes		6.770	7.540	8.464	9.541	10.773	
Plus: D&A		15.068	15.967	16.702	17.303	17.795	
Less: Capex		20.000	20.000	20.000	20.000	20.000	
Less: Changes in NWC		850	926	1.010	1.101	1.200	
Unlevered FCF		6.791	9.043	11.411	13.922	16.602	
(Entry)/Exit	(121.369)						204.149
Transaction CF	-	6.791	9.043	11.411	13.922	16.602	204.149
Transaction CF	(121.369)	6.791	9.043	11.411	13.922	16.602	204.149

Source: Own calculation

Table 4.30 - Intel's Intrinsic Value estimation ($, mln)

Intrinsic Value	
Enterprise Value	166.749
(+) Cash & Cash Equivalents	10.643
(+) Other Non-Core Assets	9.286
(-) Total Debt (including lease commitments)	37.805
Equity Value	**148.872**
Equity Value/Share – (Basic)	**$ 37,07**
Dilutive effect caused by employee options and convertible bonds	31
Fully diluted shares outstanding	4.047
Equity Vlaue/Share – (Diluted)	**$ 36,79**

Source: Own calculation

It must be stated that the value of "Other Non-Core Assets" in 2022 has been assumed to be 15% of "Other Assets" in 2022. Then, the dilutive effect has been assumed to be the same as it was in 2021 to be able to compute the fully diluted shares outstanding. Moreover, it must be said that Intel had no minority interests and that unfunded pension funds and NOL carried forward have not been considered in the computation of the equity value.

[158] Cash flow statement, debt repayment schedule and net working capital calculation are all self-explanatory.

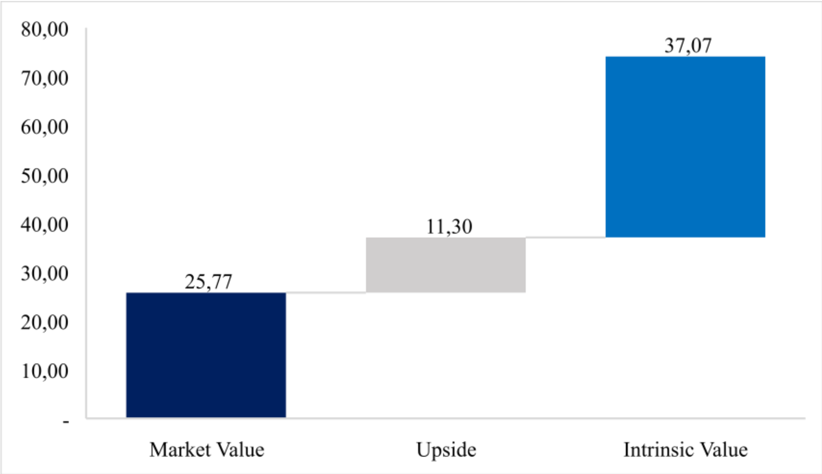
Table 4.31 - Intel’s Market Value estimation ($, mln)

Market Value	
Market Cap	103.492
(+) Debt	37.805
(-) Other Non-Core Assets	9.286
(-) Cash & Cash Equivalents	10.643
Enterprise Value	121.369
Equity Value/Share	25,77

Source: Own calculation

As it can be seen, the calculation demonstrate that Intel’s intrinsic value is much higher than what the market believes.

Figure 4.12 - Market Value vs Intrinsic Value ($)



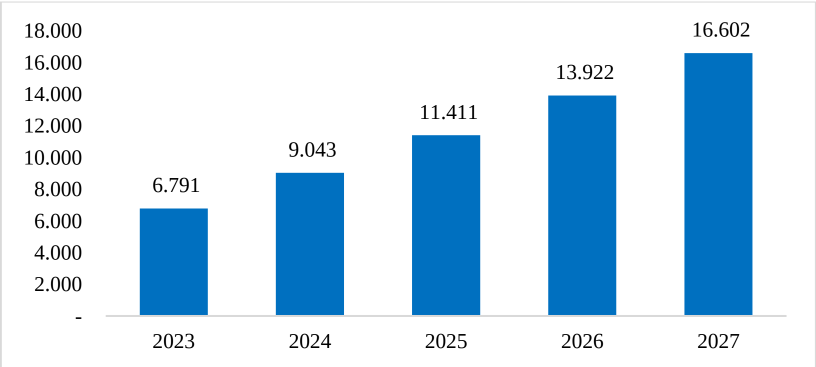
Source: Own construction

Table 4.32 - Rate of return

Rate of Return	
Target Price Upside	44%
Internal Rate of Return (IRR)	18%

Source: Own calculation

Figure 4.13 - Free Cash Flows ($, mln)



Source: Own construction

4.3.3 Intel Valuation according to Fernández and all alternative theories concerning VTS

This is the section aimed at analyzing Intel's intrinsic value by applying four different valuation methods:

- the APV
- the ECF
- the FCF
- the CCF

All methods, as it has been said in the introduction, if applied correctly will provide the same result given the same economist's theory: the difference in value will be given by the different way of computing the value of the tax shield.
The nine different theories applied are:

- Fernández
- Modigliani & Miller
- Myers
- Miller
- Miles & Ezzel
- Harris & Pringle (and Ruback)
- Damodaran (1994)
- Practitioners
- Fernández (with cost of leverage)

Always assuming a tax rate = 35%, we are now analyzing Fernández's theory without cost of leverage in the case the company grew at a constant rate of 2% perpetually (with the only exception of other assets and other liabilities which are constant for the whole forecasted period; 2022 has been forecasted by applying the same numbers forecasted in the previous valuation so as to have a common starting point for both valuations). The pre-tax cost of debt has been set equal to 4,62%, the risk-free rate has been set equal to 3,804%, the ERP has been assumed to be 5,77% as it has been assumed in the previous valuation. However, the unlevered beta has been assumed to be equal to 1 since, according to Fernández, such assumption works better in most valuations. As it can be seen, it has been decided to keep most of the previous assumptions with some exceptions proposed by Fernández (unlevered beta = 1 by default and a perpetual growth rate instead of using a short-run growth rate for the 5-year cash flows and a long-run growth rate for the TV computation) since the purpose of this valuation is to see the difference in the intrinsic value generated by the VTS, the focus is not on, unlike the previous valuation, how to compute those intermediate elements thanks to which we are able to arrive at the equity value. At this point the reader will conclude that, regardless of the valuation method or theory, the value obtained in any of the nine theories will be different from the one provided in the previous paragraphs (because of the different assumptions).

Table 4.33 - Intel's Balance sheet assuming a 2% growth in perpetuity ($, mln)

Balance sheet	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Cash and banks	10.643	10.856	11.073	11.294	11.520	11.750
Accounts receivable	6.682	6.816	6.952	7.091	7.233	7.378
Stocks	5.732	5.846	5.963	6.082	6.204	6.328
Gross fixed assets	188.818	203.582	218.642	234.002	249.670	265.651
- cum, depreciation	106.157	119.268	132.641	146.282	160.195	174.387
Net fixed assets	82.661	84.314	86.001	87.721	89.475	91.265
Other assets	61.906	61.906	61.906	61.906	61.906	61.906
TOTAL ASSETS	**167.624**	**169.738**	**171.895**	**174.095**	**176.338**	**178.627**
Accounts payable	2.971	3.030	3.091	3.152	3.215	3.280
Debt (D)	36.441	37.169	37.913	38.671	39.445	40.233
Equity (book value)	102.003	103.329	104.682	106.062	107.469	108.904
Other liabilities	26.210	26.210	26.210	26.210	26.210	26.210
TOTAL LIABILITIES	**167.624**	**169.738**	**171.895**	**174.095**	**176.338**	**178.627**

Source: Own calculation

Table 4.34 - Intel's Income statement assuming a 2% growth in perpetuity ($, mln)

Income statement	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	
Sales	67.170	68.514	69.884	71.282	72.707	74.162	
Cost of sales	13.434	13.703	13.977	14.256	14.541	14.832	
General expenses	22.166	22.610	23.062	23.523	23.993	24.473	
Depreciation	12.854	13.111	13.373	13.641	13.913	14.192	
Margin	**18.716**	**19.091**	**19.472**	**19.862**	**20.259**	**20.664**	
Interest payments	1.762	1.685	1.719	1.753	1.788	1.824	
Gains on equity investments		2.784	2.839	2.896	2.954	3.013	
PBT	**16.954**	**20.189**	**20.593**	**21.005**	**21.425**	**21.853**	
Taxes	5.934	7.066	7.208	7.352	7.499	7.649	
PAT	**11.020**	**13.123**	**13.385**	**13.653**	**13.926**	**14.205**	
+ Depreciation	12.854	13.111	13.373	13.641	13.913	14.192	
+ Δ Debt	762,02	728,81	743	758	773	789	
- Δ WCR	- 386	- 402	- 410	- 418	- 426	- 435	
- Investments	- 13.438	- 14.764	- 15.059	- 15.361	- 15.668	- 15.981	
ECF = Dividends	10.812	11.797	12.033	12.273	12.519	12.769	13.024,60
FCF	11.195	12.163	12.406	12.655	12.908	13.166	13.429,19
CCF	11.812	12.753	13.008	13.268	13.534	13.804	14.080,33
Debt cash flow	1.000	956	975	995	1.015	1.035	1.055,73

Source: Own calculation

Table 4.35 - Valuation by Fernández (no cost of leverage) assuming a 2% growth in perpetuity ($, mln)

	Valuation	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	
	Beta U	1	1	1	1	1	1	
	RF	3,804%	3,804%	3,804%	3,804%	3,804%	3,80%	
	MRP	5,77%	5,77%	5,77%	5,77%	5,77%	5,77%	
	Ku	9,58%	9,58%	9,58%	9,58%	9,58%	9,58%	
	Vu = FCF/(Ku - g)	160.549	163.760	167.035	170.375	173.783	177.259	
	WITHOUT TAXES							
	FCF WITHOUT TAXES		19.819	20.216	20.620	21.032	21.453	21.882
	Vu without taxes	261.603	266.835	272.172	277.615	283.168	288.831	
APV	***WITH TAXES***							
	Kd	***4,62%***	***4,62%***	***4,62%***	***4,62%***	***4,62%***	***4,62%***	
	Beta d	0,1	0,1	0,1	0,1	0,1	0,1	
	DTKu/(Ku-g) = VTS	16.121	16.444	16.773	17.108	17.450	17.799	
	VTS + Vu	176.670	180.203	183.807	187.483	191.233	195.058	
	- D = E 1	**140.229**	**143.034**	**145.894**	**148.812**	**151.788**	**154.824**	
ECF	Beta E	1,14	1,14	1,14	1,14	1,14	1,14	
	Ke	10,41%	10,41%	10,41%	10,41%	10,41%	10,41%	
	E 2 = ECF / (Ke-g)	**140.229**	**143.034**	**145.894**	**148.812**	**151.788**	**154.824**	
FCF	WACC	8,88%	8,88%	8,88%	8,88%	8,88%	8,88%	
	D + E = FCF / (WACC-g)	176.670	180.203	183.807	187.483	191.233	195.058	
	- D = E 3	**140.229**	**143.034**	**145.894**	**148.812**	**151.788**	**154.824**	
CCF	$WACC_{BT}$	9,22%	9,22%	9,22%	9,22%	9,22%	9,22%	
	D + E = CCF / ($WACC_{BT}$-g)	176.670	180.203	183.807	187.483	191.233	195.058	
	- D = E 4	**140.229**	**143.034**	**145.894**	**148.812**	**151.788**	**154.824**	

Source: Own calculation

As it can be seen, regardless of the valuation method, we always obtain the same results.

We should remember that the debt beta has been computed as:

$$\beta_d = \frac{R_d - R_f}{ERP}$$

And the interest expenses at time t have been computed as the pre-tax cost of debt multiplied by the debt value at time t_{-1}.

Dividing the equity value at t_0 (year 2022) by the number of outstanding shares, we obtain an intrinsic equity value equal to $ 34,92.

Table 4.36 - Equity Value per share assuming a 2% growth in perpetuity

Shares outstanding (in mln)	4.016
Share price ($)	34,92

Source: Own calculation

The table below demonstrates that the VTS in Fernández is none other than the difference between the present value of the taxes paid by the unlevered firm and the present value of the taxes paid by the levered firm. As it can be seen, if compute the difference between $ 101.055 mln (the taxes paid by the unlevered firm) and $ 84.933 mln (the taxes paid by the levered firm), we obtain $ 16.121 mln: the value of the tax shield in 2022 (our t_0) as it can be checked in table 4.35.

The tax risk is different from the ECF risk, the risk will be the same if and only if the summation of tax and ECF is equal to the PBT (which only occurs if ECF is equal to PAT). In our case since PBT ($ 20.189 mln) is higher than ECF ($ 11.797 mln), then the tax risk is lower than the risk associated with ECF: K_{TL} is 10,32% and K_e is 10,41% indeed.

Table 4.37 - Valuation summary assuming a 2% growth in perpetuity ($, mln)

	WITHOUT TAXES		**WITH TAXES (35%)**	
	No debt	With debt	No debt	With debt
	D = 0	D = 36.441	D = 0	D = 36.441
ECF	19.819,17	18.863	12.163	11.797
Taxes	—	—	7.656	7.066
Debt cash flow	—	956	—	956
Total cash flow	19.819	19.819	19.819	19.819
Ke	9,58%	10,38%	9,58%	10,41%
Kd	—	4,62%	—	4,62%
KTL	—	—	9,58%	10,32%
E = ECF/(Ke-g)	261.603	225.162	160.549	140.229
D = Debt cash flow/(Kd-g)	—	36.441	—	36.441
G = Taxes/(KTL-g)	—	—	101.055	84.933
E+D+G	**261.603**	**261.603**	**261.603**	**261.603**

Source: Own calculation

In the case of perpetuities[159] (as it can be seen in table 4.40):

- PAT = ECF because D&A must be equal to the investment to maintain the cash flow generation capacity constant
- The required return to tax in the unlevered firms (K_{TU}) is equal to the required return to equity in the unlevered firms (K_U)
- The required return to tax in the levered firms (K_{TL}) is equal to the required return to equity in the levered firms (K_e)

[159] Fernández, P. (2019) ‘Discounted Cash Flow Valuation Methods: Examples of Perpetuities, Constant Growth and General Case’, *IESE Business School*, pp. 1-20.

The case in which the company grows perpetually at 0% will now be analyzed.

Table 4.38 - Intel's valuation with no growth in six different situations ($, mln)

		[A]	[B]	[C]	[D]	[E]	[F]
		D = 0	D = 0	D = 36.441	D = 36.441	D = 36.441	**D = 72.881**
	T =	0%	35%	**0%**	**35%**	35%	35%
				Kd = 4,62%	Kd = 4,62%	**Kd = 4,98%**	Kd = 4,98%
	Margin	19.091	19.091	19.091	19.091	19.091	19.091
	Interest	-	-	1.685	1.685	1.815	3.629
	Gains on equity investments	2.784	2.784	2.784	2.784	2.784	2.784
	PBT	21.874	21.874	20.189	20.189	20.059	18.245
	Taxes	-	7.656	-	7.066	7.021	6.386
	PAT	21.874	14.218	20.189	13.123	13.039	11.859
	+ depreciation	13.111	13.111	13.111	13.111	13.111	13.111
	- Investment in fixed assets	(13.111)	(13.111)	(13.111)	(13.111)	(13.111)	(13.111)
	ECF	**21.874**	**14.218**	**20.189**	**13.123**	**13.039**	**11.859**
	FCF	**21.874**	**14.218**	**21.874**	**14.218**	**14.218**	**14.218**
	CCF	**21.874**	**14.218**	**21.874**	**14.808**	**14.853**	**15.488**
	Unlevered beta (ßu)	1,000	1,000	1,000	1,000	1,000	1,000
	RF	3,804%	3,804%	3,804%	3,804%	3,804%	3,804%
	MRP = market risk premium	5,77%	5,77%	5,77%	5,77%	5,77%	5,77%
	Ku	9,58%	9,58%	9,58%	9,58%	9,58%	9,58%
	Vu	**228.425**	**148.476**	**228.425**	**148.476**	**148.476**	**148.476**
APV	D	0	0	36.441	36.441	36.441	72.881
	Kd			4,62%	4,62%	4,98%	4,98%
	Beta of debt (ßd)			0,1421	0,1421	0,2037	0,2037
	VTS = DT	0	0	0	12.754	12.754	25.508
	VTS + Vu	228.425	148.476	228.425	161.231	161.231	173.985
	- D = **E1**	**228.425**	**148.476**	**191.985**	**124.790**	**124.790**	**101.104**
ECF	Levered beta (ßL)	1,000	1,000	1,163	1,163	1,151	1,373
	Ke	9,58%	9,58%	10,52%	10,52%	10,45%	11,73%
	E2 = ECF / Ke	**228.425**	**148.476**	**191.985**	**124.790**	**124.790**	**101.104**
FCF	WACC	9,58%	9,58%	9,58%	8,82%	8,82%	8,17%
	FCF / WACC	228.425	148.476	228.425	161.231	161.231	173.985
	E3 = (FCF / WACC) - D	**228.425**	**148.476**	**191.985**	**124.790**	**124.790**	**101.104**
CCF	WACCBT	9,58%	9,58%	9,58%	9,18%	9,21%	8,90%
	CCF/WACCBT	228.425	148.476	228.425	161.231	161.231	173.985
	E4 = (CCF / WACCBT) - D	**228.425**	**148.476**	**191.985**	**124.790**	**124.790**	**101.104**

Source: Own calculation

We are in a scenario where no growth is assumed after 2023 (our year 1). Each column represents a different scenario (as if it was a different company) which varies according to: the presence or absence of taxes, the amount of debt, the cost of debt (interests paid).

The fourth column (D) is the scenario that best represents Intel's growth, were Intel's growth to be zero perpetually: the cost of debt, the amount of debt, and the tax rate are the same present in the table representing Fernández's 2% perpetual growth rate (with the only difference consisting in having no variation in terms of NWC and the investments being equal to depreciation because of the abovementioned reasons).

Table 4.39 - Equity value per share for each scenario assuming 0% growth in perpetuity (no growth)

	[A]	[B]	[C]	[D]	[E]	[F]
Share price ($)	56,88	36,97	47,80	31,07	31,07	25,18

Source: Own calculation

Table 4.40 - Valuation summary assuming a 0% growth in perpetuity ($, mln)

	WITHOUT TAXES		WITH TAXES (35%)	
	No debt	With debt	No debt	With debt
	D = 0	D = 38.863	D = 0	D = 38.863
	[A]	[C]	[B]	[D]
ECF	21.874	20.189	14.218	13.123
Taxes	—	—	7.656	7.066
Debt cash flow (interest)	—	1.685,02	—	1.685
Total cash flow	21.874	21.874	21.874	21.874
Ke	9,58%	10,52%	9,58%	10,52%
Kd	—	4,62%	—	4,62%
KTL	—	—	9,58%	10,52%
E = ECF/Ke	228.425	191.985	148.476	124.790
D = Debt cash flow/Kd	—	36.441	—	36.441
G = Taxes/KTL	—	—	79.949	67.195
E+D+G	**228.425**	**228.425**	**228.425**	**228.425**

Source: Own calculation

As it can be seen, the VTS can be measured as the difference between the taxes paid by the unlevered firm ($ 79.949 mln) and the taxes paid by the levered firm ($ 67.195 mln) = $ 12.754 mln, which is exactly the result present in the table 4.38.

Now the results concerning the nine theories will be reported in three different table, one for each scenario: 2% growth (base case), 3,5% growth (best case) and no growth (0%, worst case).

Table 4.41 – Intel's valuation assuming a 2% perpetual growth rate

Scenario: 2 % growth	**E**	**Vu**	**D**	**VTS**	**BETAe**	**Ke**	**WACC**	**$WACC_{BT}$**
Fernández - NO cost of leverage	140.229,10	160.548,55	36.440,67	16.121,23	1,145	10,41%	8,88%	9,22%
Miles & Ezzell	132.260,81	160.548,55	36.440,67	8.152,94	1,233	10,92%	9,21%	9,56%
Modigliani & Miller	151.002,06	160.548,55	36.440,67	26.894,19	1,135	9,81%	8,49%	8,80%
Myers	146.583,33	160.548,55	36.440,67	22.475,45	1,082	10,05%	8,65%	8,97%
Miller	124.107,88	160.548,55	36.440,67	0,00	1,334	11,51%	9,58%	9,94%
Harris & Pringle - Ruback	131.892,36	160.548,55	36.440,67	7.784,48	1,237	10,94%	9,23%	9,58%
Damodaran	137.665,38	160.548,55	36.440,67	13.557,50	1,172	10,57%	8,99%	9,32%
Practitioners	127.948,17	160.548,55	36.440,67	3.840,29	1,285	11,22%	9,40%	9,76%
With cost of leverage	136.284,92	160.548,55	36.440,67	12.177,04	1,187	10,66%	9,04%	9,38%

Source: Own calculation

Table 4.42 - Intel's equity value per share assuming a 2% perpetual growth rate

Theory	***Share price***
Fernández - NO cost of leverage	34,92
Miles & Ezzell	32,93
Modigliani & Miller	37,60
Myers	36,50
Miller	30,90
Harris & Pringle - Ruback	32,84
Damodaran	34,28
Practitioners	31,86
With cost of leverage	33,94

Source: Own calculation

Table 4.43 - Myers' and MM's conditions

Myers condition when Ke < Ku	MM condition when Ke < Ku
DTKd / (Kd - g) > D → g > Kd * (1-Tc)	if VTS > D [Ku - Kd * (1 - Tc)] / (Ku - g)

Kd*(1 - Tc)	**DTKd / (Kd - g)**	**D [Ku - Kd * (1 - Tc)] / (Ku - g)**
3,01%	22.475,45	31.603,75

Source: Own calculation

As it can be observed, the 2% growth scenario includes the results obtained in the previous figures as equity value per share = $ 34,92 by Fernández in the absence of cost of leverage.

Table 4.44 - Intel's valuation assuming a 3,5% perpetual growth rate

Scenario: 3 % growth	**E**	**Vu**	**D**	**VTS**	**BETAe**	**Ke**	**WACC**	**WACCBT**
Fernández – NO cost of leverage	158.478,49	174.818,07	36.440,67	20.101,09	1,128	10,32%	8,95%	9,25%
Miles & Ezzell	148.543,05	174.818,07	36.440,67	10.165,66	1,207	10,77%	9,24%	9,56%
Modigliani & Miller	297.973,15	174.818,07	36.440,67	159.595,76	1,068	7,13%	6,68%	6,85%
Myers	190.846,77	174.818,07	36.440,67	52.469,38	0,928	9,16%	8,17%	8,43%
Miller	138.377,39	174.818,07	36.440,67	0,00	1,300	11,31%	9,58%	9,91%
Harris & Pringle – Ruback	148.083,64	174.818,07	36.440,67	9.706,25	1,211	10,79%	9,26%	9,58%
Damodaran	155.281,85	174.818,07	36.440,67	16.904,46	1,153	10,46%	9,04%	9,35%
Practitioners	143.165,74	174.818,07	36.440,67	4.788,35	1,255	11,05%	9,41%	9,74%
With cost of leverage	153.560,59	174.818,07	36.440,67	15.183,20	1,166	10,53%	9,09%	9,40%

Source: Own calculation

Table 4.45 - Intel's equity value per share assuming a 3,5% perpetual growth rate

Theory	***Share price***
Fernández - NO cost of leverage	39,46
Miles & Ezzell	36,99
Modigliani & Miller	74,20
Myers	47,52
Miller	34,46
Harris & Pringle - Ruback	36,87
Damodaran	38,67
Practitioners	35,65
With cost of leverage	38,24

Source: Own calculation

Table 4.46 - Myers' and MM's conditions

Myers condition when Ke < Ku	**MM condition when Ke < Ku**
DTKd / (Kd - g) > D → g > Kd * (1-Tc)	if VTS > D [Ku - Kd * (1 - Tc)] / (Ku - g)

Kd*(1 - Tc)	**DTKd / (Kd - g)**	**D [Ku - Kd * (1 - Tc)] / (Ku - g)**
3,01%	52.469,38	39.405,80

Source: Own calculation

As far as the worst case scenario (0% growth) is concerned, Fernández's result (no cost of leverage) in the following tables is equal to the one provided by column D in tables 4.38 and 4.39 (Equity value per share = $ 31,07).

Table 4.47 - Intel's valuation assuming a 0% perpetual growth rate

Scenario: 0 % growth	E	Vu	D	VTS	BETAe	Ke	WACC	WACCBT
Fernández - NO cost of leverage	124.790,01	148.476,45	36.440,67	12.754,24	1,163	10,52%	8,82%	9,18%
Miles & Ezzell	118.485,94	148.476,45	36.440,67	6.450,16	1,260	11,08%	9,18%	9,56%
Modigliani & Miller	124.790,01	148.476,45	36.440,67	12.754,24	1,163	10,52%	8,82%	9,18%
Myers	124.790,01	148.476,45	36.440,67	12.754,24	1,163	10,52%	8,82%	9,18%
Miller	112.035,78	148.476,45	36.440,67	0,00	1,370	11,71%	9,58%	9,97%
Harris & Pringle - Ruback	118.194,44	148.476,45	36.440,67	6.158,66	1,265	11,10%	9,19%	9,58%
Damodaran	122.761,74	148.476,45	36.440,67	10.725,96	1,193	10,69%	8,93%	9,30%
Practitioners	115.074,01	148.476,45	36.440,67	3.038,23	1,317	11,40%	9,38%	9,77%
With cost of leverage	121.669,59	148.476,45	36.440,67	9.633,81	1,210	10,79%	8,99%	9,37%

Source: Own calculation

Table 4.48 - Intel's equity value per share assuming a 0% perpetual growth rate

Theory	*Share price*
Fernández - NO cost of leverage	31,07
Miles & Ezzell	29,50
Modigliani & Miller	31,07
Myers	31,07
Miller	27,90
Harris & Pringle - Ruback	29,43
Damodaran	30,57
Practitioners	28,65
With cost of leverage	30,30

Source: Own calculation

Table 4.49 - Myers' and MM's conditions

Myers condition when Ke < Ku	MM condition when Ke < Ku
DTKd / (Kd - g) > D → g > Kd * (1-Tc)	if VTS > D [Ku - Kd * (1 - Tc)] / (Ku - g)

Kd*(1 - Tc)	DTKd / (Kd - g)	D [Ku - Kd * (1 - Tc)] / (Ku - g)
3,01%	12.754,24	25.003,16

Source: Own calculation

Table 4.50 - MM's, Myers', and Fernández's common characteristic in the VTS when g = 0%

Theory	D*Tc	VTS	D*Tc vs VTS
Fernández - NO cost of leverage	12.754,24	12.754,24	VTS = D*T
Miles & Ezzell	12.754,24	6.450,16	VTS < D*T
Modigliani & Miller	12.754,24	12.754,24	VTS = D*T
Myers	12.754,24	12.754,24	VTS = D*T
Miller	12.754,24	0,00	VTS < D*T
Harris & Pringle - Ruback	12.754,24	6.158,66	VTS < D*T
Damodaran	12.754,24	10.725,96	VTS < D*T
Practitioners	12.754,24	3.038,23	VTS < D*T
With cost of leverage	12.754,24	9.633,81	VTS < D*T

Source: Own calculation

As it has already been stated in chapter III, the only three theories are correct under specific circumstances:

- When the debt level is fixed in advance MM (the debt just like the cash flows are in the form of a constant perpetuity) or Myers (when the debt is repaid without issuing new debt) are applied – the tax shield is discounted at K_d
- When the firm has set a constant market leverage policy, then ME is applied – the first year the tax shield is discounted at K_d and the following years at K_u
- When the firm has set a fixed book leverage policy, then Fernández is applied and the appropriate discount rate to use is K_u

However, MM and Myers always give a result which is higher than Fernández's. This is inconsistent as it has already been explained in previous chapter whenever VTS > D.
If the perpetual growth rate were higher (in our case we set it to be equal to 3,5%), the inconsistency exists if:

- For Myers every time $DTK_d / (K_d – g) > D$, which means when $g > K_d*(1-T_c)$
  → VTS > D and $E > V_u$
- For MM every time $VTS > D [K_u - K_d * (1 - T_c)] / (K_u - g)$, which happens when leverage, tax rate, K_d, or ERP are high
  → VTS > D and $E > V_u$

Moreover, in the case of no growth, it has been demonstrated that Fernández, Myers, and MM provide the same results. In addition, they are the only ones whose theories conclude that in the case of perpetuities VTS = DT, all the other theories, according to Fernández, provide us with VTS that are too low (VTS < DT).

Since in our case a fixed book-leverage ratio policy has been assumed, then, by assuming a 2% growth rate in perpetuity (which is the base case scenario compared to 0% and 3,5% growth), we can conclude that $ 34,92 is the appropriate equity value per share. And, as we can see, it is not too far from the result obtained by applying the professionals' method ($ 37,07).

Conclusions

In this section the most important information deduced from our analysis will be gathered: our conclusions come from the empirical results provided by Intel's valuation process. Such process is none other than a practical application of all concepts, theories, assumptions, and considerations seen in the first three chapters.

From the first chapter we concluded that the optimal way to compute the cost of equity is provided by the CAPM formula which has resulted in being the most used formula worldwide among the professionals thanks to its simplicity and reliability unlike the various multifactor models.

To expand on the CAPM formula, Damodaran also provides us with the best ways to compute all its components:

- As for the risk-free rate, if we proceed with a valuation in nominal terms, then after deciding the currency in which our valuation is, we must be sure that there is a long-term bond denominated in such currency and that it is a risk-free government, as a consequence of that the 10 year treasury yield should be adopted (indeed, we have adopted the 10-year US treasury yield; had we wanted to conduct an analysis in real terms, then a long-term TIPS should have been chosen)
- As for the computation of beta, after applying the regression formula to the comparable companies' excess returns and their respective stock market index, we have obtained their equity betas, by using the Hamada equation such betas have been unlevered; the average of the unlevered betas has been assumed to be Intel's unlevered beta (which has been in turn converted by applying the inverse formula)
- The Equity Risk Premium has been computed by adopting the Implied Risk Premium method since, as Damodaran clearly explains, it is the only one which can provide some expectations about the future

Moreover, as far the cost of debt is concerned, Damodaran suggests using the synthetic rating approach when it comes to providing a reliable estimate.

It is particularly useful when other approaches cannot be applied:

- in the case there were no outstanding bonds whose average yield could be easily computed or when there are publicly traded bonds, but they represent a small portion of all the

company’s debt (implying the average yield would provide a misleading result because it would not consider the firm’s bank debt for instance)
- in the case the company’s borrowing history would not present significant data to arrive at a proper result

The second chapter gives a complete overview of the main firm and equity valuation methods, explaining that there is not a better valuation method since they all look at different aspects, thus the best way not to commit any valuation mistakes is to apply them all to find a range of values among which the potential intrinsic value is comprised (provided the different values coming from differ from each other for a justifiable reason). However, it must be stated that the FCFF method, also known as the WACC approach, is the most used method.

In the third chapter the superiority of Myers’ APV over the WACC is demonstrated by showing the two major WACC limitations: the need for iteration were the company’s capital structure to change and its inability to properly capture the fiscal benefit provided by the payment of interests.
The APV does not present such problems since it can be applied regardless of the debt policy adopted by the company, and it can explicitly show the additional value brought by the interest payments: instead of discounting the FCFs at a single discount rate (i.e. the WACC assuming a constant leverage policy), the FCFs are first discounted at the unlevered cost of capital and then they are added to the present value of the interest tax shields which are discounted at the pre-tax cost of debt. The APV would be able to detect all types of debt financing effects such as the expected costs of bankruptcy generated by an excessive leverage. The cost of such leverage has been analyzed in Fernández’s valuation only, it has not been applied to the professionals’ valuation.

After years of debating on which discount rate to use, the real innovation was brought by Professor Fernández who claimed that the value of the tax shields is not equal to the present value of the tax shields: it is the difference between the present value of the taxes paid by the unlevered firm and the present value of the taxes paid by the levered firm. And, as it can be imagined, we are dealing with two different sets of cash flows, each one with its own risk. The professor argues that the VTS depends only upon the nature of the stochastic process of the net increase in debt and today’s value of the expected increase in debt in turn depends on the financing strategy (i.e. debt policy). Moreover, the professor will claim that the VTS does not depend upon the nature of the stochastic process of the free cash flow. The real difficulty is trying to figure the proper discount rate for the present value of the net increase in debt, however, in some specific circumstances such problem can be solved.

In the fourth chapter a practical application of the theories and concepts seen in the previous chapters can be found. The APV has been adopted to value RJR Nabisco, thus by showing the convenience of such firm valuation method over WACC.

Then the core valuation is put into practice under two different views:

- first Intel is valued according to professionals (the abovementioned Damodaran's suggestions have been applied),
- in a second valuation Intel is valued according to the nine theories mentioned by Fernández in his papers (Fernández with and without costs of leverage, Miles & Ezzel, Modigliani & Miller, Myers, Miller, Harris & Pringle - Ruback, Damodaran, Practitioners)

In the second valuation it is demonstrated that all four valuation methods (the FCF, the ECF, the APV, the CCF) provide the same results given the same theory, which is something that rarely happens in the real world (i.e. the way professionals proceed with valuation) because most practitioners tend to mix assumptions belonging to different theories as well as not iterating properly. The difference in the equity values of the various theories is given by the difference in computing the value of the tax shield.

As it can be deduced, using correct valuation methods and theories is fundamental to assess the most realistic value to projects or companies. For this very reason the correct estimation of the value of the tax shield is still one of the major on-going debates and as Copeland et al. (2000) state: «the finance literature does not provide a clear answer about which discount rate for the tax benefit of interest is theoretically correct» and then they add «We leave it to the reader's judgment to decide which approach best fits his or her situation». So, although we share Fernández's views on the tax shield, we leave the reader decide how to properly measure it, provided consistent assumptions are made.

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Summary

Conducting a proper valuation is one of the most difficult tasks to be completed in the finance environment. As a matter of fact, a wrong valuation could have a very negative impact on investors' returns when it comes to allocating their money to different businesses. In order to provide the reader with a more concrete example of a possible side effect generated by incorrect valuations, it would be sufficient to think about the many companies that, after being listed in the stock market, saw their stock price drop significantly once the market realized that their actual business would never justify the extremely high IPO price in very beginning. And as we all know, since history has a tendency to repeat itself, we must be careful when we proceed with valuing a company, especially when a valuation is conducted by someone else because, as it has already happened, it would not be surprising to be in the presence of valuations that have not been done in good faith, but with the only aim of making the numbers look a certain way. Making the numbers look a certain way refers to the fact that, as the reader will deduce, valuation is not just a mere application of formulas and approaches, but it contains a huge number of subjective and personal estimates, assumptions and considerations which are the real pillars of the whole process. This final dissertation's author believes that such point is exactly what makes valuation so fascinating: the fact that valuation could be considered as science, art, or craft at the same time according to different points of view.

The aim of this thesis is to analyze how different valuation methods and theories can influence a company's intrinsic value by underlining the importance of a specific firm valuation method: the Adjusted Present Value (APV).

«*There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world*».

Keynes' quotation best summarizes the content and the objective of this final dissertation. Keynes was already able to understand how irrationality would play a key role in valuation, despite of how rational we may be when estimating a firm's intrinsic value.
Even if we made the very unrealistic assumption to be living in a world populated by rational investors only, the logic behind some of their results could be challenged because of its inapplicability under specific circumstances.

By applying four of the main firm valuation methods (APV, ECF, FCF, CCF) and by using Professor Fernández's theories, it will be demonstrated that all valuation methods always give the same result provided iteration is done properly.
It will be shown that the difference in the firm's intrinsic value is given by the applied theory, and the nine theories that have been applied are:

- Fernández (No cost of leverage)
- Miles & Ezzel
- Modigliani & Miller
- Myers
- Harris & Pringle – Ruback
- Damodaran (1994)
- Practitioners
- Fernández (With cost of leverage)

More specifically, the theories differ on the way they compute the value of the tax shields (VTS), which is, as it will be later seen, one of the key components when it comes to implementing the APV method.
This whole valuation process which includes the results provided by different economists will be compared to the result obtained by another valuation which is identified with the expression "the valuation according to professionals", such term should ring a bell in the reader's brain since it is the application of the whole valuation process as if it would be conducted by professionals in the finance world: they would simply adopt the WACC approach as their valuation method.

This final dissertation is divided into four different chapters:

- Estimating Discount Rates
- Main Valuation Models
- The Advantages of APV: The Long-Standing Debate over Debt Policy and VTS
- Practical Application

The first two chapters provide the reader with a full explanation of how to proceed when it comes to valuing a company, such chapters will intensively adopt Damodaran's knowledge which the New York University Professor acquired through many years of experience in the valuation domain to such an extent that he was honored with the "Dean of Valuation" title.

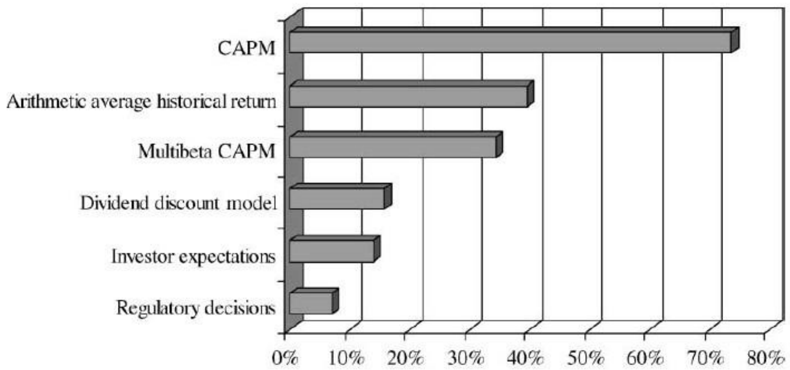
The third chapter represents the core topic of this final dissertation since it contains all the theories and considerations concerning the APV and the VTS; the fourth chapter is none other than, as the title suggests, the application of the previous chapters by using real case scenarios.

The first chapter aims to analyze different ways to properly estimate the "Cost of Equity" and the "Cost of Debt" to be able to compute the "Weighted Average Cost of Capital" since it is a function of both costs. More specifically, for the correct estimation of the WACC to be implemented, hybrid instruments (such as "preferred stocks" and "convertible bonds") are taken into consideration.
The Capital Asset Pricing Model (CAPM) introduced by William Sharpe in 1964 is compared to the most famous multifactor models in the financial literature:

- "Arbitrage Pricing Model" by Stephen A. Ross in 1976
- "Fama-French three-factor model" by Eugene F. Fama and Kenneth R. French in 1992
- "Carhart four-factor model" by Mark M. Carhart in 1997
- "Fama-French five-factor model" by Eugene F. Fama and Kenneth R. French in 2014

We conclude the CAPM is the best way to compute the cost of equity because of both its simplicity and reliability, which is something not all multifactor models can always vaunt at the same time. Such statement can easily find supporting evidence from the figure below.

Figure 1 - Cost of equity capital method, percent of CFOs who always or almost always use a given method



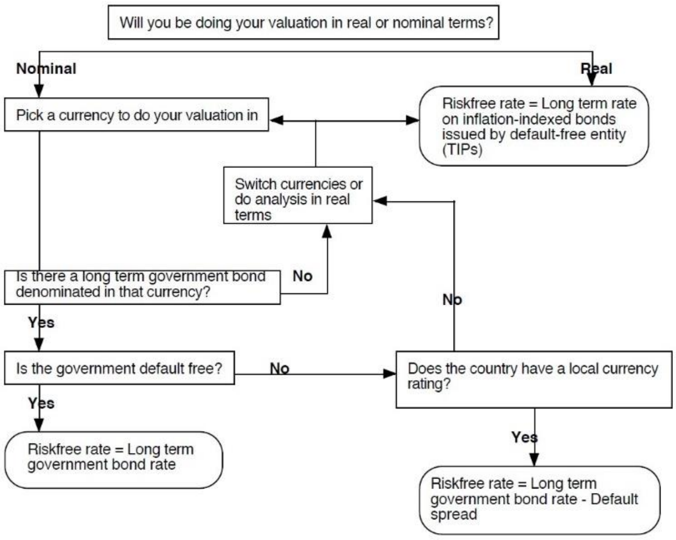
Source: Graham, J. R. and Harvey, C. R. (2001) 'The Theory and Practice of Corporate Finance: Evidence from the Field', *Journal of Financial Economics*, p. 203.

Furthermore, Damodaran specifies how the various components of the CAPM should be computed:

$$CAPM: R_e = R_f + \beta * ERP$$

The decision concerning the thinking process to be followed to identity the most appropriate discount rate can be summarized by the figure below.

Figure 2 - A Framework for Estimating Risk-Free Rates



Source: Damodaran, A. (2008) ‘What is the Risk-Free Rate? A Search for the Basic Building Block’, *Stern School of Business*, p. 30.

Conventionally, the US 10-year treasury yield is the one used as a risk-free rate and this exactly what has been done in the fourth chapter.

The beta can be computed, provided we are in the presence of a publicly traded firm, by estimating the covariance between the company’s returns over a certain period and the returns of the stock market index for the same period; after doing so, the number obtained must be divided by the variance of stock market index’s returns. Generally speaking, when we refer to a stock market index, we are dealing with the index on which the stock is listed. However, this way of proceeding has one main disadvantage of being historically based only, there are no future expectations, this is why many different formulas have been proposed, with Blume’s formula being the most popular one.

Then Damodaran explains how to implement the unlevering process, which basically consists in converting the comparable companies’ levered beta (obtained through the covariance formula) into an unlevered beta, thus eliminating the impact of the financial structure. Then, either the average or the median of all comparable companies’ unlevered beta is assumed to be the target company’s unlevered beta (which will be in turn re-levered to find the target company’s levered beta). The most accurate approach, in Damodaran’s opinion, would actually require computing the average (or median) of the comparable companies’ levered betas, assuming it to be the target company’s levered beta and only then the unlevering process shall begin. The fact of unlevering the average of the comparable companies’ levered beta should minimize the potential errors embedded in the covariance betas, such errors would be amplified were each comparable company’s beta to be unlevered

singularly. Nevertheless, such approach is exactly the one adopted in the professionals' valuation, moreover, no weighted average for the various businesses is implemented, with each business division having its own beta (with the weight represented by the division's revenues), since our target company mainly operates in the semiconductor business.
Then the ERP should be measured through the Implied Risk Premium since it is the only method that considers future expectations.
As far as the cost of debt estimation is concerned Damodaran presents two main alternatives: the bond rating approach (as an alternative to the YTM estimate) and a second much more realistic scenario consisting of either observing the company's borrowing history or applying the so-called synthetic rating approach. The synthetic rating approach is the one that can always be applied regardless of the lack of a borrowing history or absence of outstanding bonds whose yields could be observed very easily.

Despite not being the core topic of this final dissertation, the first chapter is of great importance since it lays the foundation for the next chapters by estimating the discount rates which will be intensively adopted in the various valuation methods; they are indeed one of the essential elements when it comes to dealing with valuation.

The second chapter aims to analyze the main valuation models which will be used in the third and fourth chapters. The second chapter makes it possible to apply such methods thanks to the discount rate estimation seen in the first chapter.

The two main valuation methods families are:

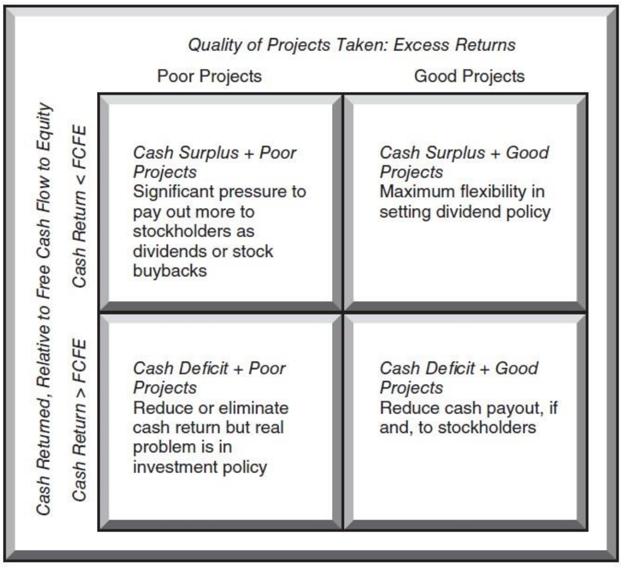
- the Discounted Cash Flow (DCF) valuation methods
- the multiples-based valuation method

The DCF valuation methods are the ones whose results provide the intrinsic valuation.

The DCF valuation can be divided into the Firm Valuation Methods such as the Free Cash Flow to the Firm and the Equity Valuation Methods such as the Dividend Discount Model and the Free Cash Flow to Equity. Their names are easily associated with the discount rate to be used when discounting their flows: the FCFF must be discounted at the WACC, while the DDM and FCFE must be discounted at the cost of equity.

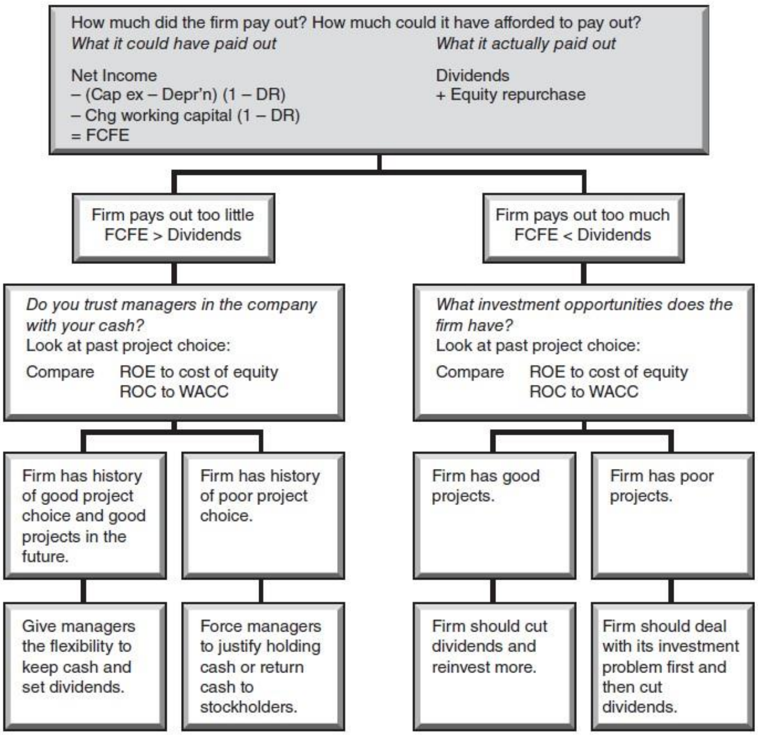
The two figures below are a clear, self-explanatory representations concerning the relation between the DDM and FCFE.

Figure 3 - Analyzing dividend policy



Source: Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 493.

Figure 4 - A Framework for Assessing Dividend/Cash Return Policy



Source: Damodaran, A. (2014) *Applied Corporate Finance*. 4th edn. United States of America: John Wiley & Sons, p. 498.

The chapter also presents the Residual Income Model and the EVA which could theoretically be considered as part of the firm valuation models, however, due to their peculiarity, they can also be seen as a different category and are known as "Value Creation Models".

The Adjusted Present Value, despite being one of the absolute valuation models, since it is the core topic of the thesis, has been given a dedicated chapter.

It has also been decided to include the discussion concerning the multiples because of their high relevance in terms of valuation practice. More specifically, it is more likely to find investors to apply multiples to value a company since they are easier to be implemented and interpreted. In addition to that, the multiples can even be found within the intrinsic valuation when it comes to computing the terminal value which, instead of being computed with the perpetual growth rate, is calculated as the EV/EBITDA multiple of the benchmark industry multiplied by the target company's EBITDA. Some of the most used asset and equity multiples, are represented in the figure below.

Figure 5 - Enterprise Value and Equity Value Multiples

Multiple	Basic formula
EV / sales	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T) \times M$
EV / EBITDA	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T) \times (1 - D)$
EV / EBIT	$\frac{ROIC - g}{ROIC \times (WACC - g)} \times (1 - T)$
EV / NOPLAT	$\frac{ROIC - g}{ROIC \times (WACC - g)}$
EV / invested capital	$\left(\frac{ROIC - g}{ROIC \times (WACC - g)} \times ROIC\right)$ *or* $\frac{ROIC - g}{WACC - g}$
EV / capacity unit	$\frac{EV}{Unit} = \frac{ROIC - g}{ROIC \times (WACC - g)} \times \frac{NOPLAT}{Unit}$
Price to earnings	$\frac{ROE - g}{ROE \times (COE - g)}$
Price to book value	$\left(\frac{ROE - g}{ROE \times (COE - g)} \times ROE\right)$ *or* $\frac{ROE - g}{COE - g}$
PE to earnings growth	$\frac{ROE - g}{100 \times g \times ROE \times (COE - g)}$

Source: UBS Global Equity Research (2001) *Valuation Multiples: A Primer*, p. 15.

In the third chapter of this final dissertation our aim is to analyze one of the most famous firm valuation models: the Adjusted Present Value. Such model was developed by S. C. Myers in 1974 and presents a great advantage over the WACC approach: it does not require iteration whenever the firm's capital structure changes. The APV is none other than the general version of the WACC and it is a much more flexible approach to valuation since it allows to capture the effect of the financial benefit arising from the tax shields.

The APV formula, indeed, is given by the summation of the following elements:

- the present value of the unlevered firm, which is obtained by discounting the FCFs at the unlevered cost of capital
- the present value of the tax shields which is obtained by discounting the interest tax shields at the pre-tax cost of debt

As far as the computation of the unlevered firm, the financial literature converges to the formula adopted by Myers, however, the same thing cannot be stated for the value of the tax shields at all. In Myers' opinion, assuming that the tax shield is as risky as the debt is, the present value of the tax shield should be discounted at the pre-tax cost of debt. This statement has been largely debated and the whole chapter shows how economists' views on the matter differ from each other: this will eventually lead us to realize that there is no common ground on how to properly compute the value of the tax shield.
One more fundamental point should be made, which is that economists differ on how to compute the tax shields according to what debt policy the company has decided to follow.

The various opinions have been classified on such criteria in this very chapter. Among the various debt policies, the most relevant ones in the finance literature are covered:

- Predetermined debt levels
- Constant market leverage policy
- Fixed book-value leverage policy
- Constant interest coverage policy

Furthermore, the element influencing the relation between levered and unlevered betas is none other than a firm's debt policy. It must be remembered that, for the purpose of this thesis, the book value of debt is always assumed to be equal to the market value of debt.

Moreover, for the purpose of this final dissertation, personal taxes will not be the object of our analysis.

Although it has been claimed that the only doubt concerning the computation of the value of the tax shields consists in identifying the correct discount rate, which is in turn based upon the firm's debt policy, professor Fernández, whose considerations will be intensively used in this chapter, has developed alternative ways of calculating them.

He then says that (assuming we are in the presence of constant growth companies in a world with no leverage costs) the VTS is given by the difference between the present value of taxes paid by the unlevered firm and the present value of taxes paid by the levered firm:

$$VTS = G_U - G_L$$

The professor argues that the VTS depends only upon the nature of the stochastic process of the net increase in debt and today's value of the expected increase in debt in turn depends on the financing strategy (i.e. debt policy):

$$VTS_0 = T * D_0 + T * PV_0[\Delta D_t]$$

Moreover, the professor will claim that the VTS does not depend upon the nature of the stochastic process of the free cash flow.

The real difficulty is trying to figure the proper discount rate for the present value of the net increase in debt.

Fernández demonstrates that in the specific case of perpetuities, the VTS is equal to the tax rate times the current value of debt; the abovementioned formula clearly confirms the professor's words since, whenever the debt is perpetual, then the debt variation is equal to zero, thus implying PV to be equal to zero as well, leaving the VTS equal to tax rate multiplied by the current value of debt.

$$VTS_0 = T * D_0$$

Always assuming constant growth companies in a world without leverage costs and that the net debt increases are as risky as the FCFs are (and that the firms is adopting a fixed book-value leverage policy), the VTS is equal to the present value of debt times the tax rate times the required return to the unlevered equity discounted at the unlevered cost of equity. This process is much different from discounting the tax shields at R_u, since the amount being discounted is higher than the interest tax shield:

$$VTS = \frac{DTK_u}{K_u - g}$$

However, there are other circumstances in which different theories, approaches and formulas are applied. As regards different valuation methods that will be adopted throughout this chapter that had not been previously covered, the so-called "Capital Cash Flow" (CCF), and the Debt Cash Flow can be found.

The formula of the APV could be further adjusted by including a third element to the abovementioned formula, which will be mentioned in the chapter as "the expected costs of financial distress". To be more precise, more costs could potentially be added; nevertheless, the APV formula applied in the case study in the fourth chapter will include the value of the unlevered firm and the value of the tax shields only.

Table 1 - Value of Tax Shields according to the 9 theories in perpetuity

Theories	**VTS**
Fernandez	DT
Miles-Ezzell	TDKd(1+Ku)/[(1+Kd)Ku]
Modigliani-Miller	DT
Myers	DT
Miller	0
Harris-Pringle	T D Kd/Ku
Damodaran	DT-[D(Kd-R_F)(1-T)]/Ku
Practitioners	D[R_F-Kd(1-T)]/Ku
With-Costs-Of-Leverage	D(KuT+R_F- Kd)/Ku

Source: Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 11.

Table 2 - Value of Tax Shields according to the 9 theories in growing perpetuity

	When D = N
Modigliani-Miller	PV[R_F; T D R_F]
Myers (1974)	PV[Kd; T D Kd]
Miles-Ezzell (1980)	PV[Ku; T D Kd] (1+Ku)/(1+Kd)
Fernandez (2007)	PV[Ku; DTKu]
Damodaran (1994)	PV[Ku; DTKu - D (Kd- R_F) (1-T)]
Harris-Pringle (1985)	PV[Ku; T D Kd]
Miller	0
Practitioners	PV[Ku; T D Kd - D(Kd- R_F)]
With-cost-of-leverage	PV[Ku; D (KuT+ R_F- Kd)]

Source: Source: Fernández, P. (2019) 'Valuing Companies by Cash Flow Discounting: 10 Methods and 9 Theories', *IESE Business School*, p. 11-16.

In the fourth chapter what has been discussed throughout the whole thesis is put into practice.
First, after a brief overview and outlook of the private equity industry and LBOs, the APV valuation method is applied to one of the major LBO in history: RJR Nabisco acquisition by KKR. Such application has been put forward to demonstrate the importance of the APV in contexts where, since there is a frequent change in the capital structure, the application of the WACC approach would result in being a tedious process. Then, we start discussing the core case study which basically gathers all methods and theories seen in the previous chapter. The company that has been analyzed is Intel Corp., it is one of the key players in the semiconductor industry, which has now become a fundamental industry in an extremely interconnected and digitalized world. Two separate valuations will be conducted:

- The first valuation is the one that professionals would do, and it consists in estimating the risk-free rate, the cost of equity, the cost of debt, the ERP (and the WACC consequently) according to Damodaran's way of proceeding; when it comes to implementing the DCF model, the WACC approach has been chosen by assuming a constant leverage policy (thus allowing not to iterate since there is no change in the capital structure)

- The second valuation gathers all theories mentioned by Fernández together with Fernández's theories themselves; as far as the risk-free rate, the cost of debt and ERP are concerned, they have been assumed to be equal to the ones estimated in the abovementioned analysis; the nine different theories mentioned above will be used together with four different valuation methods - the APV, the ECF, the FCF and the CCF;

In this second analysis, three different scenarios are set to show the inconsistency of certain theories:

- The company perpetually grows at 2%
- The company perpetually grows at 3,5%
- The company perpetually grows at 0% (which basically means that there is no growth unlike the two previous scenarios)

Intel has been chosen as the subject of our analysis to demonstrate it is undervalued by the market. The whole valuation process has been put into practice to see how different results are obtained by applying different valuation methods and theories. More specifically, despite being theoretically inconsistent, it is worth implementing the professionals-like valuation because it is the kind of valuation that is applied on an everyday basis in working environments. While it is worth analyzing the more theoretical valuation process because it shows exactly how consistent valuations should be carried. In the end, the various results will be compared to underline the differences.

First and foremost, it must be stated that the latest available data used are the ones on 30/092022. Thanks to our data, the last three months to the end of 2022 have been forecasted (in terms of financial statements) and we then assumed 31/12/2022 to be our t_0. The stock market data used are the ones on 30/09/2022, assuming Intel's and the various competitors' stock price to remain almost unchanged until 31/12/2022. As far as the financial statements are concerned, Intel's 2017, 2018, 2019, 2020 and 2021 10K documents have been used as the foundation of our forecasts.

The following four tables show the Intel's intrinsic valuation according to professionals:

Table 3 - DCF assumptions for Intel's valuation according to professionals

Assumptions (as of 31/12/2022)	
Tax Rate	35,00%
Pre-tax Cost of Debt (Rd)	4,62%
Cost of Equity (Re)	12,21%
Discount Rate (WACC)	10,29%
Perpetural Growth Rate	2,00%
Invetsment Date	31/12/2022
Fiscal Year End	31/12/2023
Current Price ($)	25,77
Shares Outstanding (mln)	4.016
Debt ($, mln)	37.805
Cash ($, mln)	10.643

Source: Own calculation

Table 4 - DCF model ($, mln)

Discounted Cash Flow	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
EBIT		19.343	21.541	24.182	27.260	30.780
(-) Cash Taxes		6.770	7.540	8.464	9.541	10.773
NOPAT		**12.573**	**14.002**	**15.718**	**17.719**	**20.007**
(+) D&A		15.068	15.967	16.702	17.303	17.795
(-) Capex		20.000	20.000	20.000	20.000	20.000
(-) Changes in NWC		850	926	1.010	1.101	1.200
Unlevered FCF		**6.791**	**9.043**	**11.411**	**13.922**	**16.602**
TV						**204.149**
PV FCF	41.674					
PV TV	125.075					
Enterprise Value (EV)	**166.749**					

Source: Own calculation

Table 5 - Intel’s Intrinsic Value estimation ($, mln)

Intrinsic Value	
Enterprise Value	166.749
(+) Cash & Cash Equivalents	10.643
(+) Other Non-Core Assets	9.286
(-) Total Debt (including lease commitments)	37.805
Equity Value	148.872
Equity Value/Share – (Basic)	$ 37,07
Dilutive effect caused by employee options and convertible bonds	31
Fully diluted shares outstanding	4.047
Equity Vlaue/Share – (Diluted)	$ 36,79

Source: Own calculation

Table 6 - Sensitivity analysis assuming the growth rate as the only changing variable (g)

Scenario	g	Stock price
Worst case	0%	30,53
Base case	2%	37,07
Best case	3,5%	44,50

Source: Own calculation

This last table shows the implementation of a sensitivity analysis with only one variable changing showing exactly how it will impact the share price.

In the following tables the most significant results concerning the more theoretical valuation have been reported.

Table 7 - Intel’s equity value per share assuming a 0%, 2% and 3,5% perpetual growth rate

Theory	***Share price g = 0%***	***Share price g = 2%***	***Share price g = 3,5%***
Fernández - NO cost of leverage	31,07	34,92	39,46
Miles & Ezzell	29,50	32,93	36,99
Modigliani & Miller	31,07	37,60	74,20
Myers	31,07	36,50	47,52
Miller	27,90	30,90	34,46
Harris & Pringle - Ruback	29,43	32,84	36,87
Damodaran	30,57	34,28	38,67
Practitioners	28,65	31,86	35,65
With cost of leverage	30,30	33,94	38,24

Source: Own calculation

Since a 2% growth rate is the assumed growth rate in the base case scenario for the computation of the terminal value in the valuation according to professionals, we have decided to report the valuation summary concerning the application of Fernández’s theory in the case of a constant growing perpetuity at 2% and without cost of leverage.

Table 8 - Valuation summary assuming a 2% growth in perpetuity ($, mln)

	WITHOUT TAXES		WITH TAXES (35%)	
	No debt	With debt	No debt	With debt
	D = 0	D = 36.441	D = 0	D = 36.441
ECF	19.819,17	18.863	12.163	11.797
Taxes	—	—	7.656	7.066
Debt cash flow	—	956	—	956
Total cash flow	19.819	19.819	19.819	19.819
Ke	9,58%	10,38%	9,58%	10,41%
Kd	—	4,62%	—	4,62%
KTL	—	—	9,58%	10,32%
E = ECF / (Ke - g)	261.603	225.162	160.549	140.229
D = Debt cash flow / (Kd - g)	—	36.441	—	36.441
G = Taxes / (KTL - g)	—	—	101.055	84.933
E + D + G	**261.603**	**261.603**	**261.603**	**261.603**

Source: Own calculation

Table 8 shows that the VTS can also be obtained as the difference between two different flows: if we subtract the present value of the taxes paid the levered firm ($ 84.933) from the present value of the taxes paid unlevered firm ($ 101.055), we obtain exactly the VTS in 2022 ($ 16.121).

Table 9 - Common results in all applied theories

Tc	D	D * Tc	Ku	Kd
35,00%	36.440,67	12.754,24	9,58%	4,62%

Source: Own calculation

Table 10 - Results provided by the implementation of different theories and growth estimates

Theory	g = 0%				g = 2%				g = 3,5%			
	E	Vu	Ke	VTS	E	Vu	Ke	VTS	E	Vu	Ke	VTS
Fernández - NO cost of leverage	124.790	148.476	10,52%	12.754	140.229	160.549	10,41%	16.121	158.478	174.818	10,32%	20.101
Miles & Ezzell	118.486	148.476	11,08%	6.450	132.261	160.549	10,92%	8.153	148.543	174.818	10,77%	10.166
Modigliani & Miller	124.790	148.476	10,52%	12.754	151.002	160.549	9,81%	26.894	297.973	174.818	7,13%	159.596
Myers	124.790	148.476	10,52%	12.754	146.583	160.549	10,05%	22.475	190.847	174.818	9,16%	52.469
Miller	112.036	148.476	11,71%	0	124.108	160.549	11,51%	0	138.377	174.818	11,31%	0
Harris & Pringle - Ruback	118.194	148.476	11,10%	6.159	131.892	160.549	10,94%	7.784	148.084	174.818	10,79%	9.706
Damodaran	122.762	148.476	10,69%	10.726	137.665	160.549	10,57%	13.558	155.282	174.818	10,46%	16.904
Practitioners	115.074	148.476	11,40%	3.038	127.948	160.549	11,22%	3.840	143.166	174.818	11,05%	4.788
With cost of leverage	121.670	148.476	10,79%	9.634	136.285	160.549	10,66%	12.177	153.561	174.818	10,53%	15.183

Source: Own calculation

Table 10 clearly shows that M&M's and Myer's theories are the ones which present the highest equity values, they are then followed by Fernández in the absence of cost of leverage. Miller provides us with the lowest value since he believes that there is no tax shield benefit. The table also shows that both M&M's and Myers' theories are not consistent since it may happen that their VTS are even higher than the value of debt (and $E > V_u$). As we can see, such event occurs when g = 3,5% and their K_e would be lower than K_u which has clearly no economic sense.

This happens, according to Fernández, when:

- For Myers, if $DTK_d / (K_d – g) > D \rightarrow VTS > D$ and $E > Vu$
- For MM when $VTS > D [K_u – K_d * (1 – Tc)] / (K_u – g) \rightarrow$ such conditions occur when either leverage, tax rate, K_d or MRP are particularly high

All the other theories provide a VTS which is too low.
As it has already been stated in chapter III, the only three theories are correct under specific circumstances:

- When the debt level is fixed in advance MM (the debt just like the cash flows are in the form of a constant perpetuity) or Myers (when the debt is repaid without issuing new debt) are applied – the tax shield is discounted at K_d
- When the firm has set a constant market leverage policy, then ME is applied – the first year the tax shield is discounted at K_d and the following years at K_u
- When the firm has set a fixed book leverage policy, then Fernández is applied and the appropriate discount rate to use is K_u

It must be remembered that pursuing a constant market leverage policy is not convenient in terms of the equity value obtained (lower than the value it could be obtained if a book leverage policy were implemented) and it is something particularly difficult to purse for all companies.
After implementing the fixed-book leverage, then Intel's intrinsic share price in the base case scenario is \$ 34,92 according to Fernández. The valuation according to the professionals provides us with a share price equal to \$ 37,07. As it can be deduced, using correct valuation methods and theories is fundamental to assess the most realistic value to projects or companies. For this very reason the correct estimation of the value of the tax shield is still one of the major on-going debates and as Copeland et al. (2000) state: «the finance literature does not provide a clear answer about which discount rate for the tax benefit of interest is theoretically correct» and then they add «We leave it to the reader's judgment to decide which approach best fits his or her situation». So, although we share Fernández's views on the tax shield, we leave the reader decide how to properly measure it, provided consistent assumptions are made.