



UNIVERSIDADE CATÓLICA PORTUGUESA

# Project Valuation and Interaction Between Financial Decisions and Investment in Real Estate Projects

The Case of Merrifield Center

Ana Filipa Vieira Oliveira

Católica Porto Business School  
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# Project Valuation and Interaction Between Financial Decisions and Investment in Real Estate Projects

## The Case of Merrifield Center

Final Work in the modality of Dissertation presented to Universidade Católica Portuguesa in order to obtain the master's degree in Finance

by

Ana Filipa Vieira Oliveira

Under the supervision of  
Professor Doutor João Pinto

Católica Porto Business School  
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# Acknowledgments

This final master's work was the result of all the knowledge and practice developed from my professional and academic experience. As an analyst of a project development company, I am required to understand all the processes behind the development of real estate projects, as well as the identification of future trends and market events.

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# Resumo

A avaliação de projetos é uma ferramenta essencial para os acionistas, tal como investidores e *developers* de um projeto do mercado imobiliário, dado a sua capacidade de identificar o potencial do mesmo. Cada projeto do mercado imobiliário tem uma significativa relevância para a sociedade porque provém infraestruturas que melhoram a vida da comunidade. A avaliação de projetos pode ser calculada através de várias formas: análise de mercado, análise de fiabilidade e modelos de avaliação financeira.

Os modelos de avaliação financeira podem ser realizados por abundantes sistemas, como referência de dados de um benchmark apropriado ao ativo em análise, como acontece nos modelos de Preço de Arbitragem, como também poderá ser realizado com base em rácios de indicadores financeiros do ativo, através dos modelos de avaliação relativa. No entanto, neste trabalho irei focar nos modelos de avaliação em formato *Discounted Cash Flow* que permite apurar o valor de mercado através da atualização dos fluxos de caixa ao longo da vida útil do projeto, tendo subjacente uma taxa de desconto específica que difere de modelo para modelo. Os fluxos de caixa podem ser considerados como uma base para cálculo de alguns indicadores de avaliação financeira, como o cálculo do Valor Acrescentado Líquido, com que os investidores usam para tomar as suas decisões.

Ao longo deste trabalho, irei usar com base em dados financeiros de um estudo de caso real, o projeto Merrifield Center, que ainda hoje está ativo, determinar o valor do projeto pelos diferentes modelos de avaliação *Discounted Cash Flow*. De seguida, comparando os resultados de cada modelo, explicarei quais as limitações e vantagens que cada modelo poderá trazer ao projeto.

Após a identificação do melhor modelo de cada projeto, podemos concluir como o investimento poderá ser realizado pelos acionistas de acordo com as decisões iniciais e realizadas ao longo da maturidade do ativo. A decisão do investidor pode ser positiva ou negativa, dado as condições económicas, políticas e sociais que vivemos.

Palavras-chave: avaliação de projetos, projetos do mercado imobiliário, investimento, *Discounted Cash Flow*

Palavras: 9,982



# Abstract

Project Valuation is a fundamental key for shareholders like investors and developers of a real estate project, due to the ability to identify its potential. Each real estate project has a significant relevance for the society because it provides infrastructures that improve the community' life. This valuation can be forecast by several factors: market analysis, feasibility analysis and financial valuation.

The valuation models can be realized by abundant systems, like the reference of data of an appropriate asset' benchmark, like what happens in Arbitrage Pricing Models, as else can be realized with base of ratios of the asset in analysis, through the Relative Valuation models. Besides, in this thesis I will focus on valuation models on Discounted Cash Flow format that compute the cash flow along the project' life with a specific discount rate that differs in each model. The cash flow can be used to calculate some financial valuation indicators, like Net Present Value, based on which investors make decisions.

Along this thesis, I will use with a base of financial data from a real case study, the Merrifield Center project, that today it's still active, to determine the project' value through the different Discounted Cash Flow valuation models. Afterwards, comparing the results of each model, I will explain what are the limitations and advantages of each model can bring to the project.

After the identification of the best valuation model of each project, it can be concluded how the investment can be realized by shareholders, according to initial decisions and along the asset' maturity. The investor' decision can be positive or negative, due to the economic, political, and social conditions in the world we live in.

Keywords: project valuation, real estate projects, cash flow, investment,  
Discounted Cash Flow

Words: 9,982



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# Abbreviations and Symbols

APT – Arbitrage Pricing Model

APV – Adjusted Present Value

CAPM – Capital Asset Pricing Model

CAPV – Compressed Adjusted Present Value

DCF – Discounted Cash Flow

EBIT – Earnings Before Interest and Taxes

EBT – Earnings Before Taxes

EP – Economic Profit

FCF – Free Cash Flow

FCFE – Free Cash Flow to Equity

FCFF – Free Cash Flow to Firm

ECF – Equity Cash Flow

NPV – Net Present Value

RV – Residual Value

$r_a$  – Unlevered rate of a firm

$r_d$  – Cost of debt

$r_e$  – Cost of equity

$r_f$  – Risk-free rate

$r_m$  – Risk of market portfolio

$r_u$  – Cost of capital without the debt

$\beta_l$  – Levered beta used in CAPM formula

$\beta_u$  – Unlevered beta used in CAPM formula



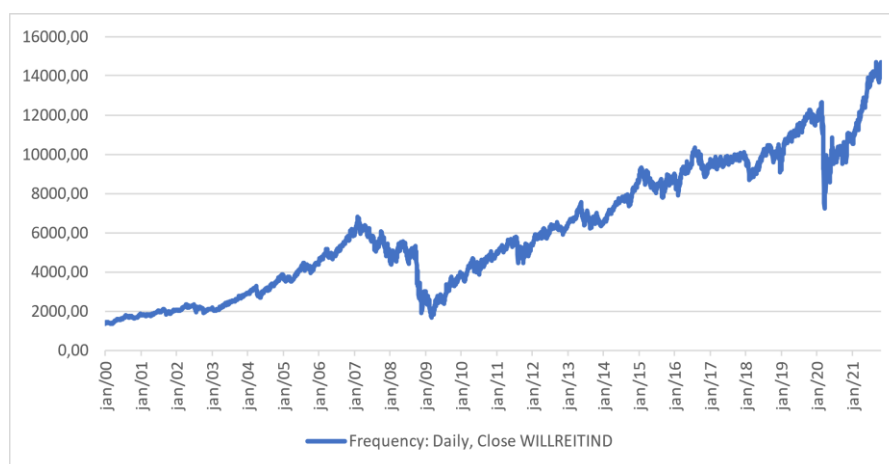
# 1. Introduction

The real estate is a market that has a big rule on the economy<sup>1</sup>, given that it provides assets, where people work and live. Therefore, these infrastructures also reflect the consumers' trends like the office buildings and has a positive impact on wealth and population growth as happens on retail market (Norges Bank Investment Management, 2015). Real estate produces infrastructure that give employment to the population<sup>2</sup>, creating a good impact to the productivity and growth rate of the economy.

Innovations and trends coming to the market can affect the real estate behavior (Saiz and Salazar, 2018). So, big changes on the rents and/or prices of those assets, had and has major consequences in the lives of consumers and the economy itself.

Real estate investment has suffered several oscillations in the last years among distinct sectors, which can be justified by the construction activity, legal changes, and other factors, like Graph 1 represents.

*Graph 1 - Wilshire US Real Estate Investment Trust Total Market Index*



*Source by: Federal Reserve Bank of St. Louis*

<sup>1</sup> In PWC magazine reveals the market trends and affirms that the expansion of emerging trends is related to the real estate' demand. This demand can be defined by the population size and age of consumers, which can have a huge impact on the residential side (Norges Bank Investment, 2015).

<sup>2</sup> National Association of Realtors confirms that one job is created with 2 homes sold.

Given the changes in performance of the market it is essential to analyze which are the factors that could influence its behavior as, e.g., Project Valuation. Before any valuation is done, the process starts on a property acquisition, where brokers need to find a property that matches with investor wishes. Whether the agent consider that there is potential, it is needed to perform a Project Valuation, which can be implemented in perspectives that have specific impact on the final project, namely: market analysis, feasibility analysis and finally, the cash flow analysis (Miles et al., 2015).

According to Baw (2015), valuation is a central piece of performance measure the future project. Valuation must be confirmed by analysts, through the study of macroeconomic indicators (Baw, 2015).

When we are facing a finance or investment on a property that produce income, market value becomes a key consideration given the fact *“the most probable price which a property should bring in a competitive and open market (...) require to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus”* (Brueggemann and Fisher, 2018).

Damodaran in 2002 presented valuation models that predict a project' value according to different methodologies which are: **Relative Valuation**, that measure value with the comparison of a selected comparable asset with the standardization of a common variable, and **Discounted Cash Flow (DCF)**, uses the expected future cash flows that the asset can generate, through the logic of the present value using a discount rate. Along this last valuation method, exists many types of DCF models, which is the most important ones: *Free Cash Flow to Firm (FCFF)*, *Capital Cash Flow (CCF)*, *Free Cash Flow to Equity (FCFE)*, *Adjusted Present Value (APV)* and the *Compressed Adjusted Present Value (CAPV)*. The

discounted rate can be by a model that is able to measure risk that is the **Arbitrage Pricing Theory (APT)**.

Therefore, the existence of several models to forecast an asset' value is very wide, so we need a rule to know how to identify the best and most appropriate valuation model, according to its capital structure, discount rate and its nature.

Being the relative valuation, a model that requires to use comparable, the finding of comparable companies and transaction can be hard (Bierman and Smidt, 2007); so, the use of DCF becomes a method that gives the best measures of asset 'returns given the use of cash flows and considers the time value of money (Damodaran, 2010).

In this thesis, I will demonstrate how Project Valuation is an important factor for the project development and how different valuation models can lead to different results, which have an impact on the decision making from the investor. Henceforward, in Table 1 I present some research questions, that I will answer them along this thesis, with the support of literature review and results of a case study selected.

*Table 1 – Presentation of the research questions*

<b>Scheme of a project creation</b>	<b>Research Question</b>
<b>Property</b>	Did property of the project influence its valuation?
<b>Project Valuation</b>	What are the factors that must be studied to performs a robust project valuation of certain projects?
	What are the decisions to be made according to the different results of Project Valuation?
<b>Forecasting Cash Flows</b>	Are the results equal in all valuation models? What are the main differences?
	What is the most robust valuation model to consider in a real estate project?

The first three research questions presented in the Table 1, respecting the Property and Project Valuation will be answer along the literature review, but the last two research questions will be illustrated by simulation of computing a project' value selected, through the DCF valuation models. These models will result five different values; so, we will select one of the models that is the best suitable for the definitions of the project itself.

This work is structured by the logic of a property development. In the first chapter, I explained the concept of property development and what are the steps taken. In the next chapter, I show the source of a market analysis of a property to check if the it matches with the investor goal. Then, in the third chapter, I present the feasibility study done by brokers and analysts to know if the cash flows predicted lead to the best profitability. Finally, the last chapter of the review literature refers to the financial valuation of the project related to the property itself, carefully analyzing several methods to forecast the project' value. All these steps will be represented in the case study that I chose, the Merrifield Center, a

building of medical offices installed in North Virginia, so the results of a project value will be represented in dollars.

## 2. Literature Review

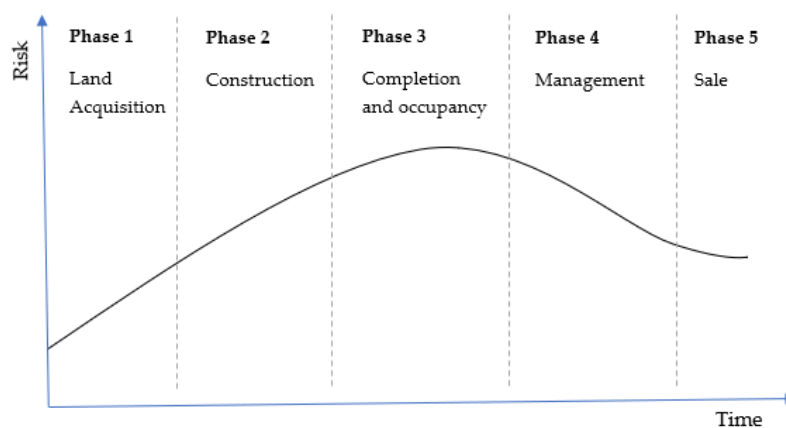
### 2.1 Property Development

Real estate is seen as an investment and/or ownership in buildings and land, or even financial products back to those elements (Staiger, 2018). Typically, an investor purchases a property as an investment, the agents need to know the proper way to analyze the investment and understand how the impact of financing will bring risk and returns (Brueggemann and Fisher, 2018).

The activity of real estate concentrates on the property development, which Brett and Schmitz (2009) support the idea of that process consist in the procedure of preparing a piece of land that becomes more suitable to convert into a building.

Bruggeman and Fisher (2018) shows the development process of a project comes together with risk. Authors introduce this process begins with a site acquisition, then it develops through construction or improvements, afterwards the finishings are implemented for the occupancy and then manages the property after completion, like Figure 1 shows.

*Figure 1 - Property Development Process*



*Source by: Brueggman and Fisher (2018)*

A property development concepts into the change of land use and/or an existing building that can be reconstructed which combines land, labor, materials, and finance (Cadman & Topping, 2002). The land is delivered to the private partner for project' development, who proposes to convert the land to receive some compensation in the coming future (Mangioni, 2018). However, this process may provide negative consequences. Per example, Hakimi and Kockelmann (2010) affirms that if the acquisition of a property is inefficient, the negotiation processes with the broker can delay projects, increase costs, and have a negative impact on society.

The transaction of a property to the new owner comes with contractions. The acquisition of a property is restricted to many governmental rules followed by some rights and obligations (Snare, 1972). The governmental regulation of property development exists to ensure that safety and prosperity are present on consumer's lives, economic progress of a city and social welfare, with an additional support of sustainable development and environmental protection guidelines (Ferlan et al., 2013).

Along the property development process, developers should make several decisions aware of the consequences now and further to the project; since the development process requires the relationship between the teams involved in like design, construction, finance, marketing, management and government (Miles et al., 2015).

Also, a good property development needs a continuous analysis, independent the phase the project is in. Keller and Kottler (2012) sustain spiral development process is used by several companies that define the returning value to an earlier stage to make improvements before moving forward.

## 2.2 Market Analysis

Brett and Schmitz (2009) show that developers do a market analysis because they can find: the advantages and limitations to each asset type and what can be more appropriated in terms of rents or prices in each market conditions; verify if the project corresponds to the expectations of the developer and also, can check if the asset meet the governmental norms.

Analysts can use the market studies to look at different metropolitan areas for development potential and decide what submarket is the most appropriate for the proposed development concept (Brett and Schmitz, 2009).

Economic factors have a big role on market analysis. The macroeconomic values that are analyzed in a market analysis can impact the demand for a particular property type, which can be the following ones: population demographics, income and employment (Mourouzi-Sivitanidou, 2021).

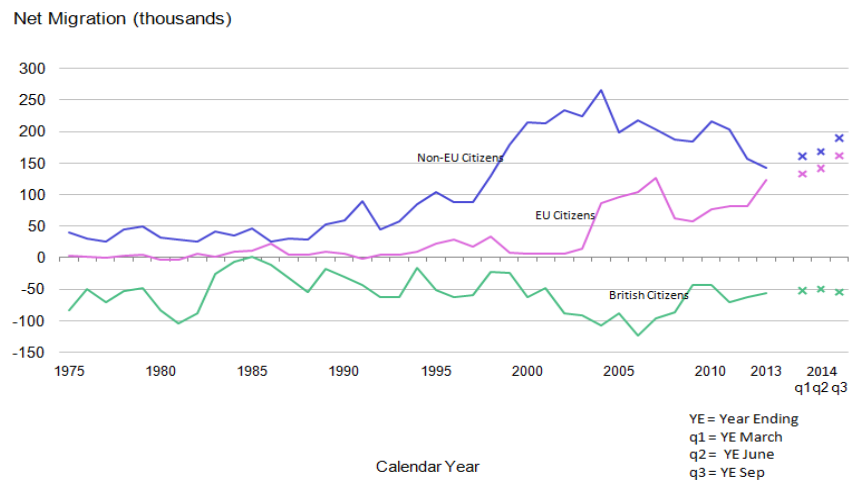
The American tradition of the real estate market concentrates on the contract law, measurement of land to enhance the conveyance and the related financial indicators (Miles et al., 2015). For Mourouzi-Sivitanidou (2021), the financial vehicles concentrate on the macroeconomic analysis that can be done through the metropolitan areas, which consists of a base premise that assumes that real estate is durable and its demand for new space is brought by the growth at the margin.

Demand and Supply of real estate is connected to the economic factors that can determine the potential of a project in a market analysis. Brueggeman and Fisher (2018) shows that investors and appraisers perform a market analysis to evaluate the supply and demand regarding the property type and evaluate it as an investment. The steps to do a market analysis are applied to building types with a focus on nodal demand, comparison and competitive buildings and opportunities for successful activities (McMahan, 2007). The demand comes from the end users which are the buyers and renters among infrastructures, but the

supply concentrates on the competitors that own properties with several stages on the project development (Brett and Schmitz, 2009).

The demand on the real estate market can be influenced by the future immigration policies that countries with its labor forces contractual will become a “replacement real estate market” between metropolitan areas (McMahan, 2007). Graph 2 can represent the demand of real estate in a certain area that the project is located.

*Graph 2 - International Net Migration in the long-term by citizenship*

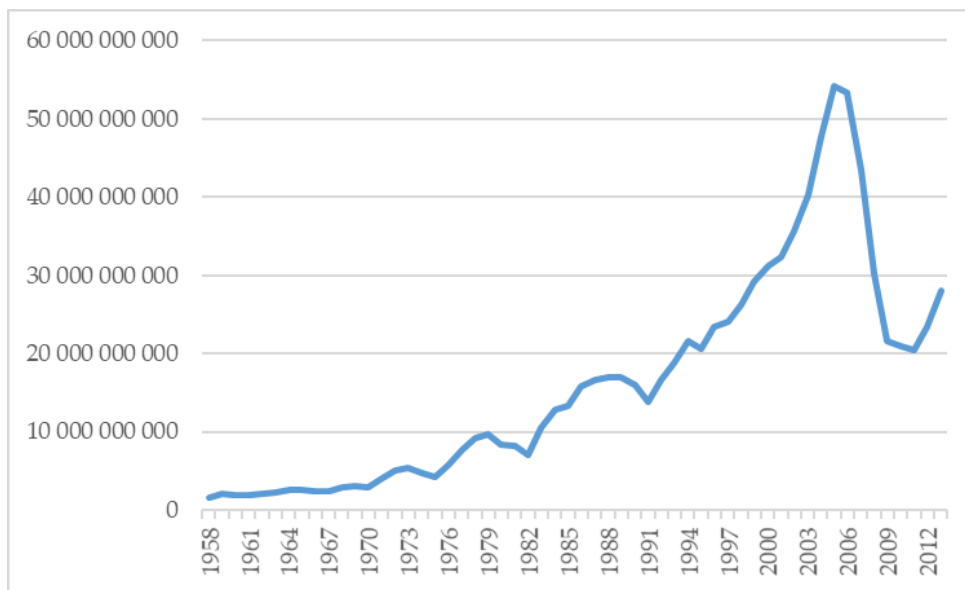


*Source by: Office for National Statistics*

However, the demand of real estate can be independent of the population, employment and income growth, due to the existence of replacement demand derived by the low depreciation rate, but new technology building can have a higher depreciation due to its durability (Mourouzi-Sivitanidou, 2021).

Regarding the supply, Miles, Netherton and Schmitz (2015) defends that land supply represents the amount of undeveloped land existing in urbanized metropolitan areas. Graph 3 represents a part of the real estate supply.

Graph 3 - Amount of dwellings and residential construction



Source by: Federal States of Saint Louis

In the Graph 2 and 3 between 2000 and 2005, there was a push down of the migration, which means there were less people entering the United States, so that reflects the availability of dwellings. The inverse relationship of Law of Supply and Demand evidence in the graphs can be justified by the statement of Kahr and Thomsett (2005), when there are many offers of certain property, the demand becomes softer.

Arroyo and Berumen (2003) affirms that either success or failure of a firm has an impact on results in the industry involved in, so the performance of the company defines the competitiveness of nation and local by influencing macroeconomics indicators like employment rates, economic growth rate and the level of well-being of people (Arroyo and Berumen, 2013, as cited in Mosqueda et al., 2011).

Exists a strong connection between property value and its income-earning capacity that denotes the importance of market analysis in real estate development and investment decision making (Mourouzi-Sivitanidou, 2015).

## 2.2.1 Real Estate Cycles

Real estate prices are a result of economic cycles (Abraham and Hendershott, 1996, as cited in Malpezzi and Wachter, 2005). A conceptual model is then developed of how real estate and local business cycles can be causally related to the demographic and economic factors, such as financial and supply conditions, geographic and regulatory norms for development and banking policies (Pollakowski and Wachter, 1990, as cited in Malpezzi and Wachter, 2005).

These cycles are defined as several stages - speculation and push down market. Speculation is the moment the investor deposits its capital in real estate in a rising market (Malpezzi and Wachter, 2005). The rising market can be a result of positive effects from a new town development program to enhance the living conditions. For example, in Hong Kong, exists the "sandwiched households," which provide accommodation at a low cost for the houses that tend to have the quickest rising living costs (Hui et al., 2016).

According to Miles, Netherton and Schmitz (2015), real estate development is a cyclical industry with several oscillations because of various factors. The decisions made by the today market can bring some issues, because the mature business cycle can be between three and five years for new buildings for sale (Alencar et al., 2011). Cash flows pronounce by the cycle in the local space market that will bring forward along the financial market cycle, so developers that maintain liquidity during a downturn is a huge concern (Miles et al., 2015).

Stevenson (2014) shows evidence of office market cycles, which shows that investments in these markets are extremely sensitive to developments in capital markets (Stevenson, 2014, as cited in, Mourouzi-Sivitanidou, 2021). In the 1970 until 1980 was a timing defined by the dramatic change to the focus of goods production for the delivery of services to the consumers, which became a growth sector concentrated in business services and health care (Miles et al., 2015).

## 2.3. Feasibility Analysis

Market analysis is an important part of the initial feasibility study for a real estate project because market conditions come into play along the development process (Brett and Schmitz, 2009). The project feasibility when it is positive confirms the existence of a potential, on contrary, the financing, design, building, selling or renting problems still exists (McMahan, 2007).

Before any decision making involving an investment, the feasibility study helps to define the project implementation on time and under budget (Goel, 2015). Financial planning is a method that verifies if goals and plans made for specific company' operations are feasible and consistent (Jaffe et al., 2010).

Feasibility Studies are parts of research realized before a main study is finished (Arian et al., 2010), and belongs to the initial step of the continuous market analysis. The evaluation of the real estate investment feasibility is made by the same measurement tools, but the goals differ along the investors and lenders; because the investors seek to maximize the value of the investment, but the lenders want to avoid lose capital by insuring the property cash flows are enough to cover the debt service payments (Miles et al., 2015).

The values of the project related on a quantitative analysis corresponds to the ultimate task related to estimation for the assessment of the financial feasibility of the project, this analysis is made by the estimation of project rent or price at the time through certain techniques, taken in account the anticipated changes in local market over the planning horizon (Mourouzi-Sivitanidou, 2021).

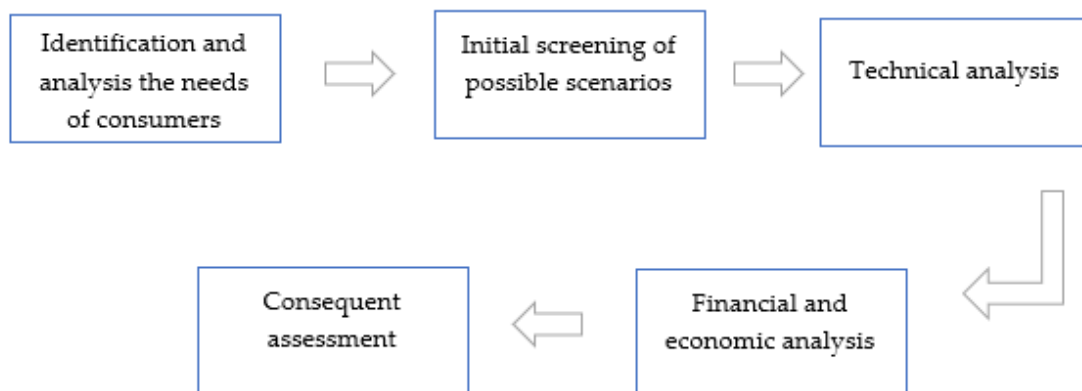
A total figure of the project is done by the combination of hard cost as the construction cost and the soft costs related to the development like insurance, property taxes, marketing, and general administrative costs (Miles et al., 2015).

The estimation and projection of these developments are made mostly by information and cost on the market (Brueggemann and Fisher, 2018). Additionally, feasibility studies the absorption rate because they determine how

long investors will have to carry the property before the start of generating positive cash flows (Miles et al., 2015).

Figure 3 consists of the main steps to follow to do a feasibility study, from the estimation of the revenues and costs of the project until the evaluation of the balance to decide.

*Figure 2 - Main steps of a Feasibility Study*



*Source: Dey (2001)*

The values defined for project costs depend on the economic, social, and environmental factors such as location and project' duration (Dey, 2001).

According to Oprea (2010), the best and deep feasibility study allows the answer the following questions: Should the property be acquired? How should or must it be financed? How long should the investment be held? How risky is the purchase?

Financial forecasting is a crucial method to make decisions. Since the market has become more global, the availability of financial forecasting' instruments have become an essential role to the existence of efficiency (Barra et al., 2020).

## 2.4 Financial Valuation

The last step of a project valuation is the cash flow analysis, where project valuation can take action because determine the asset' value.

Project Valuation' goal isn't just evaluating a project but is also to compare how can emphasize from other competitors with the same investment (Kodukula and Papudesu, 2006).

There is a measure that indicates the project' value is NPV. Fabozzi and Peterson (1999) represent the NPV with the use of the sum of cash flows, positive if inflows and negative if outflows during the economic life of the investment with a discount by the cost of capital. In that sense, Formula 1 refers the computation of NPV that can be seen as a present value of cash flows with a required rate of return of the project compared with the initial investment (Gallo, 2014).

$$NPV = \sum_{i=1}^n \frac{Cash\ Flow_i}{(1+r)^i} - Initial\ Investment \quad (1)$$

Where:

NPV – Net Present Value of an asset

i– period that comes along with the asset' maturity

r– cost of capital

NPV is a measure of how much the owners of wealth are expecting to rise with an investment, which can be a great guide to identify the projects that maximize the wealth of owners (Fabozzi and Peterson, 1999). When the measure is positive, the project is profitable and the company recovered its cost of capital (Goel, 2015). When we are facing mutually exclusive projects, we accept the projects that have the highest positive NPV (Brigham and Ehrhardt, 2010). NPV has different cycles of definition, the strategic cycle where firms use financial ratios to help choose initiatives and investment, and the delivery phase which needs to decide between two best options (Daves, 2012).

A discount rate represents an important indicator to compute the NPV, so we will analyze the concept. Manganelli, Morano and Tajani (2014) presents that the discounted rate is seen as a criterion of opportunity costs with the assumption that return rate as an alternative investment, in terms of risk and duration.

Exists many formats of discount rate, WACC can be one of them. The WACC corresponds to the rate of discount that relies on the average costs of debt and equity capital of the firm, which we discounted the cash flows from asset' firm with WACC, we have the firm's value (Jud and Winkler, 1995). Damodaran (2012) completes affirming that the cost of capital is defined as the weighted average of costs of instruments to fund the investment, which means by the change of the component's weights, companies might change their cost of capital. In this way, WACC may be related to the return on equity and expose the risk structure of the future debt, which can be more progressive and less synthetic with the adaptation of any tax shield valuation model (Farber et al.,2006). The WACC formula follows:

$$WACC = \frac{E}{V} * r_e + \frac{D}{V} * r_d, \quad (2)$$

where:

E – Equity' value of an asset

D – Debt' value of an asset

V – Asset' value

r<sub>e</sub> – Cost of equity

r<sub>d</sub> – Cost of debt

Sharpe (1964), during its development of the Capital Asset Pricing Model (CAPM), contributed for the acceptance of a method that estimate the r<sub>e</sub> empirically (Sharpe (1964), as cited in Jud and Winkler, 1995). Treynor (1961) and Sharpe (1964) developed CAPM and along the time, the model proved that can be a benchmark for performance analysis (Dimson and Mussavian, 1985). If CAPM is used as benchmark, that means the market tends to anticipate

information, due to the fact the most of price adjustments is finished before the event is revealed to the market (Dimson and Mussavian, 1985).

After the selection of a discount rate and forecast the cash flow, we are able to compute the asset' value. Brueggeman and Fisher (2018) presents several approaches that determine the property' value under different assumption:

- **Sales comparison** – appraiser use information from a market analysis, like sales transaction data on comparable properties.
- **Income approach** – a property is evaluated based on the principle that the one can produce cash flow.

With the base of income approach, in this chapter we are analyze how can different methods of compute cash flow influence a final decision making. The valuation models can use revenues and costs from comparable assets, but cash flow is calculated by different indicators with the same mathematical formula.

### 2.4.1 Arbitrage Pricing Theory (APT)

Ross, who developed APT argues that if the “equilibrium prices” offer any arbitrage opportunities over asset portfolios, then the expected returns are nearly linear to the factor's loadings, which corresponds to the betas that are proportional to the covariance of the returns (Huberman and Wang, 2005). In APT, the beta measure the responsiveness to the factor, but in CAPM the beta measure the responsiveness to a movement on a market portfolio, which makes the two alternative models of risk and return (Jaffe et al., 2010). CAPM represents the risk premium that matches the investment beta, the one that measure market movement like Jaffe, Ross and Westerfield mentioned, multiplied by the market risk premium (Berk and DeMarzo, 2013), like we can see in Formula 3.

$$R_i = R_f + \beta_i * (R_m - R_f) \quad (3)$$

where:

$R_f$  – Risk-free rate

$R_m$  – Risk of market portfolio

$R_i$  – Cost of capital measure by CAPM Model

$\beta$  - beta of the market

CAPM presents two types of risk associated with a firm that are the systematic risk related to the market, and the non-systematic risk related to a specific firm (Iqbal and Shah, 2012). Cox and Griepentrog (1988) defines that risk measure should generate a risk premium that incorporates the systematic and unsystematic risk investors are forced to accept due to the existence of market constraints.

The cost of capital consists of the best expected return available in the market for investments with similar risk, so CAPM represents a practical way (Berk and DeMarzo, 2017). CAPM formulation was created under some assumptions: the market portfolio is well-diversified, and the efficient portfolio is a non-diversifiable risk in the economy (Berk and DeMarzo, 2017). In the sense that CAPM can be used as a benchmark of discount rate, Berk and DeMarzo (2017) affirms that similar investments have the same risk if they were exposed to the same sensibility of the market risk, measured by the beta.

In CAPM, the covariance represents the measure of risk that investors are not able to avoid it by diversification, which tends to be well diversified, given that the funds are associated with the factors and the  $r_f$  (Huberman and Wang, 2005), like we can verify in the Formula 3. Market portfolio will not be optimal in the sense that investors will hold distinctive portfolios, especially hedged ones; this also applies in CAPM, because market portfolio will not be efficient in an international framework, so Internal Arbitrage Pricing Model does not yield operational conclusions (Solnik, 1983).

## 2.4.2 Relative Valuation Models

The multiple approach consists of the estimation of the future value through the multiple application that looks to comparable entities in the business today that is priced by the market; so, this model is simple but can have a huge impact on the company value, making it a relative valuation and not a DCF (Damodaran, 2001). However, Damodaran identifies a limitation to the use of relative valuation that comprehends the fact that two companies can be identical but can differ on risk, growth potential and cash flows, so it is very important to know how to control these differences when an agent is comparing firms using a multiple approach. To produce income, analysts use additional ratios like cash flows, sales or even the book value of recent transactions (Martin and Titman, 2016).

There is an example in application of real estate that Martin and Titman (2016) explain that is the use of a ratio of prices in square feet in the recent neighborhood for the calculation of the price of the new project that can be sold out.

## 2.4.3 Discounted Cash Flows Models

As I mentioned previously, DCF models are the one more used from project valuation; because can be more feasible and show the more truthful methodologies to forecast future value according to the project' features. The need to forecast future values of cash flows come from the investor to know how the cash inflows will be in the future and if the cash outflows will be able to cover them. Virlics (2013) adds saying that the basis of investment behavior can be the neoclassical theory of optimal capital accumulation and the assumption that business firms maximize utility.

DCF method is the best one can estimate the most efficient way to calculate the best rate of return for the project' owner. Damodaran (2002), who developed all models of DCF, affirms that this method is easy to apply in assets or

companies because cash flows are currently positive and have the capacity to estimate with some credibility to the future periods, where there exists a proximation of risk that can be used to obtain discount rates.

Exists numerous of DCF models, but all share the same foundation that are based on the computation of the NPV along the project' life cycle, taking in account the investment costs and production phase related to its free cash flows (FCF) (Kodukula and Papudesu, 2006).

Additionally, enterprise DCF and discounted EP consist of two ways of many to value an asset. Goedhart, Koller and Wessels (2010) explains that DCF continues to be the favorite models of practitioners due the focus of cash inflows and outflows and not on the earnings calculated by accounting; however discounted EP valuation has a strong relationship with economy theory and competitive strategy.

#### 2.4.3.1 Free Cash Flow to Firm (FCFF) Model

Damodaran (2002) explains that the forecast of the cash flow is based on the earning measure, and in FCFF also aligns with that sense, because consist of the use of after-tax operating earnings. The FCF defines the expectations of earnings before interest and taxes (EBIT) times 1 substrate by the tax rate (t) that the firm would have if it had any debt and is discounted with the WACC (Gup and Thomas, 2010), like it is Formula 4.

$$FCF = EBIT \times (1 - t) + Depreciation - (\Delta net\ working\ capital + Capital\ Expenditures) \quad (4)$$

The aggregate FCFF can be estimated by the cash flows after operating expenses, taxes, and capital investment crucial to create future growth in fixed assets and working capital, but before any debt payments (Damodaran, 2012).

FCF computation leads to the FCFF model that corresponds to the one that matters due to the availability for the distributions to all investors, including

creditors and stockholders, depending on sales revenues, operating costs, and taxes, and required new investments in operating capital (Brigham and Ehrhardt, 2010).

This method of an asset' valuation use the cash flows use for distribution for the shareholders along the life cycle, with a cost of capital represents the risk associated, which helps to determine the best rate of return for the investor. The FCF model functions using FCF and discount with WACC of the project (Bierman and Smidt, 2007).

Cost of capital has a big role on the calculation of an asset' value, because can represents the opportunity cost. In that sense, Bierman and Smidt (2007) argues that FCF methods provide a more reliable measure of value if the WACC reflects time value and risk of the project.

Formula 5 represents how the value of an asset is computed by the FCFF model.

$$V = \sum_{t=1}^n \frac{FCF_t}{(1+WACC)^t} + \frac{RV_n}{(1+WACC)^n} \quad (5)$$

where:

V - Value of the asset

FCF<sub>t</sub> - Free Cash Flow of a certain period (t)

RV<sub>n</sub> - Residual Value of a certain period (t)

WACC - Weighted average cost of capital

t - period time that can begin with period 1 and ends in period n

n - period time that matches with maturity of the asset

Since the capital structure is constant along the timing, if the expected values of EBIT and capitalization rate does not change, the formula 5 measures the value of the levered firm (Bierman and Smidt, 2007). In that sense, when the FCFF remains the same and the structure of debt and equity changes, the value of a firm will rise as the costs of capital reduce, so this example follows the goal of a firm by the maximization of a firm value, it is necessary to minimize the cost of capital (Damadoran, 2012).

Usually, a project or several ones does not affect the capital structure of a firm, so it is reasonable to use NPV by FCF model with an assumption of constant capital structure (Bierman and Smidt, 2007). Debt financing pre-commits are used to pay this type of cash flow rather than when positive NPV investment opportunities are near zero (Schlingemann, 2004). FCF is one of the indicators that gives a base for the judgments of investors (Soros, 2015).

#### 2.4.3.2 Free Cash Flow to Equity (FCFE) Model

FCFE method drives for the same logic of FCFF, because use the FCF that corresponds to the capital available to distribute the investors in the point of view of equity holders; but the cost of capital does not correspond to WACC, but to  $r_e$ . The FCF related to the model consist of the capital left over after all financial payments, like debt payments and capital and working capital expenditures (Damodaran, 2002). The Equity Cash Flows (ECF) is forecast by the following formula:

$$ECF = FCF - (FE * (1 - t) - \Delta net\ debt) \quad (6)$$

Damodaran (2012) completes affirming that companies can reinvest some of their cash flows into new assets and extend the period, so cash flow will grow with a constant rate forever, which will correspond to the terminal value. Residual value (RV) is the value gradually accumulated when the investment' disposal occurs and belongs to one of the revenue components such the net income received, that is the purchase price which should be added or subtracted by the (de)valuation at the end of period of the property (Manganelli et al., 2014).

However, the Modigliani-Miller Dividend Irrelevance Theorem affirms the investors are unaffected financially by a decision of the firm to reinvest earnings or distributes the dividend among the investors (Kania, 2005).

The FCFE of a project represents the expected amount of additional cash the firm has available to pay dividends each year, because these cash flows are payments for equity holders that are discounted by the  $r_e$  (Berk and DeMarzo, 2017).

The value of FCFE valuation model is represented by the discounted expected cash flows to equity discounted with the rate of return required by equity investors in the company (Gardner and Moeller, 2009). Formula 7 represents the equity value of an asset calculated by the FCFE Model.

$$E = \sum_{t=1}^n \frac{ECF_t}{(1+r_e)^t} + \frac{RV_n^E}{(1+r_e)^n} \quad (7)$$

where:

E - value of the equity' asset

ECF<sub>t</sub> - equity cash flow of a certain period (t)

RV<sub>n</sub><sup>E</sup> - Residual value equity of certain period (t)

$r_e$  - cost of equity

t - period time of the project

n - period that corresponds to the maturity lifetime

The calculation of FCFE can be simpler if we assume that net capital expenditures and working capital changes using a fixed mix of debt and equity (Gardner and Moeller, 2009).

This is related to the dividend policy that has a big function in the financing and investment decisions of the firms, this relies on the fact that understandings on the environment influence the dividends payments which contributes for the firm's savings (Forbes and Lee, 1982).

In this model focused on net income growth, the expected growth rate consists of a function of the equity reinvestment rate and the return on equity (Damodaran, 2012). This justified the fact the equity valuation models are better to value a financial service firm comparing the enterprise valuation models (Damodaran, 2009).

Berk and DeMarzo (2017) confirms the identical mathematical methods along the DCF models presented by Damodaran, affirming that FCFE model is identical to the computation of NPV using WACC and APV methods.

#### 2.4.3.3 Capital Cash Flow (CCF) Model

Ruback (2002) suggested the CCF model was a method easier in application as a result and less probable to error (Ruback, 2002, as cited in Booth, 2007). CCF is a sum of the flows available to equity, net income, depreciation minus the capital expenditure, and the increase in working capital sums with interest paid to debtholders (Magiera, 2002).

The CCF model uses the cash flows resulting from flows from all capital contributors (Bierman and Smidt, 2007), as we see in the Formula 8.

$$CCF = FCF * (1 - Tc) + Tc * I \quad (8)$$

where:

CCF – Capital Cash Flow

FCF – Free Cash Flow

Tc –Corporate Tax

I – Interest payments

First, we need to forecast the CCF using the indicators referred – FCF, corporate tax and interest payments – indicators that we already calculated for the previous DCF model. In this formula, the first term corresponds to FCF and the second one to the value of interest tax shield (Bierman and Smidt, 2007).

In this valuation model, the tax shield is forecast by using the discount rate of the WACC, which seems that CCF model might directly add tax shield to FCF and APV method that would be obtained separately (Acosta-Calzado et al., 2010).

In capital cash flows, we use the same discount rate for FCF and the tax shield; so, this project' cash flows and tax shield is discounted by the discount

rate with the  $r_a$  (Berk and DeMarzo, 2013). Formula 9 presents the asset' value from the computation respecting the CCF model.

$$V = \sum_{t=1}^n \frac{CCF_t}{(1+r_a)^t} + \frac{RV_n}{(1+r_a)^n} \quad (9)$$

where:

V – Asset' value

CCF<sub>t</sub> – Capital Cash Flow in a certain period (t)

R<sub>a</sub> – Unlevered rate of a firm

RV<sub>n</sub> – Residual Value in the final life cycle of an asset (n)

t– period time during the asset' life cycle

n– maturity of the asset

#### 2.4.3.4 Adjusted Present Value (APV) Model

The DCF model presented by Damodaran have some similarities. Bierman and Smidt (2007) explains that CCF and APV are the models that are useful if the capital structure is not constant.

APV is a method, where the unlevered value of the firm is adjusted for the advantages related to the use of debt (Booth, 2007). This method is forecast by the sum of FCF discounted by the costs of assets and the interest tax shields discounted by the  $r_d$ , which seems that tax shields are less risky compared with assets (Magiera, 2002).

According to Damadoran (2012), there is a few steps to follow in order to compute the asset value from APV model, that is the following ones:

- Step 1. Estimate the value of the unlevered asset, like it had no debt with the discount with a  $r_e$ .
- Step 2. Forecast the expected tax benefit from a given level of debt, that can be the function of the tax rate of an asset with the discount with the  $r_a$ .
- Step 3. Evaluate the effect of a given debt level on a default risk and the expected bankruptcy costs. This computation can be done by the estimation of the probability of default; which corresponds to one of the disadvantages to forecast the asset value through the APV method;

because many analysts ignore the bankruptcy costs and lead to the conclusion that firm value increases as the debt is higher.

The APV method uses the NPV of the investment and assumes that it is financed with stock equity capital discounted by  $r_e$  (Bierman and Smidt, 2007). Additionally, in the formula is added the after-tax benefits' present value without the consideration of debt financing, discounted by the  $r_d$  (Bierman and Smidt, 2007). The tax savings matches with debt interest related to debt used for investment (Bierman and Smidt, 2007).

$$V = \sum_{t=1}^n \frac{FCF_t}{(1+r_u)^t} + \frac{RV_n}{(1+r_u)^n} + \sum_{t=1}^n \frac{DE_t}{(1+r_d)^t} \quad (10)$$

where:

V – Value of an asset

FCF<sub>t</sub> – Free Cash Flow in a certain time (t)

RV<sub>n</sub> – Residual value in the final period of the maturity (n)

DE<sub>t</sub> – Debt expenses in a certain period (t)

$r_u$  – cost of capital without debt

$r_d$  – cost of debt

t – period that belongs to the life cycle of the asset

n – maturity of the asset

#### 2.4.3.5 Compressed Adjusted Present Value (CAPV) Model

Besides the existence of thousands model of valuation models, CAPV is the last model that I will present in this thesis. CAPV has a particular aspect that differs the other valuation models already mentioned. Daves and Ehrhardt (2002) refers that CAPV is a model that the growth rate can be any value but can be restricted by the discount rate on the tax shield to match the  $r_u$ . Unlike standard adjusted NPV, assumes that tax shields and cash flow have the same systematic risk (Kliestik and Michalkova, 2018).

The CAPV method allows nonzero growth and risky debt with a nonzero debt beta, because the tax savings is discounted by the high  $r_u$  (Brigham and Ehrhardt, 2017). This model is used to determine the value of a firm that the capital

structure is changing during the forecast period but begins with a valuation of a constant capital structure (Brigham and Ehrhardt, 2017). Formula 11 represents the computation of asset' value through the CAPV model.

$$V = \sum_{t=1}^n \frac{CCF_t}{(1+r_u)^t} + \frac{RV_n}{(1+r_u)^n} \quad (11)$$

where:

V – Value of an asset

CCF<sub>t</sub> – Capital cash flow from a certain period (t)

RV<sub>n</sub> – Residual value from the maturity of the asset (n)

r<sub>u</sub> – cost of capital without debt

t – period that comes along with the asset' life

n – final period of the maturity of the asset

### 3. Methodology

The inexistence of a unique research methodology to all research problems, reveals that each one has its own weakness and strengths. Therefore, the selection of a research methodology varies on the research activity, beliefs, theory that informs the research and how can that knowledge may be acquired, which represents the concept of methodology (Tuli, 2010). Positivist researchers tend to adopt a quantitative methodology based on surveys and questionnaires, but interpretive researchers use more qualitative methodology with a base of interviews and ethnographies (Mathi, 2004).

On the contrary of quantitative methodologies, there exist other approaches that allow more flexibility, dynamic and individual research processes (Coenen et al, 2012). Qualitative methodology is use by researchers that belong in a culture or group that observe people and interaction between them, they also can participate in activities like interviews, take life histories, construct case studies or analyze documents: all these methods consist of to capture an insider's way of a group that is developing a study (Tuli, 2010). Case studies are likely to focus on small samples and pretend to analyze a real-life phenomenon (Taherdoost, 2018).

Case studies comes from many data sources which gives large amount of information to analysis, with these researchers can build and produce theory (Krusenvik, 2016).

Many authors also presented additional advantages related to the case studies which are: understands and change complexities related to interpersonal process in a social environment, details analysis on a specific real-life event, and also can be a good tool to encourage to structure future research due to the fact case studies can be great method for creating hypothesis (Krusenvik, 2016).

Case studies brings many advantages to the research, I choose to use this method to prove that DCF models are the best to compute a project' value and

define what are the best one specified on the asset. The case study is a real project that needed to have an appropriate valuation to the investor make the optimum decision, according to the goals that already established. I will use the information that the case study brings to build the distinctive DCF methods and conclude which method is the best to value a specific project.

The main goal of this paper is to demonstrate that each real estate project can lead to several results and consequently different decisions, which the case study will help to demonstrate it. Financial Valuation convert into a central piece of this paper, because each model leads to a different result and decisions; due to the fact each model has its calculation approach that leads to the project value.

Among the research questions previously represented on the Table 1, the three questions have been answered along the review literature. The answer to the other research questions presented will be done by a methodology that will prove the importance of DCF models in Project Valuation and how can models that share formula mathematical equivalents gives different results. The methodology that I will use is a case study because it will prove the answer with a project that exists on the market and replies to the reality that happens on the market. I will use a case study selected by a book of an institute of professional development of real estate, the Urban Land Institute, whose mission is to shape the industry' future and create thriving communities with projects.

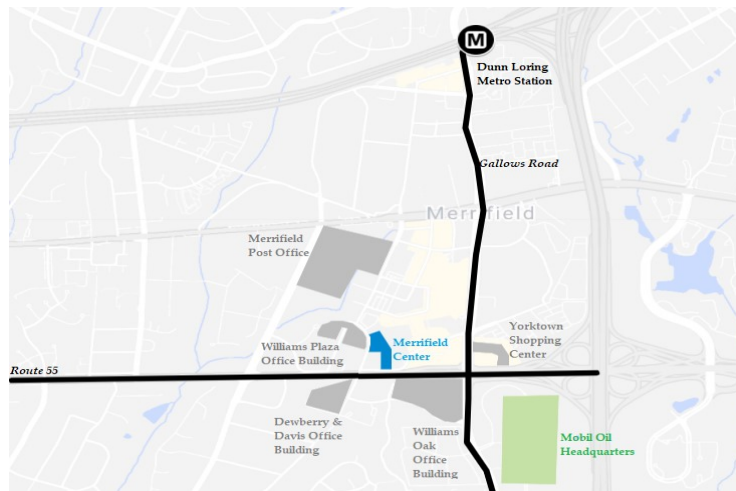
In the procedure of the methodology, I need to make some assumptions that were not included in the project, but it is precisely justified, for example the capital structure and its interest rate.

## 4. Case study: The Merrifield Center

### 4.1 Property & Ownership

Merrifield Center is composed of six buildings that constitute the basis of the office market segment. The property has 97,260 square foot rentable space and an additional site for 337 parking spaces.

Figure 3 - Location and competitors of Merrifield Center



**Caption:**

Blue plot represents the project in analysis

Grey plots represent the competitors

Black lines represent the roads that drives accessibilities to other areas

Green plot represents an infrastructure of the area

Merrifield Center was purchased by the National Insurance, a major insurance company, for \$6,961,000 in February 1982. Until 1990, the company already invested in cash around \$7,792,706, and the book value of the asset is \$4,810,977.

However, in 1991, the property lost a major client, the B&O Telephone Company of Virginia, because it wanted to move its suburban operations to other infrastructure.

The National Insurance works with Greystone Realty Corporation whose activity' principle is strategic asset management, through the driving of value of

certain assets according to the market' features and defining position on the market. GreyStone is the great firm to work with the National Insurance, because the last one is deciding what path should be taken according to a real estate portfolio in the next few years. Real estate represents the major piece from the National Equity portfolio (68%), the remaining sectors that the firm invests in are industry (17%) and retail (15%). But the Merrifield Center owner wants to vary its heavy suburban assets, in the way that will be able to maintain, or increase the return on its portfolio.

## 4.2 Office Market

In the 90's was a time that the office market had a very poor performance, regarding to the lowest absorption level register in 5 years. This behavior was present in Northern Virginia, because only 21 million square feet was from vacant speculative office space, which does not include the amount of sublease space that represents the direct competition of the property.

The Merrifield submarket attracted several national and local developers, due to the easy accessibility and visibility that the area benefits. The new development that took place around the property are the competitors represented in the Figure 3.

The Table 2 represents the competitors located on the submarket of Merrifield Center and this respective estimated rent, date of completion of the project and available space.

Table 2 - Rents of Merrifield Center' competitors

Name of the competitor	Status	Estimated Rent	Available space
2980 Fairview Park Drive	Completed in 1991	\$21 until \$21.50	37%
Metro Place Phase I	Completed in 1991	\$26.50	100%
Metro Place Phase II	Project	\$26.50	100%
Metro Place Phase III	Project	\$26.50	100%
2675 Prosperity Avenue	Project	\$24 until \$27	100%
2677 Prosperity Avenue	Project	\$24 until \$26	100%

If these competitors referred to on the table were Class A office buildings, its estimated rents were respecting the market. On the contrary, the Merrifield Center is a Class B office building, but it is suggested that the rents follow the market of its respecting rating.

Merrifield Center was being rented at \$18 per square foot, which situated a little higher level of the market rental of Class B office buildings. Since we were and we are in a world that the prices tend to go higher and higher following the inflation rate, the rents should follow the same behavior.

### 4.3 Strategic action

Since the National Insurance, owner of Merrifield Center, wanted to explore the best path that should be followed for the maintenance or rise of its returns, GreyStone went along with the process for the better creation of value, according to the goals and preferences defined by the major insurance company.

Merrifield Center is known as “producer”, what investors call when a property has relatively constant and predictable revenues. However, the office building had some risk involved like the uncertainty of which tenants will stay and what and how many tenants will come to the space available.

Regarding the property' costs have many assumptions starting at 1991, which are the following ones:

- Operating expenses will be \$5.60 per square foot;
- Real estate taxes will be \$1.47 per square foot;
- Management fee will be \$0.32 per square foot.

The expenses above mentioned will have a positive behavior according to the inflation of 4.5% per year.

According to the pro forma cash flow projections in Annex 1, I will create a simulation to determine the project' value.

#### 4.4 Financial data collected from the case study

After a brief presentation of the case study we are analyzing, it is an important step to collect some financial data to make financial statement that will be a base for the definition of the distinctive cash flows– FCF, ECF and the CCF.

As the case study of Merrifield Center was collected on the book, I do not have the direct contact with the firms involved in, so the DCF valuation models were developed by data represented in the pro status forma and some assumptions.

The balance sheet is developed by follow sense that total assets and invested capital is the same along the asset' maturity. The balance sheet that I developed with the base of pro status forma, I need to make some assumptions regarding the working capital and the capitalization structure of Merrifield Center. Regarding the working capital represents the management fees, given the management team is the one that is creating value. About the capitalization structure, I know that in 1991 hospital covers its costs with financial debt: 25,4% of its costs were supported by medicare, an insurance support the operational activity, 15,9% from governmental funds and 5,1% miscellaneous funds, making the total of 46,40% financed (Laschaber and Vertress, 1991). So, I assumed that this medical services office is structure by the same way of hospitals in 1991, the year the property needed to be invested. The balance sheet of the project is

represented in Annex 2 and it was developed by the following sense represented in the Table 3.

*Table 3 – Balance Sheet Construction*

<b>Assets</b>	<b>Debt</b>
Fixed Assets	Long term debt
Working Capital	

After the construction of balance sheet focus on the project itself, I constructed a financial statement as well with the same pro status forma, where the receipts collected was from the rents paid by tenants, rents that were established by the market analysis of the area. Regarding the costs, were stipulated some assumptions and rules that I already referred in the Chapter of Strategy Action from Merrifield Center.

The financial statement is constructed by the following functions and methods referred on the Table 4.

*Table 4 – Financial Statement Construction*

Sales – Cost of goods sold – Depreciation – Other operating costs
= EBIT (Earnings Before Interest and Taxes)
-Interest expenses
= EBT (Earnings Before Taxes)
-Taxes
= Net income

With the analysis of the construction of a financial statement, I needed to define the source of this indicators. The sales define in the Table 4 is referred of the rents collected through the tenants that are using the property, rents that were defined based on the competition, with a base of \$18 per square foot in office

rents and \$10 per square foot in deli units. Regarding to the costs, is determine two types of costs: the cost of goods sold and other operating costs. Finally, for the net income, I consider as taxes, the real estate taxes that the property needs to cover every year, to maintain the activity and provide welfare for the community, through the accessibility of the medical services provided by Merrifield Center.

Regarding to the management fee be assumed on this thesis as a working capital, given this type of cost will be needed for the FCF computation. After FCF define, all the rest of cash flow types is calculated for the project' value through the DCF valuation models, like it evidences in the Table 5 and as well, in Annex 4.

*Table 5 – Cash Flow computation*

EBIT+ (1- Discount Factor) + Depreciation – (Variation of Net Working Capital + Capital Expenditures)	
= FCF	
-(Financial Expenses*(1 – Discount Factor) – Debt Variation)	+ Financial Expenses* Discount factor
= ECF	= CCF

This map of cash flows, where represents the computation of several cash flows types, demonstrate that EBIT needs to be determine first, for the purpose of the FCF be computed and afterwards the ECF and CCF.

In the next chapter, I will demonstrate how each type of cash flows was determine and how the project' value was computed by the DCF valuation models.

## 4.6 Valuation Methods used in practice

As I referred previously, I will use DCF models as a valuation method to identify the value of the project. This choice can be justified for the fact is the only model that can match more to the reality, because compute the project' value among the true cash flow on the present and predict future values among the discount rate used and growth rate established by the market performance. Other valuation models are very restricted, because APT only use benchmark as a computation of the project' value and Relative Valuation use ratios by the measures of performance, which is a method very limited.

This chapter, I will show the formulas used on the determination of the project value, the Merrifield Center, among the several models inserted in DCF models, and represent in Annex 5 to 9.

### *1) Free Cash Flow to Firm model*

In the project in analysis, EBIT was calculated through the Financial Statement by the subtraction of the revenues and operating expenses, resulting in 1991:

$$EBIT_{1991} = \text{Rents received} - \text{Cost of goods rented} = \$1,024,857 - \$544,348 = \$480,509 \quad (12)$$

However, this EBIT from FCF method will be considered net EBIT with the discount by the tax rate that was define as 17,17% by the division of total taxes paid by the EBT.

$$\text{Tax rate} = \text{Total taxes paid} / \text{Total EBT} = \$2,962,974 / \$17,257,714 = 17,17\% \quad (13)$$

$$\text{Net EBIT}_{1991} = EBIT * (1 - \text{tax rate}) = \$480,509 * (1 - 17,17\%) = \$398,010 \quad (14)$$

In the case of the Merrifield Center, I will not assume any depreciation for the simplicity of the computation. But exists some net working capital which corresponds to the management, which:

$$\Delta \text{ net working capital } 1992 = \text{Working capital } 1992 - \text{Working capital } 1991 = \$32,507 - \$31,270 = \$1,237 \quad (15)$$

In terms of Capital Expenditures is related to the capital required to do a property' renovation that will be needed in the first years of the investment (I assume 5 years in this case). This renovation is required because in 1990, an architectural firm identified that the mechanical system of the building was not very efficient given their type, age, and construction of the building. Among tree options given by the architectural team, I assume the National Insurance decides to go forward to the option that would make more comfortable for tenants but does not extend the useful life, this option has a total of \$626,478. Given the assumption, this capital expenditure would be paid in equal amounts in the next 5 years of the initial investment, the capital expenditures in 1991 is \$125,296.

Finally, what left to know to forecast the project value is determine the discount rate that matches with WACC. The capital structure of the project is defined by the health care' industry<sup>3</sup>, assuming the debt value was finance by governmental funds and not cover of any security funds, because the owner of the project is itself a National Insurance company, being the debt ratio of 46,40%.

The  $r_e$  is computed by the rationality of CAPM, the formula needs to know the levered beta that will be computed using the unlevered beta ( $\beta_u$ ) that measure the systematic risk of the industry that the project is insert in. The  $\beta_u$  in health care' industry<sup>4</sup> is 1,196. However, the beta we need to compute the  $r_e$  through CAPM is the levered beta ( $\beta_l$ ), which is forecast by the Formula 3. The target capitalization is represented by the division of debt and equity, in this case is 86,57%.

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<sup>3</sup> The beta is related to health care system define by a study related to the estimation of market beta for the cost of equity (Suh, 2011).

<sup>4</sup> A study about the financial structure of USA in 1991, demonstrate it was a year full of expenditures focus on health care (Laschaber and Vertress, 1991). This study reveals that the hospital is the main element on the health system in USA, so this justify my selection of the industry regarding the capital structure, because the case study is insert in and it is focus on medical services.

$$\beta l = \beta u * (1 + \text{capital structure} * (1 - \text{tax rate})) = 1,196 * (1 + 86,57\% * (1 - 17,17\%)) = 2,05 \quad (16)$$

To forecast the  $r_e$ , I consider the  $r_f$  of Standard & Poor's P500 of 3,65%, and the market risk premium of 3,05%.<sup>5</sup>

$$\text{Cost of equity} = \text{risk-free rate} + \text{market risk premium} * \text{levered beta} = 3,68\% + 3,05\% * 2,05 = 9,95\% \quad (17)$$

The  $r_d$  is 4,915% defined by the average of interest rate in USA in the year 1991<sup>5</sup>, because we don't have that information on the case study.

However, the WACC inserted on the formula of FCFF model to compute the project' value is net, so it is necessary to discount by the tax rate.

$$R_{d \text{ net}} = r_{d \text{ gross}} * (1 - \text{tax rate}) = 4,915\% * (1 - 17,17\%) = 4,07\% \quad (18)$$

$$WACC_{\text{net}} = E/V * \text{cost of equity} + D/V * \text{cost of debt} = 53,6\% * 9,95\% + 46,4\% * 4,07\% = 7,22\% \quad (19)$$

After the collection of indicators, we can compute the FCF in the 1991:

$$\begin{aligned} FCF_{1991} &= EBIT_{1991} * (1 - \text{tax rate}) + \text{depreciation}_{1991} - \\ &(\Delta \text{net working capital} + \text{Capital Expenditures}) = \$480,509 * (1 - 17,17\%) + \\ &0 - (\$31,270 + \$125,270) = \$241,445 \end{aligned} \quad (20)$$

In the formula 5 represents the way to calculate the value of an asset though the FCFF model, which adds the forecast of a residual value.

$$RV_n = (FCF_n * (1 + g) / (r - g)) = (FCF_n * (1 + g) / (WACC_{\text{net}} - g)) = (\$1,619,537 * (1 + 4,5\%) / (7,22\% - 4,5\%)) = \$62,150,463 \quad (21)$$

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<sup>5</sup> The market risk premium and cost of debt was collected by the Data World Bank (data.worldbank.org). The risk-free rate was discover in multtp.com.

## 2) Free Cash Flow to Equity model

Financial expenses refer to the interest of the debt collect to cover the cost of capital expenditures, in that sense, the Financial Expenses in 1991 is \$369,841.

As we already know, the debt represents 46,40% of all expenses, so the variation of net debt in 1992 is:

$$\Delta Net\ debt\ 1992 = Net\ debt\ 1992 - Net\ debt\ 1991 = \$7,124,871 - \$7,524,747 = (-)\$399,876 \quad (22)$$

With all the information collected, we can forecast the ECF in 1991.

$$ECF\ 1991 = FCF\ 1991 - (FE\ 1991 * (1 - tax\ rate) - \Delta Net\ debt\ 1991) = \$241,445 - (\$369,841 * (1 - 17,17\%) - 0) = -\$64,898 \quad (23)$$

This ECF in 1991 is negative, which means the receipts does not cover the costs, so it is not profitable to use this type of cash flows to measure the project' value. The sign of this cash flows just turns it to positive since 1994 and maintains positive afterwards.

In order to calculate the project value through the ECF model, we already know how to calculate the ECF and we already know that the  $r_e$  is forecast by the CAPM model with the levered beta.

Regarding the last cash flow in FCFE method is related to the RV of equity that is determined by the difference between the RV of the last DCF method analyzed (FCFF model) and the debt of the last year of the maturity.

$$RV = FCF - Debt = \$62,150,463 - \$645,926 = \$61,504,537 \quad (24)$$

## 3) Capital Cash Flow model

In this valuation model, the discount rate used is the unlevered rate of the firm, this represents the gross WACC that the only differences are the  $r_a$  without the consideration of the debt.

$$WACC\ gross = E/V * r_e + D/V * r_{d\ gross} = 53,6\% * 9,95\% + 46,4\% * 4,92\% = 7,61\% \quad (25)$$

Lastly, as in FCF model the cash flow use in the last year of the project' maturity is the RV.

$$RV_n = (CCF_n * (1 + g) / (r - g)) = (CCF_n * (1 + g) / (r_e - g)) = (\$1624,988 * (1 + 4,5\%) / (7,61\% - 4,5\%)) = \$54,520,265 \quad (26)$$

#### 4) *Adjusted Present Value model*

As we can verify in the formula 10, the asset' value is calculated using the FCF with the discount rate of  $r_u$ .

The only component that we did not estimate previously was the unlevered cost of capital that tends to follow the same logic of CAPM but uses the  $\beta_u$  instead of levered beta ( $\beta_l$ ).

$$\text{Unlevered cost of capital} = r_f + \beta_u * \text{risk premium} = 3,68\% + 1,196 * 3,05\% = 7,33\% \quad (27)$$

Regarding the RV that consist of the last cash flow to be computed by the model.

$$RV_n = (APV_n * (1 + g) / (r - g)) = (APV_n * (1 + g) / (r_e - g)) = (\$1,619,537 * (1 + 4,5\%) / (7,33\% - 4,5\%)) = \$59,748,143 \quad (28)$$

In this DCF valuation model, the project value in each year is calculated by adding to the FCF discounted with the  $r_u$ , the interest tax shields that represents the net interest rate taking into account the present tax rate of the project. This sum is the project value that is compared with the other valuation models.

#### 5) *Compressed Adjusted Present Value model*

In this last DCF model, the project' value is determined using CCF that we already computed in the CCF method and is represented in the map of cash flow, with the discount rate of  $r_u$ , which means the  $r_u$  that we can verify how to compute using the financial rates of the year that the project would begin to start, year of 1991.

As the previous DCF model analyzed previously, the RV is a value taken in account during the computation of the asset' mode. In this last model to be calculated, follows the same formula as the previous ones.

$$RV_n = (CAPV_n * (1 + g) / (r - g)) = (CAPV_n * (1 + g) / (r_e - g)) = (\$1,624,988 * (1 + 4,5\%) / (7,33\% - 4,5\%)) = \$59,949,230 \quad (29)$$

## 5. Results and Discussion

The broker that presented the Merrifield Center as an option to invest to the National Insurance company, along with a pro status forma that reveals the projection of revenues and costs along 15 years of project' maturity. With this information, I developed a Balance Sheet and Financial Statement focus on the project itself, and not for the investor. These maps were essential to calculate the map of cash flows, where we identify the several type of cash flows presents on the DCF valuation models such as, FCF, CCF and ECF.

To develop and compute the project' value according to the different DCF valuation models, we define the discount rate appropriated with each model, to use the same rate with the type of cash flows of each valuation models.

Table 6 presents the results of using the five different DCF valuation models.

*Table 6 - Summary Table of the application of DCF methods*

Item	FCF	CCF	ECF	APV	CAPV	Average
Discount rate	7,22%	7,61%	9,95%	7,33%   4,92%	7,33%	
<b>Project value</b>	<b>30 413 030</b>	<b>26 816 873</b>	<b>24 543 193</b>	<b>29 736 324</b>	<b>29 617 020</b>	<b>28 225 288</b>
Debt value	7 524 747	7 524 747	7 524 747	7 524 747	7 524 747	7 524 747
Equity value	22 888 282	19 292 126	17 018 445	22 211 576	22 092 273	20 700 541
<b>Ranking on project' value</b>	<b>1</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>3</b>	
Deviation vis-a-vis the average	2 187 742	-1 408 414	-3 682 095	1 511 036	1 391 732	

Like we can verify in the Table 6, all DCF valuation models represent a positive NPV, which mean a positive project' value. If we are going to interpret in the way that positive NPV means the project values the investment, we can choose all 5 valuation models. However, we need to go deeper in the analysis, we need to analyze the capital structure along the project' maturity and choose what valuation model is better to predict the value of Merrifield Center.

The capital structure is capture by the ratio of debt per equity, as we can verify in Annex 5, the capital structure differs along the timing; so FCF and APV are

not the best valuation models to predict the project value, given these models share the use of the same cash flows, the FCF that are based only on income that will be distributed for the investors, taking in account the operating expenses, taxes, working capital and capital expenditures, but not any cost related to financing; which means the FCF assume the capital structure is the same along the time. What differs in FCF and APV valuation models is the discount rate, because the first model uses the WACC net and the second one the  $r_u$ .

Being FCF and APV deleted from the list of best valuation models to predict the project' value, it seems to be CCF is the best one. The CFF valuation model predict an asset' value from capital cash flow and discounted with the WACC gross. The WACC gross estimated the cost of capital by the weight average of debt and equity discounted by the respective cost of capital, so the model can predict an asset' value with an unstable capital structure. This can be justified from the unstable capital structure and not knowing the specific beta of the property. If we have that information, the best valuation model would be CAPV, given the discount rate use by that model is the  $r_u$  that uses the levered beta forecast of the asset and uses as well the CCF.

The last DCF valuation model to analyze is the ECF. According to the theory, this valuation model is the best to evaluate a financial service firm, given the cash flows that follow a specific regulation and need to evaluate from a dividend perspective. Since we are evaluating a project itself and not the investor, ECF model is not the best valuation model. The investor is a major insurance company, so if we were evaluating the project in an investor' perspective, maybe the ECF may be a better valuation model to predict its value, but in this case, I focus the evaluation of the project itself, so the best valuation model continues to be the CCF model, given the existence of unstable capital structure.

Now, we can confirm that a simple analysis of NPV results is not enough. It is essential to identify analyze in a deeper way to see what type of cash flow the

valuation model is using and what discount rate, to know if these indicators are appropriated for the capital structure and nature (if the asset is a financial service firm or not) of the asset.

DCF valuation models are models that use cash flows with a certain discount rate, this is what makes the models mathematical identical. However, the results from the five DCF models differ using different types of cash flows and different discount rates.

## 6. Conclusion

This dissertation has a purpose of showing the valuation process of each real estate project and how different financial models result into distinctive project value, and consequently, investment and financial decisions of investors.

I use case study to show how this behavior is present on any real estate project. With a principle of the investor' goal, it was identified the best property that matches what the investors wishes. After the property' selection, market analysis represented the next step, where it is analyzed what price competitors were doing, and if the property had the capacity to compete in that market, according to its location and activity related. Besides market analysis, a feasibility study is made by brokers or even the investors, that verifies if the project has the financial capacity to overcome the goals of the investor, this analysis is mostly done by the information gathered from market analysis like the rental price, and the operating costs. In this feasibility study, it can realize the exercise of transposing all cash flow information into different financial models and decide which one is the best one that can identify the project value over the 15 years of investment.

Through the results from valuation models of DCF models, the case study shows only CCF valuation model is the best one to predict the project' value, given the fact its capital structure is not stable along its maturity.

Additionally, the market behavior and its efficiency have a big presence on the case study presented, because in 1991, when the property was invested by the National Insurance, it was a year full of uncertainty in office markets, but the investor trust the market behavior and wanted to invest in that portfolio to diversify it.

The limitations of this work were the fact the case study does not provide any information about the balance sheet and financial statement, so I need to make

several assumptions to construct it. These maps were crucial to compute the different types of cash flows and the discount rates of each DCF valuation model.

To further investigations, I propose that use a case study that collects more information regarding the interest rate and capitalization ratio to construct the DCF valuation models without any assumptions, like I did in this work. Additionally, it will be very interesting that besides the development of DCF valuation models, construct the project' value according to the other valuation models that I referred along the thesis.

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## 8. Annexs

### *Annex 1 - Pro Status Forma*

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Gross Rental Income	\$1 042 345	\$1 083 574	\$1 512 355	\$1 749 492	\$1 979 052	\$2 000 330	\$2 001 606	\$2 151 455	\$2 361 208	\$2 440 287	\$2 530 790	\$2 720 281	\$2 835 128	\$2 880 710	\$3 021 034
Vacancy Allowance	\$17 488	\$18 213	\$26 192	\$29 989	\$34 375	\$34 626	\$34 468	\$37 220	\$39 902	\$41 144	\$42 693	\$46 211	\$48 379	\$50 695	\$52 945
<b>Total Income</b>	\$1 024 857	\$1 065 361	\$1 486 163	\$1 719 503	\$1 944 677	\$1 965 704	\$1 967 138	\$2 114 235	\$2 321 306	\$2 399 143	\$2 488 097	\$2 674 070	\$2 786 749	\$2 830 015	\$2 968 089
Real Estates Taxes	\$142 560	\$148 975	\$155 679	\$162 685	\$170 005	\$177 656	\$185 650	\$194 004	\$202 735	\$211 858	\$221 391	\$231 354	\$241 765	\$252 644	\$264 013
Operating Expenses	\$544 348	\$568 844	\$594 442	\$621 191	\$649 145	\$678 357	\$708 883	\$740 782	\$774 117	\$808 953	\$845 355	\$883 396	\$923 149	\$964 691	\$1 008 102
Managament Fee	\$31 270	\$32 507	\$45 371	\$52 485	\$59 371	\$60 010	\$60 048	\$64 544	\$70 836	\$73 209	\$75 924	\$81 608	\$85 053	\$86 421	\$90 361
<b>Total Expenses</b>	\$718 178	\$750 326	\$795 492	\$836 361	\$878 521	\$916 023	\$954 581	\$999 330	\$1 047 688	\$1 094 020	\$1 142 670	\$1 196 358	\$1 249 967	\$1 303 756	\$1 362 476
<b>Net income</b>	\$306 679	\$315 035	\$690 671	\$883 142	\$1 066 156	\$1 049 681	\$1 012 557	\$1 114 905	\$1 273 618	\$1 305 123	\$1 345 427	\$1 477 712	\$1 536 782	\$1 526 259	\$1 605 613

Annex 2 – Balance Sheet

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fixed assets	\$7 955 403	\$7 583 537	\$8 014 744	\$8 349 431	\$9 807 940	\$12 987 427	\$20 180 197	\$35 237 925	\$65 560 354
Working capital	\$31 270	\$32 507	\$45 371	\$52 485	\$59 371	\$60 010	\$60 048	\$64 544	\$70 836
<b>Total Adjusted Assets</b>	\$7 986 673	\$7 616 044	\$8 060 115	\$8 401 916	\$9 867 311	\$13 047 437	\$20 240 245	\$35 302 469	\$65 631 190
Equity	\$461 926	\$491 173	\$1 350 361	\$2 128 691	\$4 049 991	\$7 706 009	\$15 333 088	\$30 847 862	\$61 650 348
Debt	\$7 524 747	\$7 124 871	\$6 709 754	\$6 273 225	\$5 817 320	\$5 341 428	\$4 907 157	\$4 454 607	\$3 980 842
<b>Total invested capital</b>	\$7 986 673	\$7 616 044	\$8 060 115	\$8 401 916	\$9 867 311	\$13 047 437	\$20 240 245	\$35 302 469	\$65 631 190

	2000	2001	2002	2003	2004	2005
Fixed assets	\$126 419 831	\$248 884 652	\$494 386 545	\$985 650 910	\$1 968 804 861	\$3 935 913 290
Working capital	\$73 209	\$75 924	\$81 608	\$85 053	\$86 421	\$90 361
<b>Total Adjusted Assets</b>	\$126 493 040	\$248 960 576	\$494 468 153	\$985 735 963	\$1 968 891 282	\$3 936 003 651
Equity	\$123 008 889	\$245 995 081	\$492 044 378	\$983 879 361	\$1 967 627 268	\$3 935 357 724
Debt	\$3 484 151	\$2 965 495	\$2 423 775	\$1 856 602	\$1 264 014	\$645 926
<b>Total invested capital</b>	\$126 493 040	\$248 960 576	\$494 468 153	\$985 735 963	\$1 968 891 282	\$3 936 003 651

Annex 3 – Financial Statement

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Sales	\$1 024 857	\$1 065 361	\$1 486 163	\$1 719 503	\$1 944 677	\$1 965 704	\$1 967 138	\$2 114 235	\$2 321 306	\$2 399 143	\$2 488 097	\$2 674 070	\$2 786 749	\$2 830 015	\$2 968 089
Cost of good sold	\$544 348	\$568 844	\$594 442	\$621 191	\$649 145	\$678 357	\$708 883	\$740 782	\$774 117	\$808 953	\$845 355	\$883 396	\$923 149	\$964 691	\$1 008 102
Depreciation															
Other operating cost															
<b>EBIT</b>	\$480 509	\$496 517	\$891 721	\$1 098 312	\$1 295 532	\$1 287 347	\$1 258 255	\$1 373 453	\$1 547 189	\$1 590 190	\$1 642 742	\$1 790 674	\$1 863 600	\$1 865 324	\$1 959 987
Interest Expenses	\$11 469	\$11 983	\$12 704	\$13 356	\$14 030	\$14 629	\$15 244	\$15 959	\$16 731	\$17 471	\$18 248	\$19 106	\$19 962	\$20 821	\$21 758
<b>EBT</b>	\$469 040	\$484 534	\$879 017	\$1 084 956	\$1 281 502	\$1 272 718	\$1 243 011	\$1 357 494	\$1 530 458	\$1 572 719	\$1 624 494	\$1 771 568	\$1 843 638	\$1 844 503	\$1 938 229
Taxes	\$142 560	\$148 975	\$155 679	\$162 685	\$170 005	\$177 656	\$185 650	\$194 004	\$202 735	\$211 858	\$221 391	\$231 354	\$241 765	\$252 644	\$264 013
<b>Net Income</b>	\$326 480	\$335 559	\$723 338	\$922 271	\$1 111 497	\$1 095 062	\$1 057 361	\$1 163 490	\$1 327 723	\$1 360 861	\$1 403 103	\$1 540 214	\$1 601 873	\$1 591 859	\$1 674 216
Dividends	\$0	-\$31 892	-\$2 645	\$406 258	\$627 298	\$839 606	\$847 160	\$831 418	\$960 505	\$1 148 796	\$1 207 086	\$1 275 597	\$1 440 191	\$1 530 583	\$1 550 554
Equity	\$461 926	\$941 458	\$1 907 651	\$3 837 683	\$7 698 455	\$15 348 830	\$30 718 775	\$61 462 058	\$122 950 598	\$245 926 570	\$491 879 783	\$983 788 969	\$1 967 607 297	\$3 935 244 051	\$7 870 520 260
Debt	\$7 524 747	\$7 124 871	\$6 709 754	\$6 273 225	\$5 817 320	\$5 341 428	\$4 907 157	\$4 454 607	\$3 980 842	\$3 484 151	\$2 965 495	\$2 423 775	\$1 856 602	\$1 264 014	\$645 926

Annex 4 – Map of Cash Flow

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
EBIT	\$480 509	\$496 517	\$891 721	\$1 098 312	\$1 295 532	\$1 287 347	\$1 258 255	\$1 373 453	\$1 547 189	\$1 590 190	\$1 642 742	\$1 790 674	\$1 863 600	\$1 865 324	\$1 959 987
Taxes on EBIT	\$82 499	\$85 247	\$153 099	\$188 569	\$222 430	\$221 024	\$216 030	\$235 808	\$265 637	\$273 019	\$282 042	\$307 441	\$319 961	\$320 257	\$336 510
Depreciation															
Capital expenditures + Change in WC	\$156 566	\$126 533	\$138 160	\$132 410	\$132 182	\$639	\$38	\$4 496	\$6 292	\$2 373	\$2 715	\$5 684	\$3 445	\$1 368	\$3 940
<b>Free Cash Flow</b>	\$241 445	\$284 737	\$600 462	\$777 333	\$940 921	\$1 065 684	\$1 042 187	\$1 133 149	\$1 275 260	\$1 314 798	\$1 357 985	\$1 477 549	\$1 540 194	\$1 543 699	\$1 619 537
Interest expenses	\$369 841	\$350 187	\$329 784	\$308 329	\$285 921	\$262 531	\$241 187	\$218 944	\$195 658	\$171 246	\$145 754	\$119 129	\$91 252	\$62 126	\$31 747
Interest tax shields	\$63 498	\$60 124	\$56 621	\$52 937	\$49 090	\$45 074	\$41 409	\$37 590	\$33 593	\$29 401	\$25 024	\$20 453	\$15 667	\$10 666	\$5 451
<b>Capital Cash Flow</b>	\$304 943	\$344 861	\$657 083	\$830 270	\$990 011	\$1 110 758	\$1 083 597	\$1 170 740	\$1 308 853	\$1 344 199	\$1 383 009	\$1 498 003	\$1 555 861	\$1 554 365	\$1 624 988
Change in debt	\$0	-\$399 876	-\$415 117	-\$436 529	-\$455 905	-\$475 892	-\$434 271	-\$452 550	-\$473 765	-\$496 691	-\$518 656	-\$541 720	-\$567 173	-\$592 588	-\$618 088
<b>Equity Cash Flow</b>	-\$64 898	-\$405 203	-\$87 819	\$85 412	\$248 184	\$372 334	\$408 139	\$499 245	\$639 429	\$676 262	\$718 599	\$837 154	\$897 436	\$899 651	\$975 152

Annex 5 – Valuation model through the FCF Model

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Free Cash Flow</b>	<b>241 445</b>	<b>284 737</b>	<b>600 462</b>	<b>777 333</b>	<b>940 921</b>	<b>1 065 684</b>	<b>1 042 187</b>	<b>1 133 149</b>	<b>1 275 260</b>
Residual value									
<b>Total cash flow</b>	<b>241 445</b>	<b>284 737</b>	<b>600 462</b>	<b>777 333</b>	<b>940 921</b>	<b>1 065 684</b>	<b>1 042 187</b>	<b>1 133 149</b>	<b>1 275 260</b>
WACC (net)	7,22%	7,22%	7,22%	7,22%	7,22%	7,22%	7,22%	7,22%	7,22%
<b>Project (market) value (V)</b>	<b>30 413 030</b>	<b>32 368 347</b>	<b>34 421 606</b>	<b>36 307 449</b>	<b>38 152 638</b>	<b>39 967 518</b>	<b>41 788 727</b>	<b>43 764 979</b>	<b>45 793 016</b>
Debt value (D)	7 524 747	7 124 871	6 709 754	6 273 225	5 817 320	5 341 428	4 907 157	4 454 607	3 980 842
Equity value (E)	22 888 282,3	25 243 475,8	27 711 851,9	30 034 224,8	32 335 317,8	34 626 090,5	36 881 569,5	39 310 372,0	41 812 174,1
<b>D/V</b>	<b>24,74%</b>	<b>22,01%</b>	<b>19,49%</b>	<b>17,28%</b>	<b>15,25%</b>	<b>13,36%</b>	<b>11,74%</b>	<b>10,18%</b>	<b>8,69%</b>

Item	2000	2001	2002	2003	2004	2005
<b>Free Cash Flow</b>	<b>1 314 798</b>	<b>1 357 985</b>	<b>1 477 549</b>	<b>1 540 194</b>	<b>1 543 699</b>	<b>1 619 537</b>
Residual value						62 150 463
<b>Total cash flow</b>	<b>1 314 798</b>	<b>1 357 985</b>	<b>1 477 549</b>	<b>1 540 194</b>	<b>1 543 699</b>	<b>63 770 000</b>
WACC (net)	7,22%	7,22%	7,22%	7,22%	7,22%	7,22%
<b>Project (market) value (V)</b>	<b>47 825 429</b>	<b>49 965 107</b>	<b>52 216 150</b>	<b>54 510 222</b>	<b>56 907 354</b>	<b>59 474 127</b>
Debt value (D)	3 484 151	2 965 495	2 423 775	1 856 602	1 264 014	645 926
Equity value (E)	44 341 277,6	46 999 612,3	49 792 374,8	52 653 620,2	55 643 339,4	58 828 201,1
<b>D/V</b>	<b>7,29%</b>	<b>5,94%</b>	<b>4,64%</b>	<b>3,41%</b>	<b>2,22%</b>	<b>1,09%</b>

Annex 6 – Valuation model through the ECF Model

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Equity cash flow</b>	<b>-64 898</b>	<b>-405 203</b>	<b>-87 819</b>	<b>85 412</b>	<b>248 184</b>	<b>372 334</b>	<b>408 139</b>	<b>499 245</b>	<b>639 429</b>
Residual value (assets)									
Debt value									
Residual value (equity)									
<b>Total cash flow</b>	<b>-64 898</b>	<b>-405 203</b>	<b>-87 819</b>	<b>85 412</b>	<b>248 184</b>	<b>372 334</b>	<b>408 139</b>	<b>499 245</b>	<b>639 429</b>
Cost of equity ( $r_e$ )	9,95%	9,95%	9,95%	9,95%	9,95%	9,95%	9,95%	9,95%	9,95%
<b>Equity value (E)</b>	<b>17 018 445</b>	<b>18 776 960</b>	<b>21 050 779</b>	<b>23 233 498</b>	<b>25 460 203</b>	<b>27 745 728</b>	<b>30 134 552</b>	<b>32 725 298</b>	<b>35 482 759</b>
Debt value (D)	7 524 747	7 124 871	6 709 754	6 273 225	5 817 320	5 341 428	4 907 157	4 454 607	3 980 842
<b>Project (market) value (V)</b>	<b>24 543 193</b>	<b>25 901 831</b>	<b>27 760 534</b>	<b>29 506 723</b>	<b>31 277 522</b>	<b>33 087 156</b>	<b>35 041 709</b>	<b>37 179 904</b>	<b>39 463 601</b>

Item	2000	2001	2002	2003	2004	2005
<b>Equity cash flow</b>	<b>676 262</b>	<b>718 599</b>	<b>837 154</b>	<b>897 436</b>	<b>899 651</b>	<b>975 152</b>
Residual value (assets)						62 150 463
Debt value						645 926
Residual value (equity)						61 504 537
<b>Total cash flow</b>	<b>676 262</b>	<b>718 599</b>	<b>837 154</b>	<b>897 436</b>	<b>899 651</b>	<b>62 479 689</b>
Cost of equity ( $r_e$ )	9,95%	9,95%	9,95%	9,95%	9,95%	9,95%
<b>Equity value (E)</b>	<b>38 374 450</b>	<b>41 517 078</b>	<b>44 930 113</b>	<b>48 564 247</b>	<b>52 499 754</b>	<b>56 824 695</b>
Debt value (D)	3 484 151	2 965 495	2 423 775	1 856 602	1 264 014	645 926
<b>Project (market) value (V)</b>	<b>41 858 601</b>	<b>44 482 573</b>	<b>47 353 888</b>	<b>50 420 849</b>	<b>53 763 769</b>	<b>57 470 621</b>

Annex 7 – Valuation model through the CCF Model

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Capital cash flow</b>	<b>304 943</b>	<b>344 861</b>	<b>657 083</b>	<b>830 270</b>	<b>990 011</b>	<b>1 110 758</b>	<b>1 083 597</b>	<b>1 170 740</b>	<b>1 308 853</b>
Residual value									
<b>Total cash flow</b>	<b>304 943</b>	<b>344 861</b>	<b>657 083</b>	<b>830 270</b>	<b>990 011</b>	<b>1 110 758</b>	<b>1 083 597</b>	<b>1 170 740</b>	<b>1 308 853</b>
WACC (gross)	7,61%	7,61%	7,61%	7,61%	7,61%	7,61%	7,61%	7,61%	7,61%
<b>Enterprise (market) value (V)</b>	<b>26 816 873</b>	<b>28 553 940</b>	<b>30 383 360</b>	<b>32 039 862</b>	<b>33 649 313</b>	<b>35 221 578</b>	<b>36 792 819</b>	<b>38 510 864</b>	<b>40 272 590</b>
Debt value (D)	7 524 747	7 124 871	6 709 754	6 273 225	5 817 320	5 341 428	4 907 157	4 454 607	3 980 842
Equity value (E)	19 292 126	21 429 069	23 673 606	25 766 638	27 831 993	29 880 151	31 885 662	34 056 257	36 291 748

Item	2000	2001	2002	2003	2004	2005
<b>Capital cash flow</b>	<b>1 344 199</b>	<b>1 383 009</b>	<b>1 498 003</b>	<b>1 555 861</b>	<b>1 554 365</b>	<b>1 624 988</b>
Residual value						54 520 265
<b>Total cash flow</b>	<b>1 344 199</b>	<b>1 383 009</b>	<b>1 498 003</b>	<b>1 555 861</b>	<b>1 554 365</b>	<b>56 145 253</b>
WACC (gross)	7,61%	7,61%	7,61%	7,61%	7,61%	7,61%
<b>Enterprise (market) value (V)</b>	<b>42 030 351</b>	<b>43 886 614</b>	<b>45 845 415</b>	<b>47 838 377</b>	<b>49 925 238</b>	<b>52 172 503</b>
Debt value (D)	3 484 151	2 965 495	2 423 775	1 856 602	1 264 014	645 926
Equity value (E)	38 546 201	40 921 119	43 421 640	45 981 775	48 661 224	51 526 576

Annex 8 – Valuation Model through the APV Model

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
<b>Free cash flow</b>	<b>241 445</b>	<b>284 737</b>	<b>600 462</b>	<b>777 333</b>	<b>940 921</b>	<b>1 065 684</b>	<b>1 042 187</b>	<b>1 133 149</b>	<b>1 275 260</b>	<b>1 314 798</b>	<b>1 357 985</b>	<b>1 477 549</b>	<b>1 540 194</b>	<b>1 543 699</b>	<b>1 619 537</b>
Residual value															59 748 143
Total cash flow	241 445	284 737	600 462	777 333	940 921	1 065 684	1 042 187	1 133 149	1 275 260	1 314 798	1 357 985	1 477 549	1 540 194	1 543 699	61 367 680
Unlevered cost of equity ( $r_U$ )	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%
<b>Enterprise value   unlevered (<math>V_U</math>)</b>	<b>29 175 319</b>	<b>31 073 179</b>	<b>33 066 909</b>	<b>34 891 106</b>	<b>36 672 192</b>	<b>38 420 291</b>	<b>40 171 807</b>	<b>42 075 251</b>	<b>44 027 305</b>	<b>45 980 384</b>	<b>48 037 137</b>	<b>50 201 515</b>	<b>52 405 034</b>	<b>54 707 483</b>	<b>57 175 256</b>
Interest tax shields	63 498	60 124	56 621	52 937	49 090	45 074	41 409	37 590	33 593	29 401	25 024	20 453	15 667	10 666	5 451
Interest tax shields' perpetual value															293 170
Total cash flow	63 498	60 124	56 621	52 937	49 090	45 074	41 409	37 590	33 593	29 401	25 024	20 453	15 667	10 666	298 621
Interest tax shields' discount rate ( $r_d$ )	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%	4,92%
Interest tax shields' present value	<b>561 004</b>	<b>525 080</b>	<b>490 764</b>	<b>458 264</b>	<b>427 851</b>	<b>399 790</b>	<b>374 366</b>	<b>351 356</b>	<b>331 035</b>	<b>313 713</b>	<b>299 731</b>	<b>289 438</b>	<b>283 211</b>	<b>281 464</b>	<b>284 631</b>
<b>Project value   levered (<math>V_l</math>)</b>	<b>29 736 324</b>	<b>31 598 259</b>	<b>33 557 673</b>	<b>35 349 370</b>	<b>37 100 043</b>	<b>38 820 080</b>	<b>40 546 173</b>	<b>42 426 608</b>	<b>44 358 340</b>	<b>46 294 097</b>	<b>48 336 867</b>	<b>50 490 953</b>	<b>52 688 245</b>	<b>54 988 947</b>	<b>57 459 887</b>
Debt value (D)	7 524 747	7 124 871	6 709 754	6 273 225	5 817 320	5 341 428	4 907 157	4 454 607	3 980 842	3 484 151	2 965 495	2 423 775	1 856 602	1 264 014	645 926
<b>Equity value (E)</b>	<b>22 211 576</b>	<b>24 473 388</b>	<b>26 847 919</b>	<b>29 076 145</b>	<b>31 282 723</b>	<b>33 478 653</b>	<b>35 639 016</b>	<b>37 972 001</b>	<b>40 377 499</b>	<b>42 809 946</b>	<b>45 371 372</b>	<b>48 067 178</b>	<b>50 831 642</b>	<b>53 724 932</b>	<b>56 813 961</b>

Annex 9 – Valuation model through the CAPV Model

Item	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Capital cash flow</b>	<b>304 943</b>	<b>344 861</b>	<b>657 083</b>	<b>830 270</b>	<b>990 011</b>	<b>1 110 758</b>	<b>1 083 597</b>	<b>1 170 740</b>	<b>1 308 853</b>
Residual value									
Total cash flow	304 943	344 861	657 083	830 270	990 011	1 110 758	1 083 597	1 170 740	1 308 853
Unlevered cost of equity ( <i>ru</i> )	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%	7,33%
<b>Project (market) value (V)</b>	<b>29 617 020</b>	<b>31 483 770</b>	<b>33 447 483</b>	<b>35 242 965</b>	<b>36 996 915</b>	<b>38 719 734</b>	<b>40 448 134</b>	<b>42 330 431</b>	<b>44 263 605</b>
Debt value (D)	7 524 747	7 124 871	6 709 754	6 273 225	5 817 320	5 341 428	4 907 157	4 454 607	3 980 842
Equity value (E)	22 092 273	24 358 899	26 737 729	28 969 741	31 179 595	33 378 307	35 540 977	37 875 824	40 282 764

Item	2001	2002	2003	2004	2005
<b>Capital cash flow</b>	<b>1 383 009</b>	<b>1 498 003</b>	<b>1 555 861</b>	<b>1 554 365</b>	<b>1 624 988</b>
Residual value					59 949 230
Total cash flow	1 383 009	1 498 003	1 555 861	1 554 365	61 574 218
Unlevered cost of equity ( <i>ru</i> )	7,33%	7,33%	7,33%	7,33%	7,33%
<b>Project (market) value (V)</b>	<b>48 243 904</b>	<b>50 398 420</b>	<b>52 595 923</b>	<b>54 896 703</b>	<b>57 367 684</b>
Debt value (D)	2 965 495	2 423 775	1 856 602	1 264 014	645 926
Equity value (E)	45 278 409	47 974 645	50 739 321	53 632 688	56 721 758