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Discounted cash-flow valuation: From theory to practice.

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Abstract

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This Bachelor's thesis presents the theoretical framework for conducting discounted cash-flow valuation and provides insight as well as compares theoretical valuation concepts to the real business models for conducting discounted cash-flow valuation. This research additionally investigates what the valuation tools used by experts are, and how they are applied.

Discounted cash-flow valuation is a complex subject whose application in the business world can vary from the theoretical concepts, as such the results of this thesis can be key for valuation students who wish to learn more about valuation in practice, or experts wishing to learn more about industry practices.

This research, having established the key theoretical framework of discounted cash-flow valuation, provides an examination of the practical approaches of different valuation experts. This paper is a mono method qualitative research, whose data was collected by conducting qualitative interviews.

There are different approaches and alternatives to applying discounted cash-flow valuation, but generally the process is as such: The underlying assets' earnings and expenses are forecasted for an explicit number of years, then an appropriate discount rate is estimated to discount future cash-flows into a present value and the terminal value of the asset is estimated.

Having interviewed the research participants and analysed their comments, this research concluded that the valuation approach of experts can vary significantly depending on whether the valuation is conducted for a buyer or a seller. The most key denominator amongst participants, are the difficulties in establishing common baselines for conducting valuation as part of a large team. Amongst the various alternatives for estimating the variables in a valuation, experts always attempt to use the ones that best reflect the market. Such methods may vary substantially from what is established in theory. MS Excel was found to dominantly be the most used valuation tool, with some tools reportedly being used in addition for estimating specific variables.

Keywords
Investment valuation, discounted cash-flow, theory-practice comparison, valuation practices, valuation tools

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1 Introduction

This paper is a research based type of a bachelor's thesis for the Degree Programme in International business in the major specialization of Financial Management in the Haaga-Helia University of Applied Sciences. Throughout this chapter, the main objective of the thesis as well as the Research Question (RQ), Investigative Questions (IQs) and demarcation will be defined. Additionally, this chapter contains information on the international aspect of this thesis, the expected benefits and the risks threatening the implementation of this research.

1.1 Background

Every asset has a value, and it is key to not only arrive to what the value of an asset might be, but to also understand the sources of the value (Damodaran 2012, Introduction to Valuation). As early as 1890 the principle of business value creation was conceived: "companies that grow and earn a return on capital that exceeds their cost of capital create value" (Koller, Goedhart & Wessels 2015, 3). This notion is still universally accepted. However, there are times when managers and investors have forgotten this notion, resulting in financially disastrous events such as the dotcom bubble or the 2007-2008 Global Financial crisis (Koller et al. 2015, 3).

There is a relation between valuation and macro-social change which is empirically expressed in finance, for example in the onerous search for stable values in times of financial turmoil. (Aspers 2013, 13-14.) Valuation research can be useful in a multitude of ways in society, such as, for political or industrial purposes where theoretical and methodological models can support the valuation of complex projects whose implementation is inapplicable with traditional economic tools. (Aspers 2013, 16-17.)

This thesis, by researching the processes and tools used by investment analysts to conduct discounted cash-flow valuation models, can contribute to improving the standards of conducting stock valuation. Industry experts can use this paper to learn more about the stock valuation processes and tools that other colleagues in the industry use, while anyone wishing to learn more about how discounted cash-flow valuation is conducted in practice can learn more from this paper. The author, being intrigued by stock valuation and hoping to develop a career in the field of investments, can benefit by obtaining valuable experience in communicating with investment professionals and learning more about how they operate.

1.2 Research Question

The purpose of this thesis is to research how investment analysts conduct discounted cash-flow valuation in practice, as well as to identify themes and differences in their approaches. This thesis also aims to explore the different types of tools that are involved in the valuation process as well as their role. The need to research the business practices in real-world valuation cases, arises from the author's belief that there is a disconnection between what is being taught in investments classes in upper education institutions, and how investment practices are conducted presently. Investments as a sub-field of financial management require from students extensive studying of theory and models, and combined with the implied difficulty, students at the latter stages of their financial management studies and recent graduates struggle to grasp the full picture of how stock valuation is conducted in practice.

The following research question (RQ) was formulated in order to define the main purpose of this thesis: "What are the discounted cash-flow valuation processes and tools of investment professionals?"

The research question was divided into investigative questions (IQs):

IQ 1. What are the discounted cash-flow valuation processes of investment professionals like?
IQ 2. How are the different variables used in the valuation model calculated?
IQ 3. How do experts approach estimating the terminal value?
IQ 4. What tools do experts use when conducting discounted cash-flow valuation and how are they utilized?

Table 1 below presents the investigative questions, theoretical framework components, research methods and results chapters for each investigative question.

Table 1. Overlay matrix

Investigative question	Theoretical Framework	Research Methods	Results (chapter)
IQ 1. What are the discounted cash-flow valuation processes experts use?	Discounted cash-flow valuation framework, Discounted cash-flow model considerations, Cost of capital, Estimating future cash flows, Terminal value	Qualitative interviews with investment analysts	4.1

IQ 2. How are the different variables used in the valuation model calculated?	Discounted cash-flow valuation framework, Discounted cash-flow model considerations, Cost of capital, Estimating future cash flows	See above	4.2
IQ 3. How do experts approach estimating the terminal value?	Terminal value	See above	4.3
IQ 4. What tools do experts use when conducting discounted cash-flow valuation and how are they utilized?	Discounted cash-flow valuation framework	See above	4.4

1.3 Demarcation

This thesis research solely focuses on discounted cash-flow valuation processes, and as such other stock valuation methods will not be considered. The data collected in this research is exclusively collected by qualitative interviews conducted with investment analysts working in Europe, either for investment banks or firms, or as a part of a “Mergers and acquisitions” team in a corporation.

Throughout this research, only current and soon-to-be implemented practices will be considered as the purpose is to investigate the discounted cash-flow valuation processes and tools relevant to the field in the present, rather than in the past.

1.4 International Aspect

Stock valuation is inherently an international issue, as it is practiced using the same principles across the globe. Therefore, the results of this research are internationally relevant, as they can be of use to aspiring or working investment professionals globally.

1.5 Benefits

Experts working in stock valuation will be able to learn more about how others operate in the industry. Optimally, investment professionals will be able to identify processes and tools that other experts working in the field are using, and potentially implement said tools and parts of processes in their own work.

Working or aspiring investment professionals such as the author, will also be able to get a better understanding of how discounted cash-flow valuation is done in practice. The author of this thesis will additionally obtain experience by communicating with and interviewing investment analysts, acquiring an insight on how the industry operates.

1.6 Key Concepts

Free cash flow is "the incremental effect of a project on a firm's available cash" (Berk 2015, 296). A free cash flow is the net cash inflow (or outflow) that a firm generates after accounting for expenses paid for in cash.

Time value of money is defined as the difference in value between money received today and money received in the future. Two cash flows at two different points in time have different values, therefore in valuation, future cash flows are discounted to represent their present value. The later a cash inflow is to be received, the higher the discount. (Berk 2015, 104.)

Discounted free cash-flow model is "a method for estimating a firm's enterprise value by discounting its future free cash flow" (Berk 2015, 328). In a discounted free cash-flow valuation model, the future free cash flows of an asset are estimated, as well as the cost of financing the asset, in order to apply the proper discounting rate.

Capital structure includes "the relative proportions of debt, equity, and other securities that a firm has outstanding" (Berk 2015, 428). Firms must choose how to raise funds, and the main options include either issuing equity (stock) or debt (loans). The capital structure of a firm, therefore, refers to how a firm is financed.

Default Risk refers to the risk of a firm defaulting, in other words failing to meet its debt obligations (Vassalou & Xing 2002, 1). When a firm defaults on its payments, its creditworthiness is diminished and there is an increased risk of bankruptcy.

Default Spread is a term closely related to default risk. As default risk refers to the probability of a firm to meet its debt obligation, lenders require from borrowers a spread, in other words a margin, over the risk-free rate of interest. This spread is an increasing function of the probability of default of the individual firm. (Vassalou & Xing 2002, 1.)

2 Discounted cash-flow valuation framework

This chapter includes all key concepts, models and theory that is best suited for the implementation of this thesis project.

Figure 1. below, illustrates the main key concepts and theory models that the theoretical framework consists of, as well as the relationships of these to each other.

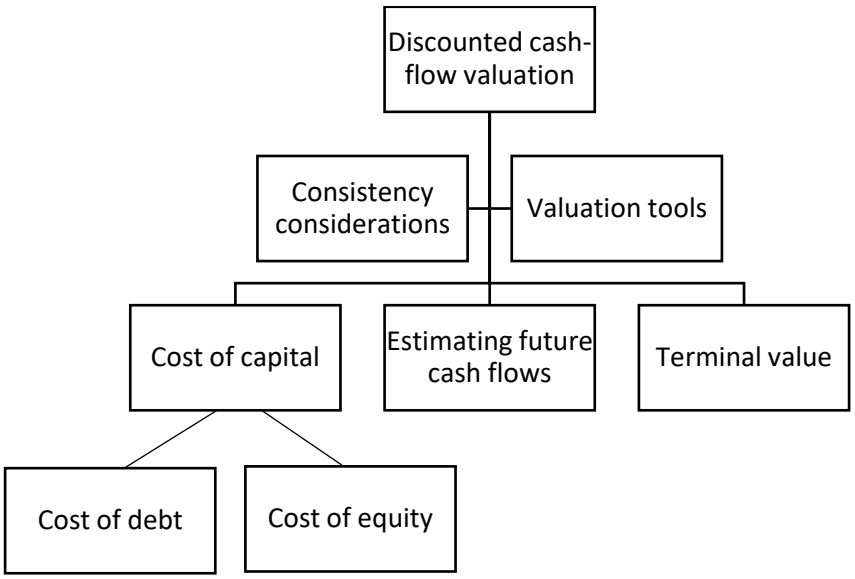

Figure 1. Discounted cash-flow valuation framework

As stated by Damodaran (2018, Foundations of Value) “Every asset has an intrinsic value. In spite of our best efforts, all we can do, in most cases, is arrive at an estimate value.” Discounted cash-flow valuation is the favourite framework amongst both academics and practitioners, as it relies solely on cash inflows and outflows instead of accounting-based earnings (Koller et al. 2015, 136). Damodaran considers that most valuations done in the real world are done using relative valuation methods, however he reaffirms the importance of discounted DCF valuation by claiming that in order to apply option pricing models, often analysts first need to begin with a DCF valuation and that in order to do a relative valuation, analysts need to understand the fundamentals of DCF valuation. (Damodaran 2012, Basis for Discounted cash flow valuation.)

The basis of DCF valuation can be expressed using the following formula (Damodaran 2012, Discounted cash flow valuation.)

$$\text{Value} = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t}$$

Where:

n = Life of the asset

CF_t = Cash flow in period t

r = Discount rate reflecting the riskiness of the estimated cash flows

There are various types of cash flows, and they vary from asset to asset, as for example, there are dividends for stocks, the face value for bonds or the after-tax cash flows for a real project. (Damodaran 2012, Basis for Discounted Cash Flow Valuation)

Theoretically the value of a company equals to the sum of all present values for all time periods, from one to infinity, however in the real word it is very hard to work with time periods that extend to infinity while maintaining rationality and therefore, the distant future is typically combined into one value that represents the estimated sale price, known as the termina value. (Larrabee & Voss 2012, The DCF Formula.)

Thus, a more realistic formula can be derived, one that is used more often in practice: (Larrabee & Voss 2012, The DCF Formula.)

$$\text{Value} = \sum_{n=1}^{t} \frac{CF_n}{(1+r)^n} + \frac{TV_t}{(1+r)^t}$$

Where:

CF = cash flow

r = discount rate

n = time periods, time = 1 to t

TV = terminal value

Using this model, analysts attempt to estimate individual cash flows for a set of years, typically five or ten. Then, the terminal value, the value at which the company could be sold at the end of that set of years could be sold, is estimated. These estimates will then be discounted to their present values at the valuation date using the discount rate, and the present values are added together to reach a final value. (Larrabee & Voss 2012, The DCF Formula.)

2.1 DCF Categorization and Consistency considerations

There are numerous DCF valuation models in existence, however, the DCF models can only vary in a couple of dimensions, and all models when applied correctly, should yield the same result under the same assumptions and expectations. (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

There are two approaches to valuation in a business: To value just the equity stake in the business, or to value the entire business. Both approaches discount expected cash flows, however, each approach requires the use of different relevant cash flows and discount rates. (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

2.1.1 Equity Valuation

The following formula expresses the basis of DCF valuation, when valuing only the equity stake of a firm: (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

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

Where:

n = Life of the asset
CF to equity $_t$ = Expected cash flow to equity in period t
k_e= Cost of Equity

The value of equity is the sum of the cash flows to equity, in other words, cash flows after meeting all expenses including tax obligations and interest and loan payments, discounted at the cost of equity. (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

2.1.2 Firm Valuation

The following formula expresses the basis of DCF valuation, when valuing the entire business: (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

$$\text{Value of firm} = \sum_{t=1}^{t=n} \frac{CF\ to\ firm_t}{(1+k_e)^t}$$

Where:

n = Life of the asset
CF to firm $_t$ = Expected cash flow to equity in period t
WACC = Weighted average cost of capital

The value of the firm is the sum of all expected cash flows to the firm, in other words, the cash flows after meeting operating expenses, reinvestment needs and taxes, but not taking into consideration payments to debt and equity holders. This sum is then discounted at the rate of the weighted average cost of capital (WACC). (Damodaran 2012, Categorizing Discounted Cash Flow Models.)

2.1.3 Currencies and rates

To value any asset with default risk, analysts first have to estimate how much they could earn as a rate of return on a riskless investment. This is called the risk-free rate. Analysts generally use government bond rates as risk-free rates, as some do not have default risk. However, estimating the risk-free rate can be problematic, for example, with some currencies, the governments do not issue bonds, or the issued bonds are not traded. Where issued bonds are not traded, long-term bond rates are impossible to obtain. Additionally, not all governments are default risk-free. (Damodaran 2018, Chapter 1; Interest Rates.)

When valuing a company under a currency for which there are no long-term risk-free bond rates, one way to obtain a risk-free rate is to use the risk-free rate of another government's bonds, and to adjust that rate by the implied default risk of the original currency. (Damodaran 25 August 2014, 12:40 – 17:30.)

Valuation can be done either in nominal terms, or in real terms. Under real terms, inflation is ignored, and the appropriate interest rates are the real interest rates. Under nominal terms, currency becomes an issue. Any company can be valued in any currency, but once the currency in which the cash flows are estimated is picked, the discount rate will have to be in the exact same currency. (Damodaran 25 August 2014, 1:35 – 2:27.)

2.1.4 Remaining internally consistent

In order to conduct a DCF successfully without making fundamental mistakes, analysts need to ensure that they are internally consistent in the values that they use. Discounting cash flows to equity, at the WACC, or cash flows to the firm, at the cost of equity, will yield a final valuation that does not reflect the assumptions and expectations of the analyst. (Damodaran 9 February 2021, 53:04 – 53:58.)

The risk of not remaining internally consistent in conducting a valuation is also present in other stages of a valuation process, such as when estimating the growth of earnings and expenses. Estimating high earnings growth rates with little reinvestment into the business to generate this growth is highly improbable. Additionally, assumptions about inflation have to be consistent across cash flow estimates and discount rates. (Damodaran 2018, 1. The Dark Side of Valuation: Valuation phase.)

2.2 Discounted cash-flow valuation tools

Stock screening is a method that finds systematic patterns, that can increase the profitability of an investment portfolio. Stock screening models, contain more than one stock selecting rules and parameters, based on fundamental indicators, such as the price-earnings ratio, the earnings growth rate, the market capitalization and more. While some investors may even single handedly revolve their investment strategies around a screening method, stock screening can also be used as a supplement. Stock screening methods can be used to find stocks that have strong financial fundamentals, while the decision to invest or not invest, will be a result of a discounted cash-flow valuation. (ChiangLin 2006, 1; Gold & Lebowitz 1999, 61)

Having conducted strenuous research, the author concluded that there is no reliable research on the tools that valuation professionals use. However, there is a general consensus over valuation professionals, academics and students alike, that the overwhelmingly dominant valuation tool is MS Excel, while parts of a valuation are sometimes conducted with the help of either third-party tools or tools developed in-house.

2.3 Estimating cash flows

”Free cash flow is the sum of the sources of cash, less the capital expenditures necessary to stay in business and continue to grow at the expected rate” (Larrabee 2012, 107). These capital expenditures must be included, because without them machinery gets outdated, and the firm cannot grow without significant increases in working capital (Larrabee 2012,107).

As stated in chapters 2.1.1 and 2.1.2 there are two different approaches to valuation: Valuing the equity stake in a firm or valuing the whole firm. Consequently, there are two relative cash flows, Free cash flows to equity (FCFE) and Free cash flows to firm (FCFF).

In order to estimate how much a firm can afford to return to its stockholders (dividends), analysts need to convert income to a cash flow by subtracting reinvestment needs. Capital

expenditures (CapEx) are subtracted, while depreciation and amortization are added back as they are not cash expenses. High-growth firms tend to have high CapEx relative to earnings, while low-growth firms may have low or negative. The above can be summarized as follows: (Damodaran 2012, Chapter 14: Free Cash Flows to Equity.)

$$\begin{aligned}\text{FCFE} = \text{Net Income} - (\text{Capital Expenditures} - \text{Depreciation}) \\ - (\text{Change in noncash working capital}) + (\text{New debt issued} \\ - \text{Debt repayments})\end{aligned}$$

There are two ways to measuring the FCFF, one which reverses the process to get to FCFE, which won't be analyzed here, as there is a simpler way of getting to FCFF by beginning with the Earnings before interest and taxes (EBIT) and netting out taxes and reinvestment needs: (Damodaran 2012, Chapter 15; Free cash flow to the firm.)

$$\text{FCFF} = \text{EBIT}(1 - \text{Tax Rate}) + \text{Depreciation} - \text{Capital expenditure} - \Delta\,\text{Working Capital}$$

This FCFF does not include the tax benefits due to interest payments, as the after-tax cost of debt in the cost of capital already considers this benefit (Damodaran 2012, Chapter 15; Free cash flow to the firm).

2.4 Risk and Discount Rate

This subchapter addresses risk in valuation, and how analysts adjust for risk in their financial modelling when adjusting a valuation. What risk refers to in a valuation and the types of risks that are relevant when valuing a firm are addressed, as well as how an appropriate income rate is estimated.

2.4.1 Risk in valuation

In finance, risk refers to the variance in actual returns around the expected return. This risk includes both good, and bad outcomes, in other words, the possibility of receiving both higher and lower returns from the expected. Thus, for an investment to be risk-free, the actual returns should always be equal to the expected return (Damodaran 2012, Chapter 4: What is risk?; Damodaran 2018, Chapter 6)

2.4.2 Risk types

In financial economics, risk can be divided in three main categories: maturity risk, systematic risk, and unsystematic risk (Hitchner 2011, Chapter 6: Defining Risk).

Maturity risk is specifically tied to the changes in the general level of interest rates, resulting in increases or decreases in the value of the investment. The longer the term of an investment, the greater the maturity risk. As an example, the fluctuation of the yields of U.S Government bonds, which are usually considered to be risk-free, means that the return demands of the investors change, and this risk is greater in longer time periods. (Hitchner 2011, Chapter 6: Maturity Risk.)

Unsystematic risk refers to the uncertainty of future returns, which arises from uncontrollable movements in the market as a whole, typically because of external, macroeconomic factors that affect the whole economy. (Hitchner 2011, Chapter 6: Systematic Risk.)

Unsystematic risk is unrelated to the variation of returns in the market as a whole, as it refers to the risk associated with individual companies and the characteristics of the industry they operate in (Hitchner 2011, Chapter 6: Defining Risk).

2.4.3 Cost of Capital

When valuing an asset, investors need to use the discount rates that reflect the riskiness of the expected cash flows. That discount rate is the weighted average cost of capital (WACC), which incorporates the weighted average of the after-tax cost of debt and equity. The cost of debt needs to incorporate a default spread for the default risk of the debt, and the cost of equity needs to include a risk premium for equity risk. (Damodaran 2012, Chapter 4: The Basics of Risk; Koller et al. 2015,294.)

According to Koller et al. (2015, 294) “the weighted average cost of capital equals the weighted average of the after-tax cost of debt and equity”:

$$\mathrm{WACC} = \frac{\mathrm{D}}{\mathrm{V}}\mathrm{k_d}(1 - \mathrm{T_m}) + \frac{\mathrm{E}}{\mathrm{V}}\mathrm{k_e}$$

Where:
D/V = Target level of debt to enterprise value using market-based values
E/V = Target level of equity to enterprise value using market-based values
k_d = Cost of debt
k_e = Cost of equity
T_m = Marginal income tax rate

The weighted average cost of capital (WACC) has three main components: the cost of equity, the after-tax cost of debt and the target capital structure of the target company. To estimate the cost of capital numerous models and approximation methods are employed,

based on corporate finance theory, and built on empirical observations about the market value of companies. (Koller et al. 2015, 294.)

2.4.3.1 Cost of equity

The cost of equity is the most difficult component of WACC to estimate. There have been numerous models proposed, by academics and practitioners alike, however none has been universally accepted. Additionally, the dot-com crash of 2001 and the global financial crisis of 2007-2009 have made estimating key ingredients of the cost of equity challenging. (Koller et al. 2015, 296.)

The first step to estimate the cost of equity, is to estimate the expected return on the entire stock market. The market return provides a benchmark for assessing how reasonable estimates of individual firms are. The second step is to measure company-specific risk, by using financial models that will be mentioned in the following paragraphs. (Koller et al. 2015, 296.)

The Capital Asset Pricing Model (CAPM) is the risk and return model that has both been in use the longest and still is the choice of most practitioners (Damodaran 2012, Chapter 4: Capital Asset Pricing Model). According to Koller et al. (2015, 302), "the CAPM defines a stock's risk as its sensitivity to the market as a whole". In addition to the CAPM, amongst others, there are two more main models to estimate the cost of equity. The Fama-French three-factor model, which defines risk as a stock's sensitivity to three portfolios, the stock market, a portfolio based on firm market capitalization, and a portfolio based on book-to-market ratios. The arbitrage pricing theory (APT) is the most general model, which neither proposes the number of factors nor which factors are appropriate, and as such, it's not widely used. (Koller et al. 2015, 302.)

2.4.3.2 Estimating the cost of equity using the CAPM

The following formula expresses the basis of the CAPM: (Damodaran 2012, Chapter 8: Cost of Equity.)

$$E(R) = R_f + \beta(R_m - R_f)$$

Where:

E(R) = Expected return

R_f = Risk-free rate

β = Beta of the investment

R_m = Market expected returns

To apply the CAPM in practice, each component must be estimated (Koller et al. 2015, 306). As mentioned in chapter 2.4.1, for an asset to be **risk-free**, the actual returns on the investment need to always be equal to the expected returns (Damodaran 2012, Chapter 7: The Risk-Free Rate). For an asset to be risk-free, there are two additional conditions that need to be met. The first, is that there can be no default risk. The only securities that have a chance of being default risk-free are government securities, because governments control the printing of a currency. However, not all governments and therefore their securities are default risk-free. The second condition is that there needs to be no reinvestment risk. In valuation, expected returns often need to be forecasted for periods ranging from 1 to 10 years, therefore, a six-month U.S Treasury bill rate would not suffice as a risk-free rate, as, despite being default-risk free, there would be reinvestment risk, as it is not known what the rate would be in six months. (Damodaran 2012, Chapter 7: The Risk-Free Rate.)

When doing investment analysis on an asset, in most developed markets, where the government is viewed as a default-free entity, the risk-free rate is should be the government bond rates. For investment analysis over long-term projects, the appropriate risk-free rate is a long-term government bond rate, and similarly, for short-term projects, the appropriate risk-free rate is a short-term government security rate.

Most practitioners use one of two methods to estimate the overall stock **market return**. The first method is backwards-looking and focused on historical market returns. However, as historical returns are influenced by inflation, a historical market risk premium is added to today's interest rate, which incorporates the expected inflation. (Koller et al. 2015, 297.)

The second preferable method is to calculate the cost of equity implied by the relationship between stock prices and aggregate fundamental performance indicators, such as earnings, return on invested capital and growth expectations. This is method is typically applied using a large sample of companies, such as the Standard & Poor's (S&P) 500 index. Although this method requires a forecast of future performance, it is very powerful as it incorporates up-to-date market prices. (Koller et al. 2015, 297-298.)

According to Damodaran (2012, Chapter 8: Betas), "in CAPM, **the beta** (β) of an investment is the risk that the investment adds to a market portfolio". There are three approaches available to estimate the beta: historical market betas, bottom-up betas, and accounting betas (Damodaran 2012, Chapter 8: Betas).

The standard **historical market beta** procedure to estimate betas, is to regress stock returns against market returns: (Damodaran 2012, Chapter 8: Betas.)

$$R_j = a + b * R_m$$

Where:

R_j = Stock returns

R_m = Market returns

a = Intercept from the regression

b = Slope of the regression = Covariance $(R_j, R_m)/\sigma^2_m$

There are a few statistics that can be derived from a regression beta analysis, however, most importantly, the slope of the regression, which is the covariance of the stock and market returns, corresponds to the beta of the stock, and measures the riskiness of the stock. (Damodaran 2012, Chapter 8: Regression estimates of betas.)

Bottom-Up betas provide for an alternative way of estimating betas, in which the beta is broken down to their business risk and financial leverage components of a firm, without looking at the past prices of an individual firm or asset. To develop this alternative approach, additional properties of betas need to be introduced. Under a bottom-up beta analysis, the beta for a firm is the weighted average of the betas of all the different businesses it is in. (Damodaran 2012, Chapter 8: Bottom-Up Betas.)

Accounting betas is the third approach to estimate the market risk parameters, using accounting earnings rather than traded prices. This model relates changes in earnings at a division or a firm, on a quarterly or annual basis, to changes in earnings for the market, in same periods, to arrive at an estimate of an accounting beta to use in the CAPM. This model, while appealing, suffers from the fact that accounting earnings are biased, influenced by nonoperating factors, such as changes in depreciation or inventory methods, and from the fact that accounting earnings are only measured few times a year, resulting in regressions with few data points. (Damodaran 2012, Chapter 8: Accounting Betas.)

2.4.3.3 Cost of debt

According to Berk (2015, 431), “a firm’s cost of debt is the interest it would have to pay to refinance its existing debt, such as through new bond issues”. This rate is different from the coupon rate on the firm’s existing debt, as the rate on the existing debt reflects the interest rate the firm had to offer at the time the debt was issued (Berk 2015, 431).

Generally, the cost of debt is determined by the following variables: the risk-free rate, the default risk, and the tax advantage associated with debt. As the risk-free rate that investors can earn by investing in investment grade government bonds increases, so does the cost of debt. The higher the default risk of a company, the higher the cost of debt, and the better the tax benefit (the higher the marginal tax rate) associated with debt, the lower the cost of debt. (Damodaran 2012, Chapter 8: Calculating The Cost of Debt.)

According to Damodaran (2012, Chapter 8: Calculating the Cost of Debt) "the simplest scenario for estimating the cost of debt occurs when a firm has long-term bonds outstanding that are widely traded". In these cases, the pre-tax cost of debt is the yield to maturity (YTM). To solve for YTM, the discount rate required to set the present value of the bond's promised cash flows equal to its price, needs to be reverse engineered: (Koller et al. 2015, 313.)

$$\text{Price} = \frac{\text{Coupon}}{(1+\text{YTM})} + \frac{\text{Coupon}}{(1+\text{YTM})^2} + \cdots + \frac{\text{Face} + \text{Coupon}}{(1+\text{YTM})^{\text{N}}}$$

Ideally the yield to maturity calculation should be done for liquid, option-free and long-term debt. Short-term bonds yields are an inconsistent proxy of a firm's cost of debt, as they will not match the (longer) duration of the firm's free cash flow. (Koller et al. 2013, 313.)

A better estimation for firms that do not have bonds that are regularly traded, is by using their credit ratings and associated credit spreads (Damodaran 2012, Chapter 8: Calculating the Cost of Debt). The credit rating of a lot of companies is analysed by rating agencies like S&P and Moody's, who estimate a firms rating using the firm's most recent financial ratios, an analysis of the competitive environment, and by conducting interviews with senior management. These bond ratings are freely available to the public. (Koller et al. 2015, 314.)

Each classification of a credit rating, is associated with a default yield spread, expressing the factor of the firm's default risk over a risk-free asset. This yield spread is expressed in basis points, 100 points meaning one percent. Once the credit rating of a firm has been obtained, the cost of debt can be calculated. The cost of debt is the long-term risk-free rate, for example, for U.S firms, the long-term U.S government bond yield, plus the default spread associated with the firm's credit rating. (Damodaran 2012, Chapter 8: Calculating the Cost of Debt; Koller et al. 2015, 314-315.)

Some firms choose to not get rated and other, private, or small firms fall into this category. When there is no rating available for a firm, there are two more alternatives to estimating the cost of debt. The first alternative is to look at the most recent borrowings of a firm, and to estimate the default spreads being charged to the firm by lenders. The other, is to play the role of a ratings agency, and try to assign a rating to a firm based on its financial characteristics. (Damodaran 2012, Chapter 8: Calculating the Cost of Debt.)

2.5 Terminal value

As stated before in the introduction of chapter 2, when conducting a DCF valuation, first, individual cash flows for a set of years, typically five to ten, are estimated, after which, all of the years in past the explicit forecasting period are represented through a single continuing value formula (Jennergren 2008, Abstract). The terminal value is also sometimes referred to as the continuing value (Hitchner 2011, Chapter 5: Terminal value).

According to Larrabee (2012, 112), “the estimation of terminal value, is perhaps the most crucial part of the DCF approach, because normally over half of the ultimate appraised value comes from the terminal value”.

There are two approaches to estimating the terminal value: one is the going concern approach, which assumes that the firm continues to deliver cash flows in perpetuity, and the other is the liquidation approach, where it is assumed that the business will shut down and sell its assets at some point in time. (Damodaran 2012, Chapter 12: Introduction)

In a **liquidation value approach**, where it is assumed that the firm will cease operations at some point in the future, there are two different approaches, either to estimate the liquidation value using the **book value** of the assets or based on the earning power of the assets. Using the book value approach, the expected liquidation value is the total book value of the assets, adjusted for inflation, by multiplying the book value of the assets by, one times the expected inflation rate to the power of the average remaining life of the asset. (Damodaran 2012, Chapter 12: Liquidation Value).

In the other liquidation value approach, which is based on the **earning power of the assets**, the expected cash flows from the assets are discounted back to the present, using an appropriate discount rate. (Damodaran 2012, Chapter 12: Liquidation Value).

There are also **two** separate **going concern** approaches to estimating the terminal value. The first, is a **multiples** method, by applying a multiple to the firm’s earnings or revenues in the year after the explicit forecasting period. This approach has the virtue of relative

simplicity; however, it results in a dangerous mix of relative and discounted cash-flow valuation and is fairly inconsistent. (Damodaran 2012, Chapter 12: Multiple approach.)

The final, going concern approach, is to estimate the terminal value using a **stable growth model**. Stable growth models, assume that firms can reinvest some of their cash flows into new assets, and extend their lives. The stable growth models also assume that cash flows, beyond the terminal year, will grow at a constant rate in perpetuity. (Damodaran 2012: Chapter 12: Stable Growth Model.)

The most common stable growth model is the Gordon-Shapiro Model. The following formula expresses the basis of the Gordon-Shapiro Model: (Larrabee & Voss 2012, 111.)

$$\text{Terminal value} = \frac{\text{Cash flow}_{\text{next period}}}{\text{Capitalization Rate}}$$

Where:
Cash flow $_{\text{next period}}$ = Cash flow at the next period (after the explicit period)
Capitalization Rate = Discount Rate - Growth

The cash flow used in the formula is that of the next year, in other words of the year after the explicit forecasting period, and the capitalization rate is risk and growth adjusted. In this model, the growth rate and cash flows are assumed to last forever. The capitalized terminal value is as of the end of year t (the end of the last year of the explicit forecasting period), and as such, needs to be discounted to the present. (Larrabee & Voss 2012, 111.)

The capitalization rate is a very important variable. The terminal value estimation can have a big effect on the ultimate appraised value, and in some cases, even small percentage changes in the capitalization rate, can affect the ultimate appraised value by a big margin. As such, a lot of care needs to be taken when estimating a sustainable long-term growth rate. In most regular cases, the long-term growth rate should be a minimum of the inflation rate, plus an additional margin for real growth over inflation. (Larrabee & Voss 2012, 111.)

3 Research Methods

In this chapter the chosen research methods will be analysed. The chapter includes the research design, sampling, data collection methods, data analysis tools as well as issues of validity and reliability.

3.1 Research design

Based on the research objective and research question set above in Chapter 1, this paper is qualitative research in the form of a mono method qualitative study, in other words using a single data collection technique for all IQs (Saunders, Lewis & Thornhill 2015, 168). The chosen data collection technique is through qualitative interviews. Qualitative research allows for a focus on understanding and an emphasis on meaning, allowing the researcher to examine a phenomenon more in-depth, exploring the “how” and “why” behind different systems or behaviour. (Edmonds 2017, Part III.)

The research design can be seen illustrated in Figure 2. below.

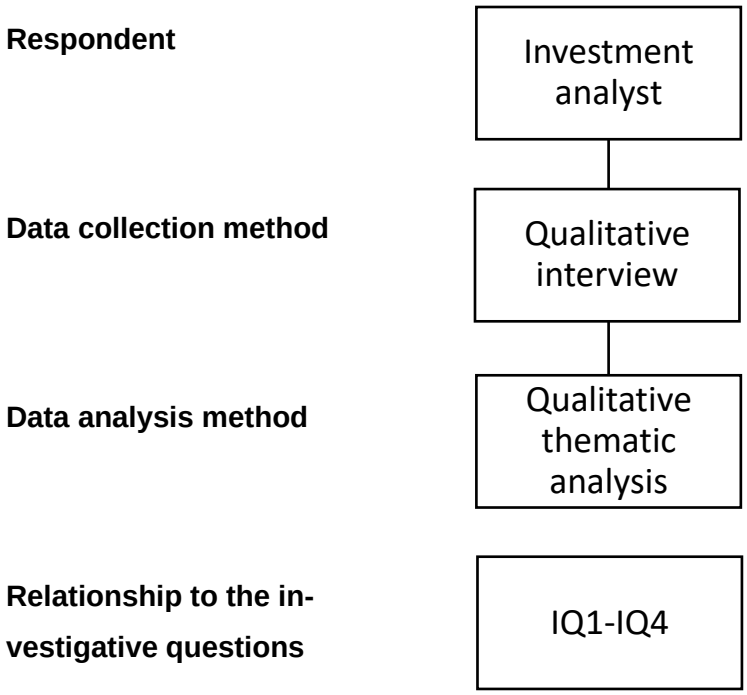

Figure 2. Research design

The main source of data collection for this research are the interviewee respondents, who are valuation experts, while the data was collected by conducting qualitative interviews with them. Having conducted the interviews, the next step of the research was to conduct a qualitative thematic analysis of the responses, in order to draw results and conclusions. The research design is explained in further detailed in the subsequent subchapters.

3.2 Population and sampling

The purpose of this research is not to make a statistical generalization and keeping in mind that the largest risk that threatens the feasibility of this research was finding interview participants, no systematic sampling techniques were used. The interviewees were selected using convenience sampling procedures according to their accessibility and suitability. (Eriksson & Kovalainen 2008, Chapter 5.)

The potential research participants included investment experts in Europe that use discounted cash-flow models in their work, working for example as analysts for investment firms or banks or in a “Mergers & Acquisitions” team of a firm, as portfolio or asset managers. The number of interviews to be conducted was decided to be in the range of three to five interviews, in order to have a significant amount of data to analyse and draw conclusions from, as well as a manageable amount of workload within the scope of this thesis project.

3.3 Data collection

It was decided to conduct the qualitative interviews as between standardized and semi-structured. The interviews adhered to a pre-planned script but with more flexibility regarding the wording and order of the questions while allowing for follow-up questions. This in-between structure was chosen, as it allows for more flexibility to respond to the particular issues that might arise during an interview, while the more standardized structure provides a more formal interview tone and alleviates the challenges involved with conducting semi-structured interviews. Semi-structured interviews typically demand that the interviewer is somewhat experienced. (Eriksson & Kovalainen 2008, Chapter 7.) The interviews were thematic and were conducted as online video-meetings.

The actual number of interviews conducted, was three, with valuation experts working in Europe. Interviewee 1 has eight years of experience working with real estate valuation in two different countries, having held titles such as Analyst, Associate, Senior Associate and most recently Portfolio Manager in a large European pension fund. Interviewees 2 and 3 are Associate Directors for a world-leading real estate services company based in Europe. Interviewee 2 has seven years of working in real estate valuation, having held roles such as Graduate Surveyor, Surveyor, Senior Surveyor and currently works as an Associate Director. Interviewee 3, has five years of experience working in real estate valuation, having worked as a Graduate Surveyor, Senior Surveyor and currently as an Associate Director.

3.4 Data analysis methods

Upon collecting the data through the qualitative interviews, it was thematically analysed, in other words organized into themes so that the emerged concepts, trends, ideas or distinctions could be derived in order to develop a storyline. (Eriksson & Kovalainen 2008, Chapter 14.)

3.5 Reliability and relevance

According to Saunders et al. (2015, 203), the threats to reliability are: participant error, participant bias, researcher error and researcher bias. Participant error refers to any factor that might alter the way in which a participant performs, such as being tired or in a hurry. Participant bias refers to factors that induce false responses, such as conducting interviews in an open space where the participant might have the fear of being overheard. To eliminate these threats to the reliability of this research, participants were asked well on-time to offer alternatives of dates and times where they would be most easily available, and they were briefed on the interview design and questions, in order to be familiar in advance with the interview environment, and with the information that was asked of them. Researcher error refers to factors that alter the researcher's interpretation, such as being insufficiently prepared or tired, whereas researcher bias induces the bias in the researcher's recording of the responses. In order to eliminate these threats to the reliability of this research, the author was prepared well in advance and arranged their schedule so as to be both well prepared and energetic. The author additionally was alert in all stages of the research of the threat of their own bias. (Saunders et al. 2015, 203.)

The research participants were chosen carefully so as to guarantee the reliability and relevance of their responses. All of the research participants, were professionals with various years of experience, working in various roles of investment management, however all working closely with discounted cash-flow valuation. The number of participants (three) poses a slight threat to the reliability and relevance of this research, as the quantity is relatively low so as to draw generalized conclusions.

3.6 Risks and Risk Management

This thesis plan relied heavily on managing to interview a number of investment analysts. The primary risk that the plan faced is not managing to successfully conduct interviews to gather enough the data to analyse and draw conclusions from. This risk could render the research impossible to complete. The likelihood of such scenario was not high, as long as appropriate time is invested into contacting possible interviewees, well on-time.

Upon managing to contact experts potentially interested interviewees, confidentiality issues arise. Investment professionals would potentially not want to reveal industry secrets, or information on their utilized processes or tools that provide a comparative advantage over their competitors. Interviewees might want to leave some information undisclosed. In such cases, non-disclosure agreements can be signed so that any information that reveals the identity of the interviewee or of the organisation that they work for, can be excluded at the stage of publication.

Since the results of the research depended on the author's interpretation of the interview responses, bias will posed a risk. Bias refers to the author's personal beliefs that might affect the impartiality of conclusion drawing. This is a moderate risk as the gathered data was solely be based on qualitative interviews. To manage this risk, the author structured interview questions well, leaving minimum leeway for misunderstandings. Where clarity is needed upon an interviewee's statement, it was a practice to ask the interviewee to rephrase their statement. When analyzing the gathered data and upon presenting results, the author continuously kept in mind bias as a risk factor.

4 Results

This chapter includes the results that have been derived from analysing the data collected during the interviews. The results are organized into the different investigative questions that were defined in chapter 1.2.

It was agreed upon with the interview participants that information that could personally identify them or their employer would be redacted from this thesis. Therefore, the research participants and their respective employers will be referred to as follows: Interviewee 1 is a Portfolio Manager working in real estate valuation for a European pension fund, that will be referred to as Pension Fund A. Interviewees 2 and 3, are both Associate Directors for a world-leading real estate services firm based in Europe, that will be referred to as Firm A.

4.1 IQ1 Discounted cash-flow valuation processes

The participants were asked a set of questions regarding the process of conducting valuation as can be seen in Appendix 1. The questions were regarding the overall process of conducting a valuation, regarding what triggers the beginning of a new valuation project, the different stakeholders involved in a practical valuation, as well as their roles and cooperation. Additionally, there was a question regarding the consistency in conducting a valuation as a group.

Amongst the research participants, despite conducting valuation on similar assets (real estate), there were significant differences between the nature and the needs of conducting valuation.

According to Interviewee 1 (Interviewee 1 22 February 2022), in their current and previous workplaces, in their work they buy assets. The specific assets that end up being subject to a valuation, are identified via a process called origination. The pension funds that they have worked for, are known in the market, and there are other large companies with brokers working for them, who bring deals to them. It is a recurring process that can happen as well during conferences, where there is an opportunity for both sides to discuss about what they have to offer and what they are looking for respectively.

On the other hand, according to Interviewees 2 and 3 (Interviewee 2 11 July 2022; Interviewee 3 25 July 2022), in their experience for Firm A, they work as a third-party valuator, for either buyers or sellers who are looking for a real estate asset to be valued. There are different stages in which they could get involved, such as while the client is already engaged with a property, or during early-stage due diligence. In most cases, the purpose of

the valuation is for funding of developmental assets, or for refinancing of assets that have already gone through one round of funding.

As the nature of the need of conducting a valuation differs amongst the participants, so do the stakeholders that are involved in it. In the case of Interviewee 1 where they are buying assets (Interviewee 1 22 February 2022), there are the following stakeholders: a research team providing market research, a deal team conducting the valuation and closing the deal and there are external valuers that value the asset as part of a portfolio in a semi-annual or annual basis. In the case of Interviewees 2 and 3, they reported that within their own workplace, there are the following team members: junior staff, graduates, and interns, who work on market research, surveyors and senior surveyors who do analysis on the market and work on the initial stages of valuation, associate directors who run the valuation models and directors who oversee the process and review the outcome. Then externally, there is the bank and then the project monitor and the legal team, who are all advising the bank on different areas. All of the different stakeholders are feeding information into each other, as the valuation team requires information from the project monitor, such as whether the project will be finished on time, or from the legal team, information on legal recourse.

When it comes to conducting valuation as part of a team, the participants responded that a lot of companies struggle with having a common baseline amongst team members, and that there is a lot of emphasis and effort dedicated to ensuring internal consistency. All three participants responded that there are set guidelines and processes, as well as regulations from the regulators for ensuring internal consistency. Typically, valuation teams have internal research teams who provide market research for macroeconomic indicators. Then, when looking at specific discount and growth rates, there is a combination of information fed by the research teams, and recurrent meetings between the valuators where assumptions are compared. Interviewee 3 expressed (Interviewee 3 25 July 2022), that it typically comes down who has got more experience. The regulations and rules cannot account for every single scenario, so experience and knowledge in the market is relevant when trying to reflect the market norm. Finally, the project managers who are responsible for overseeing the process, can ultimately weigh in whenever there are differing opinions on how to reflect the market norm.

4.2 IQ2 Determining the variables

For the IQ2, The participants were asked a set of questions (see Appendix 1.) including describing the process of estimating cash flows for an explicit forecast period, regarding

the consistency on assumptions about macroeconomic indicators, and the methods of estimating growth and discount rates.

Regarding the consistency in a practical valuation on various assumptions such as inflation, discount, and growth rates and more, participants indeed expressed that it is something very difficult to do. Most macroeconomic and market indicators such as inflation earnings growth (rental, in the case of the participants, as they all work in real estate), indeed derives from internal departments solely focused on analysing the market and the economy. Interviewee 2 (Interviewee 2 11 July 2022) expressed that from “Day 1” of conducting the valuation, to work under the same baseline, teams will work on the exact same models that are shared on a virtual drive. According to Interviewee 3 (Interviewee 3 25 July 2022), across different teams even within their own workplace in a real estate services firm, there can be differences in the base assumptions about the market and the economy. In Interviewee 3’s team, they are providing the valuation as part of legal recourse for a bank loan, and as such they need to be more conservative with their estimations, when other teams of the same firm might be looking to sell assets and have more optimistic expectations. Interviewee 3 stated (Interviewee 3 25 July 2022) that there are two ways to balance that out. One, is to talk to the research and local teams in the area involved with the asset, and to make sure that they have the same understanding, and any differences of opinion are out there. Secondly, all teams rely heavily on the research team, that almost gives a third-party view, and are completely separate. Further, their team also looks at evidence on the ground and rationalize every part of their report, having a source for every variable.

The participants responded that due to the nature of the assets that they value, being real estate, which is a private asset, the historical data that they obtain on the asset, always comes from the client or seller. According to Interviewee 1 (Interviewee 1 22 February 2022), there is also listed real estate, called real estate investment trusts (REITS) that effectively are shares. In these cases, the historical data is pulled from annual accounts.

Upon receiving the historical data from the clients or the sellers, the participants responded that while there are a few normalizations or adjustments they might do on the historical data, these normalizations or adjustments are very specific to real estate valuation, and the individual types of assets that they are working with. However, both Interviewees 1 and 2 (Interviewee 1 22 February 2022; Interviewee 2 11 July 2022) stated that they typically make adjustments on the Capital Expenditures (CapEx) and Operating Expenditures (OpEx) that they receive. Companies might have different baselines for reporting CapEx and OpEx, so they need to know what the baseline is, and adjust accordingly.

According to Interviewee 3 (Interviewee 3 25 July 2022), in his work with residential assets, the models run under the assumption that the residential assets will have a one hundred percent (100%) occupancy rate from the moment that they are built, and therefore they need to adjust for the associated opportunity cost of having vacant units until they all get rented.

With regard to growth rates, Interviewees 1 and 2 (Interviewee 1 22 February 2022; Interviewee 2 11 July 2022) reported that there is very extensive research conducted on growth rates, and in their case, rental growth rates as they work on real estate. Interviewee 1 stated (Interviewee 1 22 February 2022) “That is probably the most important thing. You drill on those numbers extremely”. According to all respondents, in real estate valuation, the macro-research teams are the ones analysing growth extensively, through analysis on supply and demand dynamics, the macro-environment, the micro-environment, and through looking at key drivers that impact demand and governmental laws that could impact supply. However, according to Interviewee 3 (Interviewee 3 25 July 2022) “I would say (estimating growth rates) it is between a guess and an estimation”. Additionally, their colleague, Interviewee 2 (Interviewee 2 11 July 2022), had stated that they do not have full visibility on how the independent market research team is arriving at specific growth rate figures. It is the conclusion of the author that Interviewee 3’s belief that growth rate estimation is between a guess and an estimation, rather than methodical, comes from their lack of full visibility on growth rate estimation and perhaps a lack of cooperation between the teams. According to Interviewee 3 (Interviewee 3 25 July 2022) their research team might have a very profound rationale as to why they have arrived at a specific figure, however, in certain cases the provided growth figures should only apply to assets located in the city centre of a city, but in examples where the asset is located on the outskirts, there might be a need for adjustments, as long as there is good rationale.

According to the participants, the most predominantly used method of estimating discount rates is the CAPM (see Chapter 2.4.3.2), however there are comparable methods that are utilized too. Interviewee 1 (Interviewee 1 22 February 2022) stated that in their work in pension funds, the cost of equity is derived from independent internal departments and while they do not have full visibility, they believe the method utilized is the CAPM. The return itself is typically a low figure, as pension funds, where they have worked, have low target returns. In the case of Interviewee 2 and 3 (Interviewee 2 11 July 2022; Interviewee 3 25 July 2022), the cost of equity method of choice is generally a comparable method, while the CAPM might be used at times. The comparable method is more focused on the market and less based on a theoretical framework. In a comparable method, similar assets for comparison are analysed and information on the discount rates that have been

applied on these similar assets is derived. In these cases, the applied discount rate is an applicable comparable to the underlying case.

Thematically analyse the answers and draw some trends. Start with valuation approach, historical data. Move to automation, adjustments, and consistency. Move to growth rates and discount rates.

4.3 IQ3 Estimating the terminal value

The interviewees were asked to describe the preferred methods of estimating the terminal value in their work experience. The responses were varying across the respondents, however there was a common consensus that estimating the terminal value is a process in which a lot of time and effort is dedicated, often utilizing a combination of different methods, and taking into consideration different macroeconomic indicators.

Interviewee 1 (Interviewee 1 22 February 2022) stated that they believe that in real estate valuation, estimating the terminal value is relatively less simple compared to terminal value estimation in stock valuation. According to Interviewee 2 (Interviewee 2 11 July 2022) a whole separate DCF valuation model might be run to estimate the terminal value, or there might be a combination of utilized methods. Interviewees 2 and 3 (Interviewee 2 11 July 2022; Interviewee 3 25 July 2022), the baseline of calculating the terminal value, derives from calculating the gross income of the asset, deducting any cost, capitalizing that on an appropriate rate and then deducting any purchase fees. In some cases, clients might have a specific value at which they want to buy the asset after an explicit time period, but even in those cases, two different models are created, one with the value the client is expecting, and a second one estimated with various methods in order to also find a market facing value. According to Interviewee 1 (Interviewee 1 22 February 2022), historically in real estate, there is a correlation between yields and government bonds or inflation. Historically for real estate assets, there is a yield spread against bonds, so therefore, if there are estimations that government bonds are going to increase, then, there is an assumption that the yields will also expand by the same amount.

4.4 IQ4 Discounted cash-flow valuation tools

The participants were additionally asked to list and describe the different tools and software that they utilize when conducting a discounted cash-flow valuation.

There is a general consensus amongst students, professors, and practitioners alike that MS Excel is the most dominantly used tool by valuation practitioners, and that consensus

was reaffirmed with the responses given by the participants. All three participants agreed that the tool that they most utilize in their work is MS Excel. In the cases of Interviewees 2 and 3 (Interviewee 2 11 July 2022; Interviewee 3 25 July 2022), they stated that they almost exclusively use MS Excel spreadsheets and drives for all purposes and parts of conducting a valuation, with the exception of using Argus Developer, a tool utilized by them only for calculating the residual terminal value of residential assets. In their case, all of the internal databases with relevant information on market research and indicators, is accessible via MS Excel spreadsheets.

Interviewee 1 (Interviewee 1 22 February 2022) expressed that in their experience there are more software and tools that they utilize in their work. While for them, MS Excel is still the main tool for conducting the main work of their valuation, they do source a lot of information from third-party services. For macroeconomic research and market indicators, Oxford Economics, and Bloomberg are widely used, while Capital IQ an excel add-on, is also used for downloading historics such as balance sheets and income statements of any company they might want. In Interviewee 1's (Interviewee 1 22 February 2022) experience, in real estate valuation Argus is another widely used valuation tool, however to their knowledge mostly in the United States of America and less in Europe. Interviewee 1 (Interviewee 1 22 February 2022) additionally stated that they know for a fact that some companies have their own, internal valuation systems. Those systems might be MS Excel automations running on Visual Basic, or they might be fully in-house developed software.

5 Conclusions

5.1 Key findings

What sparked the authors interest in writing this thesis, was the theoretical and pragmatic complexity of conducting discounted cash-flow valuation, which is vastly a result of the various models that can be applied when conducting discounted cash-flow valuation, the many different variables that are taken into consideration. All of the aforementioned, made the author imagine that there must be a lot of variances in the ways that discounted cash-flow valuation is actually conducted in practice versus what is discussed in theory.

As a result of analysing the data collected from the interviews, the following key findings are presented:

1. Discounted cash-flow valuation theory and the subsequent estimation models and theory on how to estimate the different variables are the backbone and the founding pillar of any valuation practitioner, however, practitioners do make a lot of adjustments or combine methods in order to try to reflect the market norm as accurately as possible.

2. Firms, tend to have the following teams involved with different parts of valuation, with different levels of responsibility: There is an independent market research team, which provides analysis on a macroeconomic or broad market level, providing insight on, amongst others, levels of inflation, interest rates and expectations about growth. The market research teams typically consist of graduates and interns. At the next level, there are the valuation practitioners who run the models, who tend to have more experience and typically have worked in market research before. At a higher level, there are project (team) leaders, who are responsible for the timeliness and coordination of a valuation project.

3. Practitioners agree that consistency in valuation is challenging. Conducting valuation as part of a team, and retaining the same base assumptions, or being consistent in the way of valuing assets across different valuation teams within a firm, are challenging areas for valuation practitioners. Practitioners claim, that to alleviate inconsistency, rules and guidelines need to be followed and there need to be recurrent meetings across team members and across different teams.

4. MS Excel is the most widely used tool in valuation, with some practitioners using MS Excel almost exclusively for all purposes. Practitioners may use other tools either for data on other companies, or the economy, or alternatively, to model a small part of the

valuation with a tool specifically designed for the valuation of assets of a certain type. Some firms have developed valuation tools in-house, whether as independent software, or as MS Excel plug-ins.

5.2 Suggestions for further research

The author acknowledged that the reliability and relevance of this research is limited by the low number of research participants. The author believes that a larger and broader research on this topic, than the scope of this thesis, would be greatly interesting. Such research could include a large pool of participants, with data collection being quantitative rather than qualitative. Such research could draw generalised conclusions with more accuracy and reliability and would be able to provide better and more accurate insights to students, practitioners, and researchers.

5.3 Reflection on learning

For the author, this project has been an invaluable learning experience which has broadened their theoretical knowledge of discounted cash-flow valuation as well as taught them more about how discounted cash-flow valuation is conducted in practice. As this project has been the largest single project that the author has taken sole responsibility of, it has also been a great experience, to learn how to go about conducting a project of this scale, and how to conduct research.

The most valuable experience for the author, has been being able to directly communicate with different valuation practitioners, obtain a first-hand understanding of what their work is like, asking high-level questions about the valuation process and through the process of interviewing the participants, building a connection with investment professionals.

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Appendices

Appendix 1. Interview question set

General Preface: These questions are not targeted towards specifically examining how DCF valuation is conducted in your current job, instead, you can reply to these questions considering your overall experience. You may think of every question, as if it is prefaced with "In your experience".

Introductory questions:

1. What is your experience with DCF valuation? How long have you been working with DCF valuation, and how often do you utilize the method?

IQ1: (Process)

2. In your experience and roles, what has the need to evaluate an asset come from? *(Example: The strategic need of the upper management of buying/selling an asset?)*

3. What are the different stakeholders involved in a practical valuation, and what are their roles? *(Senior management, analyst team, the different roles within the team)*

4. In what ways do the different stakeholders cooperate?

5. **IF** you conduct valuation as part of a group, how can multiple people working on the same valuation, work consistently and with the same assumptions?

6. Describe the general process, from the moment of screening an investment, to making an investment decision.

IQ2: (Variables)

7. There are a lot of factors with which an analyst has to be careful to remain consistent. Cash flows and discount rates, assumptions about inflation and currencies need to remain internally consistent. *(Using the same currencies, not using both nominal and real interest rates)* How is internal consistency ensured in a real-world valuation?

8. Describe the process of estimating cash flows for the explicit forecast period. *Where do you usually draw the historical data from? At what level is the process automated What are some typical earnings adjustments or normalizations that you do?*

9. As earnings growth rates impact heavily the ultimate appraised value, how much time and effort are dedicated to estimating the earnings growth rates (*To what degree to you try to be precise? Are the growth rates estimated methodically, or are they between a guess and an estimation? If methodical, how?)*

10. When estimating the discount rate, what is the preferred method of estimating the cost of equity? *(Example: CAPM, Fama-french three factor)*

11. **IF** the preferred method is the **CAPM**, do you draw the risk-free rate, and the expected market returns from somewhere *(Examples: a financial service, your organizations resources),* or do you estimate them yourself?

IQ3: (Terminal value)

12. (Preface:) Often, over half of the ultimate appraised value, may come from the terminal value, despite the terminal value's simplicity in its' inputs. How much time and effort is dedicated in estimating the terminal value?

13. (Preface:) There are a few methods to estimate the terminal value, such as based on the liquidation value of the asset, by using growth rates, or by using multiples.

14. (Question:) Upon deciding on what method to use depending on the investment that you are appraising, what affects the decision of your method of choice? **OR** If you are only typically using one method for all assets you appraise, why?

15. Describe the process of estimating the terminal value. (What are the key inputs/variables? How long is the process?)

IQ4: (Tools)

16. What tools or types of tools and software are you utilizing in a DCF valuation?
17. At what stage of the valuation process is each tool used and for what purpose?

Appendix 2. Interview 1 transcript

Date: 21 February 2022

Part of the introduction and outro of the interview (in *italics)* was done in Greek as it is a common language between the interviewer and the interviewee. It has been translated to English.

Nikolaos *:To begin with, we can do the introduction in Greek, however we will switch to English as it will be easier to discuss over terms, for the writing of the transcript and for my professor to understand our discussion.*

Generally, as part of my research, and with every interviewee, as with you, I will not disclose their full your full name or the name of your workplace, this information will be partially hidden, and information such as that you are working for a pension fund in Europe, will only be disclosed, as well as your level of experience. Just letting you know!

Generally, you do not need to answer these questions from the standpoint of only your experience in your current workplace, instead, you are encouraged to answer keeping in mind any work experience, and as such, I will not be asking you to reveal to me detailed processes of your workplace in case you would not be able to answer these types of questions.

Interviewee 1*: Something I can tell you, is that I cannot talk to you about specific deals, however processes are not a secret, and whoever you might talk with, processes are not a secret, and organizations do often compare processes.*

Nikolaos: Alright, so that was the introduction, let's switch to English, if some of my questions are unclear, let me know to further explain them.

The first question, you kind of already have answered: What is your experience with valuation and discounted cash-flow valuation. How long have you been working with cash-flow valuation, and how often do you utilize the method? Do you also use other methods?

Interviewee 1: So, there are different methods. I think, from my experience, DCF, you probably see more of a DCF approach in Europe. I have also worked in (*redacted, country A)* for 7 years, and I just started working in (*redacted, country B)* and I actually see quite a different approach. In the current company, they use a lot of DCF, and their agents and

brokers use a lot of DCF. However, in (*redacted, country A)*, the most common approach is, I mean, it's the same as a DCF, but it's basically an IRR method. You build out your cash-flow and you calculate an IRR, versus taking those cash-flows and discounting them with the discount rate.

Nikolaos: Then, I will move to the questions related to the process of doing a valuation. My first question is, in your working experience, or maybe your current one, where does the process start, or how does the need to valuate an asset start from?

Interviewee 1: In my business, we buy assets, so the valuation comes in pretty much Day 1. We look at the underlying cash flows immediately, and the expenses, and the goal is to evaluate that asset and make a bid.

Nikolaos: One question then, how is a specific asset identified then, how do you decide, this is the specific asset we are going to look at?

Interviewee 1: This process is called origination; you might have heard of the terminology. Very large companies have brokers working for them, and you are known in the market. For example, the two companies that I have worked for *Pension Fund A* and *Pension Fund B*, everybody knows that they are interested in buying. They know they have X amount of cash, and they just bring deals to the table, and ask, hey, *Pension Fund A*, hey *Pension Fund B*, are you interested in buying this? It is recurring, you also meet in conferences, you tell the brokers or other companies, oh, I am actually more interested in offices this year, or, I am interested in retail, and they bring you these type of deals, and of course then you also have your internal connections, so, for example, because I have worked for *Pension Fund A*, I can now reach out to *Pension Fund A*, and say, hey, would you guys like to do something together with *Pension Fund B*, and we both go to the market and look at something.

Nikolaos: The next question would be, what are the different stakeholders maybe in your organization, so there could be an analyst team, senior management, that is involved in the valuation process, so what are these different stakeholders from your organization's point of view and what are their roles?

Interviewee 1: So, in the DCF, particularly, I think there is a valuation department usually, and these are the ones that are more involved, but it is the deal team's responsibility to carry that out.

Nikolaos: And then within one valuation team, what are the different members, and also in a sense, is valuation done, I am guessing, as part of a team, and how do the

different team members cooperate them, what different roles might different people have in a valuation team, that is valuating one asset.

Interviewee 1: So, the deal team is the one that is doing the valuation, the deal team that is closing the deal, and ultimately doing the valuation. Then, once you buy the asset, that asset is being valued as part of your portfolio, in a semi-annual or annual basis, by external valuers. And these external valuers, for example, CBRE, they have an army of people, being on the ground, analysts, directors, and they just go through line by line.

Nikolaos: And then, I think that also answers my next question, but, if you in your work use DCF, and you do it as part of a team, my questions is how you within a team can be consistent, with the assumptions of a valuation, about different aspects such as inflation or others. It might be a difficult question to ask, but how can a team be consistent, when everyone needs to be on the same page about the assumptions?

Interviewee 1: I think it is actually a great question, and you will find that most of the companies struggle with having a common baseline. There are items, as you mention, inflation, that are relatively similar, and it is easy to have a common approach, for example, the largest companies take a look at Oxford Economics for the macro-numbers. Then when we are looking at specific discount rates, or rental growth, which is important for us, or yields, then, what we have done in the past is, you just meet up as a team on a semi-annual basis, and you compare all of your assumptions, but obviously there are changes, and people have different opinions.

Nikolaos: Yeah, exactly, that has been a problem already in a theoretical level when we have had a group valuation of stocks, because everyone has different assumptions about yields, and for some of them, there is no specific macro indicator that you can find, you just have to kind of assume.

Interviewee 1: Yeah, exactly, it is a thing that a lot of people struggle with. *Pension Fund B* does it, I think, well, because they do meet quite often, and they try to give some guidelines to everybody, but you see the result and you compare different item classes, and they make no sense, but that is where you adjust.

Nikolaos: That is a very good answer, thank you. And then I would say, if you could give me a very general description of the process. So how is it streamlined, from the identification of an asset, to making a buy, or no-buy decision, or a decision on the level of the bid.

Interviewee 1: Yeah, so, again, for real estate, I think I can also speak on behalf of infrastructure, because I know they follow the same as us, both *Pension Fund A and B* follow the same approach, and they are massive companies. What happens is, there are typically 3 stages. The first one is called screaming stage, where you present to your committee very high-level returns and strategy and the thesis of the investment. Then, if you get the green light from the committee, then, you have a specific amount of money that you are able to spend, to carry out further due diligence, and engage lawyers, commercial brokers, technical due diligence, environmental and everything, and that is stage 2. You carry out all of that due diligence, and you are in an update-memo-state. Where you give out all of the detail, and that is the time, where you have almost fully finalized your valuation. So, you present to your committee all of your assumptions, and a final bid price. If you do get the green light then, then there is the final stage, which is the final investment committee, where effectively you have also negotiated all of the contracts with the counterparty, the seller, and you are ready to sign.

Nikolaos: Perfect, thank you very much. Now, I will move to questions that are more technical, about the different variables and estimations within a DCF valuation. Now, this question does have a preface, that there are a lot of factors as we've said before in a valuation where you need to be consistent, be it inflation, be it rates, and the question is how can you become internally consistent, when it comes also to currencies, interest rates, is it much of the same, where, you need to have constant communication and guidelines?

Interviewee 1: So, interest rates, real interest rates, what do you mean, as in the banks?

Nikolaos: So, in different stages of valuation you might need for your calculations, on top of my head, you might need to use either real or nominal interest rates, but you can't mix and match them.

Interviewee 1: Oh, I see, got it. So, in terms of currencies, you typically have an internal department, that carries out that internal analysis for the company, at least in large companies, and they have everything on the drive accessible, and it's typically being updated on a monthly basis. Exchange rates it's pretty easy, because it is provided by the macro research team, in each company. Inflation is the same, in terms of inflation, you have a very specific provider, in our case, it is very common to use Oxford Economics, so you just take the inflation from there, and I think they are updating it as well on a quarterly basis.

Nikolaos: So then, the next question would be, regarding cash-flow estimation, and the question is, what is the process like, where do you usually draw historical data from, at what level is the process automated, or are there some typical adjustments or normalizations that you do, for example over accounting earnings that are non-cash?

Interviewee 1: In terms of historical data, because real estate is a private asset, we take it from the seller, so, they set up a data room and they have all of the historics. There is also listed real estate, called REITS, real estate investment trusts, so effectively, they are shares. In these cases, we take them from the annual accounts. And there are half-year, and also full-year annual accounts, and then we update everything ourselves.

Now the second question, on automation, also, again this is a very good question; there are companies, so for example Blackstone, or *Pension Fund B*, that have their own, relatively automated valuation model. That has been set up internally. That is a very bespoke system, that doesn't necessarily work 100%. So, you do need to make some adjustments, and you do need to put the initial inputs right, but even on that model, it automatically pulls the inflation rates that we discussed, and this is very helpful. But there are adjustments that you need to do, and sometimes you lose flexibility, through that automation. In stocks, it is probably less relevant, but in real estate, it is a very niche asset, so you can get very large differences between asset classes.

What are the typical adjustments? I think it is very real-estate focused, we don't really have non-cash items, we don't really work with balance sheets, so I don't think it is relevant for you.

Nikolaos: Maybe if you could give me, some adjustment categories, without going into detail?

Interviewee 1: I mean, one of the most important things is probably CapEx or OpEx for real estate, CapEx is the capital expenditure of the company and OpEx is the operational expenditure of the company, so, a lot of the times, companies report CapEx and OpEx based on different baselines, so, you need to know what that is. And also, when you are looking at platform investments, a lot of the companies have a management company on the side. It's also a matter of, how do you value this, and how do you include this in your cash-flow.

Nikolaos: Moving on, this question depends on how you estimate cash-flows in a valuation, but if this approach is the case, my question is that earning growth rates

can impact a lot the ultimate value of the valuation. Then how much time, and effort is dedicated in estimating the earnings growth rates?

Interviewee 1: So, this in real estate would probably be the rental growth, so, the growth on your top-line revenue line. I mean, that is probably the most important thing. You drill on those numbers extremely. How much time and effort? I mean, a lot. We analyze supply and demand dynamics, we look at the macro-environment, the micro-environment, and we look at the key drivers that really support demand, because if there is demand, then there is going to be rental growth. And then of course you look at governmental laws that could impact supply, so, for example, in some cases the government decides, you are not going to build another logistics in this area, so the one logistics center you have, that's where the rental growth is going to go. So, we look at all of these things, and then, we also look at historics.

Nikolaos: Another technical question about the discount-rate, is, when estimating the discount-rate, what is the preferred method for estimating the cost of equity, for example, the Capital Asset Pricing Model, or the Famma French or, something else.

Interviewee 1: I think pension funds, until now, in my experience, the cost of equity is something that is given, from the company itself, and I do not have visibility on how they actually get those numbers. Typically pension funds, have a target return in their mind, and that is not very high, because it is a pension fund. So, the cost of equity, is a value that they get from internal departments. But, if I have to say one, it's probably the CAPM, because that is what everybody uses.

Nikolaos: Then, another question that has been partially answered, if the preferred method is the CAPM, where are some of the variables drawn from? I imagine, if measures such as inflation are drawn from external sources, then, there are internal or external sources for measures such as the risk-free rate, and the expected returns of the market.

Interviewee 1: Yeah, exactly.

Nikolaos: So, this has been the main part of the technical questions, I have a few more related to the terminal value. And, one is, there is a preface to it; Typically, half or over the half the ultimate value of an asset comes from the terminal value, which, is generally a very simple model, no matter what you do, and then, how much time and effort is dedicated in estimating the terminal value, as it is relatively simple but impactful.

Interviewee 1: So, in real estate, it is not as simple I think, as it is in stocks. In real estate, you underwrite the asset on a month-by-month basis, versus, I know that in stocks, you typically do an annual, pretty high-level forecast. So, there is a lot of thought behind the actual exit value. What we would do is, the key elements for the exit value are: one is what is the yield that you are assuming, and the other is the top-line revenue. So, the top line revenue we have discussed, you haven't grown on a monthly basis, you diligence that, a lot. So, the yield is where the uncertainty comes in. For the yield, you have benchmarks. So, you see, historically what the yield has been, and you know that at least in real estate, you need a specific spread against bonds. And then, from Bloomberg you can actually get bond and inflation forecasts. So, you say, if I believe that my government bond will increase in the next 10 to 15 years by 50 basis points, I will also assume that my yield expands by that amount over the next 10 to 15 years, so, there is a correlation between these two, and this is how we typically approach it.

Nikolaos: And so, regarding the exit value, after a specific forecast of the rents of an asset, for an X number of years, is the exit value calculated using multiples?

Interviewee 1: No, it's always yields. So, the yield, is very simple. It is effectively the opposite of a multiple. So, if you have a multiple of 10, your yield, is 1/10, that's it, it is the same thing.

Nikolaos: We can move to the last two questions, which are regarding the tools that are used in a valuation, such as different types of software; the first question is, and a lot of them have already been mentioned, but what would you say are the tools and software that are being utilized?

Interviewee 1: I think across the board, in the real estate industry, you would probably look at Excel, so, you do your own bottom-up Excel, or companies have their own set-up excel that you adjust. In real estate, again, there is one called Argus, so, that is a valuation tool, that a lot of brokers, especially in the U.S use. It has never kicked-off in Europe, so, Europe uses Excel, the U.S uses Argus.

And then, you also have on a company-by-company level, their own internal systems, as I mentioned Blackstone, I know for a fact have their own valuation tool, *Pension Fund B* is building their own, but it is not something that you can buy, out there.

Nikolaos: And, if we extend, the software that is being used, to software that also accesses historical data or macroeconomic inputs? I know we've mention Bloomberg for example, or Oxford Economics.

Interviewee 1: So, it's Oxford Economics, and they are absolutely great actually, do take a look at them, in terms of macro. Bloomberg of course. Capital IQ, so that is again, a plug-in in Excel, where you can download historics, pretty much all of the balance sheet and the P&L of every company that you want, they're pretty expensive though. And then, also something more real estate specific, they are called Green Street Advisors, they do a lot of listed real estate, so they do have a lot of shared information, for real estate stocks, but they also do private, and they have their own macro-research department, so, we do pull out stuff from there. And effectively what we do, is a triangulation, but for the macro indicators I have to say that there is a lot of consistency, and we haven't seen massive deltas between providers.

Nikolaos: I just have a follow-up question, when you talked about automation, and you said that, different pension funds, investment banks and firms, might have their own valuation models, are they, Excel automations, or are they different software?

Interviewee 1: It can be both, absolutely, it can also be Excel automated models, running on visual basic. In one of the private equity funds that I worked with, ages ago, they had a guy, whose one job, was to build out, the largest Excel file you can imagine, that pretty much, you can pick and choose, oh, I want to model or underwrite a shopping center, or an office, or a company, and it would do all of these things, but it had a lot of code, and this guy was a programmer.

Nikolaos: Actually, there is one more question, if there are any AI elements in any part of valuation?

Interviewee 1: That is very interesting, never thought of it. I don't believe there has been, at least from what I have seen. I know people from the real estate side of Goldman Sachs, Apollo, pretty large private equity funds, and I haven't heard about AI in real estate, and in pension funds either. I mean, that is a very interesting concept, and potentially that is where things are going over the years.

Nikolaos: It would make a lot of sense, I mean, AI is very new, and, in a sense, valuation has remained the same, apart from automation, but the principles have been the same for decades and decades.

Interviewee 1: In real estate specifically, and in valuation as a whole, yeah, the process does change very slowly.

Appendix 3. Interview 2 transcript

Date: 11 July 2022

Nikolaos *: Generally, you do not need to answer these questions from the standpoint of only your experience in your current workplace, instead, you are encouraged to answer keeping in mind any work experience, and as such, I will not be asking you to reveal to me detailed processes of your workplace in case you would not be able to answer these types of questions.*

Interviewee 2*: Right.*

Nikolaos: The first introductory question: What is your experience with valuation and discounted cash-flow valuation. How long have you been working with cash-flow valuation, and how often do you utilize the method?

Interviewee 2: So, to give you a bit of a background, I am currently working as an Associate director at *Firm A* (redacted) who is a real estate firm, I am in the residential valuation department, so basically on a daily basis I am conducting valuations for residential assets. We are talking about big scale assets and projects. Generally, we use DCF on a daily basis. I have been doing this for just over 4 years now.

Nikolaos: Great! Then, I will move to the questions related to the process of doing a valuation. My first question is, how do you identify a target, so as to begin the process of valuation it?

Interviewee 2: So basically, we are starting from the simple thing, of why we need the valuation. It is to identify the market value of an asset, especially when talking about buying it or selling it, and that involves different stakeholders. Do you want me to tell you how we value it?

Nikolaos: No, for example how do you identify that this is the specific one, maybe upper management decides that this is a target we want to value, or you know that some asset is on sale or lease?

Interviewee 2: So, for us it starts with our clients. We get inquiries from different clients, we work with investors, banks, funds, institutional organizations. They come to us, to our team, and they are either selling or buying an asset, and they want to find the value of it.

Nikolaos: The next question would be, what are the different stakeholders involved in a practical valuation, and what are their roles?

Interviewee 2: So, we have junior members of staff who are graduates and interns, then we move to surveyors, senior surveyors, associate directors like me and then directors. So, each one, has different roles and responsibilities based on their experience basically. Graduates and interns work on the market, doing research. Surveyors and senior surveyors do analysis on the market, and sometimes they might work on the initial stages of a valuation. Associate directors like myself, we set up and run the models and valuations. Finally, the directors oversee the whole process and review the outcome, making sure that everyone is doing what they need to be doing.

Nikolaos: And then, in what ways do the different stakeholders cooperate, or at what stages?

Interviewee 2: So, everyone reports to the member that is like, one step above them so like, graduates report to surveyors and surveyors to senior surveyors, senior surveyors to associate directors and so on. However, all of the members report to the director just in case, because we need to make sure that there is continuity, and that everyone is working on the same basis.

Nikolaos: Exactly, that is a topic that I will touch upon in a second. Actually, it is my next question: If you do valuation as part of a team, how can multiple different teams or people work consistently under the same basis or assumptions?

Interviewee 2: The first thing is to understand the basis of the valuation and why we are doing the valuation. That's basic. Then, we have set models that we follow and guidance, in our team and within the company as well. Again, just in case someone doesn't understand something or follows a slightly different path, we have the director that has the full responsibility of overseeing the whole process.

Nikolaos: So, I know that we have talked about bits and pieces of the process, but could you describe the overall process of conducting a valuation, from the beginning of identifying the asset, until the decision point.

Interviewee 2: So, in my team, we don't really identify assets. Clients come to us with a specific asset, so that is not part of our role. However, we value the asset that we want and then we benchmark that asset, with other assets on the market sometimes, just to make sure that we have basically the correct value, and also that we give the client the advice that they want.

Nikolaos: So, just to understand, in your case always the valuation is done for a client, and not so that the company you work for buys the asset.

Interviewee 2: No, basically, we are doing the valuation for the client, and the client buys the asset, in my team that's what we do. In other teams, they identify assets that my company buys, so it depends on the team. In my team we act for external buyers or sellers.

Nikolaos: Now, I will move to questions that are more technical, about the different variables and estimations within a DCF valuation. So, we talked about a little bit on how you can remain consistent in one valuation, but specifically when it comes to discount rates, cash flow estimations regarding currencies, within one model consistent, especially when multiple people working on the model, they need to have the same assumptions about macro-economic inputs.

Interviewee 2: So again, we have set models that basically, we change them, so for each asset type and for each purpose, we have different set models. So, that is our basis. That's why according to what asset we are valuing, we know which model to follow and again, if all of us we need to work on the same model, basically we share it on a drive and we follow the same assumptions on the cash flows. This is something that we do from Day 1.

Nikolaos: Is it also a lot of, meeting up to talk about, ok, what are the base assumptions?

Interviewee 2: Yeah, basically, us we go through the valuations, and because our instructions are to deal with large scale projects, usually it takes us 46 weeks to conduct a valuation, and throughout this whole process, we do either once or twice per week meetings, so that we all know that we follow the same principles, and that we do what we need to do on time.

Nikolaos: Perfect, thank you very much. So then, the next question would be, if you could describe the process of estimating the explicitly forecasted years, so where do you usually draw the historical data from, at what level is the process automated, and what are some typical normalizations or adjustments that you do?

Interviewee 2: So, in my team we run 10-year cash flows. I know that some other teams and for other types of valuations they do 5-year cash flows. That is because for residential assets it seems quite accurate, and 5 years seems short. We found out the income for these 10 years, and we deduct any operating expenses, capital expenses, meaning salaries, insurances bills and patents wherever they may apply.

Nikolaos: And then the historical data for the asset you get from your client?

Interviewee 2: Yeah, the historical data we get from the client basically the client gives us what information they have throughout the years. Some of the assets that we have, we value them either on a quarterly basis or an annual basis. Basically, we have the data every quarter or every year. We also have data from other teams that deal for example with operational assets, and we take that data as a benchmark. So, we have the historical data that we get for the asset from our client, but we also have the data from within the company from other similar assets so that we can do a benchmark and see how the asset we are valuing is performing and how that compares to other assets.

Nikolaos: So then from the historical data, are there some normalizations that you need to do, or some adjustments? I understand that his question might be more oriented towards stocks so maybe in this sense it's different with real estate?

Interviewee 2: Yeah, it's different with real estate, so basically, we don't do these kinds of normalizations that you would do on other types of assets. Basically, what we get from this data is like the operating expenditure of this asset, and we are looking at whether there is a trend on the operational expenditures, and then we actually make adjustments on these.

Nikolaos: So then, let's move on to the next question: Earning growth rates, I know that in real estate you might use something different, but with the same effect, can heavily impact the ultimate value. So, how much time and effort is dedicated off the general process, to that?

Interviewee 2: So, we do not use earning growth, but we use growth rates as well. For residential assets, they have a huge impact on the valuation. We have a specific team that does the research for growth rates. I do not have full visibility on what they do, but I can tell you that they run models on specific assets, they collect data from what is going on in the market regarding growth and inflation, and they run different models based on the current market and based on prediction. Then, they provide us with growth rates for every year of the 10-year process that we need. For example, now that we have a situation with inflation and with the market, basically we run 2 valuations let's say, one with the assumption that everything goes normal and one with growth rates, taking into consideration the inflation and crisis going on right now in Europe.

Nikolaos: So, scenario based. Thank you very much. Then let's move to the discount rate. Again, I think this is a little stock-oriented, but I think it applies also to real estate. So, when estimating the discount-rate, what is the preferred method? Is it CAPM?

Interviewee 2: So, I have used the CAPM model before, but for residential assets, it is not so useful. Basically, what we do for discount rates is that we use the comparable method. We find comparables and analyze other assets, and from these other assets we get information on the discount rates that have been used. We analyze these, and then we try to apply something that is comparable to our case. So, we don't use a theoretical approach, it is more based on the market.

Nikolaos: So, this has been the main part of the technical questions, I have a few more related to the terminal value. And, one is, there is a preface to it; Typically, half or over the half the ultimate value of an asset comes from the terminal value, which, is generally a very simple model, no matter what you do, and then, how much time and effort is dedicated in estimating the terminal value, as it is relatively simple but impactful.

Interviewee 2: So, basically for us, we put a lot of effort and time to do that. We either run a separate DCF valuation to do that, we use different methods to do it. For operational assets, what we do, we use the investment method. We basically calculate the gross income of the asset, we deduct any cost, and then we capitalize that on an appropriate rate and deduct the purchase cost. If it is a residential asset, we use the residual method to do that, and then we put that value into our cash flow. Basically, we do a combination of valuation methods in order to make it more accurate. Sometimes we might get from clients, that they want to buy an asset saying, we want to buy the asset, but at the end of the 10-year period, we want an (X) amount of value, and on this scenario, we use that as a set value that the client wants. But in order for us to be 100% sure that this is accurate and achievable, that would be the first scenario, but we will also run a second scenario using different valuation methods in order to look at a market facing value.

Nikolaos: So, there are many different terminal value methods that you might use-

Interviewee 2: Yeah, there are a lot of different terminal value methods that we might use, depending on the asset or the purpose, and again, depending on the type of valuation, we use different variables or multiples.

Nikolaos: My next question is regarding tools, in my thesis I wanted to really work at what tools might be used, or what databases might be used. So, what tools and software are you utilizing when conducting a valuation?

Interviewee 2: So, basically we use spreadsheets, and Microsoft Excel, that's our main tool. When we run investment methods, again we use Excel. If we have a developmental

asset, where we do a residual valuation for the terminal value, then we also use Argus Developer, but that is only for calculating the residual terminal value, and after that we will move again to using the Excel spreadsheets.

Nikolaos: But then, also regarding for example, macro-economic inputs, or historical data, are there other tools or websites or databases that are used?

Interviewee 2: So, for the growth rates, I am not sure what the research team is using to do that, but basically no. We run everything on spreadsheets.

Nikolaos: So the internal databases that you might use, that have expectations maybe about the future of the market, that is all information that is available in Excel spreadsheets?

Interviewee 2: Yeah, Excel Spreadsheets or drives.

Nikolaos: I think this answers my next question as well, so in that sense, we have finished! Thank you so much for your interview!

Interviewee 2: I hope I was of help!

Nikolaos: This has been extremely helpful, it is so hard to find willing interviewees, and I am learning so much personally from this, and getting so much information for my thesis!

Appendix 4. Interview 3 transcript

Date: 25 July 2022

Nikolaos ***: Generally, you do not need to answer these questions from the standpoint of only your experience in your current workplace, instead, you are encouraged to answer keeping in mind any work experience, and as such, I will not be asking you to reveal to me detailed processes of your workplace in case you would not be able to answer these types of questions.***

Interviewee 3*: Right.*

Nikolaos: The first introductory question: What is your experience with valuation and discounted cash-flow valuation. How long have you been working with cash-flow valuation, and how often do you utilize the method?

Interviewee 3: So, obviously, as you know, Interviewee 2 and I work in the same team, doing investment valuation. I have done it for 3 years now. Started out in our capital markets business for a year and spent some time in our agency business as a surveyor, and moving on to valuation, where most of my work focuses on investment.

Nikolaos: Great! Then, let's jump into the first category of questions regarding the process of conducting a valuation. My first question is, how do you identify a target, so as to begin the process of valuation it?

Interviewee 3: Sure so, for me and my team where I work, it is a client that needs an asset to be valued. There are different purposes. It could be that they are already engaged with that property, or it could be an early-stage due diligence. I suppose that these are the two points in which I would get involved, so yeah. Origination would be part of it, most of what we do, it is already engaged. The asset has already gone through one round of funding, and they are refinancing, or it is under development, and they need financing.

Nikolaos: So, it is for properties that have not been built yet, are under development and are going to be leased

Interviewee 3: Exactly, however, having said that you can have a lot of investment loans, where there is a development loan, where upon completion of the project, it will get refinanced as an investment loan. At that point in completion, as it gets refinanced, where it could be open for a couple of years but there is still debt on it, we value it.

Nikolaos: The next question would be, what are the different stakeholders involved in a practical valuation, and what are their roles?

Interviewee 3: So, there could be a lot or there could be only a few, the key stakeholders, obviously for a loan, the borrower and the lender are the two big ones. Sitting alongside them, would be some sort of a project monitor, overseeing and making sure everything is happening on time, and then there is us. The bank will also have their legal team and potentially other third-party advisors. The borrower will as well have an entire organization and a lot of advisors advising them individually.

Nikolaos: And then, in what ways do the different stakeholders cooperate, or at what stages?

Interviewee 3: So, we all feed in- I suppose if you break it down between the valuer, the project monitor, and the legal team, we are all advising the bank on different areas, but ultimately the advice is on whether they should or should not give the loan. Or, if it's a purchaser, on whether they should or should not buy the asset or invest in it. So, we all interact with each other in that, our valuation is only valid in so far as, there is a legal recourse, should it go wrong, the bank can get their money bank for example. So, to do that, we need to know from the lawyers, what is the relationship and recourse etc. We need to know is the project going to be completed on time, we cannot judge that, it is the project monitor who can weigh in on that. We are all feeding into each other, in a way.

Nikolaos: In this sense, a lot of the input comes both ways in order to complete the valuation, you can't go off on your own.

Interviewee 3: I would say, maybe 80% of it, we go off and do our valuation, on the basis that because it has reached it stage, the legals are probably going to be okay, and it is probably going to be able to be built. However, before we submit in final, we need that 20% of the jigsaw to be filled in, I guess 10% and 10% from those two parties.

Nikolaos: So, then regarding your own team in particular, as part of this jigsaw, as you are conducting, I imagine, valuation as part of a group, how can you with multiple people working on the same valuation, work under the same assumptions and basis?

Interviewee 3: Ok, so there is two things to this. Firstly, within valuation we have standards that we all have to follow, and that is set by the regulator, and we will follow that so that we will follow that to be on the same page, but obviously, they can't prescribe every single scenario, so there is a little bit of flexibility. Part of that comes down to the people

valuing it having experience and knowledge in the market, in order to reflect the market norm, because that is ultimately what we are trying to do. If it went wrong and someone else was going to buy it, we want to look at it through their perspective. Then it is basically, whoever has the most experience in that sector, would be the lead party, who would then manage the valuation. You reference in terms of model – how do we ensure consistency there, again, it comes down to the lead valuers understanding and running the show. Obviously, people will feed into the one who is responsible. Another thing that doesn't necessarily happen in my line of work, but, referencing what other firms might be doing, there is generally a pen holder, and they are the one who is responsible for everything. We do kind of have that, when I am working, me and my boss, I am the one who is generally responsible for all the changes and everything kind of feeds in through one person to ensure consistency.

Nikolaos: So, we've talked about bits and pieces of the process, but could you describe the general process of conducting a valuation, from the moment of identifying the asset, to the point of reaching an end.

Interviewee 3: I suppose the first part is identifying what can or cannot be delivered on the site. Basically, what is the end product going to be, and what is the structure in a more legal sense. What interest are you actually valuing? What are you actually going to buy or what parts are going to be sold to other parties? So, for example, in affordable housing. Then for all asset classes, there is sourcing comparables, to work out the individual value of that asset, and for us that comes down to valuing apartments, and working out an aggregated value. So, you have the gross income, then you take off all associated costs, associated with that development to arrive at end value for that piece of land as it is today, that is kind of the main process I would say in a high-level sense.

Nikolaos: As for the process in a sense of the level of meeting that have to be done with the different stakeholders, or the different stages maybe, so from an analysis point of view, you gave me the picture, but what are the different stages in a sense?

Interviewee 3: The initial stage is kind of reviewing information provided to us, understanding of what is there, and part of it is going to the sight and actually seeing it and understanding what is there. Then, there is formulating your opinion of overall value and running the valuation. In terms of third-party stakeholders and meetings and so on, you might have a kick-off call with the clients or developers or the investor, a lot of times that happens during the sight inspection where you meet them, you discuss, and then it is an ongoing process of discussing wherever there is a need to ask for information from either side. We do not generally have meetings with the other advisors, so, with the lawyers or

whatever. They produce a report independently, and they will send us a copy, and if we have questions, we might call them and ask, but there is no recurrency. It is more ad-hoc.

Nikolaos: Now, I will move to questions that are more technical, about the different variables and estimations within a DCF valuation. So, we talked about a little bit on how you can remain consistent in one valuation, but specifically when it comes to discount rates, cash flow estimations regarding currencies, how can you remain consistent, especially when multiple people are working on the model, and also when valuing assets of different classes.

Interviewee 3: It is a good question, and it is very difficult to do. Because, for instance, the lengths that we will be looking at things, will be different, from our capital markets team. We are more conservative naturally, where in the other side of the business, they are agents who are trying to sell, and they might be a little bit more optimistic about things, in order to try and sell the product. We are being more cautionary, with our inflation and growth assumptions, while they are being more aggressive. So, how do we balance that out? I think, there is two ways: One, we speak to each other, we talk to our research teams and the local teams in the area involved with that, in order to make sure that we all have the same understanding, and any differences in opinion are out there, and secondly, we rely a lot on our research team, who almost give a third-party view, and are separate from the both of us. Connected to that, we look at the evidence on the ground, and therefore rationalize everything within our reporting. So we always have a source, for every variable.

Nikolaos: So then, if I understood correctly, the research team has more of a theoretically refined, or a more correct opinion on what certain levels of inflation should be, and if there are differences between the teams in your company, they exist because of the purpose of valuing, one being more cautionary because of legal reasons, and the other more aggressive trying to sell?

Interviewee 3: Yeah, exactly.

Nikolaos: So, when you meet you understand that maybe, ok, we are more cautious, you are more aggressive, and the unbiased figures lie in the middle?

Interviewee 3: Yeah.

Nikolaos: Then, another more specific question: If you could describe the process of estimating cash-flows for the explicit years, where do you usually draw the historical data from, at what level is the process automated, and are there some adjustments or normalizations that you typically do? I understand that this question is a little bit more stock oriented.

Interviewee 3: So, has Interviewee 2 walked you through how our valuations for income producing assets are structured?

Nikolaos: I believe so, yes.

Interviewee 3: So, basically, we do an income cap approach, so NOI over cap rate, gross value, take off your costs, that is your purchase price. The DCF therefore is a cross-check for us. You are putting in that purchase price, and ultimately, the IRR that that drives, that for us is the output, rather than the input. I mean high-level, we start with gross rent, then we take off costs of operation, to arrive at, we call it NNOI, it is like a before tax cash flow, and then on top of that you've got your cost of purchase in period 0, and the proceeds from sale in period 120 and that therefore then would form, what we would typically call your NOI, and that is what we run our IRR on.

Nikolaos: If I may interrupt, what is period 120?

Interviewee 3: So, we run our cash-flows in a 10-year period, so each period is a month. Commercial might look at it quarterly, but in residential assets, we look at it monthly, payments are generally monthly, you pay your rent each month in advance, right? That is why, we are capitalizing that income. And because of that, rightly or wrongly, our growth, we apply on a monthly basis rather than on an annual basis.

Nikolaos: Then, from what I have talked with Interviewee 2, if you had any historical data regarding macro-economic factors, that would then come from your research team?

Interviewee 3: Yeah, it probably would, or then, we do a lot of tracking the market ourselves. Who is in the investment market, who is buying and selling buildings, what are they trading for, who are the main parties, as well as speaking to both other valuers, and the investors that we are involved with, where is the market going, and trying to track. It is more about forecasting than building up on historical data.

Nikolaos: Perhaps a more stock-oriented question, but is there any adjustment or normalization that you typically do?

Interviewee 3: So, there is one adjustment that we make, and that is a little bit different, it is quite niche. Obviously, if you think about how we value, for the end-value, we are assuming that the asset has got 100% occupancy from the moment it is built. So, it takes a bit of time, to rent all these units, and therefore you have an associated cost, there is an opportunity cost there. So, we do calculate the lost revenue, over that one year, or however long that may be, and deduct that from our investment value, to work out effectively what it would be before it is vacant.

Nikolaos: And I imagine, throughout the years there is also an (x) percentage of turnover rate? Where people leave, it's empty for a while, and you need to adjust for that too?

Interviewee 3: Yeah.

Nikolaos: So, my next question would be, as earning growth rates heavily impact the ultimate value, how much time and effort is dedicated in estimating the growth rates, in your case I assume, rental growth rates, and then, would you say it is more methodical, or between a guess and an estimation?

Interviewee 3: To be honest, I would say it is between a guess and an estimation. So, we will speak to our research team who will have done a lot of research in that area, and they have a very profound rationale, as to why they have said 3% or whatever. Now there is an element of, for every project, we can not put in the time, and forecast everything ourselves, that is why we have a research team, so we have to a certain extent take it at face value. However, there is an element of, ok, you said 3%, but for this city, that would apply if you were in the city center that would apply, but we are on the outskirts, you might not get the same, maybe we will adjust it down. But we would have to have good rationale, to do that.

Nikolaos: So, I am not sure what in real estate you do for the discount rate, I am sure you have a cost of equity, so the question is, what method do you use for the cost of equity, is it CAPM, or something else?

Interviewee 3: So, for us as I've said, the IRR is an output, so we are trying to work, if this were to be purchased, what the result in IRR be, and is that, within a range that we are tolerant to, that we would accept for the type of investor that is coming to buy it? So, we are looking at it through a completely different way. We cannot estimate the cost of equity because we are not an investor. It is very different; we do not know what that would be for everyone. We can not therefore say, oh that is probably going to be bought by a legal, in

general their cost of equity is this much, and therefore it makes sense. It is more of like, if it is a high-risk asset, you would expect a certain range of IRR , and if the range is within that, fine, happy with that. Our funding team for instance, they will use the CAPM model to work out what cost of equity is, the way that you would be referring to.

Nikolaos: So, this has been the main part of the technical questions, I have a few more related to the terminal value. How do you estimate the terminal value, which is the sales price of the asset after 120 periods, but what is the method of estimating it?

Interviewee 3: So, it is the same as the entry price, so Net Income, over cap rate, less purchase costs, and that is how you estimate it. And that would be the exit price, and then we do have sales fees, that we would take off separately, to work out the proceeds from sale.

Nikolaos: My next question is regarding tools, in my thesis I wanted to really work at what tools might be used, or what databases might be used. So, what tools and software are you utilizing when conducting a valuation?

Interviewee 3: Microsoft Excel, and that is probably it. I mean, we do use Argus, but we do not use it for DCF.

Nikolaos: But then, are there more tools for example regarding where you draw data from, or is there any part that you model separately on another software, or that automates a process?

Interviewee 3: No, pretty much everything I do is in Excel.

Nikolaos: Then, have you heard maybe from other experts that they use some other tools?

Interviewee 3: So, we use Argus Developer and Enterprise, more for development appraisals which is different to this. I know that there is various things out there like FactSet, that stock investors might use, but that is obviously not relevant to us.

Nikolaos: Alright, I think that this then concludes my questions! Thank you so much!
Interviewee 3: Best of luck, cheers Niko!