MASTER THESIS

Valuation of intangible intensive firms

Bridging the gap between theory and practice

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EXECUTIVE SUMMARY

This thesis analyses and discusses the applicability of different valuation models to intangible intensive firms within the media and entertainment industry, more specifically the film and TV segment. Although academia has produced an array of valuation models for both simple and complex valuation situations, the difficulty of applying these in the real world diminishes the valuation models contribution to practitioners. Further, it is established that the choice of valuation model to a large degree should be dictated based on the availability of data for estimating input variables rather than solely being dictated by a match of model assumptions and real option characteristics. A majority of real options within the media and entertainment industry display complex and high-dimensional issues, which call for more advanced valuation models to incorporate the value of having an option to expand in addition to these firms' value of the current business activities.

The thesis also sheds light on the issues of accounting standards relevant to intangible intensive firms within the media and entertainment industry, as these have a direct impact on the valuation process from an outsider perspective. Further, the incorrect categorisation of capital expenditures and operating expenditures are expected to have a time difference impact on the financials of the firms operating within the media and entertainment industry.

In addition hereto, the thesis explores a wide-ranging array of literature available with respect to valuation models and aim at providing a high level overview of the academic world on the matter, as well as analyse the popular models along with an application for a case study of Netflix.

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INTRODUCTION

1.1 PROBLEM IDENTIFICATION

The importance of intangible assets has increased significantly over time, as the world has moved its core focus from a manufacturing-based towards a service-based economy (Damodaran, 2009). The investment in intangible assets has continued to increase, and was, in 2010, estimated to account for between USD 800 billion to USD 1 trillion, for the US alone (OECD, 2011). Further, today's enterprises often have intangible assets accounting for more than two thirds of their company value (Shaikh, 2004). The increasing trend of companies deriving their value from intangible assets seems to be set to continue, as more businesses invest in particularly intellectual property to create new products and services. The difficulties with estimating the value of these intangible assets, both due to their nature and how they are handled in accounting, has emphasised the importance of the topic of intangible assets in valuations, especially when considering the sheer money at stake and financial risk either through M&A activity, or simply corporate investment decisions.

These days, most of the fortune 500 companies, who represents two thirds of the US GDP, have developed intangible assets in one way or the other, and several of these firms primarily rely on the intangible assets to generate revenue (Fortune, 2017). Many of these firms would be perceived as intangible intensive firms, and include companies such as Microsoft, Alphabet, Apple, Facebook, IBM, Disney, Times Warner and Netflix among others. Given that we see a large presence of these intangible intensive firms, it comes natural to question the competencies of the existing valuation tools in assigning these companies a fair value. One of the greatest challenges is that intangible assets are treated in many different ways for accounting purposes. Accounting standards may vary across the world and even within any given sector (Damodaran, 2009), especially in terms of recognition and monetary amount of value. According to Damodaran (2009), this will challenge the use of the established best practice discounted cash flow valuation model, as well as any relative valuation model.

It can be argued that, with valuation as a core concept in the decision-making process with regards to investment strategies for investors, the project investment decision of firms and the whole spectrum of mergers and acquisitions, any changes to the theoretical, and thereby practical, foundations to the field must be subject to substantial evaluation. This is partly due to the possible impact on corporate behaviour, and thereby the flow of capital. Finding a common valuation framework, which enables decision makers to get into the details rather than discussing the overall valuation concept and approach, is perceived to ease the process from a practitioner point of view (Petersen & Plenborg, 2012).

The increased presence and acknowledgement of intangible assets in past decades has challenged the established accounting standards and fuelled the increasing gap between book value and market value, affecting some of the key ratios on which firms are typically assessed. This includes an impact on debt ratios, return on assets, price-to-book and similar (Petersen & Plenborg, 2012). The recognition and accounting treatment of intangible assets thereby directly any affects any valuation driven by ratios. Valuing a firm with intangible assets thereby add an additional element of uncertainty in relation to the fair value. Some industries now have a stronger focus on the capitalisation treatment of research and development costs and other similar accounting initiatives taken to adjust accordingly (Damodaran, 2009). Naturally, this is often also seen as being the case for intangible intensive firms. Yet, the challenges relate more to measuring the intangible asset's value post-creation. However, in some industries, the main value is derived from the pipeline of new products, and among these, we typically find the pharmaceutical industry, the software and technology industry, as well as the media and entertainment industry. The commonality for all is that new projects undertaken often constitute a significant monetary size compared to the company, but equally important share in future revenue. The great uncertainty associated with the development of new products, such as a new drug, a new software program or a new series, will also be reflected in the company valuation (Goedhart, Koller and Wessels, 2015).

As a response, at least for the media and entertainment industry, a large consolidation has taken place to ensure diversification. As producing a new series or movie is often a large investment, where returns may first come several years after production, diversification becomes essential to occupy the large market, which only large enterprises have the resources to do, and further this creates a considerable barrier for new entrants on the market (Lutz, 2012).

The media industry is particularly interesting due to the recent launch of companies with an on-demand entertainment streaming services business model, such as Netflix, HBO, Hulu and now even Amazon Prime among several other. Furthermore, these companies have used their in-licensed media content to accumulate a large number of paying members to, partly, fund the production of their own original content only available as an on-demand product on their own media platforms. Latest player include Hulu, who just recently announced the launch of their first own production series. However, competitors, such as Netflix, have over the past years had great success with their own production series including, for Netflix, House of Cards, Orange Is the New Black, Narcos and their latest big bet ‘The Crown’, with a USD 130 million price-tag per season, making it one of the most expensive TV shows ever made (Loughrey, 2016).

To fuel the discussion of fair value, in the context of intangible intensive firms, we have in recent years seen several examples of tech-stocks gaining investor confidence, resulting in rapid increases in stock prices over longer periods. Examples of such include Tesla Inc., whom recently surpassed Ford Motor co. in market cap, despite Ford outcompeting Tesla on most key financials, with net income over the past 5 years amounting to USD 26 billion in contrast to a net loss of USD 2.3 billion (Welch and Hull, 2017). Analysts estimate the development to be a result of Elon Musk’s “Star Power”, which ultimately attract better talent and thereby the ability to outcompete established car manufacturers in the future (Welch and Hull, 2017). Another example is that of Netflix Inc., whose market capitalisation has increased more than 10-fold over the past 5 years (Morningstar, 2017). This is to be seen in the perspective of a rapidly growing subscriber base resulting from international expansion. However, the company is troubled with a growth in license commitments exceeding the subscriber growth and negative free-cash-flows (Collins, 2016). Despite a characteristic CEO and co-founder, technological advances and a team of high-performing talents, the current price reflect an expectation of growing income from the subscriber base by 9 times within the next decade (Stern School of Business, 2015).

In conclusion, it is a simple task to identify these intangible intensive high growth companies, in which the current share price reflects very ambitious expectations for the future, it is much harder for investors to determine whether these companies are overvalued or if they can still be a good investment? The answer to this depends largely on the angle of analysis, the concept of fair value and choice of valuation model. Subsequently, this thesis seeks to investigate whether there is a best practice valuation method, which would capture the value of these intangible intensive firms, and further what difficulties do one face when applying contemporary valuation models. Practically, the thesis seeks to investigate, from a theoretical approach, the applicability of the discounted cash flow model, but also more specifically option modelling using a case study in Netflix. The thesis will attempt to move from theory to practice, enabling a discussion of whether there is a valuation model, or a combination of valuation models, which could more accurately reflect the company value.

1.2 PROBLEM STATEMENT

This thesis will have an explanatory focus, and, acknowledging the difficulty and complexity of performing a thorough valuation of an entire intangible intensive firm from an outsider perspective, it will seek to determine if there is a valuation ‘best practice’ for intangible intensive firms within the media and entertainment industry.

The thesis builds on a hypothesis that applying only the DCF model and fundamental financial and strategic analysis is not enough to explain the high value of intangible assets, and therefore a combination with option models is needed to capture the remaining value. The scope of this paper is to provide an overview of the main academic perspectives of valuation of intangible intensive firms and to identify the challenges practitioners are faced with. This will be done through model testing of a case example, Netflix, allowing for a greater level of detail. Gaining knowledge from an empirical test of valuation concepts based on a publically traded firm may also add value for private companies or for managers holding private subsidiaries engaged in the media and entertainment industry.

The aspirations of what we intend have yielded the following problem statement:

To what extent can contemporary valuation models explain the fair value for an intangible intensive firm, in the context of the media and entertainment industry?

1.2.1 RESEARCH QUESTIONS

To focus the thesis and foster the necessary insight needed to answer the problem statement, it is essential to narrow the scope, therefore the following research questions have been included, addressing a fundamental issue of the problem statement:

- Sub-question 1: Do the existing valuation tools provide the necessary framework to achieve a fair value for intangible intensive firms within the media and entertainment industry?
- Sub-question 2: What considerations should be made when assessing the assumptions, to which the model of choice is subject to?
- Sub-question 3: What are potential drivers behind the differences in the estimated value and market observed value (if any)?

1.3 METHODOLOGY

This section will elaborate and clarify the structure and research methodology for this thesis, in the pursuit of answering the research question brought forth and thereby the problem statement. Firstly, an elaboration of the thesis structure will be provided, thereafter a clarification of the research approach, data collection and delimitations will be laid out to improve the arguments and choices made throughout the thesis.

1.3.1 STRUCTURE

The thesis is structured into four parts; each part follows on from the previous part. Figure 1 below illustrates the structure.

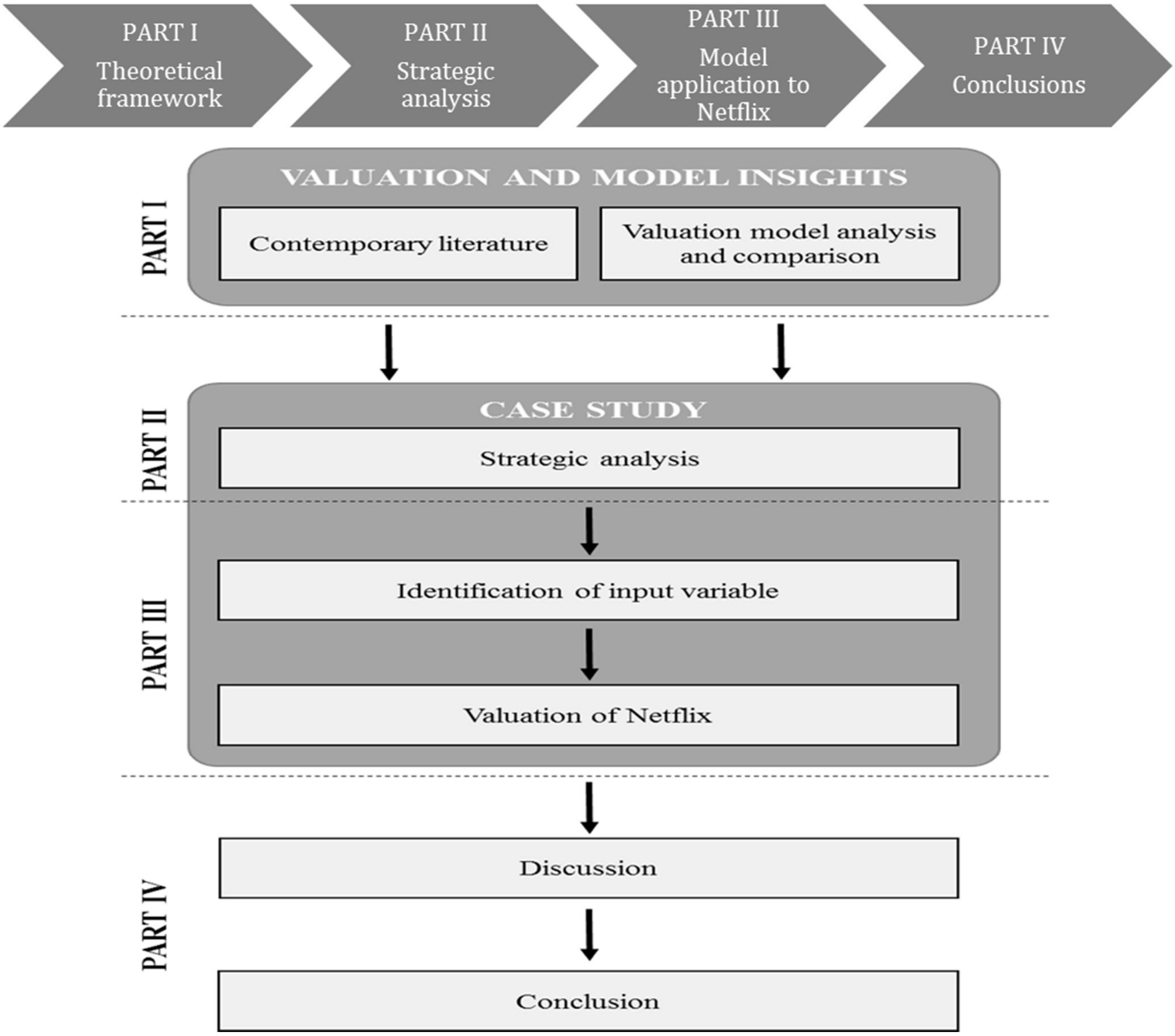
Part I develops and establishes the theoretical foundation through, firstly, an exploration of intangible assets and the existing valuation models. Thereafter, the valuation frameworks will be analysed and compared to assess the utility of the models. By critically assessing the existing models, it will be possible to clarify the conceptual framework embedded in the models, thereby providing insight into which can be useful in the valuation of intangible assets.

Part II provides a strategic analysis, which includes an environmental analysis as well as a strategic company analysis. This is necessary to provide the insight essential to determine the required valuation inputs and assumptions.

Part III will seek to practically apply the relevant models on Netflix, based on the model analysis and conceptual understanding from Part I, and the in-depth understanding of the media and entertainment industry and Netflix provided via the strategic analysis in Part II. The central focus will be on how to determine the inputs and assumptions, as well as the results obtained.

Part IV will discuss the findings from Part I and Part III, both theoretical and practical finding. The practicality and implementation of the models will be discussed and reflected upon, and thereby answering the research questions and problem statement.

Figure 1 – Structure of thesis



1.3.2 RESEARCH APPROACH

The following will provide a clarification of our research approach. It is perceived as particularly beneficial to supplement any qualitative analysis of valuation models, as theoretical concepts, with that of empirical testing through the approach of a case study. The thesis topic will therefore be assessed through a two-part analysis.

1.3.2.1 DATA COLLECTION

The scope of the thesis is to evaluate the usefulness of existing valuation models when determining the value of intangible assets, more specifically within the media and entertainment industry. The main data source is publicly available information, thus we refrain from performing primary empirical data gathering. Primary data could have provided additional, and potentially better, insight into the industry, especially with technological advances, as well as the types of decisions managers may face.

1.3.2.2 QUALITATIVE DATA ANALYSIS

The first part of the two-part analysis is composed of a qualitative analysis of the most relevant available academic theories and concepts regarding valuation models derived from a literature review of the current field of research. This is to enable the identification of the models that, in general, receives the greatest level of recognition, as well as identify supplementing models derived from the otherwise most fundamental valuation models. The qualitative analysis serves the purpose of highlighting potential shortages, limitations or particularly advantageous aspects, which the concepts under analysis might display in the context of intangible intensive company valuation within the media and entertainment industry. Furthermore, the qualitative analysis allows for a screening and selection of a few models that will function as inputs to the second stage, namely that of the quantitative testing through the use of a case study.

In addition to the analysis of valuation models, this thesis will also rely on qualitative data input, in the form of market analyses, expert opinions and insights, and news to gain a greater insight into the world of the media and entertainment industry, and what challenges industry participants may face that could impact the valuation of media and entertainment firms.

In short, the combination of qualitative data analysis should help extract valuable information in an inductive manner by limiting the scope, increase reliability of input estimates and enhance sense making from the results of the second stage.

1.3.2.3 QUANTITATIVE DATA ANALYSIS – THE CASE STUDY

The second stage include an empirical case study approach. This is to accommodate the pitfall of simply scrutinising valuation models in an academic perspective and highlight assumptions, which would often be required for practitioners to make. Furthermore, a case study approach will supplement the otherwise generic analysis performed, and allow this thesis to examine and extract learnings from otherwise contextualised and specific events in a quantitative manner. It enables a non-academic context to be reference for testing, altering or expanding the theories under analysis. Through this, it is the aim to bridge contextualised findings, through a discussion of the theoretical frameworks for valuation, into academia, highlighting particular challenges that may otherwise have been disregarded. This serves the purpose of applying theories to reality in the pursuit of studying the research topic, as model analysis can quickly become very abstract due to the high complexity of real world situations.

1.3.2.3.1 THE CASE STUDY – INTRODUCTION TO NETFLIX INC.

The high level of intangible asset utilisation, along with high growth rates, troubling free cash flows and a sky-high share price, has made Netflix the ideal case in the pursuit of highlighting the application of valuation theory. All of these features influence the assessment of a company's fair value.

Netflix Inc., founded in 1997, is a US based, publicly traded company providing online streaming of digital media and entertainment content to its members in return for a monthly subscription fee. The membership gives customers unlimited access to stream any of the available content. The database contains numerous movies, series, documentaries and specials.

Netflix initially, in 1997, operated as an online DVD rental company, first introducing subscription services in 1999, which allowed customers unlimited rental of DVDs for a monthly rate. By 2000, Netflix had developed a personalised recommendation system, based on the individual subscriber's ratings. From here, the company grew and reached 4.2 million members by 2005. However, it was not until 2007 Netflix launched the streaming services, for which they are known today. Initially, all the content available on the streaming site was licensed or acquired from respective IP owners, however, as the company grew, Netflix started funding its own production of content, marketed under the Netflix Original brand. At the same time, around 2012, Netflix started its internationalisation process. Today Netflix is available in 190 countries, has more than 100 million members, who stream more than 125 million hours of digital content on a daily basis (Netflix, 2017a).

1.3.2.4 DELIMITATION

To ensure practicality and sheer size of the theoretical sphere, it has been necessary to narrow the focus of the thesis, especially when applying the case study. The scope is still comprehensive, as valuation models are applied on the case of Netflix, with a discussion of all the complexities that may follow. It especially the complicated nature of real option models that make it necessary to limit the breadth of valuation models used in the case study, in the attempt to ensure specific conclusions that can be used practically, over superficial statements.

Furthermore, going forward in this thesis, any reference to the media and entertainment industry will only cover the film and TV market within the industry, more specifically the online distributers of visual media. By limiting the scope, we are able to narrow the focus and draw more specific conclusions, although they will only be of relevance for the companies operating in this very specific market.

1.3.3 LIMITATIONS

The methodological approach is guided by quantitative data testing as well as qualitative data collection. Through this methodological approach, the thesis mainly deals with contextualised information, which pose a clear limitation to the findings of this thesis to the industry in question, and for some results down to the firm level. The findings should thereby not only be understood in the context of intangible intensive firms, but further limited to media and entertainment firms.

Due to the scope of this thesis and the limitations of length and size, the empirical test has been based on a selected case company to highlight some key insights to bring forward. This also constitute a limitation of the findings, which may require a broader, randomly selected basis for analysis in order to bring forward more statistically significant findings.

PART I – THEORETICAL FRAMEWORK

This section provides the theoretical framework that will be applied in the case study. Firstly, a thorough literature review will be provided, exploring the field in research to gain an understanding of contemporary models. Thereafter the models will be analysed to determine which will be most useful. This is essential to narrow down our scope of models that will be applied to the case study, so meaningful conclusions that can be used will be drawn.

2.1 LITERATURE REVIEW

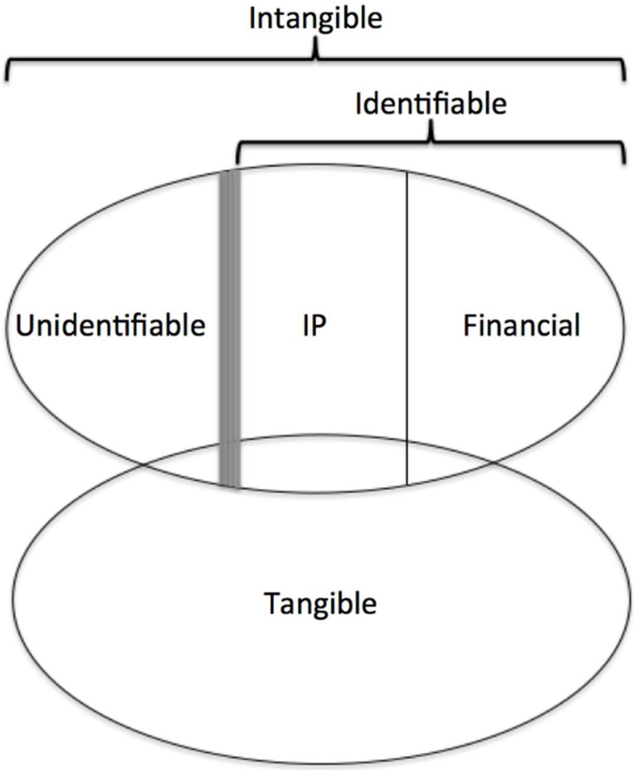
The following section will explore some of the fundamental literature present today on the topics of intangible asset and general valuation models. The section take is departure in intangible asset theory and continue into the various valuation methodologies.

2.1.1 INTANGIBLE ASSETS

Through the research for this thesis, it has become clear that a majority of the existing intangible asset definitions take a residual approach from general asset definition. Among the general asset definitions, Oxford Dictionaries defines an asset as "*an item of property owned by a person or company, regarded as having value and available to meet debts, commitments, or legacies*" (Cohen, 2005). This broad view of assets is in common with that of the Financial Accounting Standards Board, who defines an asset from an accounting perspective as a "*probable future economic benefits obtained or controlled by a particular entity as a result of past transactions or events*" (Cohen, 2005).

Taking the concept of a general asset from above and making it more specific, we find that intangible assets are commonly defined as "*economic resources that have no physical presence*" (Investopedia.com, 2017). Similarly, in '*Intangible Assets: Valuation and Economic Benefits*', Cohen defines intangible assets by applying a comparison, stating that "*The kind [of resources] that we can see, feel, taste, buy, sell, and so on are, of course, called tangible assets. Everything else is an intangible asset*" (Cohen, 2005). Despite the initially informal definition of intangible assets set forth by Cohen, he continues to provide more in-depth characteristics of intangible assets. Figure 2, seen on the next page, depicts the general classification of intangible assets into identifiable and unidentifiable intangible assets (Cohen, 2005).

Figure 2 – Intangible asset classification



Source: Cohen, 2005, page 10

2.1.1.1 IDENTIFIABLE INTANGIBLE ASSETS

Identifiable intangible assets can be split into two core groups, intellectual property and financial intangible assets. Below, each of the groups will be explained in further detail, and, as can be seen, there are a number of subgroups within intellectual property.

2.1.1.1.1 INTELLECTUAL PROPERTY

Intellectual property is the identifiable assets that have some degree of legal protection. Within this group, we find patents, copyrights, trademarks and brands, trade secrets, and other identifiable intangible assets that are considered identifiable intellectual property (Cohen, 2005).

Patents are a form of legal registration of ownership of a process, technology, design, or similar that can be considered novel, non-obvious and useful. Applying for a patent is often costly and can take up to three or more years. When registering the ownership of e.g. a technology, the company must disclose the details of the technology, thereby risking competitors designing a product or service around the existing patent. Furthermore, to enforce the protection, the patent owner must file a lawsuit against any suspected unauthorised use of the patented asset (Cohen, 2005).

Copyrights are the protection of creative or written assets such as music, books, illustrations, television programmes, film broadcasts and software code. Unlike with patents, the registration of a copyright is not subject to any review to identify possible violations of already copyrighted materials. As with patents, the copyright owner must file a lawsuit against any suspected unauthorised use of the copyright, hereunder also piracy actions such as illegal download of digital versions of movies and TV series, among others (Cohen, 2005).

Trademarks and brands. The registration of a trademark can provide some legal protection, however, it potentially only constitutes part of a brand value. Trademarks are, like copyrights, protected, while a brand on the other hand, although potentially large in economic commitment and benefit to a firm, is not legally protected in other terms than through the registered trademark. Yet, imitating a value proposition, which consumers associate with a given brand, can be difficult (Cohen, 2005).

Trade secrets. Unlike copyrights and patents, trade secrets are information not publicly known, and may typically constitute value for an outsider to the owner, namely competitors. Further, the information may not need to be useful, non-obvious or novel. Hence, unlike with patents, copyrights, trademarks, and brands, many individuals/firms may hold the same trade secrets, without the knowledge that others having said information. Examples of trade secrets include customer lists, recipes, technology and knowhow. If it is evident that the owner has taken an effort in keeping something a secret, any disclosure can lead to the owner rightfully seeking compensation for damages, however, legislation on the matter is complex and often contextual in practise (Cohen, 2005).

Other identifiable intangible assets. A company or person may own many other forms of intangible assets. Two of the more common one are Research & Development (R&D) and Software code, both of which can be very difficult, if not impossible, to protect through registrations or patents. In many ways, they may be like trade secrets; however, this need not be the case (Cohen, 2005).

2.1.1.1.2 FINANCIAL INTANGIBLE ASSETS

Financial intangible assets, more commonly known as financial intangible liabilities, exist in most firms. However, in the context of valuations of firms, they are of less interest, as liabilities and assets are net propositioned. Yet, in the valuation of firms within the banking industry, they may constitute a greater influence on the valuation (Cohen, 2005).

2.1.1.2 UNIDENTIFIABLE INTANGIBLE ASSETS

Unidentifiable intangible assets may be just as important as identifiable intangible assets, but are difficult to identify from an accounting perspective. This group of intangible assets includes management or more generally any human capital, and can come in many various sizes and shapes.

Often, much like tacit knowledge, the firm has difficulties in specifying why they achieve e.g. higher efficiency than competitors may do, and therefore there is great difficulty in patenting the relevant technology or process knowledge. Yet, customer lists can often also be classified as an unidentifiable intangible asset, due to the difficulty in deriving the exact economic value from the specific asset.

Goodwill is also a mentionable unidentifiable intangible asset, often valued through a residual approach for accounting purposes, most commonly in connection with the acquisition of a firm at a price higher than the underlying book value. It is important to know that customer lists and other intangible assets may often appear under goodwill from an accounting perspective. The value of goodwill can therefore quickly become a mix of economic benefit from several intangible assets (Cohen, 2005).

2.1.1.3 OTHER CONSIDERATIONS

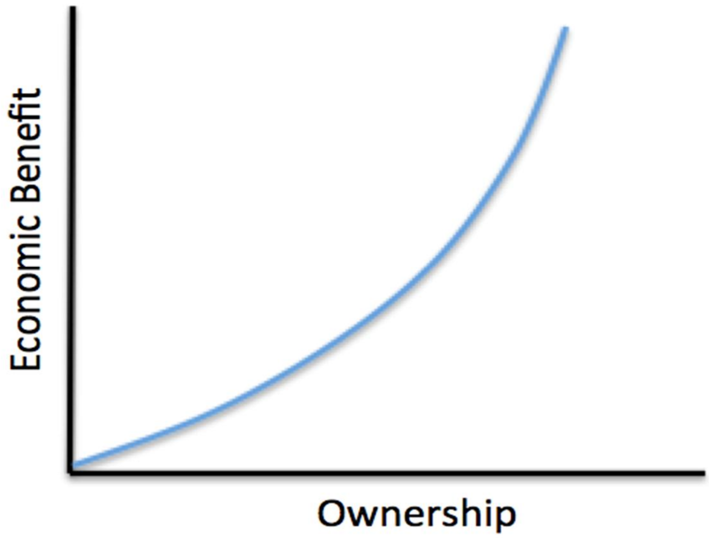
The Grey area in Figure 2 covers what Cohen defines as proto-assets. An intangible asset can be considered a proto-asset when some ownership can be established and an associated economic benefit results from the intangible asset. However, the asset falls outside what is considered an intangible asset from an accounting perspective, and therefore the asset classifies as an unidentifiable intangible asset. Examples of such proto-assets is the before mentioned management of a firm or firm performance culture and similar aspects of a company’s critical success factors (Cohen, 2005).

The Overlap between intangible and tangible assets is what Cohen defines as “*sticky intangible assets*”. These may be assets associated with tangible goods, e.g. operational knowledge of a specific type of aircraft or manufacturing machinery. It may also constitute patents in relation to the development of that very aircraft for the manufacturer, or even tangible assets provided as security for financial intangible liabilities (Cohan, 2005).

Non-assets are certain benefits a firm may have achieved, but are not considered an asset at all. For instance, this may include market share, or the competitive advantage in itself.

The value of intangible assets should always be seen in the light of the characteristics that the underlying assets exerts, as intangible assets are often information and protection sensitive. However, it is inferred from above that the measurement issues of unidentifiable assets and the incompleteness of the residual approach taken towards the estimation of goodwill, from an accounting perspective, often further complicates the value of an intangible assets (Cohen, 2005). In the perspective of intangible intensive firms, this only makes the issue of value more complex, however one thing that is certain is that as claimed ownership increases the economic benefit, and thereby the value, increases as depicted below in Figure 3.

Figure 3 – Ownership and economic benefit relationship



Source: Cohen, 2005, page 63

2.1.2 THE PERCEPTION OF VALUE

In many ways, as long as mankind has been around, some form of trading has existed, and it has, along with increased travelling, evolved and expanded across borders and with a wide range of goods. One of the most famous trading routes in history is known as the Silk Road, which created a multinational marketplace for Chinese silk, olives and wine from the Mediterranean, spices from Arabia and many other goods (Unesco, 2017). The study and knowledge of how markets and market participants value goods and services has existed for millenniums. An example being that of the Chinese silk producers, who as early as year 2,700 BC understood the value of their knowhow, in relation to silk production, and spent substantial resources guarding this knowledge (Unesco, 2017). However, it is not until the 2000th century and the 1929 Wall Street Crash that the academic realm of valuation started to accelerate. It was in the aftermath of the 1929 crash that investors and academics started to question the concept of firm valuation and fair value as seen with John Burr Wiliam's and Irving Fisher's contribution to the discounted cash flow model known today (William, 1938).

In 1931, John Maynard Keynes stated, "*There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world*" (Damodaran, 2006), and this has been cited on several occasions since. Keynes statement in many ways depicts his perception of value as being a result of behavioural factors, such as expectations and market behaviour, rather than the underlying financial fundamentals. This view is much to the contrast of that presented by the Tobin's Q ratio, developed by the 1981 Nobel Prize recipient James Tobin (Tobin, 1969). It was originally from the macroeconomic perspective that the Q ratio was developed, however, the ratio has later been applied to various concepts due to its powerful, yet simple, framework. In essence, the ratio states that the fair value of any asset must be equal to their replacement cost, as shown in below in equation:

$$q = \frac{Market\ value\ of\ installed\ capital}{Replacement\ cost\ of\ capital}$$

By virtue of relation, any ratio value in the zero to one interval is considered as undervalued, whereas any ratio value greater than one is considered as overvalued. Despite the concept not originally being developed for the purpose of assessing and individual firm's value, it has been generally accepted that the firm's book value can function as a proxy for the replacement value. Hence, the economic intuition behind Tobins Q ratio can be applied to the price-to-book ratio (Investopedia, 2017).

Unfortunately, the book value, more often than not, does a poor job in explaining the observed market prices (Damodaran, 2009). This is particularly visible with intangible intensive firms, where numerous complications can be seen, especially due to the widely different accounting standards applied around the world. Simple capitalisation of R&D costs related to an intangible asset can to some extent bridge; however, it often fails to value flexibility, control and first mover advantages that the intangible asset may establish (Damodaran, 2009).

2.1.3 TRADTIONAL VALUATION APPROACHES

From the perspective of traditional valuation theory, there are three possible approaches that can be used to estimate the value of a firm: (i) the market approach, (ii) the income approach, or (iii) the cost approach (Cohen, 2005).

The dilemma of understated value on the balance sheet, compared to observed market prices, is closely linked to the cost approach, also known as the asset valuation approach. In short, the cost approach departs in the balance sheet and deducts any liabilities to reach the equity value. To complete the valuation, one must adjustment for any off-balance sheet assets. Theoretically, this approach functions, however, in practice this may turn out to be rather difficult. The approach is closely linked to the concept of replacement costs, as set forth by Tobin, where, in an ideal world, the balance sheet would take into account any assets that constitute a value. For many tangible assets, it is fairly straightforward, as the purchase price would be booked on the balance sheet and then a pre-determined depreciation scheme would be utilised. Alternatively, the market value of the asset may often be available, e.g. for commodity reserves such as oilfields or similar. In general, the more unique an asset, which the company controls, the more challenging this approach becomes, e.g. patents for drugs, trademarks, copyrights to music and movies and similar intangible assets. The only initiative used in practice to bridge this balance sheet value gap, is the capitalisation of the expenditures associated with the purchase or development of such intangible assets (Damodaran, 2009). As a direct result, the approach is generally not seen fit for some industries, whereas others employ the cost approach more frequently, e.g. the real estate industry, where replacement costs are often more transparent.

On the contrary, the market approach departs in comparable transactions or firms. The most common form of the market approach is that of relative valuation, where key ratios, whether industry or firm specific, are compared. The approach assumes that markets are equally inefficient (or efficient) and that comparable firms should therefore be achieving the same financial performance in relative terms. Examples of commonly used ratios include the price-to-book value, price-to-earnings and price-to-revenue. Due to the simplicity, and vast data availability in most cases, the relative valuation approach is a majority of the time part of a firm valuation in practice (Petersen & Plenborg, 2012). Yet, it is rare for a valuation, using comparable ratios, to stand on its own, as a trade-off between ease of use and accuracy is being made. Often finding a comparable firm is difficult, and at times impossible, combined with industry standards possibly being misleading for a single firm. After all, no single firm in an industry may realise what is considered the average for its industry. Further, introducing unique intangible assets may further add to this complication.

The last approach, the income approach, is perhaps the most commonly valuation approach undertaken by practitioners today (Petersen & Plenborg, 2012). At the very core of the income approach is the discounted cash flow model ("DCF"), as initially set forth in John Burr William's *The Theory of Investment Value* from 1938 (William, 1938). Today, the more common approach towards a discounted cash flow model includes aspects of the dividend discount model, which accounts for the continuous time cash flow, also referred to as terminal value, resulting from the estimation of a long-term growth rate as developed by Myron J. Gordon (Petersen & Plenborg, 2012). One of the great advantages of the DCF model is the simplicity and intuitive setup, allowing practitioners to modify discount rates, growth rates and free cash flows in the forecast period with ease. Thereby, valuators can simulate value sensitivity towards macroeconomic developments, changes to revenues, working capital or similar. Further, as a valuation is often made from different perspectives, e.g. buy-side and sell-side, the general acceptance and understanding of the discounted cash flow model enables practitioners to engage in details quicker than if the valuation is a result of more exotic valuation approaches, e.g. contingent claim valuations. Yet, there are different versions of the DCF framework, such as one which takes into account the flow of free cash flow to equity holders only, or for instance the adjusted present value version that take into account tax shields on interest bearing debt. None of these versions are considered to be substantially different from that of the fundamental DCF model.

Some of the inputs that drive the majority of the value, resulting from a DCF analysis, are the free cash flows, growth rates and the discount rates. Typically, the weighted average cost of capital ("WACC") is perceived as an appropriate estimate of the discount rate. In simple terms, the cost of equity and cost of debt are weighted by the respective share of financing the assets. In the past, several researchers have developed models to estimate the systematic risk in relation to the cost of equity. The more popular models include the Capital Asset Pricing Model ("CAPM") and the Fama-French Factor models ("FFM"), both can be escalated in terms of analytical substance and complexity. Nonetheless, recent studies suggest that for long-run capital budgeting, a simple risk-neutral term structure may be equally as good (or bad) in predicting the rates of return on risky assets (Welch and Levi, 2013).

2.1.4 VALUING FLEXIBILITY

Despite the DCF model's popularity, academics have pointed out several substantial shortcomings, which could be considered critical when valuing a firm. The main shortcoming is the model's inability to assign value to the flexibility that may be available to managers (Stern & Chew, 2003). Examples hereof could be the value of delaying investments until more favourable market conditions apply, to expand the investment if the outcome turns out to be particularly beneficial, or to simply cut investments at an early stage if not. In turn, some researchers have highlighted that option models often overestimate the value and suffer underestimation errors to the input variables (Van Putten & MacMillan, 2004). The discussion has been prominent in the theoretical realm for a longer period, with literature all seemingly indicating the difficulty of bridging the theoretically acceptable concepts to the practical approach.

At the core of option models, it can be seen that value today is driven by decisions to maximize value in the future, which will depend on new information. In other words, it is an option, not an obligation, to pursue a monetary upside potential, but with the possibility of limiting losses in terms of further investments based on new information. Most theories currently available deal with option pricing from the perspective of a financial derivative instrument valuation. One such theory is the Black-Scholes framework from 1973, which was modified by Merton (Haug, 2007).

The following subsections will provide a high-level overview of the different option types and features of the most commonly traded options followed by input on how this converts into the world of real options, as well as how to value these kinds of options.

2.1.4.1 VANILLA OPTIONS

Vanilla options take their origin in the very basics of option modelling, referring to the rights to buy (call) or sell (put) an underlying asset at time T at strike price X. There are two categories of options;

(i) European options, where ones rights can only be exercise *at* a specific time T, and (ii) an American option, where ones right can be exercised through the entire period *until* time T. Common for the Vanilla options as financial derivative instruments are their Over-The-Counter ("OTC") trade characteristics. These options are widely used for most traded stocks, currencies and commodities and are strictly regulated (Haug, 2007).

2.1.4.2 EXOTIC OPTIONS

Exotic options differ in the sense that they most often are not traded OTC, and tend to be subject to less regulation. Further, they come in many shapes and sizes, taking its departure in the vanilla option concepts. Examples of exotic options are (Haug, 2007):

- ***Compounding options*** is when the underlying option is another option. At the first lag, this allows for the combination call-put / call-call / put-call / put-put, as well as Americans on Europeans and vice versa.
- ***Barrier options*** are similar to the basic vanilla option, but with a barrier before which the option is not active. It can take both the form of a knock-in or a knock-out option based on the barrier construction.
- ***Asian options*** is when the strike price is calculated at expiration date as an average of the period leading up to the expiration date.
- ***Basket options*** is when the underlying asset is a bundle of assets with a weighted average strike price.
- ***Rainbow option*** is a bundle of options, which must all move in the expected direction before exercising becomes profitable. Thereby, all underlying options must be 'in the money' to exercise the rainbow option.
- ***Bermuda options*** is when there is a recurring exercise date at a fixed interval, e.g. monthly or similar.
- ***Quanto option*** is an option settled in a different currency than the underlying asset.

Exotic options are by no means limited to the above and can, in principle, take any form as long as two parties agree to the contract.

2.1.4.3 REAL OPTIONS

The discussion of real options accelerated in the1980s and 90s academic world, with an increase in books and articles released aimed at the practitioners, to increase awareness of these real option models (Stern & Chew, 2003). Despite taking its departure in the financial option models, real option models are often highly differentiated in practice, to customise the models for the context of an individual company. Further, implementation of option modelling more commonly occurs on a project level. According to the PwC consultants Alex Triantis and Adam Borison's study of best practices of real option implementation, only few industries, such as the life science industry and oil & gas industry, have shown particular interest in real options (Stern & Chew, 2003). They further classify a firm's dependence upon the real option concept into the following:

- *A way of thinking*: the concepts are employed primarily as a way to communicate rather than making decisions. The general framework of the option to delay, expand, abandon etc. is known, however, it is only indirectly put in practice with no calculations.
- *An analytical tool*: the concepts are employed as a way to value projects.
- *An organisational process*: the concepts are employed as part of a broader process for management to base their decisions upon.

In practice, these real option models mainly revolve around simple structures such as the option to expand, delay, abandon and similar (Stern & Chew, 2003). Nonetheless, it is not difficult to imagine a situation, in which the correct setup would in fact call for a basket option, where the underlying asset is composed of several assets or development phases in the context of intangible assets, or a case in which compounding options are in place.

2.1.4.4 OPTION VALUATION

Having established that options are often embedded in projects, it becomes increasingly important to look at how one can price a given option. Most pricing models that concern the valuation of options have been developed to price the financial derivative instruments, mentioned earlier, as either vanilla options or exotic options.

In its very essence, an option pricing model can be defined as "*a mathematical algorithm or formula by which the theoretical fair value of an option may be calculated*" (Katz & McCormick, 2005). In extension to the model, theorists are often concerned with the so-called Greeks, which can be defined as "*the partial derivatives of the pricing model's output (theoretical fair premium) with respect to its inputs*" (Katz & McCormick, 2005). Table 1, next page, gives an overview of what, in practice, is considered as the Greeks.

Table 1 – The Greeks

Partial derivative with respect to	Description
Delta	Represents the hedge ratio, which measures an option's sensitivity to movements in the underlying asset.
Gamma	Represents the rate at which Delta changes with movements in the underlying asset.
Theta	Represents the rate at which time decay erodes value.
Vega	Represents the sensitivity towards volatility changes.
Rho	Represents the sensitivity towards interest rates.

Regardless of the model choice, value of the underlying asset, volatility, strike price, time to expiration, risk-free rate and dividends tend to be considered determining factors for the output value of most models (Stern & Chew, 2003). This goes for both real options and financial options. Based on the above table of partial derivatives with respect to 'the Greeks' of option pricing, the impact for each determinant can generally be perceived as shown below in Table 2 (Stern & Chew, 2003).

Table 2 – Effect of input changes

Factor	Effect of call option	Effect on put option
Increase in value of underlying asset	Value will increase	Value will decrease
Increase in volatility	Both become more valuable when volatility increases	
Increase in strike price	Value will decrease	Value will increase
Increase in time to expiration	Both become more valuable when time to expiration increases	
Increase in risk-free rate	Value increases	Value decreases
Increase in dividends	Value decreases	Value increases

Few popular models account for a majority of the pricing methodologies implemented in practice (Stern & Chew, 2003). These primarily constitute of the Black-Scholes-Merton and the Cox-Ross-Rubinstein binomial model in the form of finite tree models. The below subsections will, in short, outline the main characteristics of each model before exploring relevant theory with respect to measuring volatility in general.

2.1.4.4.1 COX-ROSS-RUBINSTIEN BINOMIAL MODEL

The binomial model was first introduced in 1979 by Cox, Ross and Rubinstein ("CRR") and is categorised as 'Trees and finite difference methods'. The core concept of the binomial model is to construct scenarios through a binomial tree structure. The model is widely used to value American options on stocks, futures and currencies among others (Haug, 2007). In contrast to closed-end formula models, this form of modelling can with more ease be set-up due to the intuitive manner in which it is constructed. Mathematically, the Binomial model for a European call option can be defined as seen in the equation below (Haug, 2007):

$$Call: c = e^{-rT} \sum_{t=0}^{n} \left(\frac{n}{i!\,(n-i)!} \right) p^i (1-p)^{n-i} \, max\left[S u^i d^{n-i} - X, 0 \right]$$

Where nodes in the binomial tree are represented as (j, i) and the corresponding probability of reaching node (j, i) is given by $\frac{j!}{i!(j-i)!} p^i (1-p)^{j-i}$ for which the following can be defined:

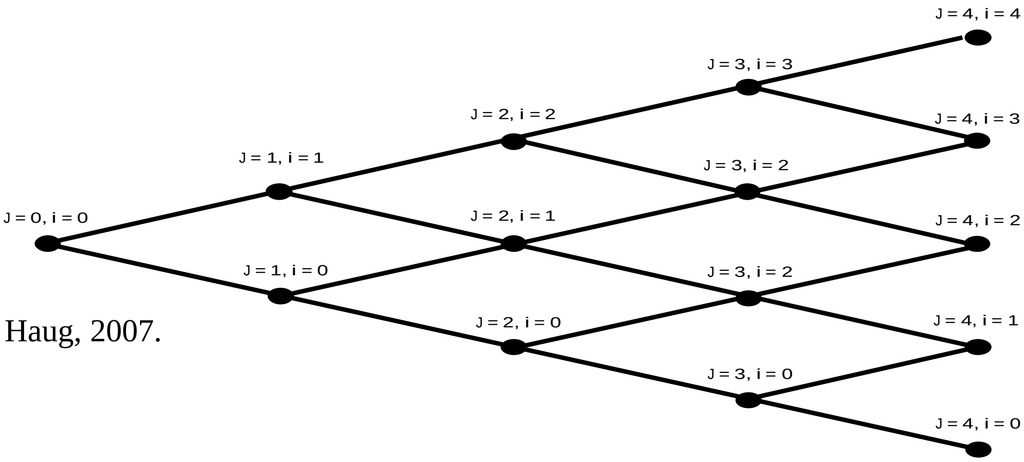
$$Up\ factor: u = e^{\sigma\sqrt{2\Delta t}}$$

$$Down\ factor: d = e^{-\sigma\sqrt{2\Delta t}} = \frac{1}{u}$$

$Probability\ of\ increase: p = \frac{e^{b\Delta t} - d}{u - d}$, where b is cost of carry.

In the above setup, S_t is the exercise price, and X the strike price. Typically, in practice, the above mode will be constructed in the form of a grid, such as the one illustrate in Figure 4 below.

Figure 4 – Binomial tree example



Source: Haug, 2007.

2.1.4.4.2 EXPANDING ON THE CRR BINOMIAL MODEL

Various models share the basic concept of the CRR binomial model, but in an extended, more advanced, or modified version. Examples hereof include (Haug, 2007):

- ***The Rendleman Bartter binomial tree***, which sets the probability equal to 50% as a standard. This model is more commonly used as a Stochastic one-factor model for the valuation of short- term interest rate derivatives.
- ***Leisen-Reimer binomial tree***, where the up and down factors are defined slightly different, to center the tree around the strike price, making it more efficient in pricing standard options.
- ***Trinomial trees***, which allow for more flexibility with its triple-path set-up in comparison to the dual-path setup of the binomial model. This mainly impacts the up and down factors, by introducing a middle factor, as can be seen in the equations below:

$$u = e^{\sigma\sqrt{2\Delta t}}$$

$$d = e^{-\sigma\sqrt{2\Delta t}} = \frac{1}{u}$$

$$P_u = \left(\frac{e^{\frac{b\Delta t}{2}} - e^{-\sigma\sqrt{\frac{\Delta t}{2}}}}{e^{\sigma\sqrt{\frac{\Delta t}{2}}} - e^{-\sigma\sqrt{\frac{\Delta t}{2}}}}\right)^2 \text{, where b is the cost-of-carry}$$

$$P_d = \left(\frac{e^{\sigma\sqrt{\frac{\Delta t}{2}}} - e^{\frac{b\Delta t}{2}}}{e^{\sigma\sqrt{\frac{\Delta t}{2}}} - e^{-\sigma\sqrt{\frac{\Delta t}{2}}}}\right)^2$$

$$P_m = 1 - P_u - P_d$$

  This setup tends to be more efficient for exotic options than vanilla options, and the flexibility will potentially reduce the amount of steps needed in comparison to the binomial model.

Furthermore it is worth mentioning that many of the exotic options, mentioned earlier in this literature review, can also be modelled using the binomial or trinomial approach, and the framework can be adjusted to account for more than one underlying asset to value certain exotic options.

2.1.4.4.3 BLACK-SCHOLES-MERTON MODEL

Moving away from the finite tree set-up approaches, we find the Black-Scholes-Merton model, which, in continuous time, the binomial model converges to, hence, the Black-Scholes-Merton model is not something completely new in comparison to the binomial model. However, the model is in its essence limited to the pricing of European vanilla options, with a very simple framework. However, this simplicity does come at a price. The setup is less intuitive and has been criticised by some for being a black box of formulas for practitioners, who simply estimate some input variables and rely on the output without necessarily engaging in any deeper investigation of the actual model generating the output. Further, the model can in its basic form only value European options and does not allow for any flexibility in terms of, for example, fluctuating volatility estimates. Still, the framework, which builds on the no-arbitrage argumentation, is considered a well-founded in theory. The Black-Scholes-Merton framework for call and put options is provided in the equations below:

$$c = SN(d_1) - Xe^{-rT}N(d_2)$$

$$p = Xe^{-rT}N(-d_2) - SN(d_1)$$

Where,

$$d_1 = \frac{Ln\left(\frac{S}{X}\right) + \left(r + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{Ln\left(\frac{S}{X}\right) + \left(r - \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = d_1 - \sigma\sqrt{T}$$

In which S = stock price, X = strike price, r = risk-free rate, T = time to expiration, σ = volatility of the underlying stock price and N(x) is the cumulative normal distribution function (Haug, 2007). The above framework requires less computational effort than the previous mentioned models, which may also partly be the reason behind its relatively widespread application by practitioners (Katz & McCormick, 2005).

2.1.4.4.5 MONTE CARLO SIMULATION

To enhance accuracy in the modelling with respect to probability as well as allow for flexibility in the pricing model, one could look towards the Monte Carlo Simulation method. In its originality, the Monte Carlo method was not developed for the purpose of pricing derivatives, but merely to estimate movement in atoms and similar within the field of physics. However, it was later introduced into the world of finance as a way to estimate future stock movements (Solver, 2017).

The Monte Carlo Simulation, as presented by Boyle in 1977, is a stochastic process and in nature very general (Haug, 2007). Nonetheless, the method considers the volatility of the underlying asset, the risk-free rate, the nature of stock price variation and can, in general, be perceived as a more statistically founded model (Katz & McCormick, 2005).

Running a Monte Carlo Simulation requires help from computers, which can run algorithms generating random numbers. The basic random number generator *'=rand()'* in excel has received much critique for its shortcomings, and authors like Katz, McCormic and Haug recommend using more advanced functions through VBA coding or alternative software solutions (Katz & McCormick, 2005; Haug, 2007). In simple terms, the Monte Carlo Simulation rely on the Brownian motion to model random movements, much like many other probability models (Katz & McCormick, 2005). The Monte Carlo Simulation split the movement into two, the drift and the random shock, both explained in slightly more detail below (MomentsInTrading, 2013):

(i) ***The drift***. Being the expected rate of return with the greatest odds of occurring, by some defined as average historical return eroded by volatility at the rate of half of the variance over time, refer to equation below:

$$drift = u - \frac{\sigma^2}{2}$$

In contrast, some researchers argue that u should in fact be represented by the risk-free rate if building on the no riskless arbitrage argument, or, to follow the random walk theory, the drift should always equal 0 (MomentsInTrading, 2013).

(ii) The second movement is representing the random shock, which will be generated by random numbers (MomementsInTrading, 2013). This follow the Central Limit Theorem, which states that returns should move towards a normal distribution as the number of observations increase.

Theory on Monte Carlo Simulation is substantial, as several fields of research rely on this method to estimate the probability of a movement.

2.1.4.4.6 VOLATILITY MEASURES

Regardless of the model, the reliability on a volatility measure as an input variable remain at the center of most models. Further, the volatility in the underlying asset is considered a significant driver of option value (Katz & McCormick, 2005). A correct estimate of the volatility input is therefore of the utmost importance. In its most basic form, the historic or realised volatility is given by the following:

$$\sigma = \left[\frac{1}{N}\sum_{i=1}^{N}(r_i - \bar{r})^2\right]^{\frac{1}{2}}$$

Where i can take any value between 1 and N, the average value = $\bar{r}$.

As with the option pricing models, volatility estimation models come in many shapes and sizes. Among the more generally known, and widely used, models we find moving averages, as well as the Autoregressive Conditional Heteroscedasticity model ("ARCH") and the Generalized ARCH model ("GARCH") (Katz & McCormick, 2005; Schmidt, 2011). A short and high-level description of each will be provided below (Katz & McCormick, 2005; Schmidt, 2011):

- ***Moving Averages***

  When volatility is stationary, the very fundamental volatility measure of realised volatility, as presented above, may be suitable to reflect an assets underlying volatility. However, often volatility is non-stationary, in which case only recent historical data is representative for more accurate forecasting. In such cases, moving averages are particularly beneficial. Among the more common moving average models, relying on the random walk forecast of $\widehat{\sigma_t} = \sigma_{t-1}$, we find the below:

  Simple moving average

  $$\widehat{\sigma_t} = \frac{(\sigma_t + \sigma_{t-1} + \cdots + \sigma_{t-T})}{T}$$

  Exponentially weighted moving average

  $$\widehat{\sigma_t} = \frac{\sum_{i=1}^{n} \beta^i \sigma_{t-1}}{\sum_{i=1}^{n} \beta_i}, \qquad where\ \beta = \frac{2}{n+1}$$

- ***ARCH and GARCH***

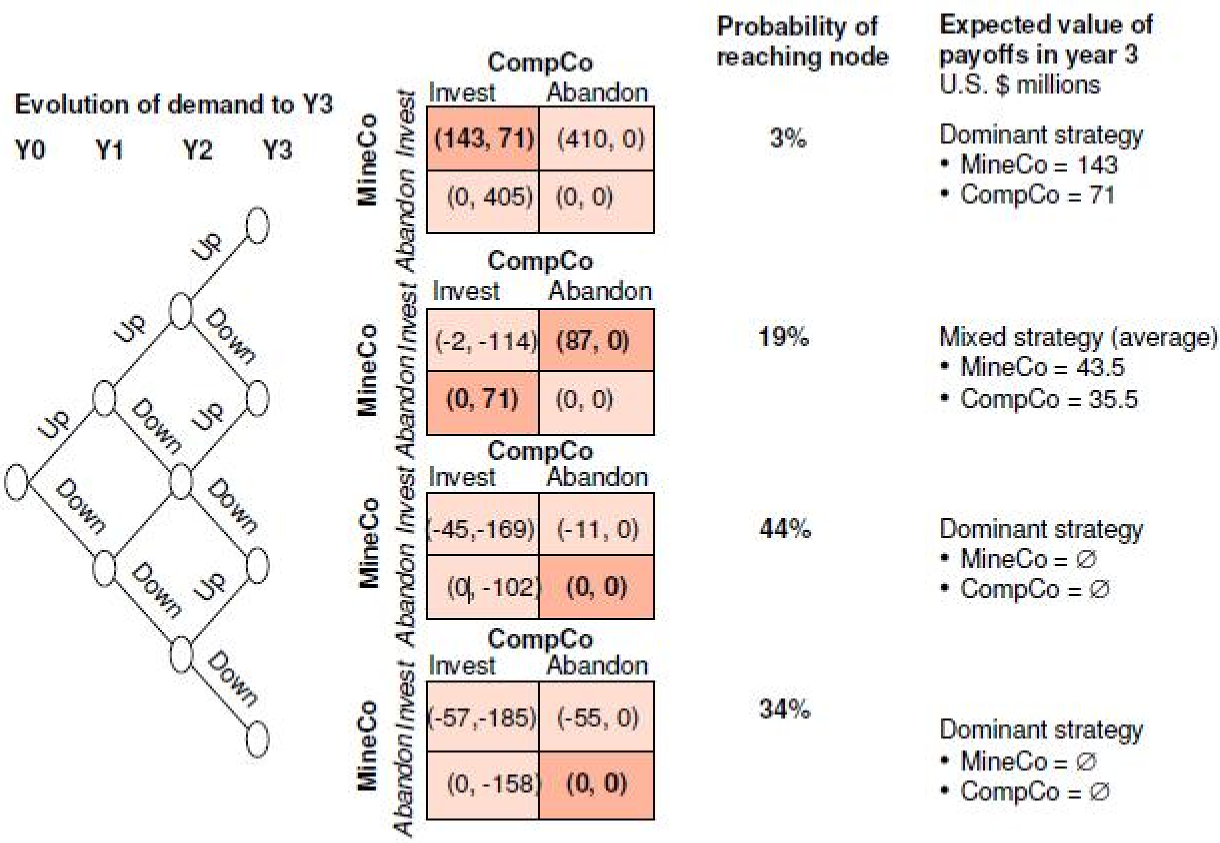
  It is a common phenomenon that volatility is conditional in the sense that the variance is uncorrelated, but not independent. Further, data is often heteroscedastic, meaning the expected value of the error term does not remain constant. ARCH and GARCH are two widely used conditional heteroscedasticity models that utilise the concept of lags, following the idea that large returns (positive or negative) follow large returns, and thereby the model considers volatility clusters. The GARCH model holds an advantage over the ARCH model in the cases where any lags are required for the ARCH model. In short, the variance associated with the GARCH model, depends on both its own lags and the lags of the squared error term. Based on this, and the fact that the GARCH model uses fewer parameters, often makes it the preferred model of the two by practitioners. Despite this, the models are more complex than the moving averages, and an introduction to the underlying mathematical relations will not be provided here, due to the significant space required to provide a satisfyingly explanation, without significant value-add.

Above models all revolve around how to estimate future volatility from the movements observed in the historical data available for a given asset. Yet, in the perspective of real options, the data availability quickly becomes less tangible and connected to a greater amount of uncertainty. This naturally poses a challenge for the above-mentioned models ability to produce reliable outputs, hence, making the option valuation less reliable.

2.1.5 OPTION GAMES

In 2008, three consultants from McKinsey&Company set out to explain the importance of considering the value of flexibility. The main critique of the DCF model concerns the overall NPV intuition that practitioners employ the DCF model within. As a result hereof, managers become overly cost focused in regards to investments, in order to drive up NPV, and thereby fail to realise that they are investing in cheap structures, which are usually very volatile, inflexible and situated in capital-intensive industries (Ferreira, Kar and Trigeorgis, 2008). In contrast to this, the real option analysis forces analysts to think in terms of scenarios and probabilities, from the perspective of a delay, expand or abandon option. The article continues to challenge this ‘standard’ setup, and suggests incorporating a competitive perspective, in which game theory play an important role (Ferreira, Kar and Trigeorgis, 2008). The hybrid model propose incorporating Neumann’s basic principles of game theory into an option valuation framework. The result becomes several possible firm/project values, dependent on the projected competitive situation and the associated estimated PV and probabilities. In that sense, the value is expressed through Neumann’s strategic scenario layout. Figure 5 below illustrates an example, originally presented in the ‘Option Gams’ article, of a mining company, with an option to invest or abandon in year 3 of the analysis (Ferreira, Kar and Trigeorgis, 2008).

Figure 5 – Option games



Source: Ferreira, Kar and Trigeorgis, 2008.

As visible from above, the suggested hybrid model now accounts for a given firm's competitor(s) decisions, which yield an array of possible firm/project values. Although adding an additional layer of complexity to the valuation framework, this hybrid model manages to incorporate one of the core foundations of the free markets in a capitalistic setting. Ignoring the impact of competitors' actions, or absence of action, does add a substantial limitation to any model, however, the addition further complicates the estimation of input variables and thereby the reliability of the outcome as being the true fair value.

2.1.6 CUSTOMER LIFETIME VALUE

Only limited research is present for the valuation of intangible intensive firms in the media and entertainment industry. Several practitioners, such as PwC, have published insights on several occasions in relation to valuation and the media and entertainment industry in general (PwC, 2012). However, these reports tend to be very limited in their scope.

Nonetheless, some researchers have with reasonable accuracy, presented different models that contribute to the understanding of these media and entertainment industry firms, including some studies of Netflix (Shoutong, 2016). One such article is that of Thomas Zhang Shoutong, who propose using Customer Lifetime Value approach to estimate the market capitalisation of any given streaming firm, such as Netflix or similar. The theory builds on Gupta and Lehmann's "managing customers as investments" concept and succeeds in explaining the developments in Netflix's market capitalisation over a historical period through the proxy of customer equity. The very basics of the theory is stated in the below relation:

$$Customer\ Lifetime\ Value\colon CLV_0 = n_o \sum_{t=0}^{\infty} m_t \frac{r^t}{(1+i)^t} - n_0 c_0$$

Where: n_0 is number of customers acquired at time 0, m_t is margin per customer at time t, r is the period retention rate, i is the period discount rate, t is time period and c_0 is the cost per customer acquired at time 0.

The above framework utilises one of Netflix's most watched figures when reporting, namely the subscribers growth (Collins, 2017). It further underlines that the numbers of subscribers largely drives the value of online-streaming companies. The model primarily relies on simple historical data inputs and follows a process much like that of the discounted cash flow model.

2.1.7 EXPANDING ON THE CONCEPT OF FAIR VALUE

Fair value is, needless to say, context dependent. However, a simple, yet, powerful definition is provided by Katz and McCormick in their 2005 '*Advanced Option Pricing Models*' book as "*that value or price which discounts all foreseeable events and all public information (fundamental, technical, or otherwise) regarding a security. It is that price which allows no exploitation by traders for a profit, and to which the market price of a security will return should that security momentarily become over-priced or under-priced. In short, a security is fairly valued when it is efficiently priced by the market.*"

This definition has several implications with regard to a greater understanding on fair value. In general, when markets behave in accordance with the efficient market hypothesis, all securities will be traded at their fair value. However, this is seldom the case and would require all market participants to behave in an efficient and rational manner. To build on this, the multiplicity of fair value may be assessed, as an asset or security may have several fair values depending on the context, i.e. if value from an acquisition perspective, specific trading strategy[1], or a completely different angle (Katz & McCormick, 2005).

From this is can further be concluded that fair value is related to the concept of arbitrage and speculation. Fair value from an arbitrage perspective can be perceived as the price when no arbitrage opportunities remain and markets operate efficiently. On the other hand, the speculative fair value is when a trading strategy is designed to exploit a single or a set of market inefficiencies; hence, fair value is context dependent to the given strategy's aim of exploiting only some of these market inefficiencies.

2.1.8 TAX AMORTISATION BENEFIT

In determining value in an acquisition context, it is important to take into account some of the practical implications of the real world. Some models, to a greater or lesser extent, tend to rely on assumptions imposed to display the theoretical world, in which they can be proven true. However, one assumption often made is that of no taxes (Grant Thornton, 2008). In practice, this is very rarely the case, only with the exception of a few tax havens around the world. One framework that may add to the fair value we would expect to see is that of the tax amortisation benefit achieved by the buy-side in an acquisition context. In simply terms, the acquiring company is allowed to amortise, for tax purposes, the goodwill purchased in a given transaction (Grant Thornton, 2008). Thereby, this potential future tax saving adds value from a buy-side potential, and may partially explain why we at times observe deals entered at what seems far beyond the fair value.

2.1.9 SUMMARY AND CONCLUDING REMARKS ON LITERATURE

It can be concluded that the literature on valuation models and intangible assets is generally substantial and well developed with countless nuances. It therefore requires some time for practitioners to gain a full overview of the field, which will most certainly continue to grow both academically and practically. Despite the vast amount of concepts and models developed, the obstacle remains to be the estimation of accurate input variables. Although researchers and practitioners agree that, any flexibility does constitute some given value, the implementation of these option pricing models lack in practice (Petersen & Plenborg, 2012).

[1] Different trading strategies are designed to exploit different market inefficiencies; hence, fair value is context dependent to the given strategy's aim of exploiting only some of these market inefficiencies.

2.2 CHOICE OF THE IDEAL VALUATION MODEL

As outlined in above section, the menu of valuation models is plentiful, and can possibly cause confusion for any practitioners, who despite substantial training, may not have been introduced to all the models or concepts. Yet, this does not make the choice of valuation model any less important. In the article '*Choice of (ideal) valuation model*' Plenborg puts focus on which parameters should be weighted heavily in the decision-making processes when choosing a valuation model (Plenborg, 2000). Four criteria, split into fundamental and cosmetic, are set forth for any good valuation model to be measured on the basis of:

i. ***Correct input estimation*** (fundamental)
   Although this may seem obvious, it is in many cases a great challenge to estimate all the input variables of a valuation model. A model can thereby be very strong from a theoretical aspect, however, have little value in practice due to input estimation challenges.
ii. ***Realistic assumptions*** (fundamental)
   To avoid systematically incorrect valuations, the assumptions regarding the model of choice should be carefully considered and evaluated in the context to which it is intended to be utilised. A valuation model is never better than the weakest assumption imposed.
iii. ***User-friendliness*** (cosmetic)
   As also touched upon earlier in this literature review, the intuition of the valuation model is of high importance. That being said, a non-intuitive model is not necessarily wrong, but simply unlikely to be employed in practice. Further, user-friendliness includes data availability, computational time and resource requirements, as well as complexity.
iv. ***Understandable output*** (cosmetic)
   The output should be interpretable, not only to the analyst performing the valuation, but the stakeholders in general. It is worth considering whether the model should depict the distribution of value across departments/assets or depict value at certain milestones and goals.

The above criteria should not be understood as a complete evaluation framework for any valuation model, but merely as a tool kit to ensure that the model which is considered covers the most essential characteristics that practitioners should have in mind during the valuation model decision process (Plenborg, 2000).

The fundamental requirements address the realism of a model's assumptions and results, in terms of preciseness, whereas the cosmetic requirements focus more on the user-friendliness and intuition of the results. In many ways, the fundamental requirements may be considered more important than the cosmetic requirements, as deviations from the fundamentals could lead to irrational decision-making. This is not to say that the cosmetic requirements should be underestimated, as understanding the models and requirements is important to understand the valuation framework.

Plenborg's framework will be applied in section 3.4 to evaluate the models from the literature review, from which we can then decide what models would be 'best' to apply to the case.

2.3 ACCOUNTING STANDARDS

Prior to assessing the models in the above-mentioned context, it is important to understand the accounting standards that shape the information in the annual report, and their challenges, as the various valuation models to a large degree will build on data from the annual reports.

One of the greatest challenges when dealing with intangible intensive firms is the low transparency of how accounting data has been treated. When it comes to development costs, it becomes tricky to see the clear cut between when something should be treated as a capital expense, i.e. generate benefits over more than one year, and when it should be treated as an operating expense. As stated by Damodaran in his 2009 article on valuation of companies with intangible assets:

"*… accountants routinely miscategorise operating and capital expenses, when firms invest in intangible assets. Thus, R&D expenses, which are really capital expenses, are treated as operating expenses, thus skewing both reported profit and capital values.*" (Damodaran, 2009).

Ultimately, whether a company capitalises their R&D expenditures or book them as operating expenditures, should yield the same profit, only with a time difference. This is based on the fact, that any capitalised R&D expenditure can be amortised, and thereby will affect the future income. The challenge, as an outsider to the firm, is to identify exactly what has been done and whether a mix of the two accounting strategies have in fact been employed. Only then can one make the adequate adjustments.

The above challenge primarily influence the traditional valuation methods, such as the DCF model, in which these numbers are used as the foundation for the forecasting (more specifically, the importance of maintaining the consistency between re-investment and return on capital), and the relative valuations, as assets will be stated lower and financial results are lowered as well. Further, not capitalising development costs of intangible assets may boost debt-to-assets ratio, as well as complicate forecasting of future net income, given the fact that firms often reach a steady-state intangible asset level, from which an expansion is less vital for the continued operation of the firm (Damodaran, 2009).

The facts mentioned above are, according to Damodaran, vital to understand and appreciate, yet practitioners in valuations far too often ignore them. This is what Damodaran refers to as '*The Dark Side of Valuation*' (Damodaran, 2009). In short, this phrase covers the practice in which analysts trust historical data, management forecasts and the logic of "*all of the firms in a sector should be equally impacted … and that comparison across the firms should therefore not be affected*." (Damodaran, 2009).

Making appropriate adjustments for above may in most cases be very difficult, if at all possible, and often result in vague estimations. However, it will most likely drag the valuation more towards the true value than if simply ignored.

2.4 MODEL ANALYSIS – ASSESSING POPULAR VALUATION FRAMEWORKS

Below section will set out to analyse the relevant valuation models from a theoretical perspective, applying Plenborg's framework from section 3.2, to establish a theoretical framework for application in the case study as well as provide insight on the pros and cons of each model.

2.4.1 THE DCF MODEL

Given the framework of the discounted cash flow model, as presented in the literature review, it generally does not manage uncertainty and the possibility of other outcomes than the forecasted revenue-stream particularly well. Based on this characteristic, the model is perceived to constitute a limitation to the valuation of a company in rapid development, and for which the business model may yet to be defined in completeness, or simply, in case it may be amended. This is due to the fact that the DCF mainly operates in a one-scenario world. Although possible to employ in the scenarios and situations outlined in Part III, it would require some more thought being put into the forecasting of revenue streams as expected values. However, it builds on significant fundamental ideas of setting fair value equal to all future income. Yet, modelled in a way that fit distribution firms with pure licensing activities in a more appropriate manner. In the case of a pure licensing business model, in which the company is able to pick and license only the successful movies and series, post-production, the risk assumed is considerably lower, in comparison to any distributor with production activities or a pure production firm.

As a result, the DCF model will most likely estimate the fair value of a firm lower, than other models, and potentially the observed market value, as it does not incorporate the value of the possibility to abandon, expand or delay, which exist in the production phases.

Below subsections will each analyse an area of Plenborgs criteria framework presented in section 3.2, to evaluate the DCF model and its usefulness for the purpose of this thesis.

2.4.1.1 CORRECT INPUT ESTIMATION

When applying the DCF model as main valuation tool there are some core input requirements, which will be the same for any industry and company. Each input requirement will be considered below.

2.4.1.1.1 FORECASTING FREE CASH FLOWS

The very essence of the model is the forecasting. To increase the accuracy, or correctness, of the forecast, one must take into account the macroeconomic projections, industry developments, the firm's strategy and product pipeline, as well as many other factors. Typically, the forecasted period is 5 to 10 years. Within this timeframe, it is somewhat possible to project the generation of free cash flow from operations with respect to certain expected events and initiatives. Yet, the fair value of a firm is not limited to the next 10 years of free cash flow. Projecting free cash flow reliably for the long run is much more difficult and often a wild guess, based on current trends and figures. To overcome this, most DCF models incorporate the terminal value, in which for the last projected free cash flow, a long-term growth rate and the discount rate are used to compute the perpetuity value of future free cash flows. Naturally, this becomes one of the core drivers of value in the model.

2.4.1.1.2 LONG-TERM GROWTH RATE

The main question raised in terms of growth rate is how can we go about estimating the long-term growth rate? Since this single input typically drives the majority of the value output, it is crucial to develop reliable estimate for this. Firstly, despite the appealing easiness of using a perpetual growth rate, it must be considered as a highly theoretical tool. Although one can argue that firms always mature and will converge towards the growth rate of the overall economy, this is seldom the case due to disruptive innovation, business cycles, competition and unforeseeable events. Therefore, this input factor can be seen as one of the largest challenges to the correct input criteria set forth by Plenborg in his ideal valuation model framework.

2.4.1.1.3 DISCOUNT RATE

The discount rate is a variable that tends to generalise the world very drastically, much like that of using a perpetual growth rate. More often than not, analysts would apply the Weighted Average Cost of Capital, shortened to WACC, although variations may show in the way the cost of equity is estimated. The typical models used are CAPM or the Fama-French factor model, which both set out to estimate the opportunity cost of an equity investment. The models are typically used in a simplified form, despite the vast array of versions with increased complexity that set out to reach a higher degree of significance. However, as with the long-term growth rate, history seldom repeats itself, hence, decreasing the accuracy of these models. Though the lack of better estimation models mean that these are the theoretical concepts used, relying on simple inputs such as beta, risk-free rate and historical market premium. Given these for the CAPM, the input variables are not per se connected to a great level of estimation uncertainty, as is the case with the future free cash flow.

2.4.1.2 REALISTIC ASSUMPTIONS

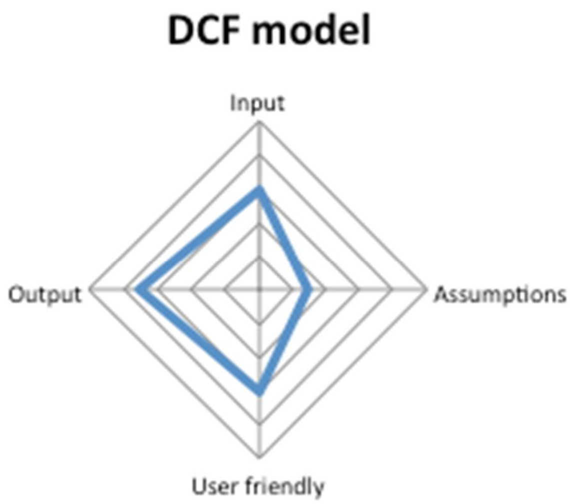
Building on this, the assumptions made in relation to the long-term growth rate and the discount rate both decrease reliability of the model, as they are mainly based on historical figures. Further, the perpetuity growth model assumes that free cash flows grow at a constant rate and that the opportunity cost will be constant for the future as well. This assumption is avoidable, though it would require substantial Excel modelling, to map out several years. Given the above diminishing reliability of forecasts, the benefit of doing this manually often come short of the costs of doing so.

2.4.1.3 USER-FRIENDLY AND UNDERSTANDABLE OUTPUT

The greatest force of the DCF model is its user-friendliness. The layout enhances the intuition of the process and understanding of the drivers behind the results, which boosts the understanding of the output. This further allows analysts to implement adjustments and model different scenarios, although only one at the time.

2.4.1.4 SUMMARISING THE DCF MODEL

Figure 6 – DCF model ratings



Source: Constructed by thesis Authors

Figure 6 summarises the DCF model in terms of Plenborg's framework. In general, the DCF is a solid but very simplified framework for estimating the true fair value of a firm and can generally be deemed unfit for valuation of firms in rapidly changing industries. Further, the model can also be deemed unreliable for the valuation of firms that have several investment opportunities with the possibility to influence and close down investments along the development process. This is based on the assumptions made by the model, which impose a limitation in terms of applicability. However, although the fundamentals may be somewhat lacking, the user-friendliness for practitioners makes it the most commonly used model in the real world, also as it is easier to explain the output to individuals who do not have the theoretical foundation.

2.4.2 THE RELATIVE VALUATION APPROACH

The idea of using existing market valuations of comparable firms, to value the firm in question, is a very potent concept. This enables the valuation process to be much simplified, unfortunately, it is often also too god to be true. By applying the four criteria framework of analysis presented by Plenborg, the following can be stated about the relative valuation model:

2.4.2.1 CORRECT INPUT ESTIMATION

To reach an estimate for the fair value, one must simply provide a few simple ratios comparing a comparable firm's given financial post to the market capitalisation of that firm. The same ratio should then hold true for the firm in question. However, building on what Damodaran call the dark side of valuation, this is a more complicated process than it may seem at first, the reason being that accounting standards differ, hence, decreasing the correctness of the input one can pull directly from the financial statements. Adjustments can be performed, but from an outsider perspective, this is often difficult, if possible, to perform correctly. Using key figures based on e.g. EBITDA before R&D costs is one potential way to minimise the issues. However, for most media and entertainment industry firms, the R&D costs are a crucial factor in their value, hence, the accuracy of the valuation will decrease.

As the model only relies on a few inputs, the results are quickly skewed by potential incorrect treatments of data. More often than not, a relative valuation of a single key figure does not stand-alone, thus the approach often yields a value range. Further, any input estimation will typically include all market inefficiencies the comparable firm is subject to.

2.4.2.2 REALISTIC ASSUMPTIONS

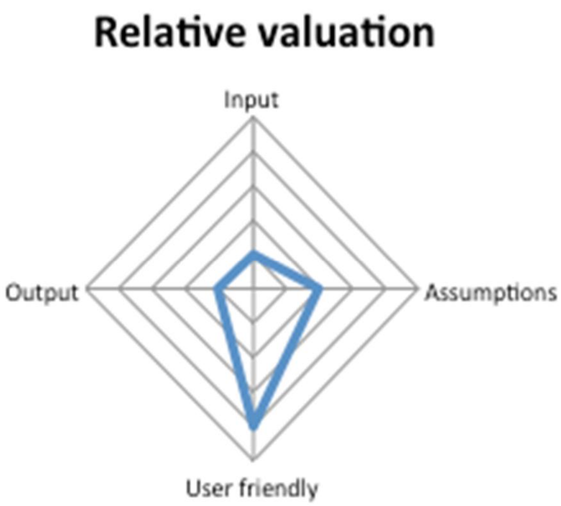
The main assumption behind the relative valuation approach is that of perfect comparability, which is to be established through a Comparable Company Analysis ("CCA"). In theory it should be possible to find some comparable firms, however, in practice, any differences will decrease the reliability of the model. Furthermore, the diversification strategy must be expected to be widely used, which function as a guard against competition. This can potentially be harmful to the relative valuation process, which often rely on data for competitors. Also one must take into account the business circumstances under which the comparable firm is traded, for example if you had compared a US firm to that of a Greek publicly traded company in 2009 or 2010, the valuation would have probably been very different.

2.4.2.3 USER-FRIENDLY AND UNDERSTANDABLE OUTPUT

The model is in its simple form very user-friendly, unfortunately, it does not highlight all the inconsistencies, potential comparability issues and business circumstances that all help determine just how well the output in fact is. Further, the result is often a range that can potentially cover a considerable span due to the many factors that may affect to comparable firms' market capitalisations.

2.4.2.4 SUMMARISING THE RELATIVE VALUATION APPROACH

Figure 7 – Relative valuation ratings



Source: Constructed by thesis Authors

To summarise, as seen in Figure 7, the relative valuation approach is limited in accuracy due to the heavy reliability on finding comparable firms with transparent annual reports, to ensure that you match data treated in the same manner. As this transparency and comparability is often taken as less substantial, the output may often be very difficult to truly understand, as the inputs may in fact reflect completely different firm characteristics and accounting standards. However, the model is very quick and easy to use.

2.4.3 THE CUSTOMER LIFETIME VALUE APPROACH

The CLV approach differs a bit from the DCF, but builds on the same intuition, except from the fact that the model incorporates subscribers as the main driver of future free cash flows. By applying the four criteria framework of analysis below, the following can be stated about the Customer Lifetime Value model:

2.4.3.1 CORRECT INPUT ESTIMATION

A majority of online entertainment distributors within the media and entertainment industry will disclose both number of subscribers as well as margins per subscriber. The core of the model generally focuses on the contribution margin, as mention before, and the churn rate (Shoutong, 2016). The churn rate is the rate at which existing subscribers end their subscription period, in other words it is the opposite of the retention rate. Combined with the number of new subscribers the two should be able to explain any development in total subscribers. Despite the number of total subscriptions often being disclosed, the churn and retention rate, on a separate level, can be tricky to estimate, if not disclosed. Nonetheless, a majority of online streaming providers disclose total subscription numbers, which provides a fairly high degree of accuracy.

In addition, the model rely on the estimation of a per customer gross margin. As the model relies on account data at a gross level, the issues highlighted with reference to Damodaran's '*Dark Side of Valuation*' are of lesser concern, the reason being the limited plausibility that an online streaming provider would incorporate any R&D costs at this level. Nonetheless, an annual report more often than not does not provide a great level of transparency in this regard. Example hereof is the Netflix FY2016 annual report, in which Netflix disclose their contribution profit as (Netflix, 2017b):

$$CP = Revenue - Cost\ of\ revenue - Marketing$$

Above provides some insight as well as the opportunity to not include marketing costs[2] in the calculation of the contribution profit. Reason hereof could be to consider these as brand development costs and thereby capital expenditure rather than operating expenditure. However, little knowledge of the cost of revenue post is provided.

[2] The CLV model is typically used for calculating payback on advertising investments, hence, the obvious reason for disclosing these in this connection.

Some may argue that the model input should in fact not consist of the contribution profit, but merely the net income – or even the free cash flows. This will of course affect the output of the model, however, in the model version presented in the literature review, the author Thomas Zhang Shoutong uses the contribution profit as input for his model. This was done in the context of estimating the market value of Netflix on a historical level. It is recognised that this may in fact not be the most appropriate choice of input variable when estimating entire enterprise value. The contribution profit may in fact be more beneficial for the evaluation of whether or not to proceed with a given marketing strategy, rather than in the context of a company valuation.

2.4.3.2 REALISTIC ASSUMPTIONS

The CLV approach is modelled in a way where value is primarily derived from the development in the number of subscribers, based on the churn rate and retention rate. In other words, the model output represents the present value of the combined customer relations' expected future income by relation of the formulas mentioned under the literature review. As with a majority of other models, including the DCF framework, the accuracy of forecasting impose a limitation to the valuation. Further, the model only has a simplistic approach towards forecasting future customers and does not take into account any changes in contribution margin, hence, ignoring economies of scale and similar. Modifications to accommodate this can be performed, however, requires building a larger model, which could be considerably resource consuming, and little value-add.

In intuitive terms, the firm value is set equal to the value of its current and future customers. The valuation approach focus on the development of the customer base rather than the products offered. In that sense, the model assumes a fixed product offering and does not assign any value to the flexibility of investments nor the possibility of developing the business model in the future. In this sense, the model is limited in its ability to reflect the fair value of high-growth technology firms.

2.4.3.3 USER-FRIENDLY

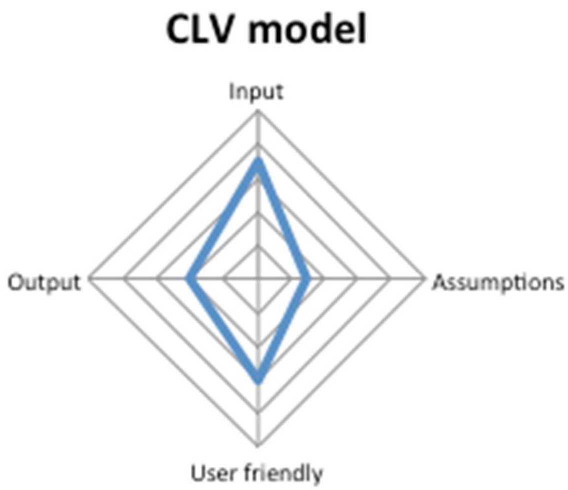
The model is relatively user friendly, given its basic mathematical setup and rather intuitive approach towards managing the input parameters, thus for most marketing practitioners and decision-makers there are few variables to form opinions and assumptions for. Unfortunately, this user-friendliness is perceived to be derived from the simplistic assumptions the model build on. Hence, the very fact that it is user-friendly stems from the limitations that make it less accurate.

2.4.3.4 UNDERSTANDABLE OUTPUT

It can be a tricky to fully understand the output, which is highly correlated to the input. In the model, the initial ‘cash flow’, being contribution profit, net income or free cash flow, has a large impact on the output. It should for instance not be expected that a CLV model, based on contribution profit, would in fact explain the observed market value and even less so that it represents the fair value of the entire company. The variability of input parameters thereby add to the confusion regarding the output, hence, the model is considered less user-friendly in terms of understanding the output.

2.4.3.5 SUMMARISING THE CLV MODEL

Figure 8 – CLV model rating



Source: Constructed by thesis Authors

The CLV model is at first fairly simple to use and the input is often provided directly in the companies’ annual reports. One downside is the assumption that value is only driven by number of customers with little flexibility for changes in margin, as well as a simplistic forecasting tool for future customers. Further, it is very important to understand the margin input variable, as gross margins will provide very different values in comparison to utilising net income or free cash flow. This must be clear to the practitioner to fully understand the output.

2.4.4 THE BLACK-SCHOLES MODEL

The Black-Scholes model is widely used, as established in the literature review, and most commonly employed to price financial instruments such as derivatives. As a standard, the model only price European options for which a replicating portfolio exists. Below analysis is not affected by the difference of a put or a call option, as this will only become applicable when implementing the model in practice. By using the four criteria framework of analysis from Plenborg, the following can be stated about the Black-Scholes model:

2.4.4.1 CORRECT INPUT ESTIMATION

The main input requirements for the Black-Scholes model are listed below. These will be conceptualised from a real option perspective, hence, not follow the context of the original model. This does not alter the model itself, but merely the naming and characteristics of the input parameters.

2.4.4.1.1 UNDERLYING PRICE / PROJECT REVENUE

One of the main drivers of value is the estimated future revenue stream from the project. This is difficult to forecast with great accuracy, just as is the case with the DCF model. In practice, this often relies on best guess or generalised growth rates as seen with the terminal value for the DCF model. For real options, the often associated changes to be incorporated also means ‘business as usual’ is non-existing. This is only adding to the complexity and uncertainty of forecasting revenue figures. For online streaming companies, this is also highly correlated to the success and popularity of the offered entertainment content, which retains and attracts paying subscribers.

2.4.4.1.2 STRIKE PRICE / PROJECT COST

The cost at which the exchange for future revenue can be made, i.e. the cost of undertaking the project, being either cost to delay, abandon, expand etc. These costs must represent the non-recoverable investment commitments taken, to actively pursue the scenario with its associated estimated revenue stream. The costs are typically associated with less uncertainty, as these are more quantifiable in terms of licensing fees, development costs of a new series, development costs of new software or similar. Further, these are also costs controlled directly by the company, which offers a level of control that cannot be achieved with revenue streams.

2.4.4.1.3 TIME TO EXPIRATION

In general, for regular options, this is not connected with any uncertainty due to the contractual expiration date. As mentioned in the literature review, time to expiration has a great influence on the option value, as options become more valuable the longer the timespan between today and the expiration date. For real options, several considerations come into play. The expiration date is no longer a contractual date, unless the real option regards a patented product or a license agreement, but merely a result of events such as competition making the project non-profitable or disruptive innovation making the project obsolete. Estimating this is, to some extent, a pure guess, as the information needed is rarely known. One can in the short-run construct an informed guess based on trends observed in the market, but when trying to predict 10+ years into the future, it is difficult to have any concrete predictions to base the choice on. If looking towards the accounting standards, intangible assets are often amortised over a 7-year period, however, this too does not reflect the true lifetime, but merely a standardised accounting rule. For some projects it may be correct to employ models with continuous time, however, this too is perceived as rather incorrect approach, as only a very limited number of things are expected to continue forever.

2.4.4.1.4 VOLATILITY

As with projected revenues and time to expiration, the volatility has a high degree of uncertainty associated with it. For regular options, estimating the volatility of the underlying asset would have been less uncertain, as historical share prices often are available – at least for publicly traded firms. The volatility of the underlying asset is thereby easily accessible for analysis. For real options, the volatility is to be estimated as the volatility of the forecasted revenue streams. As real option set-ups in the media and entertainment industry often relate to a new territory, such as completely new markets, the volatility estimate becomes more uncertain than the revenue forecast. The question then becomes how much a given new market is expected to fluctuate in size, or in other words, how quick is it estimated to grow. In some cases, where markets have developed, this is potentially the best proxy available for estimating the volatility. Examples of such cases could be Amazon launching their streaming portal for Amazon Prime members, which could have benefitted from employing a real option model utilising total market size volatility for the online streaming market as a proxy. However, even in this case, the input estimation has a higher degree of uncertainty and incorrectness associated with it.

2.4.4.1.5 RISK-FREE RATE

The last input variable is perhaps the most reliable input of the model. Unfortunately, this is also the least significant in terms of value drivers. Nonetheless, it is generally accepted to employ government bond yields as a proxy for the risk-free rate. For a US based firm, the risk free rate would thus be assumed equal to the yield on a US treasury note with a maturity aligned with the time to expiration of the option.

2.4.4.2 REALISTIC ASSUMPTIONS

Below set out to provide an analytical approach to each of the main assumptions behind the Black-Scholes model.

2.4.4.2.1 EXERCISING AT EXPIRATION

The Black-Scholes model assumes that the option can only be exercised at expiration and thereby only suitable for European options. From a real option perspective, this is problematic as the actual circumstances surrounding these kinds of option are often more of American nature, in which the option can be exercised at all times until expiration.

2.4.4.2.2 DIVIDENDS

The model assumes no dividends are paid during the period in which the option is active. This is less of an issue for real options, as they in general do not provide any pay-outs before exercise.

2.4.4.2.3 HOMOSCEDASTIC VOLATILITY AND RISK-FREE RATE

Another influential assumption of the Black-Scholes model is that of constant volatility input. The constant risk-free rate assumption is not as such a substantial limitation due to its limited impact and the ability to match maturity and time to expiration fairly well (at least up until 30 years). Volatility on the other hand is generally known to fluctuate over time. This is also why we see volatility-measuring models such as moving averages and ARCH /GARCH models have wide range of applications. These take into account volatility clusters and acknowledge that volatility will most likely not be constant over time. For options of shorter periods, this assumption naturally limits the model less. However, as real option projects are typically of a greater time horizon than just a few months or a year, this becomes a substantial limitation to the correctness of the output. In addition, the model is limited to only assigning a value based on the uncertainty resulting from a single variable.

The model thereby does not deal well with risks from two variables, such as for example in the case of an oil reserve, in which both price and quantity are related to some degree of uncertainty.

2.4.4.2.4 REPLICATING PORTFOLIO, NORMAL DISTRIBUTION, EFFICIENT MARKETS AND NO TRANSACTION COSTS

Among the more general assumptions, we find the assumption of efficient markets, normal distribution of returns of the underlying asset (which does not hold in times of crisis or bubbles) as well as no transaction costs (related to liquidity risk and does not hold either). Furthermore, the concept of creating a replicating portfolio is also a core assumption for the Black-Scholes model. While this holds for regular stock options, the assumption is not perceived as possible for a majority of real options structures, the reason being that the real option is covering illiquid non-tradable opportunities often unique to the company.

2.4.4.3 USER-FRIENDLY

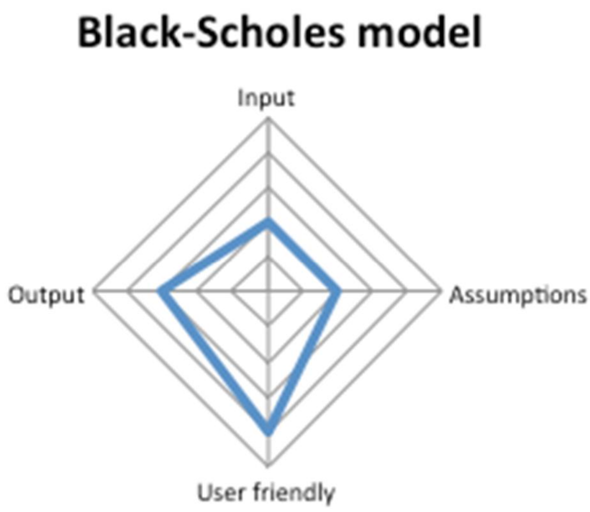
The model has generally been appreciated for its user-friendliness. Once the input variables have been estimated, the remainder of the process is fairly simple and not very time consuming. As a result, several online Black-Scholes calculators exist, which further adds to this user-friendliness.

2.4.4.4 UNDERSTANDABLE OUTPUT

Looking towards the critiques of the Black-Scholes, it has been mentioned in several occurrences that practitioners have a tendency to see the Black-Scholes model as a black box, which transforms the input variables into a value. This entails that the understanding of the model is low and that the assumptions are ‘hidden’, in the sense that a practitioner is not faced with these in the same sense as one is with the relative valuation model or a DCF model.

2.4.4.5 SUMMARISING THE BLACK-SCHOLES MODEL

Figure 9 – Black-Scholes model rating



Source: Constructed by thesis Authors

The Black-Scholes model is often criticised for being a big black box in which a practitioners input estimations are turned into some output. This has its benefits of easiness of use, but comes at a price. Despite difficulty in correctly estimating the input parameters, the model is very limited in applicability due to its assumptions. The setup is very rigid and does not allow for much change. Further, it is less intuitive how the changes in input will translate into a value.

2.4.5 THE BIONOMIAL MODEL

In a sense, the binomial model does not differ substantially from the Black-Scholes model. In fact, the Black-Scholes model is in some ways a more limited version of the binomial model, in the sense that it only deals with European options and has constant risk-free rate and volatility. Further, the binomial model allow for more modelling and can value both American and European options, as well as the more exotic option types as a result of this flexibility in the model. The downside is that this freedom comes at a price in terms of workload. Below is, as with the Black-Scholes model, seen from a real option perspective, which differs from the typical context of financial instrument valuation. By using the four criteria framework of analysis presented by Plenborg, the following can be stated about the binomial model:

2.4.5.1 CORRECT INPUT ESTIMATION

Despite a different setup, the binomial model rely on the same input variables as the Black-Scholes model, hence, face the before mentioned issues of correctly estimating these inputs. The main input difference relate to the project revenue as well as the project cost. In the binomial model, these are represented at each node, hence, requires a more explicit estimation. The revenue and cost estimations can thereby be adjusted throughout the model and does not have to be in the form of a single value. This flexibility does not necessarily increase validity, however, it does allows for a greater variability.

2.4.5.2 REALISTIC ASSUMPTIONS

Building on the above, one can assume costs being stochastic, which adds another dimension to the model. Although possible, the binomial model generally does not handle high-dimensional issues particularly well. This is perceived as a limitation of the application of the binomial model, as real options embedded in firms within the media and entertainment industry often demand high-dimensional models to reflect the actual option characteristics.

One of the advantages of the binomial model, over the Black-Scholes model, is the ability to incorporate early exercise, hence, allowing for the valuation of American styled options. In the context of real options, this is perceived as reflecting the characteristics of the actual real options in question in a more suitable manner.

Aside from the above and assuming that there are only two possible prices for the next period, the binomial model does differ substantially in the assumptions drawn. Hence, the binomial model also assume no transaction costs exist, underlying asset pays no dividends and similar.

The assumption of only two possible outcomes in the next period, being up or down, does impose a limitation in terms of replicating the actual characteristics of a real option. More advanced models, such as the trinomial model do exists, as mentioned in the literature review. Yet, the concept of limiting the possible outcome to a fixed set of standardised scenario forecasts continue to limit the model. Naturally, a model that would be able to replicate the real world developments would be far too complex to calculate, however, the binomial and trinomial models do approach this in a very simplistic form.

The binomial model is also limited to risk resulting from a single variable, as is the case with the Black-Scholes framework. In addition hereto, the binomial model further assumes that all events will take place in the nodes. This is challenged by the ability to estimate when the event will take place. Adding more nodes will increase the accuracy; yet, complicate the model in terms of typing it out. For regular options, coupon payments for instance are fairly easy to predict the timing on, as this is specified in each contract. However, for real options, this is not the case. The limitation of a discrete model thereby decreases the correctness of such model.

2.4.5.3 USER-FRIENDLY

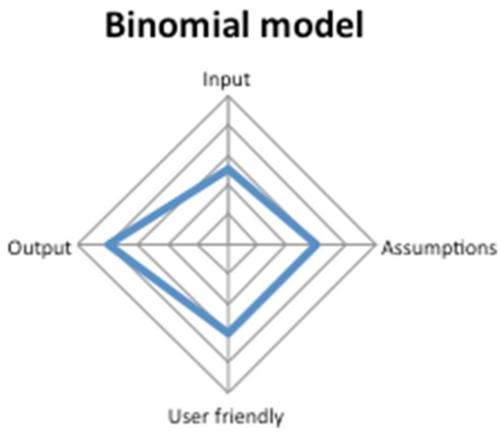
Although the binomial model, in cases of longer time to expiration, may become time consuming from a computation perspective, this model is rather intuitive, transparent and straightforward, making it user-friendly. However, the model is not very friendly in terms of computing several different scenarios or high-frequency calculations, due to the computational task of constructing the model with many nodes.

2.4.5.4 UNDERSTANDABLE OUTPUT

The output is fairly approachable and for American options, the output is easier to follow as the model display great transparency with expressing the value at each node.

2.4.5.5 SUMMARISING THE BINOMIAL MODEL

Figure 10 – Binomial model rating



Source: Constructed by thesis Authors

The binomial model allows for more modelling, and its intuitive construction provides insight into how input estimates are formed into value. Despite building on many of the same assumptions as the Black-Scholes model, the binomial model also allow for American styled option valuation, which is perceived as a must for real option valuation. Challenges are still present in terms of estimating the inputs of the model.

2.4.6 THE MONTE CARLO METHOD

The Monte Carlo method is no revolutionary approach in contrast to the other option based valuation models, and the main difference is found in the manner it handles probability. Unlike the binomial distribution, as employed in the binomial model, the Monte Carlo method utilises the Gaussian distribution. Further, Monte Carlo simulations allow for continuous distribution of returns and not the discrete setup of a binomial model. By using the four criteria framework of analysis presented by Plenborg, the following can be stated about the Monte Carlo method:

2.4.6.1 CORRECT INPUT ESTIMATION

Performing an option valuation using a Monte Carlo simulation will, to a large extent, require the same input variables as both the binomial model and the Black-Scholes model. As a result of the Monte Carlo method dealing with uncertainty from a normal distribution perspective, the volatility input is slightly different. In essence, the volatility input consists of both a drift factor as well as a stochastic variable:

2.4.6.1.1 DRIFT VARIABLE

This represents the expected rate of return and will typically be estimated based on averaged historical development of the underlying asset. This expected rate of return is eroded by a rate of half the variance, in accordance to below.

$$Drift = u - \frac{\sigma^2}{2}$$

To estimate the drift, different inputs can be used to represent u in the above functions. Alternatives to the expected rate of return of the underlying asset, the risk free rate or simply a 0 can be used.

2.4.6.1.2 STOCHASTIC VARIABLE

The stochastic variable represents the effect different events have on the expected growth. This is typically estimated by a series of random variables, generated with respect to the volatility of the underlying asset.

In general, none of the above are difficult to estimate, although one can estimate both volatility and expected rate of return in several manners with different nuances. None of which are perceived to substantially alter the picture, however, a GARCH model may, in cases of high data availability, enable a better prediction of next period volatility, as well as geometric and arithmetic averages may influence the results slightly.

2.4.6.2 REALISTIC ASSUMPTIONS

The Monte Carlo method bases its generation of possible paths on the central limit theorem, which assumes that returns are normally distributed in a bell shape. The method utilises this assumption, in combination with random numbers, to generate random paths. This is very beneficial for the calculation of American options, but does require a high amount of paths, as well as a good algorithm for generating random numbers. Further, the method allows for a greater level of modelling and is particularly beneficial for the calculation of exotic options of high-dimensions.

2.4.6.3 USER-FRIENDLY

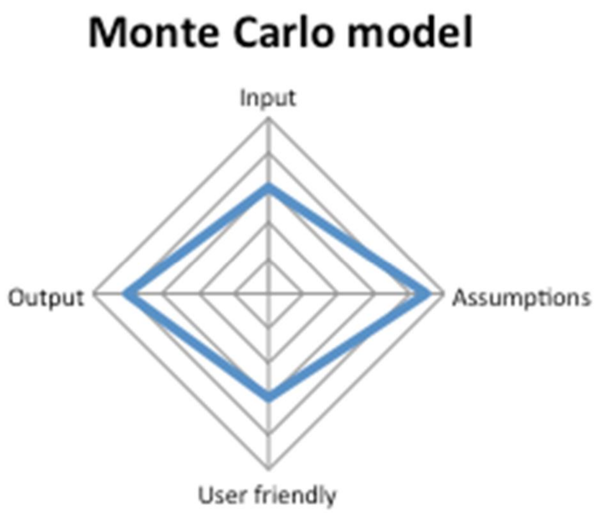
Along with the ability of addressing more complex and high-dimensional computations also comes a more complex setup. This entails producing random numbers to estimate different paths of upwards of 150 thousand paths. For doing so, one must employ specialised mathematical and statistics software that goes beyond the level of Microsoft's Excel. This is perceived as decreasing the user friendliness, although the model in itself is fairly intuitive with visible paths.

2.4.6.4 UNDERSTANDABLE OUTPUT

The process of generating the paths and setting up the model takes place in the before mentioned intuitive manner. This also helps the practitioner gain a greater understanding of how each variable influence the output. This transparency is perceived as increasing the practitioners understanding of the output.

2.4.6.5 SUMMARISING THE MONTE CARLO METHOD

Figure 11 – Monte Carlo model rating



Source: Constructed by thesis Authors

The clear advantage of using the Monte Carlo method is its way of handling open-end problems and high-dimensional option valuations. Despite some computational work, the model is somewhat intuitive and leaves the practitioner with an understanding of the output.

2.4.7 THE EXOTIC OPTION MODELS

Exotic options cover a broad array of options as explained in the literature review. Not all of these options are considered appropriate for the real option valuation approach towards an entire enterprise. Yet, some are perceived as particularly beneficial for the valuation of embedded real options of firms within the media and entertainment industry.

One being based on the fact that firms are often not just faced with uncertainty from one source, but in reality more likely that a project is influenced by uncertainty from market level of sensible membership fees charges, number of subscribers, actual cost of development as well as scalability. Alternatively, the option may rely on several different assets. These characteristics call for a rainbow option – the more colours in the rainbow, the more assets it includes (Benhamou, n.d.).

At the same time, some projects are structured in terms of phases. Examples hereof could be series, movie trilogies or other products, which captures the customer and ensure a future return of the customer. These projects basically depict the characteristics of compounding options, meaning the company has an option to exercise the right for an underlying option, i.e. although producing a season 1, the might still have an option to produce season 2 and so forth.

By using the four criteria framework of analysis, presented by Plenborg, the following can be stated about the two types of exotic option mentioned above:

2.4.7.1 CORRECT INPUT ESTIMATION

Both types of options are more technical to calculate than the “standard” option pricing models such as the Black-Scholes model or the binomial model.

For rainbow options, one approach takes its departure in the Black-Scholes framework, or alternatively a Monte Carlo method, and link these outcomes for each of the underlying assets to each other based on the correlation (Benhamou, n.d.). In terms of input variables, not much change, except the multiplication of underlying assets. In a real option context, this escalates the complexity, as we now must estimate volatility for all the uncertainty sources. For real options, one can easily imagine a scenario, in which the option rely on several assets, however, also scenarios, in which the underlying asset is exposed to uncertainty from more than one source of uncertainty. One can treat the different uncertainty sources as separate assets and hold all but one source of uncertainty fixed per asset. The estimation of volatility was one of the weak points in ensuring correct input variables for the Black-Scholes and binomial models. Adding more only makes the estimation process even more complex and difficult. In addition, the construction of a rainbow option then rely on the correlation between each of these stochastic inputs among the assets.

For compounding options, the duplication of input is required with respect to strike price and exercise date. As with rainbow options, the process of estimating new inputs will increase the level of complexity and further drive the possibility of incorrect estimates. Calculating compound options entails estimating the date at which the real option switch takes place. In practice, this might in fact be possible to estimate, as real options with phase characteristics are often not involving long run estimations. However, it should be noted that the application of compound options suit fewer real options within the media and entertainment industry and is thereby less generically applicable.

2.4.7.2 REALISTIC ASSUMPTIONS

For what concerns the rainbow options, these manage to remove one of the core limitations of the Black-Scholes and binomial models, and are thus perceived to represent the actualities surrounding the real options in a more correct manner. This thereby adds to the theoretical accuracy of the model.

With respect to compounding options, the model does address one of the limitations by the other option models when the real options can be characterised as developing in phases. However, this is perceived to be more observable for single projects rather than entire firm valuations. In such cases though, the models assumptions do display a more theoretically correct setup, hence, a more accurate value estimate.

2.4.7.3 USER-FRIENDLY

With regard to the rainbow options, the process of "constructing" these hypothetical assets, in which all, but one, uncertainty sources are held constant, decreases the intuition behind the model. Further, practitioners are tasked with estimating not just one vague volatility input but several inputs.

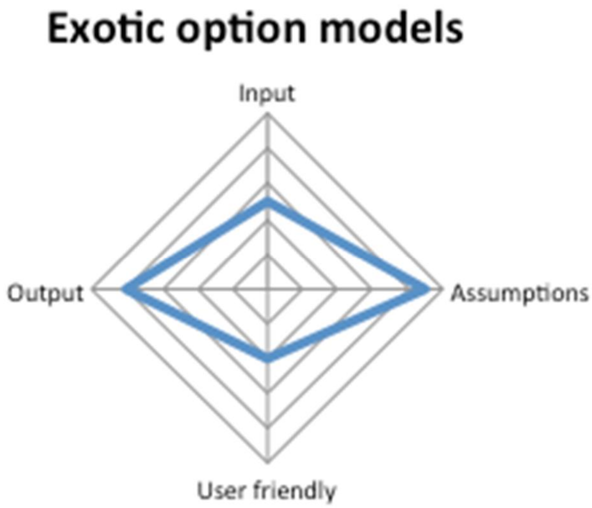
Further, compounding options quickly becomes incomprehensible due to the amount of different combinations the compounding can take. In addition, the intuitive aspect diminishes as the levels of compounding options increases.

2.4.7.4 UNDERSTANDABLE OUTPUT

In general for both option approaches, as the complexity increases and the intuition behind the models become more challenging, the understanding of the output decreases, as the understanding how it has been reached is decreased.

2.4.7.5 SUMMARISING THE EXOTIC MODELS

Figure 12 – Exotic option models rating



Source: Constructed by thesis Authors

To summarise, generally, exotic options do display a large degree of theoretical appropriateness that match the circumstances of the evaluated real options within the media and entertainment industry. However, the increase of theoretical accuracy does come at a price, as the estimation of correct input parameters becomes increasingly more complex with the introduction of new uncertainty sources. Further, the models are less user friendly due to the escalated complexity and more challenging intuitive setup.

2.4.8 GENERAL CONSIDERATIONS ON THE DISCOUNT RATE

As mentioned in the literature review, there is a general consensus of the use of WACC as the preferred framework for discounting future cash flows. However, while the cost of debt and capital structure is often easily accessible, the cost of capital is subject of much debate. Further, for intangible intensive firms, the capital structure is often skewed due to the accounting standards, as argued by Damodaran. This result in a WACC with a cost of debt overweight. In the current market situation, with very low interest rates, the impact will be a lower discount rate in case the company has refinanced within the past 5-7 years. Below will touch upon two of the most known and accepted methods hereof.

2.4.8.1 CAPITAL ASSET PRICING MODEL ("CAPM")

The CAPM model bases its cost of capital predictions on the market premium, as well as the beta of the firm. Despite providing a framework for estimating a given company's beta, the model does not address the market premium in any comprehensive way. More often than not, this is simply an averaged historical rate of a given index, subtracted the risk-free rate. As with a majority of the above-mentioned valuation models, the historical return is theoretically and practically not necessarily a very good proxy for future market developments.

Adding to this, the CAPM includes a factor called beta, which represents the given firms historical movement, or correlation, relative to the market on which it is traded. Despite the CAPM's purpose of predicting a firm's future opportunity cost of capital by utilising the firm's beta in combination with the risk-free rate and the market premium, it rarely succeeds. Many theoretical aspects have been investigated in the quest for increasing the significance of the predictions provided by the model. In general, the model is easy to employ and the inputs can in their simple form, be estimated rather easily. The theoretical relation does seem to depict the reality in a perfect world, but accuracy is lessened due to the difficulty of forecasting future values for the input variables. A majority of literature struggle to establish a solid significance of the CAPM in the long-run, but with only limited luck (Welch & Levi, 2013). This includes both basic and highly complex versions of the CAPM theory.

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In an attempt to increase the accuracy, the Fama-French factor model does a slightly better job. Unlike the single factor CAPM, the FFM framework utilises a minimum of three factors, including a premium for company size, price-to-book value, and market risk. These can be varied widely and are often also increased, so that we see for instance a five-factor model. The model thereby assumes that factors other than market return, and the stocks associated correlation with these, are able to explain a given stocks expected rate of return. From a theoretical standpoint, assuming that more than one factor is attributable to a given stocks rate of return is perceived as largely accommodating the complexity of reality. The challenge therefore becomes to identify these factors for the media and entertainment industry, for instance, as they may differ from the standard factors proposed by Fama and French. In its regular form, the data availability is also considered as fairly good due to the high availability of trades for high-volume stocks, as well as Kenneth French's effort to continuously provide information on the observed market values and their associated factor premiums. The model remains fairly user friendly, despite its time consuming aspects in comparison to the CAPM model. To achieve a model with high significance, one must have a good intuition and understanding of the given markets of the firm in question, as specialised factors differing from the standards may be beneficial to employ, although difficult to establish or identify. While the increased complexity does provide better estimates of expected rate of return for a given firm, the models are still fairly inadequate at predicting the future developments due to its use of historical data as a proxy for the future (Welch & Levi, 2013).

In contrast to above, and building on the low significance exhibited by both models, no single model stands out as particularly beneficial for estimating a firm's opportunity cost, which is to be the foundation for discounting future cash flows. Further, estimation of these models are more complex for non-traded firms, or separate business units within a group, that are in the process of performing a valuation for a given project for instance. In such case obtaining this data would rely on comparability towards traded firms.

2.4.9 SUMMARY

Over all, the valuation models struggle to reflect the realities of the world. Most often, the result of simplifying a model increases user friendliness at the cost of theoretical correctness. It is further apparent that the more complex a model becomes, the less understanding the practitioner is expected to have of the output, as it requires more time to understand the process of turning inputs into an output. From a real option perspective, the option models are challenged on the input variables, as these are often difficult to estimate with great accuracy. As a result, the output will be equally vague. However, employing option models to a real option case must also be seen as stretching the capabilities of the models rather substantially. While constructed to value financial options for one or more assets with known current value, often a history of trading to rely on as well as contractual formulations that dictate exercise price and time to maturity, the real option context is very different with more dimensions. Nonetheless, these models are expected to be the best available currently, hence, in the lack of better, these are the tools to value the flexibility many firms have available to them through embedded real options.

PART II – SRATEGIC ANALYSIS

The purpose of the strategic analysis is to shed light on the strategic framework Netflix operates in, as well as understanding the company itself. This is especially important as the industry, media and entertainment, in which Netflix operates, is greatly exposed to customer preferences and the on-demand nature of these customers, which make it impossible to maintain a static strategy. Further, the industry is one, which is greatly impacted by technology and shorter product life cycles. The analyses will identify the factors that are expected to be influential in the future development of Netflix, hence they constitute the foundation for forecasting and thereby valuations.

3.1 ANALYTICAL FRAMEWORK

The analyses will apply acknowledged theoretical frameworks on two levels, the industry specific level and the company specific level, enabling us to understand how the market may develope, and of the key challenges and success factors. The macro-economic environment will not be analysed, however, some of the factors may be captured in the industry analysis.

The industry specific analysis will focus on the relevant general trends within the industry, as well as the market structure. For this, the PEST-model and Porter’s Five Forces will be utilised. The PEST-analysis is seen as effective for business and strategic planning, ensuring that a company’s performance is aligned positively with the forces of change affecting the business environment (Porter, 1985). Further, Kotler (1998) acknowledges the framework as a way for understanding market growth or decline, business position, potential and direction for operations, especially when combined with Porter’s Five Forces analysis framework. Using the Five Forces will enable a classification and analysis of central parameters (Porter, 1979).

The firm specific analysis will focus on the current situation, the core financial performance indicators, as no detailed financial fundamentals analysis will be performed, and then future and strategic considerations. The purpose of this is to gain an understanding of Netflix and its potential strategic options, as they will function as input factors for the valuation in Part III of this thesis.

3.2 INDUSTRY ANALYSIS

The strategic analysis performed here will illustrate the firm's current and potential future playing field through an analysis of the environment. This section seeks to clarify Netflix's markets, from which conclusions, regarding potential success factors and challenges, can be drawn.

3.2.1 PEST-ANALYSIS

3.2.1.1 POLITICAL AND LEGAL FACTORS

The media and entertainment industry, in the context of films, is greatly influenced by both local and global politics – especially as end-consumers interacts daily with the industry companies' products. Therefore, any policies, current and future, can be influential factors, though the impact can vary from country to country.

In many ways the most significant legislation to influence the media and entertainment industry, which has been passed in America, was the Federal Communication Commission's Telecommunication Act of 1996. The reason for this is it opened up the communication business for everyone, promoting competition in the telecommunications market (Economides, 1998), and thereby making it more affordable for the public. Considering that we today access the majority of our media content through devices, streaming on the go, competition within the telecommunications market allows for a wider range of accessibility to the various content at a reasonable price.

In the specific context of the operations of the media and entertainment industry, it can be seen that the main product in the industry is content, and thereby intellectual property rights are essential to ensure both fair competition and sources of revenue. This means that content licensing, as always, will remain a significant part of the industry for both production and distribution companies. The development of online streaming, with newer companies such as Netflix and Hulu, has increased the fear of digital piracy in the eyes of the content producers. This originally led to limited licensing deals, which were difficult to obtain, for services, which provided an online platform. However, with time it became clear that the threat of digital piracy did not outweigh the potential revenue source for the content producers from the online content distributors (Auletta, 2014).

The expansion into the online realm for the media and entertainment industry, discussed above, has brought a number of issues with it, which could drastically alter both the political and legal environment for the industry. It is not only the risk of digital piracy for content producers, but also the end-consumers that are at risk through the shrinking distance between the two. Big data collections and user-content has given rise to potential information abuse and cyber attacks, which in many ways go second-handed in the considerations of online services (Accenture, 2016) of the close ties to the end-consumers. Legislation and policies are in many ways outdated to keep up with the highly dynamic online world, and we can therefore expect to see drastic changes in the near future (Caldwell, 2013). This can be seen in the US case of Megaupload, a file-sharing site, which was closed down in 2012; however, the impact is limited as the site was re-launched from a different country (MarketLine, 2016). Even if the site had not been relaunched, there are numerous other sites with similar function on the Internet.

On a side note, it is important to acknowledge that the film industry is subject to numerous restrictions and censorship, such as in the US, where the Motion Picture Association of America rates films based on their suitability for audiences (MarketLine, 2016). Other countries follow similar practices, and in some instances local governments will get involved, this was for example seen with Disney's Beauty and the Beast, which received an adult rating in Russia due to a gay character, which constitutes as 'perverted sexual relations' (Guardian staff, 2017).

3.2.1.2 ECONOMIC FACTORS

It is difficult to see how the macroeconomic factors may influence the media and entertainment industry, specifically with online streaming services as the individual costs are low. However, factors such as employment rate and disposable income may give some indication as to the development that can be expected in the industry.

With the global economy experiencing economic growth, the growth rate expecting to increase from 3.1% in 2016 to 3.5% in 2017 (IMF, 2017), one may assume that momentum for employment and global trade would also be picking up. However, there seems to be a disconnect between economic growth and employment and labour productivity, with global unemployment rate expected to rise by 3.4 million in 2017 (ILO, 2017). The majority of this unemployment increase will be in developing economies, whilst developed economies will most likely continue to experience decreasing unemployment rates, e.g. in the US where the rate has fallen from 5.3% in 2015 to 4.7% in 2016 (CIA, c2017). Part of the unemployment rate increase can be ascribed to global policy uncertainty, encouraging protectionism and thereby decrease in global trade (UN, 2017).

Furthermore, income inequality remains high, exerting further pressures for inward-looking policies in developed economies, threatening the global economic integration and cooperation (IMF, 2017).

How the above impacts the media and entertainment industry may seem minimal, however there are some indirect factors, which will affect the operations of companies within the industry. Firstly, for any company that have global operations, with segmented markets, such as online services where local tastes need to be catered for, less global economic collaboration could influence both the ease of internationalisation, potentially the production of original content if film locations abroad are needed, and revenue streams.

The increasing unemployment rate could suggest that there may be another economic slowdown on its way, which suggest that the industry performance would be decreasing. However, the media and entertainment industry is expected to continue to grow, with the video on demand sector expecting CAGR growth rate of 10% in the period 2015-2020, along with a USD 4 billion increase in revenue (PwC, c2017). This suggests that regardless of the macroeconomic environment, consumers of the media and entertainment industry in many ways will continue to consume online media. However, the decrease in disposable income could result in consumers switching to cheaper services or illegal streaming.

3.2.1.3 SOCIAL-CULTURAL FACTORS

It is said that "*consumers see no significant divide between digital media and traditional media: what they want is more flexibility, freedom and convenience in when and how they consume any kind of content*" (PwC, 2016), in other words today's entertainment and media industry is all about consumer choice, innovation and experience. Therefore, with the constantly changing social-cultural environment, forever-changing trends and content creators being closer than ever to the end-consumer, it is important to understand the factors social factors and trends that could have an impact on the competitiveness of the company.

The first factor that should be considered is the movement from Pay TV to online services, also known as cord-cutting. The cord-cutting phenomenon has in many years been seen as a threat to the health of the media and entertainment industry, and has gathered momentum through 2016 (Friedman, 2017). However, it is not only cord-cutters that are driving the migration from Pay TV to online streaming, millennials are at times identified as "cord-nevers", meaning that the only way to reach them is via Internet-streaming channels (Deloitte, 2017).

Secondly, consumers are now clamoring for customisation and control, meaning they prefer an "a la carte" package of channels, they want to be access content and TV everywhere and they want an integrated platform with possibilities (PwC, 2015). Further, the content needs to be available on-demand, and it is particularly this, combined with 24/7 online connection, which has driven the shift to online services (VAB, 2016), further video-on demand viewers are expected to reach 209 million by 2021, up from 181 million in 2015 (Deloitte, 2017). Consumers now also gravitate towards "skinny bundles," pared-down, less costly subscriptions, as they offer content at low prices, and can be customised (Deloitte, 2017).

Lastly, viewing habits of ones audience, is important to consider. There has been a rise in the cultural phenomenon of binge-watching, 18% of Americans do this, through an online streaming service (Statista, 2016a). The growth in mobile viewing, including unlimited data plans, has also led to an increase in the viewing time, and the average American now spends over 4.5 hours daily watching TV (Statista, 2016b), although consumers in the US also spend 45% more time choosing what to watch non video-on-demand services than scheduled linear TV services (Ericsson, 2016). Finally, we are seeing a significant shift with Millennials, who are taking greater interest in shorter forms of content, which are user-driven, such as YouTube segments (Deloitte, 2017).

To summarise, given the continued fragmentation of audiences, their viewing habits, their tastes and preferences, the way which content is accessed as well as the needs for frequent new content, means the consumer is now in the driving seat. Thus traditional business models no longer hold, meaning many companies within the industry need to rethink their strategy to ensure their content and services reach the broadest audience.

3.2.1.4 TECHNOLOGICAL FACTORS

The new millennium has meant infinite technological improvements which have brought a number of opportunities, not only in the devices we use but also how we consumer shows. The trend of streaming video and the vast increased use of devices have functioned as the catalysts that transformed the way we consume media content, and initiated the practice of "binge-watching" (Vena, 2017). This is what we in many ways can call the rise of the digital economy, triggered by the significantly improved accessibility and speed of the Internet, driving innovation and the sharing economy (OECD, 2015). With mobile internet connections worldwide growing at a pace where they now outnumber fixed connections three to one, and growth is expected to continue to grow at a rate which will lead to a significantly larger global disruption than the Industrial Revolution (Stockes, Maitland and Edelshain, 2016).

With all the technological advancements, it is difficult to predict, what is to come next. Many online platforms have expanded to include live streaming and user-created content, catering to the millennials demand. However, unlike Hulu and Amazon, Netflix does not seem to be going down the route of a multi-purpose platform with life streaming (Snider, 2017).

Other opportunities lie within the rise of interactive media – especially virtual reality, as seen within the gaming industry, and at-home interactive entertainment, as technology extends media experiences into physical experiences (Bothun and Vollmer, c2017). An example of this is the newest within on-demand entertainment, in this case live fitness classes streamed online throughout the day for subscribers to enjoy at home (Olick, 2016). Combine this with the technology developed for virtual reality in the gaming industry, and a significant potential in the form of interactive television could be established. Further, the world is becoming increasingly app-driven, and the creators of original content need to find a way to harvest and develop this technology (Bothun and Vollmer, c2017), like the interactive reality game Pokémon Go which was a global sensation across age groups and cultures (Weinberger, 2016).

3.2.1 PORTER'S FIVE FORCES-ANALYSIS

3.2.1.1 THREAT OF SUBSTITUTES

When considering potential substitutes in the film industry, we see Pay TV, on-demand, streaming, video rental/purchase and cinemas. Though many of these have existed alongside one another successfully and can share audiences, today's trend suggests that substitutes, in terms of distribution channels, can affect the market players (MarketLine, 2016).

The wide range of potential substitutes in the form of alternative streaming sites, both paid services and illegal streaming, becomes a serious threat when consumers start to prefer the substitute due to some sort of price competition (Greco, 2015).

3.2.1.2 THREAT OF NEW ENTRANTS

The media and entertainment market is relatively fragmented, where providers need to offer a wide range of products to a highly diversified audience. When considering the threat of new entrants to the industry there are three core areas that need to be considered: (i) customer switch costs, (ii) incumbency advantages independent of company size, and (iii) capital requirements.

In the online streaming realm there are virtually no costs for switching services, and most of the services will provide very similar content (MarketLine, 2016). However, even though the switch costs may be low, there could potential be hidden switching cost in terms of the content that end-consumers value. This is potent if a service has an exclusive licensing deal, or original content, that the end-consumer value highly.

Existing companies within the industry often have advantages, which new entrants will have difficulty competing with; this is especially related to established original content and licensing agreements. Furthermore, the conglomerate nature of the large players allows significant vertical integration of production and distribution facilities (MarketLine, 2016), which limit the threat of entry.

Content is key, therefore, for smaller companies entering the market, there can be significant capital requirements to purchase the rights for distributing existing content, and even greater costs in producing own original content. Consequently, many smaller players may struggle to break through and experience losses when/if exiting the market.

Whilst there are a number of barriers to entry, firms can be tempted by the prospects of high returns in the long run, especially as the industry is growing. Therefore, the threat of new entrants can be considered moderate.

3.2.1.3 THE POWER OF SUPPLIERS

Content is the driver in the media and entertainment industry. Without attractive content, there will be no viewership, and without this, revenue will be restricted. As the content producing firms hold the rights for their own content, through copyright protection, it is possible for them to license their products out to distribution firms.

3.2.1.4 THE POWER OF BUYERS

The only time which bargaining power becomes significant is when there are major buyers, whose buying patterns can critically effect the market (Greco, 2015), although, companies such as Netflix tend to interact directly with the end-consumers, who therefore, individually, have less bargaining power. However, it is believed that the rise of the digital economy, predominantly the Internet, has shifted an increased amount of bargaining power to the end-consumers, by reducing searching and switching costs (MarketLine, 2016).

The power of end-consumers is especially emphasised through viewership. The viewership, or rather subscribers, of any company in the industry is important, as it drives the main revenue stream, as well as is a key factor in other revenue streams. If viewership decreases, revenues from subscriptions decreases, potential advertising or own original content license fee decreases. A key factor that affects is the general trend of weak brand loyalty. The reason for this is that the consumers can easily switch between the various industry players due to the absence of switching costs (MarketLine, 2016).

3.2.1.5 DEGREE OF RIVALRY

The industry experiences a number of large market players, both within production and distribution, such as Disney, DreamWorks and Netflix, as well as numerous small companies, including independents. The diverse market has technological improvements have allowed consumers to choose the services they wish directly, thereby pushing competitors to implement different services, as well as intensifying the competition.

Assuming that the number of competitors will increase and switching costs will continue to decrease along with the ease of distribution due to the nature of the products and the low brand loyalty, rivalry can be expected to intensify. This is in many ways also reflected in the number of large players that are media conglomerates, diversifying the company product portfolio, and thereby reducing the risks (MarketLine, 2016).

As original content is initially the only way to make a mark in the industry, this need to become a core product in a company’s portfolio to ensure revenue flows. The typically high production costs serve as a market barrier, and thereby reduces rivalry.

3.3 KEY SUCCESS FACTORS AND CHALLENGES

The above macroeconomic and industry analysis, from an external perspective, has provided some insight into success factors and challenges that companies within the media and entertainment industry, more specifically online streaming platforms, may face.

Some of the key industry success factors which have been identified are:

- *Wide online product portfolio*, accounting for significant differences in tastes and uses of the streaming services – including both licensed and original content, live and on-demand service etc.
- *Strong technological platform*, end-consumers want quick access to material, so having a platform strong enough to handle traffic is key. Further innovation within new complementary services is key to secure growth. Here being first mover is preferable.
- *Economies of scale*, the online distribution services need to expand into original content to remain competitive, and will have to find a way to produce mass amount of content in a short time at lower costs.

Some of the main challenges include:

- *Shorter product life cycles*, millennia's tend to have a shorter attention span and with a wide-ranging differentiation in tastes.
- *Increase pressure on price and lower customer life cycle*, the low brand loyalty and low switching cost means one of the key competition points is price (and content).
- *Digital piracy and cyber-attacks*, with the online realm, having the nature it has, means increased difficulty in protecting ones content, data and customers.

3.4 INTERNAL ANALYSIS OF NETFLIX, INC.

To analyse Netflix, this section will look at where the company strategically situated currently, the core financial performance factors needed for Part III and the future and strategic performance. The reason for analysing the core financial performance here, is that it will be done at a high-level as needed for the case study, this means that a full fundamental financial analysis is not in scope for this thesis.

3.4.1 NETFLIX TODAY

Netflix is perceived to be one of the main contributors in the accelerated digitalisation of the media and entertainment industry, through the online content platform, by securing partnerships with the major electronic companies to offer the Netflix online platform on their products, including PlayStation, Xbox, Smartphones and Smart TVs (Netflix, 2017a). In order to do so, the company had to be on the forefront of software development, to enable the provision of online on-demand entertainment services. To do so, the co-founder Reed Hastings has focused on implementing a performance culture among the company's many employees (Slideshare, n.d.). The building blocks for this culture is freedom and responsibility. Among the more controversial implications hereof, we see below.

- 'Adequate performance' releases a 'generous severance package'

Netflix aim to keep the most competent staff to ensure that the company remains highly competitive and able to innovate, develop and break technical barriers. The reason behind this generous severance package is to eliminate the assumed guilt feelings managers face, when tasked with firing employees for adequate performance. By introducing a generous severance package, Netflix try to eliminate this 'hold-up' of adequate performing employees to allow space for new employees, who are given the opportunity to perform. This ensures that employees, who thrive in this environment, will perform at the best of their ability. In the end, this allows Netflix to maintain a competitive advantage of talented employees, who are better suited for building and implementing disruptive technologies.

- Performance evaluation over time tracking

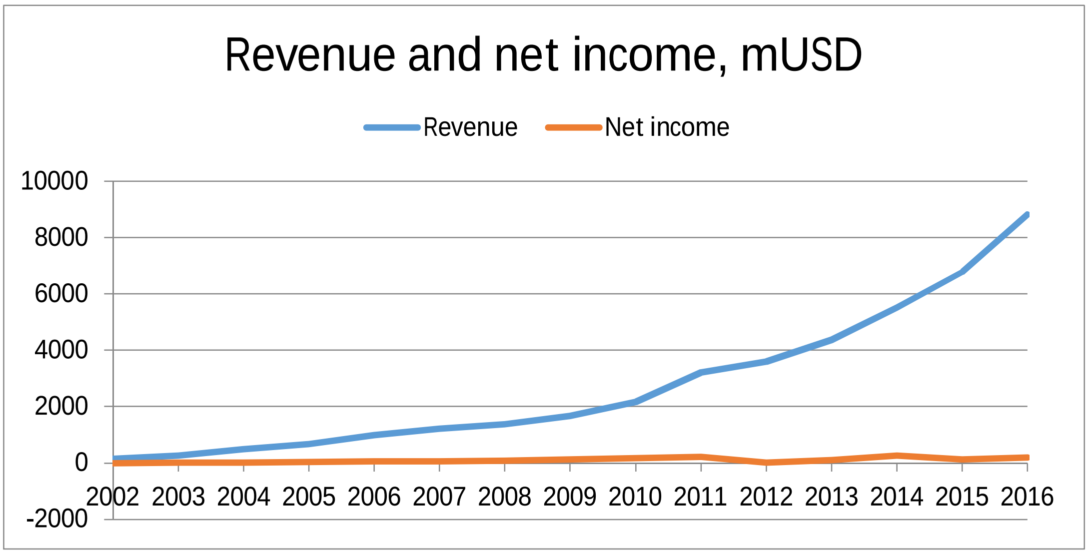
Performance is a focus of Netflix, a clear result of above; however, hard-working employees do not necessarily perform well. Therefore, in order to attract talent and reduce procedures that do not directly attribute to value creation, the company has left the holiday and time tracking regime. All that matters is the goals set at personal level. Unlike the initial sound of this, Netflix is known for their high ambition, and not tracking time and holiday means not tracking how little holiday employees actually take. With performance at the core of the culture, you scare away employees who are not truly passionate about the tasks faced at Netflix.

The performance culture makes Netflix fall within the group of new IT giants such as Alphabet and Facebook who enforce similar management styles and cultures.

3.4.2 FINANCIAL PERFORMANCE

Netflix has managed to increase the number of subscribers year-on-year during its 15 years as a publicly listed company. As a result, the revenue has nine folded in the past 10 years. Through innovation and internationalisation, Netflix has managed to maintain sky-high growth rates. A quick glance at the key income statement figures, as illustrated in Figure 13, shows the significant revenue growth from a historical perspective. However, below also reveals an almost flat trend in net income in comparison to this revenue growth.

Figure 13 – Revenue and net income, million USD

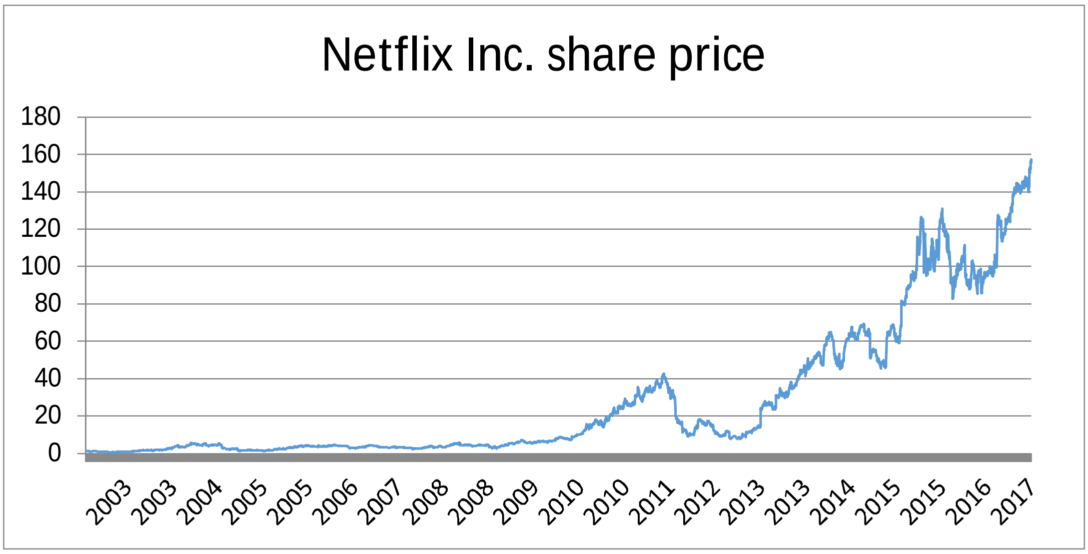


Source: Constructed by Authors based on annual reports (Netflix, 2017a)

One potential explanation hereof build on the argumentation brought forth by Aswarth Damodaran, with respect to the accounting treatment of capital expenditures actually being booked as operating expenses. In addition hereto, two factors are perceived as limiting the net income: (i) the internationalisation process means acquiring and licensing content to build a database from scratch, as media contracts often are segmented by countries, hence, acquiring the right to stream a movie in the US does not automatically include the other countries. The internationalisation is therefore associated with heavy investments and expensive licensing agreements. This limits the economies of scale and may prove non-profitable for some countries during the start-up face. (ii) To maintain a high retention rate, Netflix's customers require new releases at a regular basis, as a majority of the customers only watch the same content once. Netflix is thereby required to expand their content database regularly to attract new customers and retain the existing. This does not have any implications to the membership fee; hence, content commitments increase if not managed optimally. In fact, one of the large concerns regards the growth in future content liabilities outweighing the subscriber growth rate (Collins, 2016). Further, the free cash flow statement show that the company was bleeding cash in both FY15 and FY16 (Netflix, 2017b). In the first quarter of FY17, Netflix continued to realise a negative free cash flow equivalent to almost USD 5.3 million per workday[3].

Despite these financial challenges, investor confidence remains high and the stock continues to grow. As of May 5, the total market capitalisation of Netflix Inc. amounts to approximately USD 68.7 billion, with the share price also reaching an all time high of USD 156.7 per share. Figure 14, below, illustrates the share price development of Netflix since its IPO in 2002.

Figure 14 – Development of Netflix's share price



Source: Constructed by Authors based on trading data (Google Finance, 2017b)

If comparing the current stock price to the net income of FY16, the P/E ratio equals 368. The market thereby prices the stock with high expectations to the future growth rate. This very high price of the Netflix stocks have made many wonder, whether this price in fact is simply inflated by rumours

[3] Assuming 65 workdays in first quarter of 2017.

and market speculations, or if there are any reasonable explanation, which justify the trading price observed during the past few years (Collins, 2016).

3.4.3 THE FUTURE AND STRATEGIC CONSIDERATIONS

From the industry analysis, it is clear that Netflix operates in a highly dynamic market, where developments are constant. This is both in terms of consolidations, as seen with the most recent USD 85+ billion mega merger of AT&T and Time Warner Group (Littleton, 2017), and the emerging technologies for interactive content, including virtual and augmented reality among much more.

There have been a number of rumours regarding Netflix's potential future, which have survived for some time. One of the more persistent rumours is that of Disney acquiring Netflix (Somaney, 2017). Reasons hereof are twofold: (i) Disney owns a number of broadcasting companies, including the troubled ESPN, which suffer from a decline in viewers, resulting in major layoffs (Somaney, 2017). Netflix is perceived to offer a new platform for ESPN's live streaming of sports, as well as have synergies with all the Disney content and Disney channels currently existing. (ii) The CEO of Disney, Bon Iger (age 66), has for some time been looking for his replacement upon his declared retirement. Some analysts argue that an acquisition of Netflix could also be perceived as the acquisition of a new CEO (Melloy, 2016).

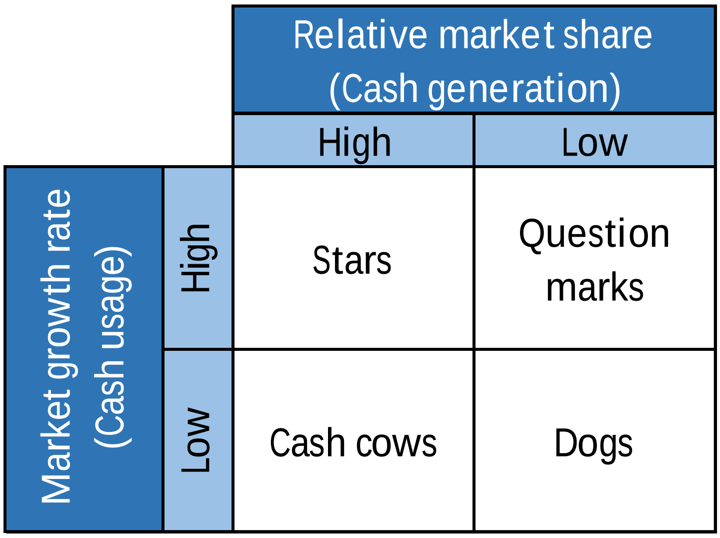
In summary, the market in which Netflix compete with companies such as Amazon, HBO, Hulu and others, is developing rapidly along with new technologies. Several competitors produce their own content as the licensing prices have risen and customers demand new content more frequently. In a response to the heavy investments needed, a consolidation is perceived to take place in the market, and as with all M&A waves, prices increase substantially upon persistent M&A rumours.

3.5 FUTURE PROFITABILITY

This section combines the findings from the environmental and company analysis to see if Netflix current business model strategically fits, allowing for a sustainable competitive position in the future, for this the BCG-matrix framework will be used.

The BCG-matrix describes the relationship between market growth rate and the market share relative to a firm's competitors, with four possible categories – dogs, question marks, stars and cash cows. Please refer to Figure 15 below for an overview.

Figure 15 – The BCG-matrix



Source: Constructed by authors based on information from NetMBA (c2010).

One of the significant limitations of this model is the assumption that each business unit is independent of the others, both in terms of revenue and investments, a dog may be assisting other business units in gaining a competitive advantage. Furthermore, the matrix in many ways over-emphasises on market growth, especially as the market size is dependent on the definition of ones market (NetMBA.com, c2010). The dualism between market position and core competencies is essential to enable the positioning of Netflix's product groups within the BCG-matrix.

Currently Netflix operates within two divisions within the film and TV market, licensing and original content. Licensing bleeds capital, but is necessary to retain and attrackt consumers.

Often when content is licensed it will only be applicable in the country / union, where it has been licensed and therefore, much capital is required to fund the database alone, especially for international companies like Netflix. Furthermore, the licensed content is a necessity to ensure the consumer retention, as original content can not be produced at the scale content is demanded. The high costs, lower market share and low growth rate suggests that licensing is a dog, however, it is the essential for the business, to ensure customer retention and thereby capital to expand the product portfolio.

Netflix original's content consumes a lot of cash as well, as the production of original series is expensive, however, it is also the original content that can generate large amounts of cash through licensing and attracting new subscribers. Netflix original content can be considered a Star.

From the two divisions in Netflix's product portfolio it could be suggested that their future profitability is rather limited, therefore they need to invest in diversifying their product portfolio further e.g. through life streaming, expansion of original content or interactive TV for growth.

PART III – PRACTICAL CASE APPLICATION – NETFLIX INC.

The purpose of this section is to bridge the theoretical realm with the practitioners use for valuation models, through the case application of Netflix. First, the findings from Part II will be expanded to turn the strategic opportunities into real option components as this will provide the foundation for the real option model. Thereafter the valuation of the case company will performed in the hope of bridging theory and practice.

4.1 TURNING THE STRATGIC OPPORTUNITIES INTO REAL OPTION COMPONENTS

Operating within a highly dynamic industry, constantly developing and exerting pressure on the services current offered, the demand for technological innovation and business model progression, to beat competitors, could not be more prominent. Netflix's technically strong team, favourable market conditions for raising capital and a large number of subscriber, gives the company the ability to both adapt to market developments and create innovate products. This infers that the company potentially has many opportunities, which can be pursued. The opportunities range from small to large, and are seen as substantial value contributors to the fair value of the company. Given the context, which has been analysed in Part II, the following are perceived as strategic options available to Netflix:

4.1.1 NETFLIX ORIGINAL CONTENT EXPANSION

Netflix currently produce their own original content, under the brand Netflix Original, which includes series such as Narcos, The Crown, House of Cards, Orange is the new black, and many more. Each of these have numerous real options embedded. The options include the ability to expand on the existing story lines, or alternatively, to simply expand the Netflix Original brand with new series. These can be considered as the option, but not the obligation, to develop further in what would resemble a call option for expansion. On an individual project level, these options have short maturities of one to two years – following the logic that people are interested in a series as long as it is running, but quickly manage to find a substitute, if the series is not expanded within a reasonable timeframe.

As a series can have the option to run for several seasons, the characteristics of these options are somewhat imitated by the compounding setup. The producers have, upon new information from the most recent season, the ability to decide whether or not to continue the series production or wrap it up. This scenario may then be repeated for many seasons, as seen with the 1989 show 'The Simpsons', which is currently airing the 28th season (IMDb, 2017).

4.1.2 LIVE STREAMING CONTENT

An alternative option is to pursue the opportunities present within the 'on-demand' trend of wherever, whenever. In this scenario, Netflix may seize the 'access from anywhere' feature to bring live events directly to the consumer. This live streaming may entail regular TV channels, building on a digital version of the well-established cable network market, as well exclusive streaming rights to live concerts, comedy shows and sports events. The option build on the on-going digitalisation process for which Netflix has an established platform, as well as direct access to millions of subscribers, who may be willing to pay a premium for having access to this type of content. Alternatively, a pay per event structure could be established, much like is known from the streaming of boxing events (DirectTV, 2017). This in many ways share the characteristics of an American call option to expand the current business, with different sources of uncertainty influencing the future business decision. It further builds on the field of purchasing or licensing the rights to certain events, in which Netflix has a well-established and experienced team of people.

Although, as highlighted in the strategic analysis of Part II, this is a viable but unlikely path for Netflix to follow in this moment of time, unlike its competitors Amazon Prime and Hulu (Snider, 2017).

4.1.3 INTERACTIVE CONTENT

A third option for Netflix concerns the technological advancements, which allow for a higher degree of interaction, as well as integration of the digital and real world, blurring the distinction between the two. As an example, the augmented reality game 'Pokémon Go' took the world by storm (Weinberger, 2016). Pokémon Go, despite being a game, reflects the new trend of technology, in which the customer becomes an active participant. Other examples of this include PlayStation Motion, the Wii console and interactive Tour de France cycling simulators for home use.

The option here for Netflix emerges from their existing subscriber base, technological talent pool of employees, development processes and the significant market positioning as a preferred home entertainment platform, being either through an Apple TV, Smart TV or similar. The option entails a development of their business model, to expand the services provided from TV entertainment to include for example a health division, with interactive exercise videos, live personal trainer and cycling simulators to name some opportunities. Further, it presents the opportunity to stretch the business model towards the gaming industry, providing virtual reality content with an integrated social aspect, allowing friends to meet in the virtual realm. Examples hereof could be a development of games similar to the popular Escape Rooms, as have already been established in physical form (Escape Games Copenhagen, 2017). Such development will not only allow for a different membership fee structure, but also generate the opportunity to sell compatible hardware for using your own bike with the simulator, virtual reality headset, webcams etc. Partnership structures may be perceived as beneficial, as this allows Netflix to focus on the software aspect, which is perceived to be their current core strength. This option displays the characteristics of an American call option with different sources of uncertainty influencing the future business decision.

Having established that Netflix faces different real options, which are potentially very valuable to the firm, the question becomes how to value these real options. Above provides what appears to be the real options present for Netflix, however, it is not by any means unimaginable that several other opportunities exists as a result of the current situation at Netflix.

4.2 VALUATION OF THE CASE COMPANY – NETFLIX INC.

In general, the value of Netflix can be split into two components: (i) the value of the business in the current form it exists today, and (ii) the value of the options available to Netflix in order to increase revenues through the development of their business model. For this reason, the valuation of Netflix will be treated as two separate parts below. Note that all valuations are performed as of 31 December 2016, as this reflects the latest complete financial year of the case company.

4.2.1 VALUATION OF THE EXISTING OPERATIONS

Netflix's core business is primarily licensing of digital content from third party production companies or IP owners, with a diversification strategy fuelling the need for Netflix Original content, unique to Netflix subscribers. This forms the foundation of the value for Netflix.

4.2.1.1 CHOICE OF VALUATION METHODOLOGY

As the core business activity will be treated as displaying no characteristics of embedded real options, the DCF model is considered appropriate as the foundation for this part-valuation. However, on its own, the model would be considered insufficient to represent the fair value, as it would not capture the value of the opportunities Netflix have. Therefore, the second part of the company valuation will account for the value of flexibility lacked by the discounted cash flow model, capturing as much of the remaining value as possible.

The choice of which model to use for the first part of the valuation was between the discounted cash flow model and the customer lifetime value, with the main driver behind the choice of model being that of data availability. Netflix provides free cash flow statements, as well as historical growth rates for revenue and other parameters, however, the margins needed for the CLV model are no longer provided. It may have been possible to re-construct the margins, however the potential inaccuracy, due to the low transparency of the annual reports, could potentially lead to an incorrect valuation, thus making the DCF model more appropriate. However, the CLV model could still be applied, as the number of subscribers is in focus. The DCF advantage over the CLV, in this case, would be concerning the modelling of future liability content. This is perceived as a more intuitive process in the DCF, whereas an extension to the simple CLV framework would be needed.

Further, the relative valuation approach has been disregarded, as these benchmark ratios on market level, hence, requiring a very substantial adjustment process to reach a 'non real option premium' value of the competitors.

Therefore, for the purpose of the valuation of the existing operations, the DCF model is considered the most appropriate, even though it has its shortcomings.

4.2.1.2 ESTIMATING INPUT VARIABLES

For the DCF, the following inputs and assumptions have been made:

4.2.1.2.1 DISCOUNT RATE

The generally accepted approach of weighted average cost of capital has been employed in determining the rate, at which the future free cash flows are to be discounted. Please refer to Appendix 1 for additional information on data sources, input variables and calculations of the discount rate.

The ***cost of capital*** was estimated with respect to the CAPM approach:

- The risk-free rate was set equal to the Us government bond with 5-years to maturity, as of 30 December 2016. The annual yield was, according to Bloomberg, 1.93%. Please refer to Appendix 1 for print screen of data source from Bloomberg.
- Market return was set equal to the historical 5-year simple average of the S&P500 index, as of 30 December 2016, of 11.06% (Google Finance, 2017a).
- Beta was regressed over a historical period of 5-years with movements against the S&P500 index, as of 30 December 2016 (Google Finance, 2017a; Google Finance, 2017b). This resulted in a beta of 1.39.

Netflix's calculated cost of capital, based on above inputs estimated to be 14.63%. Further, the company's capital structure provides an equity share to enterprise value[4] of 44.34%.

The ***cost of debt*** was obtained by calculating the weighted average coupon payments of all of Netflix's issued corporate bonds. The result was a 5.43% interest rate. Combined with a US tax rate of 33.25%, the cost of debt after tax shield results in a 3.63% rate. Further, Netflix's capital structure provides a debt share to enterprise value of 56.66%.

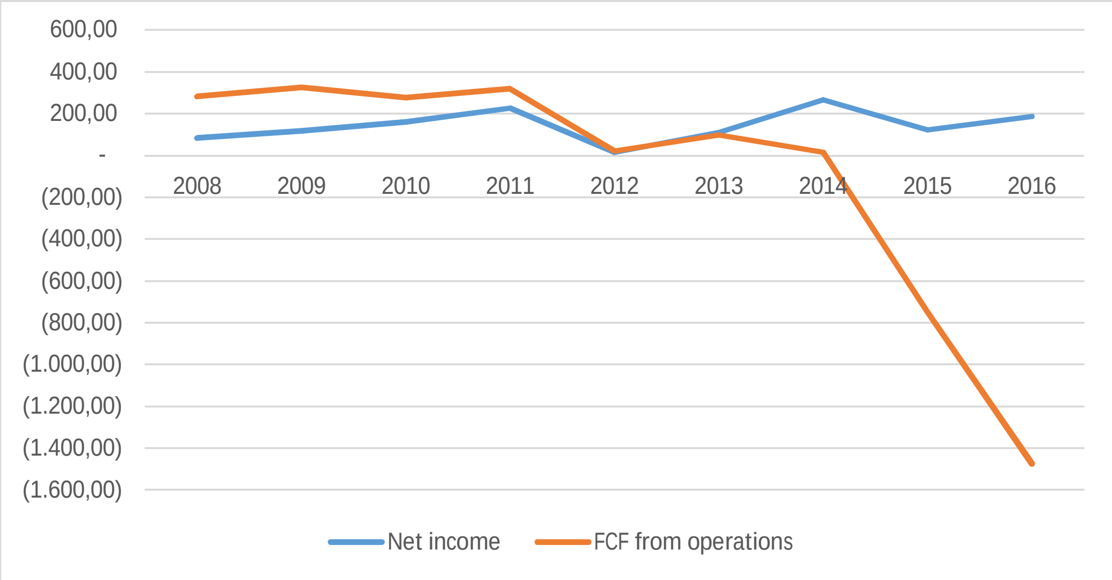
The ***WACC*** thereby results in 8.51% and has been employed using mid-year discounting, assuming the income takes place halfway through the year rather than at the end of the year, which results in over-discounting.

4.2.1.2.2 FREE CASH FLOW

In the latest three financial years, Netflix has experienced a negative free cash flow from operations, these have been adjusted to reflect what is considered 'normal' business circumstances of the streaming services. Figure 16 below illustrates the data on which this non-normal free cash flow determination has been made.

[4] Defined as net debt + equity

Figure 16 – Net income vs. FCF from operations



Source: Constructed by Authors based on annual report (Netflix, 2017b).

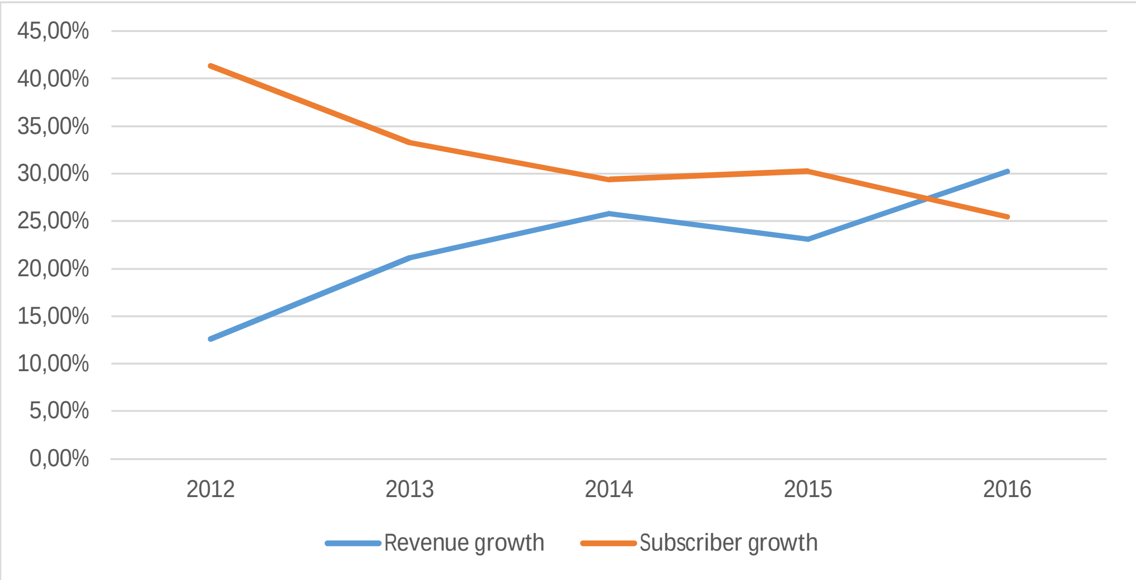
In practice, the normal business circumstances are assumed to be reflected in the years FY2012-2013, at which the free cash flow more or less match the net income. A free cash flow to net income margin has been estimated to be fixed at a 100% rate based on the FY2012-2013. This margin is assumed applicable for all future periods. This is not expected to accurately reflect the actual future free cash flows from operations, but in the lack of better data, this is the assumption made. Further, the process of estimating the net income is based on a 5-year WAVG net income margin of 2.43%. This is assumed to continue and the net income will constitute the foundation on which the free cash flow has been estimated. It should be noted that this net income margin represents the early years of internationalisation, in which content liabilities vs. number of subscribers are not assumed to have reached an optimal steady state. Therefore, economies of scale should be expected, however, this has not been quantified in the valuation.

4.2.1.2.3 GROWTH RATE

Currently, Netflix is still in the process of internationalisation, for which reason an above long-term growth rate is expected to be achieved. It is assumed that this internationalisation growth rate will continue for 5 years after which a long-term growth rate has been employed for the calculation of the terminal value.

The internationalisation growth rate has been estimated using the revenue growth of the past 5 years on a WAVG basis. This has resulted in an estimated growth rate of 24.22%, whilst the long-term growth rate has been estimated to equal 5%. The assumptions have been evaluated in combination with the historical rates, as presented in Figure 17 below.

Figure 17 – Revenue and subscriber growth



Source: Constructed by Authors based on annual report (Netflix, 2017b).

4.2.1.3 OUTPUT AND LIMITATIONS

For an overview of all input, data sources and valuation, please refer to appendix 2.

As a result of above input estimations, the DCF model values Netflix's core business activities at just above USD 14 billion, or the equivalent of USD 32.40 per share. It should be noted that this value is based on the general assumption that the historical performance of Netflix reflects future earnings, as well as eliminating any benefit from the potential economies of scale. Further, the net income is likely to be influenced by capital expenditures classified as operating expenditures, which would, if adjusted, increase the value. Unfortunately, the annual report provides little transparency for which reason such adjustments have not been performed. The value thereby constitutes a 'quick and dirty' valuation of Netflix's core business activities, without any value assigned to the embedded options.

The DCF valuation is primarily driven by the discount rate as well as the long-term growth rate, as a result, the sensitivity of the outcomes, on a per share level, with changes to these two input parameters, can greatly vary the value, as illustrate below in Table 3.

Table 3 – Sensitivity analysis

		WACC				
		7.51%	8.01%	8.51%	9.01%	9.51%
Growth rate	4.00%	33.72	29.42	26.08	23.40	21.21
	4.50%	38.66	33.05	28.84	25.57	22.95
	5.00%	45.58	37.90	32.40	28.28	25.08
	5.50%	55.95	44.67	37.15	31.77	27.74
	6.00%	73.19	54.82	43.78	36.42	31.15

Source: Authors analysis

The sensitivity analysis shows that the outcome is very sensitive to both the discount rate, as well as the growth rate, with a plus/minus 200 basis-point change for each of the growth rate inputs, the value spans from USD 21.21 to USD 73.19 per share. Thus, the long-term growth rate has a substantial impact, even when minor changes to the input estimates are incorporated. However, with the CAPM as support for the 8.51% WACC, the valuation range of USD 26.08 to USD 43.78 per share is perceived as a fair approximation of the value of Netflix's core business activities.

4.2.2 VALUATION OF THE EMBEDDED REAL OPTIONS

As Netflix currently holds more than one real option, a limitation has been imposed on the scope of this valuation. Although these real options potentially could be handled as one, the estimation of inputs and computational process required would be highly complex and resource demanding. Therefore, with the purpose of the case study in mind, a single option will be valuated to highlight some of the difficulties practitioners are faced with, as well as enable a contextualisation of the model analysis and discussion. For this reason, the valuation will be limited to the option of introducing interactive content to the product portfolio.

The real option identified for Netflix, and chosen for this analysis, concerns the development of the existing array of services to include interactive content, which not only engages the customer, but rely on a degree of interaction in the sense that inputs or feedback must be sent from the customer back to Netflix. As established in the industry analysis, this trend is starting to get a grip on the market with virtual and augmented reality games, as well as live streaming gym classes. In short, the aim is to bring people together in a virtual world by bringing on-demand services directly into the living rooms of the customers.

Further, this real option is derived directly from the competent and highly skilled workforce controlled by Netflix, which enables them to develop software solutions to highly technical problems. Netflix may also have an upper hand in terms of their currently high market penetration and international presence (Netflix, 2017a). The brand is therefore well known, trusted and associated with entertainment. This may provide Netflix with advantages when launching this new division. It is not assumed that the services should be included in Netflix’s current membership fee.

4.2.2.1 CHOICE OF VALUATION METHODOLOGY

The analysis of models provided previously in this thesis has determined that some of the more popular models among practitioners do not handle flexibility well. As a direct result, the real options appearing to exist from the current situation of Netflix should be valued using option pricing methodologies.

The specifics of the real option described dictate a need for a model that can handle complexity, high-dimension and uncertainty from several sources. As a result, an option pricing model utilising Monte Carlo simulation has been perceived as particularly beneficial. The approach allows for modelling of scenarios closer to that observed for Netflix’s real option. In contrast, although both the Black-Scholes model and the Binomial model could have been implemented to price the option in its simple form, the Monte Carlo method has been selected. The model allows for both American and European option pricing, as well as the possibility of increasing the dimensions by estimating uncertainty from several sources or incorporation of other exotic option characteristics.

4.2.2.2 ESTIMATING INPUT VARIABLES

For the Monte Carlo method, the following inputs and assumptions have been made:

4.2.2.2.1 INTEREST RATE

The risk-free rate was set equal to the Us government bond with 10-years to maturity, as of 30 December 2016. The annual yield was, according to Bloomberg, 2.44%. Please refer to Appendix 3 for print screen of data source from Bloomberg.

4.2.2.2.2 TIME TO EXPIRATION

It is generally difficult to determine the time to expiration for real options, due to the lack of underlying contract specifying this. The estimation has instead been based on an evaluation of market development, expectations and competitors. However, the real option may not per se have a sharp cut of date, but rather fade away over time, in the specific case for Netflix. A long period to the expiration date of the option of an underlying asset within a highly volatile market is an explosive combination, as option prices rise rapidly. As interactive content already has an established market with a few years of development in other segments, the trend appears to be unavoidable to influence the market on which Netflix operate. Given this, the time to maturity on a real option for interactive content development is not perceived to be any longer than 10 years. This follows the assumption that several competitors will have captured the market. A strong domination of this market will potentially cease Netflix's opportunity to successfully enter this market without the break-through technology. Waiting 10 years to introduce this technology is only seen to weaken the competitive advantage following Gordon Moore's prediction with respect to the exponential growth in computer power (Mooreslaw.org, 2017). Yet, assuming a time to expiration of 10 years is associated with uncertainty, as this may as well be 8 or 12 years. In fact, this is difficult to substantiate.

4.2.2.2.3 COST OF INVESTMENT (EXERCISE PRICE), X

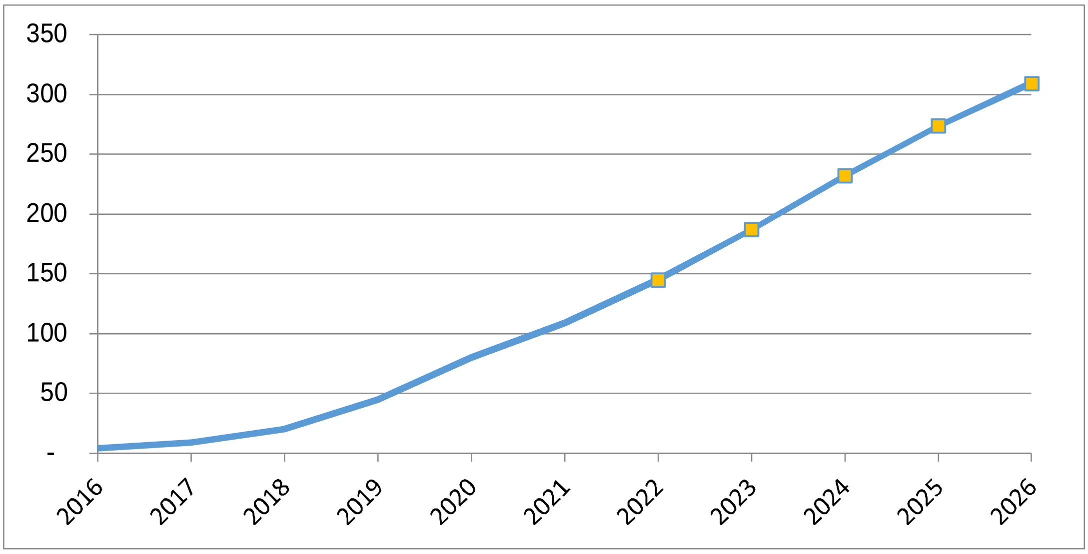
This input involves estimating the cost of developing and marketing the new 'product'. From an outsider perspective, very little information is available regarding this, thus one must look to other industries, to gain some insight on broadly comparable software program development and launches. One proxy hereof could be estimated based on costs incurred and reported by the gaming industry. The development and marketing costs of games vary significantly to upwards of USD 500 million (The Economist, 2014). This is partly due to the time consuming handcrafting of the software code and graphics design that go into creating a game. Although potentially only little comparability can be established, this may be used in the lack of a better alternative. Some data is available, however, the data sources are more often than not questionable in terms of validity. More comparable data may be available internally, as Netflix has experience with developing an online streaming platform in advance of the competitors. However, even at this level, the estimation of these costs are still connected with some degree of uncertainty, due to unforeseeable costs and delays.

For this specific real option valuation, the estimation takes departure in the gaming industry's more expensive and comprehensive games, costing approx. USD 350 million to create. The most expensive games have been eliminated, as their costs are primarily driven by global marketing initiative (The Economist, 2014). With respect to marketing, it is assumed that Netflix will benefit significantly from their current customer base and brand to attract customers to their new division.

4.2.2.2.4 CASH INFLOW (PRICE OF UNDERLYING ASSET), S

The cash inflows is another difficult input to estimate, as, in contrast to the before mentioned development costs, Netflix does not exercise the same control over these cash inflows. Further, only limited market projections exist with respect to interactive content. One must therefore look towards other markets for a proxy of the potential market size and developments. Other examples of interactive content again include the virtual and augmented reality industry. The market growth here has accelerated as a result of the most recent success story, Pokémon Go, which boosted the popularity of the augmented reality software. According to Statista (2017a), the virtual and augmented reality market is expected to achieve high growth rates over the next few years, as appears from Figure 18 below, displaying the worldwide market value in USD billion of the virtual and augmented reality market. Statista (2017a) provided the data for the market forecast, as well as an addition to reach a 10-year market forecast. The additional points, from 2022 onwards, have been extrapolated based on the trend established by Statista, marked with yellow points in Figure 18.

Figure 18 – Virtual and augmented reality market forecast (billion USD)



Source: Constructed by Authors & Statista (2017a)

However, having established a proxy for the market does not leave us with an estimation of the expected cash inflow, thus additional assumptions are needed before reaching this input in the desired form.

- Expected market penetration rate

The market penetration rate is extremely difficult to quantify, due to the penetration rate of Netflix's current business is non-comparable to that of the new market, which they are assumed to have an option to expand into. On this market, the competitors are not Hulu, HBO or Amazon, but tech giants such as Sony, Samsung, Google and the Facebook owned Oculus (Merel, 2016). Due to strong competitors pursuing customers in the virtual and augmented reality market, Netflix is assumed to take a slightly different approach, as well as benefit from their brand, resulting in an estimated 1% penetration rate. This penetration rate may be rather ambitious from day one, where it is it is expected to over-estimate, while total market value is lower. This is believed to be offset by the expected unaccounted increases in market penetration of the worldwide market, as Netflix will have the opportunity to expand and grow.

- Free cash flow to revenue margin

Relying on the assumptions drawn in the DCF analysis, the historical net income to revenue margin was 2.43%, and in the context of normal business circumstances, the free cash flows were set to equal net income. Despite the estimated cash flows do not reflect the current business activities of Netflix, some overlap is perceived to exist. Maintaining the software operational, as well as creating content is assumed to have the same cost structure. Once again, the accounting standards come into play, as content development should be treated as cash flows to investments and then amortised over the lifetime of the content. However, this does not appear to be the case with Netflix's financials and any adjustments hereof may be incorrect. For this reason, we must rely on data available.

- Future free cash flows

In addition hereto, the perpetual future free cash flows has been estimated using the WACC of 8.51% and a long term growth rate of 5% as established in the DCF analysis. This is to ensure that the real option model captures all future free cash flows estimated to flow from the project, if executed.

As a result of the above, Netflix's cash inflow is estimated to slightly less than USD 62.4 million based on the 2017 market value. This will serve as the foundation, for which the Monte Carlo simulation will generate random paths, Table 4, below, summarises the input factors.

Table 4 – Monte Carlo simulation inputs

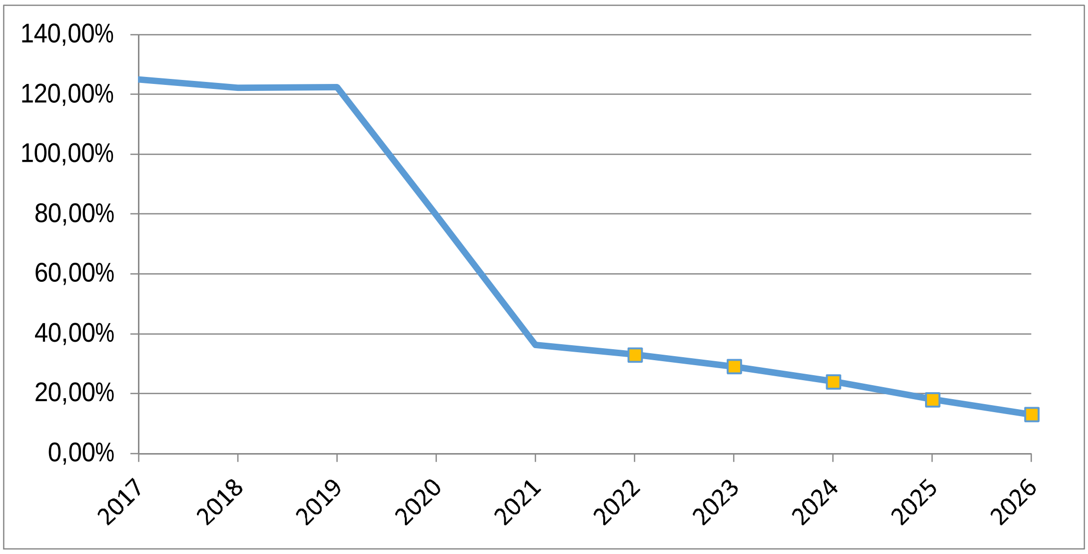
Future FCF	
Market size FY17	9,000,000,000
Penetration rate	1.00%
Revenue	90,000,000
Rev to FCF	2.43%
FCF FY17	2,187,000
WACC	8.51%
Long term growth	5%
Terminal FCF	62,372,996

Source: Authors and Statista (2017a)

4.2.2.2.5 DRIFT (EXPECTED RATE OF RETURN)

As the market is expected to move in a specific direction, namely up, we need to impose an assumed drift rate. As with any other estimations of the future, this has a degree of uncertainty, besides just volatility, and often assumes that historical events are representative of the future events. In this case, the selected market proxy will be the main determinant of the expected drift rate, to represent the drift in cash inflows from the real option project. In this particular case, the market data available from Statista represents their forecast of the worldwide market revenues. The annual growth rate in this forecasted market has an average of 97.15% and a weighted average of 36.54%. Naturally, as the market increases, the growth rate is expected to decrease. Figure 19, below, provides an overview of the forecasted growth rates. As with Figure 18, the yellow points indicate the assumed growth rate, needed to achieve the realised market value forecasted, extrapolated from the forecasted trend from Stastia (2017).

Figure 19 – Forecasted market growth



Source: Authors and Statista (2017a)

As illustrated in Figure 19, the market is assumed to initially grow rapidly in the nearest future, and thereafter the growth rates are expected to slow down as the market size increases. The average growth rate of 89.58% is not perceived to be an accurate estimate for the drift rate experienced over the next 10 years. Instead, the drift will be implemented on a year-to-year basis, taking departure in the above growth rates, eroded by half the variance. The estimated drift rates are represented in Table 5, seen below.

Table 5 – Estimated yearly drift rates

Drift rate	
Year	Rate
2017	113.94%
2018	111.16%
2019	111.44%
2020	68.71%
2021	25.19%
2022	21.94%
2023	17.94%
2024	12.94%
2025	6.94%
2026	1.94%

Source: Authors and Statista (2017a)

By avoiding having a constant drift rate, the model becomes more dynamic in contrast to assuming a fixed percentage input for all years. Thus, the calculations will illustrate the real option more accurately, increasing the validity of the results.

4.2.2.2.6 RANDOM STOCHASTIC VARIABLE

The random stochastic variable consists of two components: (i) the random generated number in accordance with the standard normal distribution properties, and (ii) the estimated volatility. The random numbers could have been generated in accordance with the volatility, however, the model becomes more generic, when multiplying standard generated random numbers of normal distribution with mean 0 and standard deviation 1 by the assumed volatility level afterwards.

- Random numbers

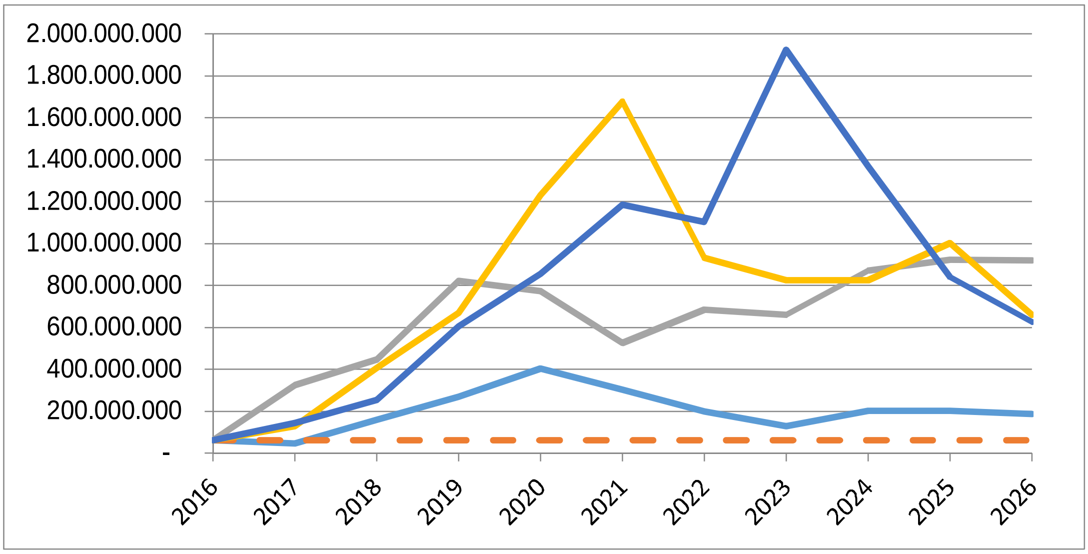
The random number is generated using Excel's Random Number Generator. The more random numbers generated, the more 'correct' the simulation becomes. For this case, a total of 10,000 random numbers have been generated for each year of time to expiration. In practice, this number may be considered rather small, however, for Monte Carlo simulations of greater scales, specialised software other than Excel is recommended.

- Volatility

As with the estimation of the drift variable, the volatility measure is estimated based on the market volatility, which has been high due to high growth rates. Further, the volatility is based on only a few annual market values, which in general is expected to decrease the accuracy. Nonetheless, the forecasted marked volatility of 46.93% is employed in this case.

Together with the drift, this random stochastic variable will enable a path generation for each of the 10,000 simulations. For an example of such paths, please refer to Figure 20 below.

Figure 20 – Examples of random paths



Source: Constructed by Authors

In Figure 20, above, the grey dotted line indicates the initial cash flow estimate, *S*. As visible, the paths fluctuate substantially over the time to expiration period, and some of the paths occasionally fall below the initial estimated cash inflow. In general, the drift variable ensures that the number of random generated paths going below the initial cash flow estimate are very limited. Reason hereof is the expected strong positive market development.

4.2.3.3 OUTPUT AND LIMITATIONS

As a result of the above input estimations, the value of the option, using the Monte Carlo method, equals almost USD 20.7 billion or USD 47.12 per share, based on a simulation of 10,000 random paths following the specified drift and random stochastic variable input. The option has been calculated as a European call option although this is characteristically incorrect. The reason for this is the theoretical implications of American call options, which are never optimal to exercise before expiration (Jia, 2009). However, should one price an American option with Monte Carlo, both direct, least square and quasi methods exist, though this increases the computational complexity substantially. Further, as American calls are never optimal to exercise early, they must have a value equal to that of European options, hence whether we have calculated the option as an American or a European option would not have led to a difference in value from a practical perspective. For a more detailed overview of the calculations, please refer to appendix 3.

In addition to above, it is of great interest to perform a sensitivity analysis of the various inputs to gain a greater understanding of the potential implications of inaccurate estimates. As it appears from Table 6, below, the value of the option is primarily driven by the cash flow estimation rather than the cost of development. Intuitively this makes sense, as the high drift rate imposed in this real option valuation makes the different paths more extreme in their developments.

Table 6 – Sensitivity analysis of inputs for S and X

		Additional revenue				
		22,664,756	42,664,756	62,664,756	82,664,756	102,664,756
Cost of expansion	150,000,000	17.08	32.39	47.69	63.00	78.31
	250,000,000	16.91	32.21	47.52	62.82	78.13
	350,000,000	16.74	32.03	47.34	62.64	77.95
	450,000,000	16.57	31.86	47.16	62.47	77.77
	550,000,000	16.42	31.69	46.99	62.29	77.60

Source: Constructed by Authors

According to the sensitivity analysis, the additional revenue is clearly the main value driver of the option value. Therefore, it may of interest to study the factors driving this additional revenue input, S, further. Table 7, on the next page, therefore shows the sensitivity towards the penetration rate, as well as long-term growth rate, which is perceived to be the two main factors of estimating the additional revenue. From this, it appears that the outcome has the greatest sensitivity to changes in the market penetration rate.

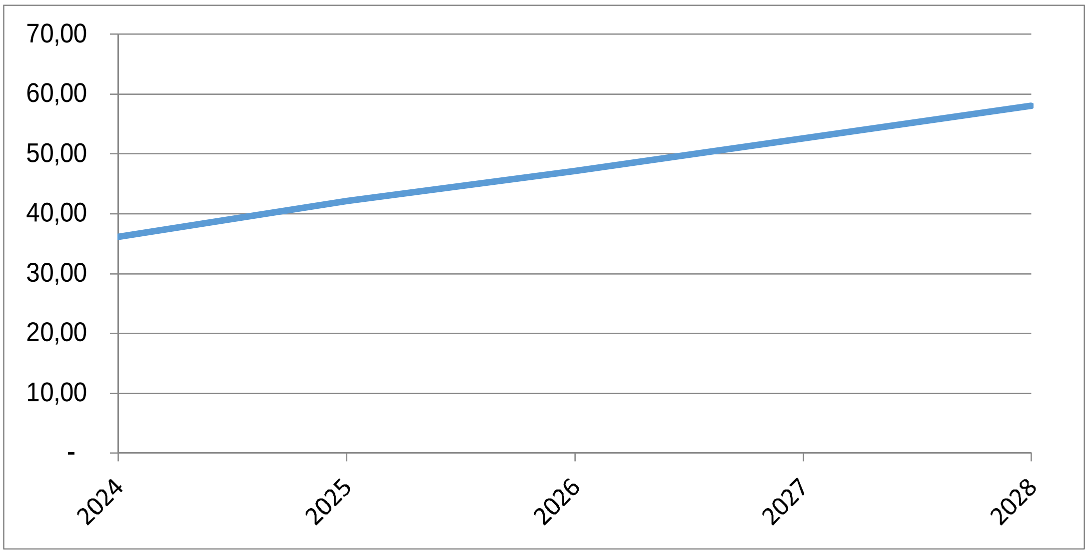
Table 7 – Sensitivity analysis of inputs to the estimation of S

		Long term growth rate				
		4.00%	4.50%	5.00%	5.50%	6.00%
Penetration rate	0.50%	17.96	20.28	23.25	27.22	32.77
	0.75%	27.24	30.72	35.18	41.14	49.47
	1.00%	36.52	41.16	47.12	55.05	66.16
	1.25%	45.81	51.60	59.05	68.97	82.86
	1.50%	55.09	62.05	70.98	82.89	99.55

Source: Constructed by Authors

In addition to above, it is also of interest to understand the impact time to exercise may have on the estimated value. It is not a surprise that there is a positive relationship between the value and time to exercise. In this case, with a real option in a rapidly growing market, the sensitivity towards the time to maturity is expected to a significant value driver as well. As visible from Figure 21, the valuation is in fact very sensitive towards changes in time to expiration. As an example, if the time to exercise was increased by 2 years, assuming the percentage growth rate is frosen in 2026 and going forward, the real option value would increase just above 24%. In fact, the value would approximately have doubled if the time to exercise is increased from 10 to 16.5 years.

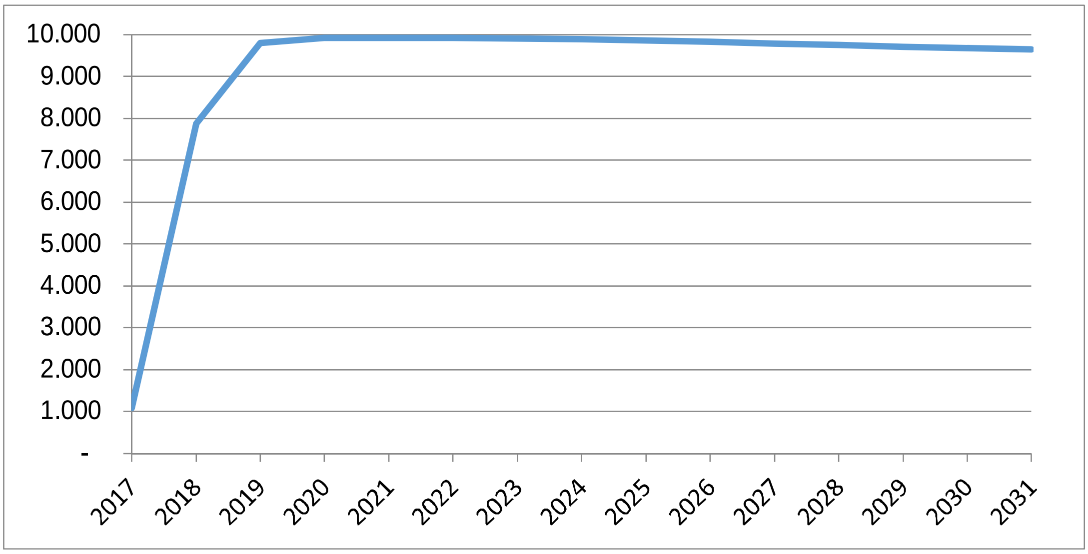
Figure 21 – Time to exercise sensitivity



Source: Constructed by Authors

Besides this, the valuation is also, to a significant degree, sensitive towards the estimated drift rate. Due to these being specific to each year, a sensitivity table is more complex to create. However, the value of the real option is highly affected by the level of this expected rate of return on the market. One way of displaying this is the rate at which a majority of the option paths becomes in-the-money, as illustrated in Figure 22 below.

Figure 22 – Number of paths ‘in-the-money’



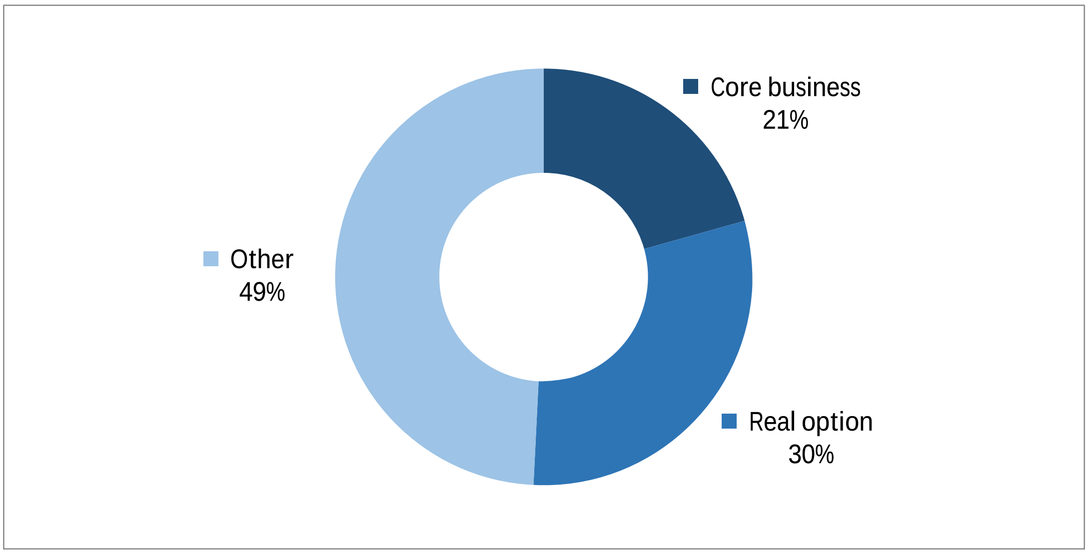
Source: Constructed by Authors

A great limitation of the option valuation is the reliance on only the virtual and augmented reality market. This market does not fully represent the real option characteristics present to Netflix, hence, the flaws of the proxy can be significantly distorting the results. The proxy comes short of estimating market growth, as well as volatility, with respect to fitness trends and the recent developments within the digitalisation of health, primarily driven by smart watches. Further, the assumptions made in this case rely on very vague data, with few data points available for analysis. In addition, the picture may be substantially different, when performing this on data adjusted for accounting standards.

4.2.3 COMBINED VALUATION

When combining the value achieved through the DCF analysis, with respect to the core streaming activities with all options excluded, and the option price calculated for just a single option, the market observed share price indicates that 44% of the value has yet to be explained.

Figure 23 – Allocation of value



Source: Constructed by Authors

This is, in part, expected to be explained by the other embedded real options, as mentioned earlier in this thesis. Additionally, the market may be more optimistic with regard to Netflix's free cash flows following the end of the capital-intensive internationalisation process, and the possibility to increase benefits from economies of scale. Yet, even if with the more optimistic approach towards the future, as well as estimate values for the remaining identified real options, this is not believed to close the gap between the valuation and the observed market value.

Another potential factor for this additional value gap may be the rumours of an acquisition, as mentioned under the internal analysis of Netflix in Part II. A premium would not reflect a potential increase of Netflix's profitability per se, but rather focus on potential synergies, which can be achieved in combination with the acquiring or merging partner. Although these synergies should account for more than USD 35 billion, it is a possibility if the acquiring entity is subsequently large and in need of a technology firm such as Netflix. A company like Disney has annual revenues of close to USD 24 billion from media networks alone (Statista, 2017b), and several other large MNEs, and conglomerates, of the same scale exist today.

PART IV – DISCUSSION

The review of literature brought the attention towards the vast spectrum of general valuation approaches established in the world of academia, as well as the concepts of fair value and intangible assets. A further analysis of selected valuation models then set out to evaluate each model based on Plenborg’s four parameters. To highlight some of the challenges practitioners face and to contextualise the analysis, the case study of Netflix was introduced, in which different valuation approaches were applied. The following section will provide comments and answers with regards to the research questions, the limitations as well as implications for practitioners and further research suggestions.

5.1 GENERAL PERSPECTIVE ON VALUATION MODELS

The consensus arising from the model analysis is that, generally, as models become more realistic with respect to the true circumstances of the valuation, the more complex each model becomes. This, in turn, decreases the user-friendliness, as well as the practitioner’s full understanding of the output and how it is affected by changes to the input variables. Thereby, a trade-off exists between accuracy and ease of use. Yet, this is not necessarily explicit when looking towards the popular choices of valuation models, as the literature review establishes a profound popularity of the DCF model, and, if option pricing is strictly necessary, the Black-Scholes model may be employed.

In this regard it may be beneficial to return to the very premise of this thesis, namely being that of the established target group of practitioners. The reason being that some practitioners are very familiar with highly complex option valuation models, presumably high-frequency practitioners located within private equity firms, banks or transaction advising firms. However, it is estimated that a majority of decision makers and business controllers are less aware of the potential implications minor changes may have, or lack an understanding of how ‘accurate’ the outcome is, based on the presented assumptions. This is perceived to be fuelled by two trends: (i) most firms are rarely in a merger and acquisition situation, in which this knowledge becomes crucial, and (ii) using these methodologies as tools for capital budgeting on large-scale projects are perceived as beneficial. Yet, managers are often only challenged with few investment decisions during their career of the same magnitude as the case study of incorporating changes to the established business model. Thereby, managers are commonly less forced to take a standpoint towards the assumptions of each model, as well as the correctness of its input to achieve the best possible outcome. Again, this viewpoint is excluding firms that are typically in a high frequency M&A industry or pursuing an inorganic growth strategy. Nonetheless, it does typically apply to all firms at some point in their business development process, whether valuing the firm with respect to bringing in new investors, acquiring other firms, receiving purchase offers or deciding on when to undertake projects, to what extend or when to abandon.

Returning to the previous point, these practitioners, with no expert status on the matter of valuation, are faced with a broad array of valuation models that each come in substantial number of versions, adjusted to account for a variety of assumptions. The confusion thereby easily arise from the current academic availability of models, with differences explained in highly technical terms, which for many practitioners may only add to this confusion and drive the popularity of the DCF analysis. The choice of valuation model is in many situations believed to be driven by the practitioners understanding of the models, and the DCF model's intuitive setup and general acceptability is a great force of the model. In the opposite corner, the option valuation models are often more complex and can potentially yield some enormous valuation outputs, which fuel the practitioners questioning of the approach. While intangible assets, despite no physical characteristics, are often well known to represent a value, the value of an option to pursue a strategy of expansion, abandonment or delay is more intuitively challenging. Furthermore, practitioners are in their choice of valuation model often met with valuation tools for stock options, hence, the setup from a context specific situation will require some thought in respect to the valuation approach. Taking into account that practitioners will often be responsible not only for performing the valuation, but also perform presentations to various stakeholders as well as answer questions, the practitioners do not only need an understanding of the tools, but feel comfortable using these. Based on this and the findings from the model analysis, it becomes clear why the discounted cash flow model is the preferred valuation tool, despite its theoretical shortcomings.

5.2 VALUATION FRAMEWORK AND FAIR VALUE

As mentioned above, the DCF model is a very popular choice when valuing firms and projects. Yet, the model often fails to fully represent the fair value of an intangible intensive firm within the media and entertainment industry. Reason hereof is the lack of option value represented by the embedded real options that will most likely be present for a majority of firms in the media and entertainment industry. The argument is driven by the rapid market developments taking place on a global scale in terms of distribution platform, licensing rights and technological advancements.

To capture this value, an option valuation approach must of course be incorporated to reflect this value. However, these concepts are not perceived to perform well for assigning value to the core activities of a majority of the firms within the media and entertainment industry, such as regular streaming services or operating cable-TV channels for instance. Reason hereof is the lack of options, so to say, as these continuous operations are not expected to be altered substantially in terms of the structure in which they are currently provided. Option valuation tools are seen as handling the value of a potential change rather than core business operations in a more beneficial matter. Treating an entire firm under a single option valuation framework is thereby not seen fit for achieving a fair value estimate. Further, this would require some highly complex option pricing models. Instead, the model analysis suggests that more than one model is combined to gain a bit of the best from both worlds. Despite differences, no single model is perceived to be superior with respect to forecasting the future due to their dependence on input estimates that are to simplify the real world. Hence, employing a DCF, CLV or similar model to estimate the value of the existing business operations as well as an option valuation model to account for the value created by the opportunities apparent to the business in question.

The above two-part approach is not necessarily the same as achieving the fair value of a firm. Nonetheless, the approach does bridge some of the assumed gap between traditional valuations and the fair value, or even just observed market value. To value these real options, both the Black-Scholes model and the binomial model are seen as less beneficial. The Black-Scholes model due to its rather inflexible framework and the binomial model due to its high computational requirements for estimating binomial trees of many nodes. Despite differences among the various models, they do to some extent overlap as a result of several modifications. This means that multiple models can be used for pricing the same option, which slightly different results. The approach, which offers flexibility in a dynamic setup, is the Monte Carlo method. This approach can calculate simple plain vanilla options as well as handle high dimensional exotic option types, which are often seen to represent the characteristics of the real option more appropriately. This was also the approach taken in the case study of Netflix.

5.2.1 CONCLUSION DRAWN FROM THE CASE STUDY

The Netflix case study contributes with some insight into this area, as a dual approach was taken. Although the case study does not value the Netflix company in its entirety, it does shed some light upon the challenges of applying these concepts to a real word scenario. This is mainly seen to be a two-folded issue of data estimations and aligning the model with real option characteristics.

Firstly, the estimation of input variables does limit the correctness of the output, and a valuation is never stronger than its weakest assumption or input variable. Despite the potential shift in value resulting from great uncertainty related to the input variables, the calculation and consideration of a real option approaches is still considered essential to understand, to some extent, the fair value of the company. For the case of Netflix, one of the greater uncertainties of the input estimations is that of the expected free cash flow. Being based of the virtual and augmented reality market forecast, which is a result of limited information of the market for general interactive content. Ideally, the cash flow expectations would be a combined result of the development in digital healthcare products, the virtual and augmented reality, the streaming and on-demand entertainment market as well as several other, e.g. fitness and personal trainer service demands etc. This should naturally also be reflected in the estimated volatility input, in contrast to what has actually been performed in the case study. In addition hereto, the free cash flow is assumed to take the same revenue-to-free cash flow margin as assumed for their current activities. Yet, the activities regarding interactive content may not necessarily reflect that of the current streaming activities due to a higher demand for programming and software developments along the way and less licensing. Further, having personal trainers or similar available around the clock does not display the same cost structure as operating an online platform with media content.

In addition hereto, value was in the valuation model primarily derived the high drift estimated. This was estimated using Statisa's forecast for the market and again represents one of the key issues between the difficulty in estimating data for regular option pricing and estimating data for real option pricing. The real option identified for Netflix involves a newly developed market, hence, only little information hereof exists. As a result, the expected rate of return becomes a very large number that drive a quick increase in all the estimated random paths. From a theoretical perspective, using a drift can be implemented in three possible manners: (i) being the expected rate of return, (ii) being the risk-free rate and (iii) being 0. However, it is perceived to be one of the Monte Carlo methods advantages that we can assume a certain direction in the random paths. In the case of this market, this turned out to be a very strong upwards movement in the short run. This also means that the Monte Carlo method reaches a higher value, as would a standard Black-Scholes for instance.

Secondly, defining the identified real option, as well as matching these characteristics with an option valuation model, may require a substantial business plan to be in place, in order to specify exactly how this real option is to be executed, if the option is chosen to be exercised. For the case of Netflix, and as an outsider, the identification of a real option is rather vague and based on numerous assumptions. This impacts the degree to which an accurate setup can be constructed, following the logic that a complex Monte Carlo simulation, to calculate a rainbow option, may in fact be the most appropriate choice, but as we struggle to estimate input data for just a simple Monte Carlo simulation, the point in making this complex setup diminishes. As an example, it would be obvious to build the model based on several markets, to better reflect the diversity in the assumed real option regarding interactive content. However, estimations for a single market has proven tricky, and adding another one to the mix only raises the question of how much weight to put on each. The point being that adding an additional layer of complexity to the model, driven by the pursuit to better replicate the actual circumstances of the real option, only raises more questions to which new assumptions must be made.

Building on this, and bridging the theoretical analysis to the case study, one can draw two different conclusions. One being that models in theory can be adjusted and developed to account for several different events, visible from the extensive number of option types and even higher number of valuation models, when counting each version of the Black-Scholes framework for instance. Therefore, practitioners should not only employ option-pricing models in valuations, but also carefully analyse the characteristics of the real option to identify the best match of option pricing model – being for example a rainbow option calculation process using the Monte Carlo method. The other conclusion, arising from the case study, in which the characteristics called for an advanced option pricing model, depict a case in which the lack of data for input estimations imposed a limitation as to how advanced a model could be employed without simply estimating inputs by pure guess. One can of course always estimate some input, however, this is perceived to harmfully interfere with the output of the model. So while there in theory is a very good match between the different models possibility of estimating the fair value, the practical approach is often limited by data availability and the need for some substance behind the estimates to provide a just slightly accurate estimate of fair value. In other words, it was deemed that the costs of increasing the complexity of the model would outweigh the potential gains from using a model that depict the real circumstances to a greater degree.

In addition to above, the cast study also included a DCF analysis of the existing streaming operations. As expected, the recent troubling free cash flow history has an impact on the expectations for the future free cash flows. However, when assuming positive free cash flows, the model does yield a value of approximately 21% of the most recent observed market price. The main driver in this DCF framework is the terminal value, which is also incorporated into the option pricing model used to price the real option of interactive content development. The concept in itself is questionable, especially in high growth areas where growth rates close in on the discount rate leading to astronomic valuations. Yet, the tool is very beneficial for summing up all future cash flows, despite assuming a fixed growth rate. For both cases, the 5% estimate employed constitutes quite a limitation to the correctness of the valuations. This only highlights the need for the two sensitivity analyses, as well as perceiving the fair value estimating as a range rather than a single price.

In conclusion, the existing valuation tools do provide theoretically strong fundament for achieving a fair value, yet, the practitioners are limited in their ability to correctly estimate the input. In return, more simple models are typically the response to the difficulties in estimating these inputs.

5.3 THE CONSIDERATIONS WHEN ASSESSING MODEL ASSUMPTIONS

Despite having trouble estimating inputs as an outsider, some cases do provide a fairly good possibility of estimating the input data. But even then, do the theoretical models perfectly manage to replicate complexity of real options? The short answer is no. The reason shall be explained in below examples drawing on the conduct of the case study, to highlight a few points worth keeping in mind when assessing the correctness of the valuation.

5.3.1 HISTORIC VS. FUTURE DATA

Common for a majority of the models is the difficulty of handling future predictions in a constructive manner other than assuming standardised growth rates. Few methods can possibly bridge this such as implementing a standardised path of business cycles, however, this comes at a high computational expense. The alternative is to rely upon recent historical movements, adjusted for extraordinary events. In doing so, and especially if employing a drift rate for the Monte Carlo simulations based on the eroded expected rate of return, one must hold this in comparison to the knowledge of the industry and market with respect to not only trends among consumers, but also the likelihood of new disruptive technologies, which may drastically change the forecasts of a given market. In the case of Netflix's real option, the volatility measure is based on forecasted market data, however, relying on such relatively vague data-basis that incorporates an assumption regarding the virtual and augmented reality being the next big technology. Basing the volatility measures on this market thereby does not take into account the possibility of breakthroughs in alternative technologies, as the market is new and only limited observations are available – less of which reflect market slow downs due to the interest in alternative technologies.

5.3.2 DISTRIBUTION ASSUMPTION

When computing the option models, one core factor is the assumption regarding the expected form of distribution of future observations. The binomial model base it's pricing on the binomial distribution, which assumes discrete data points of n amount of 'experiments' and only two potential outcomes for each n, occurring with the probability of p and 1-p respectively. This is perceived to constrain the binomial models ability to accurately price real options, as these rarely display characteristics of discrete observations taking one of only two possible forms. Instead, models assuming a normal distribution are perceived as beneficial to properly replicate the potential movements in relation to real options. Both the Black-Scholes model as well as option pricing using the Monte Carlo method allow for the use of normal distribution. The benefit of using a normal distribution is the continuous probability functions on which it relies to represent real variables with an unknown distribution. The normal distribution assumption is thereby also directly linked to the random variables estimated for a Monte Carlo simulation. These random numbers have a great influence on the actual outcome of the model, hence the importance for estimating a great number of random numbers when pricing an option using Monte Carlo simulation. Yet, having many random variables is not necessarily an easy thing. This rely on complicated algorithms to generate these numbers. In the Netflix case, the build-in random number generator was used to produce all the random numbers needed. However, this build-in Excel tool has received much critique for its poor job in estimating random numbers. This is mainly due to the simple algorithm, which employ a single string of pre-generated random variables from which is chooses these in a standardised, non-changing manner. Considering the tool used for generating random variables may therefore also be of great interest when assessing a valuation.

5.3.3 FIRST MOVER ADVANTAGE

One substantial difference between regular option pricing of contractual options for purchase of sale of an underlying stock and the characteristics of a real option is that of first mover advantage. In the case of Netflix, the option to expand their existing business by developing their business model into new areas is impacted by first mover advantage. Only limited, if any, competitors have begun their entry into this market of interactive content. It is therefore estimated that the possibility of gaining first mover advantage is present and that this would have a positive economic impact on the business in terms of branding, attracting new customers, as well as opportunity to establishing patents and copyrights on certain aspects. Further, this is perceived to be something not uncommon in the area of real options. However, the option pricing models, as design to price the contractual options of purchase of sale of an underlying asset, does not really incorporate this feature. A possibility could be to set-up an option to delay structure and estimate the potential benefits of avoiding first-mover mistakes, getting the change to analyse customer preferences based on competitive products or simply gain from a lower research and development cost base. It is therefore important to keep in mind that most projects can be valued from different angles to account for all factors surrounding a real option. From an option to expand perspective, the potential first mover advantage does contradict with the general set of beliefs regarding no early exercise of American call options.

5.3.4 COMPETITION

Closely linked to the first mover advantage is the concern of competition. Once again, this feature falls far from the circumstances under which regular options are contracted. Other companies may very well hold the option to pursue similar projects as the case with the interactive content for Netflix. Therefore, and as also suggested by three consultants from McKinsey & Company (McKinsey, 2009), the option value may be seen in the light of competitor’s actions. The hybrid model proposed by McKinsey rely on game theory and depicts a setup in which an option may in fact not have a single, but four different values, depending on the competitors actions. Naturally, this advancement falls under the previously discussed trade-off between complexity and data availability. Nonetheless, this may be a crucial context to have in mind when assessing the valuation.

5.4 DRIVERS OF THE DIFFERENCES IN ESTIMATED VALUE AND MARKET OBSERVED VALUE

The analysis of the Netflix case resulted in 49% of the observed market value to remain unaccounted for, as a result of a DCF analysis of the core business activities, as well as the single real option related to interactive content. So how come that investors are willing to pay upwards of USD 156 per share with the current situation of Netflix. Below represent some of the main potential drivers of this difference.

5.4.1 OTHER EMBEDDED REAL OPTIONS

One of the most likely reasons behind this observed difference is the additional embedded real options available to Netflix. Among these, the case study has identified both the real option towards development of current Netflix Original content, as well as entering into the live-stream segment. These are considered as less valuable in comparison to that of the option to expand into the interactive content, but are estimated to add some value to the company as well. Further, an additional difference can be an indication of more real options embedded than identified in this case study. As it has not been the primary focus of the case study solely to identify various real options, there is a high likelihood of other options being available to Netflix.

5.4.2 ESTIMATION DIFFERENCES

Another potential reason behind this difference is the more optimistic approaches towards long-term growth, greater expected success or market share captured by the development of interactive content. Nonetheless, it is the general perception that the case study rely on already optimistic assumptions of growth and similar. Building on this, if adjustments were incorporated towards accounting treatment of the capital expenditure rather than operating expenditure, this is believed to provide slightly better financials as the depreciation allows for write-down of capitalised assets over their estimated lifetime and not simply in a single year. Despite this such an adjustment would be connected with much uncertainty, it is possible that a general more optimistic approach is taken by investors namely due to this small upwards adjustment.

5.4.3 MERGER AND ACQUISITION RUMORS

A third and final potential explanation for the high share price of Netflix is that of the M&A rumors in the market. This is partly fueled by the ongoing consolidation in the industry and includes a very different approach towards valuing the firm. In an M&A situation, Netflix would naturally still hold the real options it would otherwise hold, but the value of the firm increases as a result of potential synergies between the two parties. The value of these synergies are dictated by the size of the other part, which potentially allows for very high valuations. Further, it is commonly established that a control premium is required to obtain a majority share of publicly traded firms in general (Little, 2012). Upon acquisition rumors, the share price would typically increase due to these reasons.

5.5 LIMITATIONS AND VALIDITY

Limitations and validity of one's research go hand-in-hand, as the more critical the limitations, the greater uncertainty can be assigned to the findings. Though a number of limitations where faced during the research project, only the critical ones will be discussed in this section. Some of the limitations that have been faced, in terms of modelling and data, have been mentioned above, and therefore this section will not revisit them.

One of the greatest limitations that the case study faced was that of the input variables. Only very limited information constitute the basis of the calculations. However, it was never the sole purpose of this thesis to estimate an exact value for Netflix. Instead, the case study should help identify challenges that would typically be met by practitioners in their choice of valuation model and the associated calculations. Also in this sense, the findings have their limitations due to the contextualisation of these findings. The methodological approach limits the scope of these findings to be assumed applicable for the entire industry, but mere to form a basis from which more research could be performed. The findings are further limited to only one type of options and thereby not only limited to a single company's situation, but also limited to a single real option's set of characteristics.

In addition, due to the scope of this thesis, several limitations have been imposed to limit the area of research. One being the fact that academia has produced a substantial amount of theory and models on this subject. As this thesis focus towards the more popular models, some additions, versions or models that are in fact particularly beneficial for the firms within the media and entertainment industry may have been left out. Naturally, this creates a limitation for the findings of the thesis as well.

5.6 IMPLICATIONS FOR PRACTIONERS

Certain implication for practitioners arise from this study with respect to input variable estimations as well as choice of valuation model. The thesis provides a general high-level introduction to the main valuation theories and aim at advocate for the application of real option models in the valuation of firms within the media and entertainment industry. The media and entertainment industry is perceived as particularly beneficial for this application due to the rapid market movements and technological developments that create opportunities for several firms within this industry.

The thesis further aim towards bridging the existing contemporary literature to a greater extent with the challenges practitioners are expected to be faced with. One of the themes of this thesis is the selection of valuation model, which should not solely be based on a theoretical evaluation, but to an equal extent on the ability to estimate input parameters. The thesis thereby put Plenborg's four parameters for an ideal valuation model to the test.

Supposing that the assumptions and inputs utilised are appropriate for the given case, it can be seen that option modelling captures part of the unseen value, which the DCF model neglects to capture, explaining some additional value drivers. The significant pitfall here is that the more realistic the option model is to become, the more complex the model becomes, and if the practitioner lacks the fundamental understanding of the model used there is the risk of losing the accuracy and validity of the results. Incorporating the option valuation models as a process for decision making may therefore be too large of a step for a firm to overcome at once. Nonetheless, the characteristics of projects and entire firms within this industry required for this value to be accounted for, hence, it is recommended that the concepts are slowly adapted, first as a way of discussing value in an informal way to establish a well-founded mind-set around this. Secondly, the models can be implemented with calculations that supplement existing processes within the firm before becoming a fully integrated part of the business decision making process.

5.7 FURTHER RESEARCH

This thesis has focused on bridging the gap between theory and practice. Through the analysis of the vast academic literature on valuation, it became clear that academia has previously only provided a limited focus on the application of option pricing models to an intangible intensive context of the media and entertainment industry. Despite this thesis, further research could contribute to this area of application due to the vast span of real options embedded in a majority if the firms present on this market. Other areas of interest identified through the case study employed in this thesis includes the calculation and setup of compounding option models as well as the potential put option structures for content developing firms. These are options that were not treated for valuation purposes in this paper, but not necessarily represent a less economic value nor importance to a company.

In addition, one can take numerous routes when departing from the research. Firstly, to gain a full understanding of how to adapt the input factors most accurately, to reflect the firm value, it would be beneficial to make a more in-depth study into the valuation of firms in the media and entertainment industry. More specifically, a portfolio analysis to establish market averages for inputs, such as volatility, would add value in the sense of more gaining a greater understanding of the underlying relationships of various input factors and the valuation models.

Secondly, the customer lifetime value model seems highly appropriate for this specific industry, given the subscriber driven business models, and should therefore be explored in detail to determine appropriateness and level of detail for the valuation of media and entertainment firms. Despite receiving some critique in this thesis, many variations do exists and some may potentially be possible to employ as a substitute for the DCF model employed in this case study.

Lastly, the contemporary research has a vast range of research concerning the theoretical application of option modelling, and more specifically exotic option modelling, however, there are few case examples where the theory is bridged to practice. Therefore, further research into the bridging of theory and practice, utilising a wide range of case studies, should be considered so practitioners, and the real world, can benefit from the knowledge of complex valuation modelling.

PART V – CONCLUSION

This thesis sets out to investigate how a fair value of an intangible intensive firm within the media and entertainment industry can be estimated, a general evaluation of the more popular valuation models along with highlighting some of the significant challenges that arise when applying these.

The thesis provides a broad overview of contemporary research regarding existing literature on the topic intangible assets, concept of fair value as well as valuation. This section looks into the different valuation models regarding both traditional valuation approaches, including the market, income and cost approach as well as looking into contingent claim models. As these valuation tools often exist in various shapes and sizes, to accommodate certain assumptions, the literature review explores some of the more popular models. Additionally, an industry analysis has been performed to identify recent trends and gain insight into future market developments, the competitive landscape as well as the selected case company.

These models are then analysed from the perspective of the media and entertainment industry. This analysis is performed under the framework of Plenborg's four parameters for a good valuation model, including ability to estimate correct input, incorporating realistic assumptions, user-friendliness and understandable output. The analysis focuses primarily on the two most essential parameters of realistic assumptions and the ability to estimate correct input, but provides a rating for each model based on each parameter. This highlights some of the weaknesses and advantages the different models are subject to, which ultimately affect the situations in which they are considered appropriate.

The thesis then continues to apply both the DCF and the Monte Carlo method to value some of Netflix's core business activities and embedded real options. These have been established as appropriate models to assign value to each of the respective business activities, with the DCF model not being able to assign value to the flexibility of holding an option to expand their current business activities. The Monte Carlo framework was selected due to its ability to value both standard vanilla options as well as exotic and high-dimensional options. However, in the case of Netflix, the approach of a European vanilla call option has been calculated following the policy of no early exercise on American call options. Although the real option setting of Netflix might be better represented through a rainbow option pricing setup, this has not been performed due to significant data estimation issues. A trade-off was thereby made, using a less complex valuation approach to reach a valuation outcome that remained more true to the reality with an attempt to limit the amount of variable for which the input estimations were perceived as very vague.

The thesis continues to conclude that estimating a fair value of a firm from an outsider perspective is connected with great difficulty when real options are embedded. Reason hereof is the general difficulty perceived to exist with respect to correctly estimate input variables, which in real option situations in the media and entertainment industry often revolve around the development of new markets with which little existing information is present. Further, an accurate estimation of the fair value would also entail a higher degree of details with respect to the real options, due to their commonly complex nature. This is perceived to be a driving factor for the use of the DCF analysis, as non-expert practitioners often hold limited understanding of the more complex models in which small changes can boost the valuation to astronomic levels. This is supported by the high input variable sensitivity observed in the case study.

It is further recommended that practitioners, when assessing the correctness of the output, not only look at how well the inputs have been estimated in terms assuming historic events to be representative of future events, but also consider what type of distribution the employed model assumes. Further, it is recommended that practitioners assess whether there are any first mover advantages to be gained by early exercise, if competitors entrance timing will impact the expected cash flow from project and similar factors, which may call for new nuances to the estimation of fair value. In addition hereto, it is for Netflix perceived to be the case that the observed market value trades at an assumed control premium resulting from various M&A rumours. In this regard, it is further highlighted that the fair value estimate of a company may generally be expected to fall short, as these M&A valuations incorporate elements of synergies between the two parties. This thereby extends the scope of a valuation and should be considered as an add-on to the valuation approach presented and discussed.

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LIST OF FIGURES AND TABLES

APPENDICES

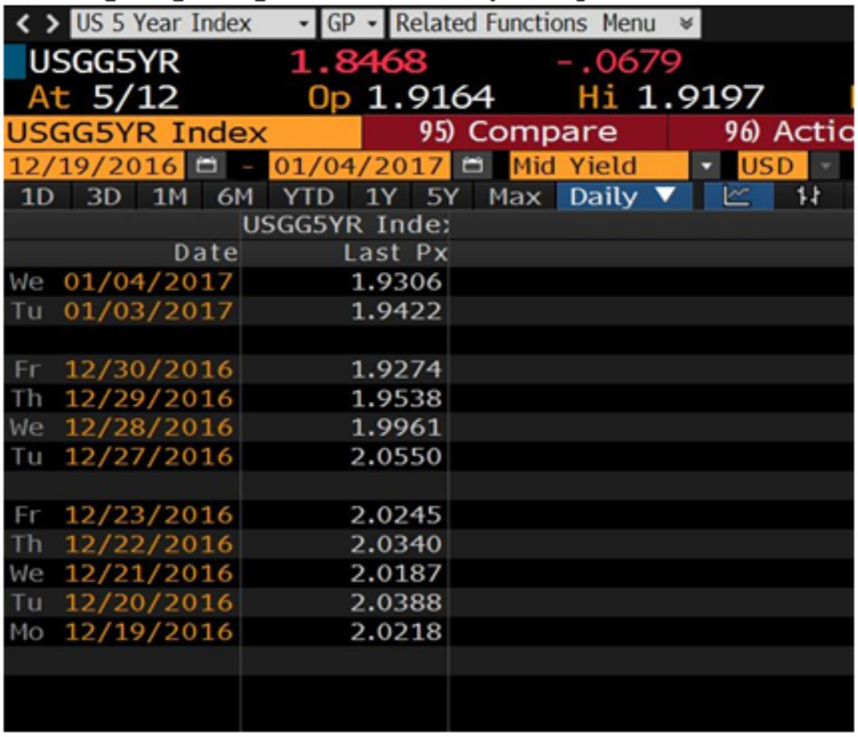
APPENDIX 1 – DISCOUNT RATE

<u>Weighted Average Cost of Capital</u>

Weighted Average Cost of Capital		
Variable	*Input*	*Comment*
Cost of Equity	14.63%	
Cost of Debt	3.6260%	Please see below specifications for comments.
Debt	3,364,311	
Equity	2,679,800	
WACC	8.51%	

Estimating cost of capital by CAPM		
Variable	*Input*	*Comment*
Risk Free rate	**1.9274%**	**US 5y treasury yield, annual**
Market return	**11.06%**	**5Y S&P500 historical average**
NFLX Beta	**1.39**	**5Y with S&P500 as reference**
Cost of equity	**14.63%**	

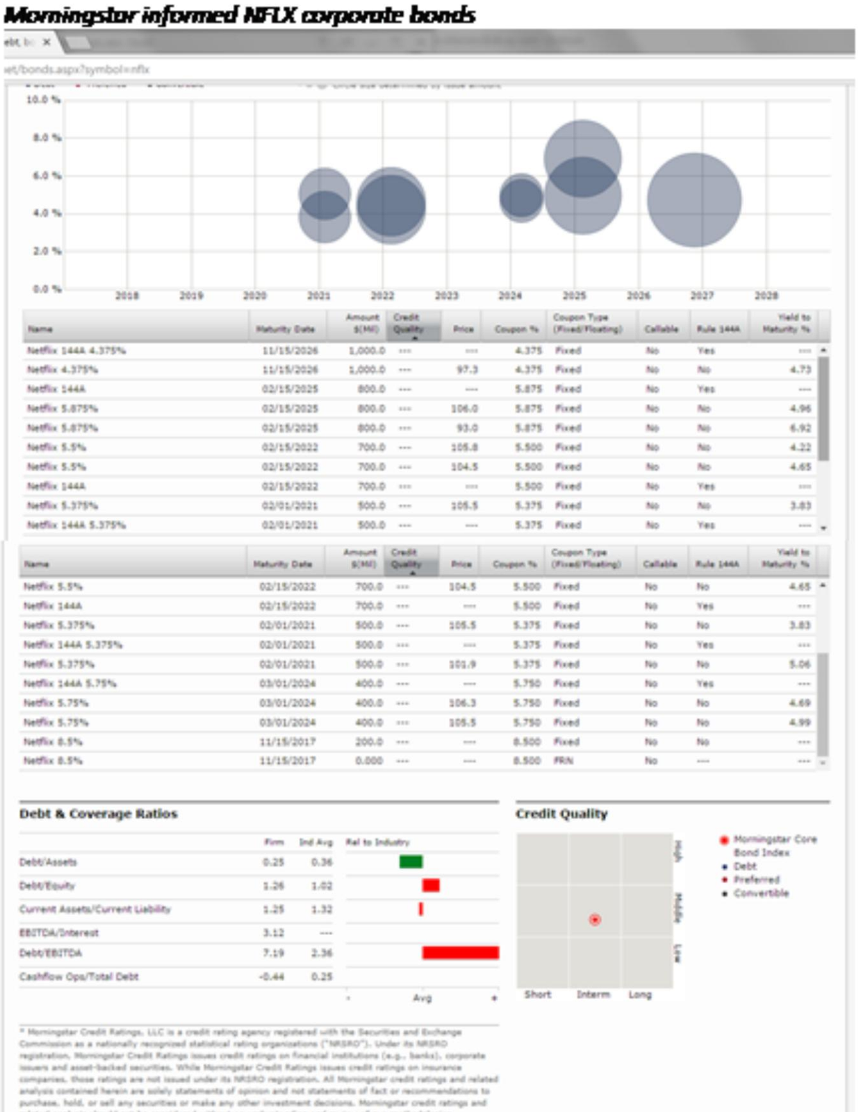
Bloomberg - US generic government bond rate, 5Y as of end 2016.



Date		Last Px
We	01/04/2017	1.9306
Tu	01/03/2017	1.9422
Fr	12/30/2016	1.9274
Th	12/29/2016	1.9538
We	12/28/2016	1.9961
Tu	12/27/2016	2.0550
Fr	12/23/2016	2.0245
Th	12/22/2016	2.0340
We	12/21/2016	2.0187
Tu	12/20/2016	2.0388
Mo	12/19/2016	2.0218

Estimating cost of debt		
Variable	*Input*	*Comment*
Interest rate	**5.4322%**	**WAVG coupon**
Long term debt	**3,364,311**	**tUSD, FY2016**
Interest expenses	**150,114**	**tUSD, FY2016**
Tax rate	**33.25%**	**US tax rate**
Implied cost of debt	**4.46%**	**May be including interest income**
Cost of debt	**3.63%**	**Based on bonds**

Morningstar informed NFLX corporate bonds



Name	Maturity Date	Amount $(Mil)	Credit Quality	Price	Coupon %	Coupon Type (Fixed/Floating)	Callable	Rule 144A	Yield to Maturity %
Netflix 144A 4.375%	11/15/2026	1,000.0	---	---	4.375	Fixed	No	Yes	---
Netflix 4.375%	11/15/2026	1,000.0	---	97.3	4.375	Fixed	No	No	4.73
Netflix 144A	02/15/2025	800.0	---	---	5.875	Fixed	No	Yes	---
Netflix 5.875%	02/15/2025	800.0	---	106.0	5.875	Fixed	No	No	4.96
Netflix 5.875%	02/15/2025	800.0	---	93.0	5.875	Fixed	No	No	6.92
Netflix 5.5%	02/15/2022	700.0	---	105.8	5.500	Fixed	No	No	4.22
Netflix 5.5%	02/15/2022	700.0	---	104.5	5.500	Fixed	No	No	4.65
Netflix 144A	02/15/2022	700.0	---	---	5.500	Fixed	No	Yes	---
Netflix 5.375%	02/01/2021	500.0	---	105.5	5.375	Fixed	No	No	3.83
Netflix 144A 5.375%	02/01/2021	500.0	---	---	5.375	Fixed	No	Yes	---

Name	Maturity Date	Amount $(Mil)	Credit Quality	Price	Coupon %	Coupon Type (Fixed/Floating)	Callable	Rule 144A	Yield to Maturity %
Netflix 5.5%	02/15/2022	700.0	---	104.5	5.500	Fixed	No	No	4.65
Netflix 144A	02/15/2022	700.0	---	---	5.500	Fixed	No	Yes	---
Netflix 5.375%	02/01/2021	500.0	---	105.5	5.375	Fixed	No	No	3.83
Netflix 144A 5.375%	02/01/2021	500.0	---	---	5.375	Fixed	No	Yes	---
Netflix 5.375%	02/01/2021	500.0	---	101.9	5.375	Fixed	No	No	5.06
Netflix 144A 5.75%	03/01/2024	400.0	---	---	5.750	Fixed	No	Yes	---
Netflix 5.75%	03/01/2024	400.0	---	106.3	5.750	Fixed	No	No	4.69
Netflix 5.75%	03/01/2024	400.0	---	105.5	5.750	Fixed	No	No	4.99
Netflix 8.5%	11/15/2017	200.0	---	---	8.500	Fixed	No	No	---
Netflix 8.5%	11/15/2017	0.000	---	---	8.500	FRN	No	---	---

Debt & Coverage Ratios

	Firm	Ind Avg
Debt/Assets	0.25	0.36
Debt/Equity	1.26	1.02
Current Assets/Current Liability	1.25	1.32
EBITDA/Interest	3.12	---
Debt/EBITDA	7.19	2.36
Cashflow Ops/Total Debt	-0.44	0.25

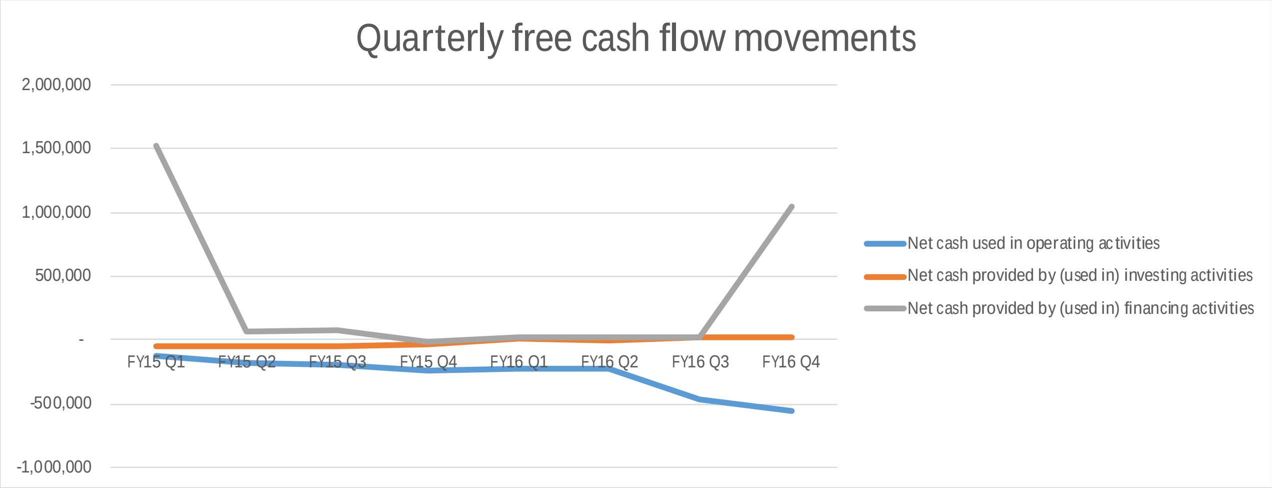
Credit Quality

* Morningstar Credit Ratings, LLC is a credit rating agency registered with the Securities and Exchange Commission as a nationally recognized statistical rating organizations ("NRSRO"). Under its NRSRO registration, Morningstar Credit Ratings issues credit ratings on financial institutions (e.g., banks), corporate issuers and asset-backed securities. While Morningstar Credit Ratings issues credit ratings on insurance companies, those ratings are not issued under its NRSRO registration. All Morningstar credit ratings and related analysis contained herein are solely statements of opinion and not statements of fact or recommendations to purchase, hold, or sell any securities or make any other investment decisions. Morningstar credit ratings and

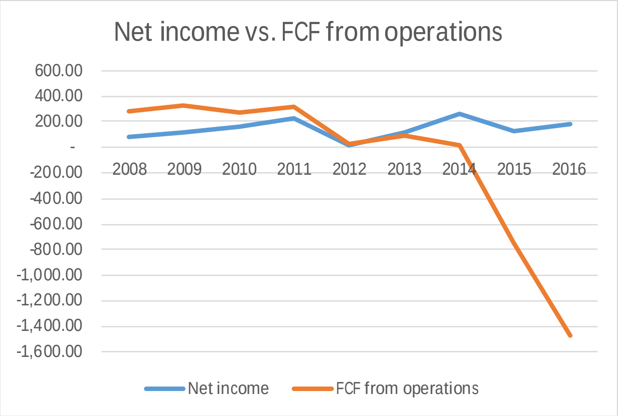
APPENDIX 2 – DCF MODEL

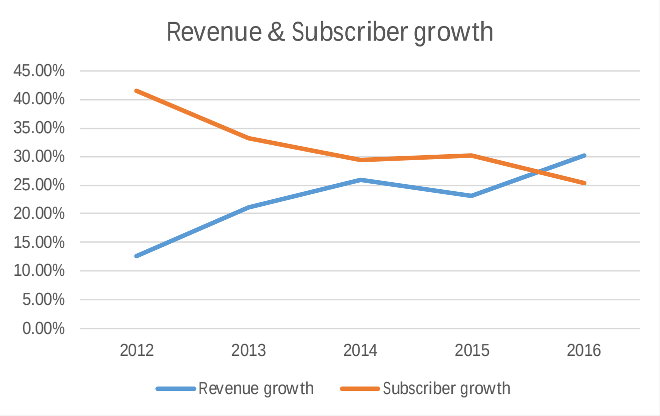
Discounted Cash Flow Analysis

Free cash flow	FY2015				FY2016			
tUSD	*FY15 Q1*	*FY15 Q2*	*FY15 Q3*	*FY15 Q4*	*FY16 Q1*	*FY16 Q2*	*FY16 Q3*	*FY16 Q4*
Net cash used in operating activities	-127,382	-181,343	-195,969	-244,745	-228,590	-226,293	-461,941	-557,160
Net cash provided by (used in) investing activities	-42,822	-48,330	-47,479	-40,561	4,263	-2,896	23,976	24,422
Net cash provided by (used in) financing activities	1,522,434	62,547	72,754	-17,458	14,907	17,612	16,639	1,042,472



Assumptions			
Item	*Historical*	*Assumption*	*Comment*
Net income margin	2.43%	2.43%	5Y WAVG
FCF from operations to Net inc.	-295.66%	100.00%	FY12-14 WAVG - eliminating two previous years of negativ FCF
Internationalization growth rate	24.22%	24.22%	5Y WAVG
Long term growth rate	n.a.	5.00%	
WACC	n.a.	8.51%	See calculations in appendix
# of dilluted shares	438,652,000	438,652,000	





Discounted Cash Flow Valuation					
Fiscal Year, mUSD	2017	2018	2019	2020	2021
Revenue	10,969.31				
Net income	266.01				
Free cash flow from operation	266.01	330.44	410.47	509.87	633.36
Terminal value					18,063.26
Net present value	255.38	292.35	334.69	383.15	12948.37

Using mid-year discounting

Company value, USD	14,213,939,186
Per share value	*32.40*

Sensitivity analysis

		WACC				
		7.51%	8.01%	8.51%	9.01%	9.51%
Growth rate	4.00%	33.72	29.42	26.08	23.40	21.21
	4.50%	38.66	33.05	28.84	25.57	22.95
	5.00%	45.58	37.90	32.40	28.28	25.08
	5.50%	55.95	44.67	37.15	31.77	27.74
	6.00%	73.19	54.82	43.78	36.42	31.15

APPENDIX 3 – REAL OPTIONS

- **Bloomberg print screen of risk-free rate.**


US 10 Year Index GP Related Functions Menu
USGG10YR 2.3257 -.0616
At 5/12 Op 2.3874 Hi 2.3891
USGG10YR Index 95) Compare 96) Action
12/19/2016 - 01/04/2017 Mid Yield USD
1D 3D 1M 6M YTD 1Y 5Y Max Daily

Date	USGG10YR Index Last Px
We 01/04/2017	2.4390
Tu 01/03/2017	2.4444
Fr 12/30/2016	2.4443
Th 12/29/2016	2.4750
We 12/28/2016	2.5080
Tu 12/27/2016	2.5596
Fr 12/23/2016	2.5373
Th 12/22/2016	2.5515
We 12/21/2016	2.5348
Tu 12/20/2016	2.5586
Mo 12/19/2016	2.5382

- **Market information from Statista as well as extrapolation.**

Forecast augmented and virtual reality (VR) market revenues worldwide from 2016 to 2021 (in billion U.S. dollars)				
Year	Virtual	Augmented	Total	Return
2016	2.5	1.5	4	
2017	6.5	2.5	9	125.00%
2018	10	10	20	122.22%
2019	15.5	29	45	122.50%
2020	21.5	58.5	80	79.78%
2021	25.5	83.5	109	36.25%
2022			145	33.00%
2023			187	29.00%
2024			232	24.00%
2025			274	18.00%
2026			309	13.00%

	5Y	10Y
Variance	15.14%	22.13%
Std. Devation	38.92%	47.04%

- **Summary of input and output.**

Input parameters	
Cost of expansion, X	350,000,000
Additional revenue, S	62,372,996
Interest rate, annual rf	2.44%
Time to maturity, T (years)	10.00
Historical volatility, sigma	47.04%
Drift factor, m	Annual
# of dilluted shares, FY2016	438,652,000

Valuation outputs	
Monte Carlo Call	20,667,263,877
Per share	47.12
NPV value of existing business	14,213,939,186
Per share	32.40
Total value	34,881,203,063
Per share	79.52
Observed market value	156.70
Core business	32.40
Real option	47.12
Other	77.18

- **Example of random paths and the associated formula for each cell.**

	10.000 random paths of S					
Period	62,372,996	62,372,996	62,372,996	62,372,996	62,372,996	62,372,996
1	47,012,411.24	210,142,124.33	129,697,881.32	293,913,266.94	215,615,514.26	190,327,010.56
2	159,913,123.01	809,188,240.88	405,844,249.05	720,277,740.67	671,418,662.10	394,973,076.61
3	269,108,861.40	2,442,103,564.64	669,608,930.52	3,707,010,119.38	2,374,916,812.86	768,562,411.53
4	403,131,990.39	3,555,324,107.01	1,232,442,466.10	8,703,278,758.43	10,591,271,151.99	1,049,319,109.35
5	303,355,439.13	4,290,136,357.79	1,676,985,492.59	9,926,721,506.65	24,064,369,236.74	1,001,839,355.70
6	198,439,214.62	4,361,781,003.09	932,792,977.56	6,805,079,614.35	20,589,896,628.82	2,783,479,983.50
7	128,611,543.92	5,916,437,221.09	825,459,907.49	8,282,450,594.93	19,001,692,281.30	2,439,745,887.09
8	203,122,379.41	83,981,604,958.04	825,036,040.36	15,109,371,933.65	13,501,135,155.58	1,415,165,811.41
9	202,936,098.31	180,023,556,022.32	1,002,491,440.16	13,604,836,840.90	17,574,052,427.58	2,936,783,208.72
10	188,348,651.14	101,792,774,802.87	659,802,201.78	5,002,186,651.19	19,515,846,440.02	2,957,069,218.41

$$path\ value_t = value_{t-1} * EXP(drift_t + random\ variable_t * \sigma_{period})$$

- **Examples of payoff for random paths.**

	Payoffs for each of the 10.000 paths					
Period	1	2	3	4	5	6
1	-	-	-	-	-	-
2	-	459,188,240.88	55,844,249.05	370,277,740.67	321,418,662.10	44,973,076.61
3	-	2,092,103,564.64	319,608,930.52	3,357,010,119.38	2,024,916,812.86	418,562,411.53
4	53,131,990.39	3,205,324,107.01	882,442,466.10	8,353,278,758.43	10,241,271,151.99	699,319,109.35
5	-	3,940,136,357.79	1,326,985,492.59	9,576,721,506.65	23,714,369,236.74	651,839,355.70
6	-	4,011,781,003.09	582,792,977.56	6,455,079,614.35	20,239,896,628.82	2,433,479,983.50
7	-	5,566,437,221.09	475,459,907.49	7,932,450,594.93	18,651,692,281.30	2,089,745,887.09
8	-	83,631,604,958.04	475,036,040.36	14,759,371,933.65	13,151,135,155.58	1,065,165,811.41
9	-	179,673,556,022.32	652,491,440.16	13,254,836,840.90	17,224,052,427.58	2,586,783,208.72
10	-	101,442,774,802.87	309,802,201.78	4,652,186,651.19	19,165,846,440.02	2,607,069,218.41
11	330,731,937.56	64,768,505,743.95	413,756,286.36	2,404,723,317.75	26,062,616,360.42	2,063,675,040.58
12	447,964,245.79	50,161,715,248.85	722,145,889.82	3,894,987,985.33	15,766,533,968.54	1,820,603,266.65

- **Average of the 10,000 paths for each period.**

Period	Average
1	10,890,842.21
2	419,378,418.82
3	2,202,258,355.93
4	5,388,111,423.92
5	7,917,686,981.45
6	11,224,959,190.91
7	15,116,467,994.78
8	19,241,392,990.95
9	22,951,013,370.23
10	26,312,431,175.54