



UIT

THE ARCTIC  
UNIVERSITY  
OF NORWAY

School of Business and Economics

# Internet Startups' Profit Dilemma

*A Theoretical Paper on Using Two-Sided Markets Theory as a Framework in a Valuation Setting.*

—  
**Håvard Erlandsen**

*Master's Thesis in Business Administration – June 2018*





## ***FOREWORD***

This thesis is the last part of my Master of Science in Business Administration at the University of Tromsø.

During my last year of the Bachelor degree I did a study abroad program at UC Berkeley, right on the other side of the bay from Silicon Valley, which inspired my interest for technology firms. I have always wanted to study the tech industry and their creative business ideas which create ripple effects felt all over the world. This thesis has given me the chance learn just that and I feel like it has sharpened my skillset towards working in this sector.

Lastly, I would like to extend my sincere gratitude to my supervisor Terje Vassdal for advice on navigating the field of valuation and to the rest of the professors at University of Tromsø for providing interesting lectures during my studies.

## ***ABSTRACT***

This paper embarks on the challenge of deriving the value of internet startups. They are difficult to value due to their obsession with acquiring users at the expense of revenues. My argument is that the key to resolve some of the high level of uncertainty surrounding these startups is to analyze if the startup can generate sufficient revenues from the userbase and how. Two-sided markets theory describes how platforms brings together two groups of customers which are interdependent and how a platform intermediary can profit from bringing them together. A common setup is to bring together users and advertisers to an internet service and profit from selling advertisement. However, a platform can be creative in selecting group of customers to bring together and is not limited to advertisers. By asking the research question “how can two-sided markets theory be incorporated to valuation of internet startups?” the paper takes a two-sided markets approach to exploring how to identify revenue opportunities embedded in many internet startups and how to derive a value from it.

The question is answered through a theoretical approach that draws on previous research on two-sided markets relevant to forecasting future revenue opportunities. The relevant parts of the theory are then used to construct an analytical framework that can be used to identify revenue opportunities of a startup. Lastly, I illustrate how the framework can be used in a valuation setting.

The findings contribute to the two-sided markets theory by showing that the theory is relevant to a broader range of internet firms than the social network and sharing economy firms covered in previous studies. Furthermore, the framework constructed and demonstrated in this paper shows that the theory is relevant for valuation purposes.

## ***KEY WORDS***

Internet startups, Two-sided markets, valuation, First Chicago Method, Real Option Pricing

**Table of Contents**

FOREWORD .....iii

**PART I - INTRODUCTION ..... 1**

1.1 Background..... 1

1.2 Problem Outline ..... 2

1.3 Problem Statement ..... 5

1.4 Research Design..... 6

**PART II - THEORETICAL FRAMEWORK ..... 7**

2.2 Internet Startups ..... 7

    Environment..... 7

    Economics of Internet Firms..... 9

2.2 Two-sided Market Theory ..... 10

    Architecture ..... 14

2.3 First Chicago Method ..... 14

    Uncertainty..... 16

2.4 Real Option Valuation ..... 17

    Fundamentals ..... 17

    Growth Options..... 19

    Deferral Options..... 20

    Network Effects ..... 20

**PART III - DISCUSSION..... 22**

3.1 Relevance of two-sided markets ..... 22

3.2 Two-sided Markets in a Valuation setting..... 24

3.3 Two-Sided Markets Analysis on a Startup ..... 26

3.4 Advantages and Limitations ..... 29

**PART IV - CONCLUSION ..... 32**

4.1 Conclusion ..... 32

4.2 Future Research..... 33

**LIST OF REFERENCES..... 34**

## **PART I - INTRODUCTION**

### **1.1 Background**

Internet startups are young firms with a disruptive idea on how to create more value to customers through their software over the internet. Google changed the way we find information, Uber changed the way we get from A to B, AirBnB offered a new way of travel, and the list goes on. With their incredibly scalable technology they are able to achieve growth rates far greater than other distribution models, which appeals to investors seeking high returns. However, the extensive use of growth at any price strategy employed by many internet ventures makes it exceptionally hard to apply traditional valuation methods.

In 2000 the market learned this the hard way when the Dot-com bubble revealed that internet firms was highly overvalued. Investors had to take big losses and it significantly affected the real economy.

New business models where they focus on growing and outright ignore making money results in an extra layer of complexity and significant uncertainty for an analyst trying to determine the value of such internet ventures. For these businesses it is all about growth through user acquisition, which in many cases entails offering free services and collecting revenue in a later stage. Not until they have a large enough user base, will they start to concern themselves with a revenue model that is profitable. The million -sometimes billion-dollar- question in a becomes; will they ever be able to acquire enough users and will they be able profit from them? Forecasting the future of internet ventures almost become like telling a fairytale, it requires a whole lot of fantasy. To academics' frustration with fantasy, they argue that option pricing theory is the better solution to valuation under high level of uncertainty.

Two-sided markets theory explains the logic behind pursuing growth in number of users and delay revenue as taking advantage of the existence of network effects in internet markets. Network effects in markets tend to create a winner-take-all environment with increasing returns, and so a race to become the largest player on the field makes perfect sense. All though growing a two-sided market is a “chicken and the egg” problem according to the literature in terms of which side to grow first, the majority of startups seems to focus on

acquiring none-paying users first and connect them with another group later that are profitable. Just like Facebook made a free social media platform for consumers and later connected it with an advertising market. In retrospect Facebook worked out quite well, but the reality is that it is hard to predict success on the internet as most internet firms do not survive. Perhaps

Risk-averse investors of course dislike uncertainty. If they are faced with two investments with equal return but different certainty, they will go with the more certain one. Unless the discount for the riskier cash flow is large enough to off-set the risk. The discount is central to investors' decision-making on allocating capital. Valuation methods have different ways of doing this, thus it is important to choose the right tool for the right job.

While past research has done great progress on sharpening the existing valuation tools for more reliable estimates on internet startups, it seems to have overlooked the value of two-sided markets theory as a framework for analysis purposes. This paper is an endeavor to contribute to the challenge of valuating internet startups with the help of two-sided markets.

## **1.2 Problem Outline**

While practitioners have sworn to the Discounted Cash Flow method (DCF) for its ease of use, scholars argue that Real Option Valuation (ROV) methods are well suited for dealing with uncertainty (Damodaran, 2005; Douglas, 2007; MacMillian, 2004; McGrath, 1997). One study learned that managers who had tried ROV for a year said that options embedded in managerial flexibility is too complex and cannot be narrowed down to 5-6 variables which is the case for option pricing (Blenko *et al.*, 2010).

An increasing gap between firms' book value and market value, referred to as the Information Age, has led academics to explore the hidden value not found on the balance sheet (Petty & Guthrie, 2000). This is especially true for Internet firms who have very little tangible assets on their balance sheet. A study done by Lev (2001) revealed that 80% of the market value of firms listed on S&P 500 between 1977-2001 was not reflected in the balance sheet. These values are Intangible Assets and can consist of things like brand value and intellectual knowledge. Although intangible assets account for a significant portion of total firm market

value, a good argument has been made to debunk valuation methods focusing on intangibles. Stephen Penman (2009) argues that intangibles are so complex and interconnected, it is impossible to include it in a financial statement without creating more uncertainty. However, he says, intangibles may not be included on the balance sheet but will, if they indeed have value, be present in the income statement. A DCF and other valuation methods that incorporates cash flows should therefore account for the value of intangibles.

This leads us back to the more traditional valuation methods. Research on how ROV can be used on High-tech firms has primarily focused on technology with a highly uncertain development stage. If the development stage is successful the technology can be patented, followed by a commercialization stage. If the firm succeed in the commercialization, they can start monetizing on their state-of-the-art technology. This is typical for pharmaceutical, semiconductor, hardware and some software firms. However, this is usually not the case for Internet firms that develop state-of-the-art software services. Internet startups belongs within the High-tech sector (Aramand, 2008; Cusumano, 2008), but they are also significantly different from their peers in regards to characteristics that are crucial to valuation.

Internet startups often do not have a clearly sequenced life cycle. Ironically, the software development itself is relatively trivial because it consists of, and is limited by, pre-existing technology (Aramand, 2008). Semiconductor firms, and also drug companies, usually file patents on their innovations to make it hard for competitors to tap into the specific market after a successful development. This is often useless for Internet startups because competitors can easily replicate a software by writing a different code. Take Dropbox for instance, a cloud storage service that lets user store files in the cloud in a convenient way and access them easily from different devices. The software code needed to do this was state-of-the-art according to Aramand's (2008) definition of High-tech, but was been replicated by firms like Apple, Microsoft, Box and several more. It illustrates how easy it is for competitors and newcomers to replicate a software. The technology that Internet firms develop to create value to their customers, despite being high-tech, is not as vital to success as in the case of its high-tech peers.

What is crucial and separates the winning internet ventures from the losers is whether they can overcome the distorted market signals confusion (Porter, 2001). Heavy subsidized prices



and sometimes free products and services employed to attract customers leads to artificially high demand. This causes the absence of revenue which eventually needs to be solved by the firms in order to succeed.

In line with Porter's (2001) distorted market signal confusion argument, this thesis contends that uncertainty around internet ventures is not resolved by successful development and commercialization of a technology. It is when a firm succeed in figuring out how to generating revenues large enough to turn profits. My argument also aligns well with Clayton Christensen (2003) who said that "it is not the technology per se but how it is being used that creates and sustain revenue".

The intense focus on high-growth strategy makes sense from a network effects theory perspective because it is the key to market power and increasing returns in many internet markets (Alstyne *et al.*, 2016). McIntyre and Chintakananda (2013) have addressed the importance of network effects during a product release in a valuation setting. They developed a growth option method where the level of network effects increases the growth option value. The method does not solve the market distortion signal confusion however.

To address this gap, I will draw on the two-sided market theory. Two-sided markets theory address network effects but can also help us identify the growth options that are profitable. Two-sided markets theory provides us with a framework to focus on the options embedded in internet startups, to add or replace agent groups (customers and suppliers) to the market platform in order to solve the profitability dilemma.

### **1.3 Problem Statement**

As stated in the problem outline, this thesis argues that often it is not the technology or the potential to grow that makes internet ventures risky, it is the uncertainty surrounding whether they are able to turn it into revenue. Furthermore, the literature has overlooked the potential of two-sided markets theory as a framework to address this uncertainty in a valuation setting. It follows that the focus of this paper will be on two-sided markets theory and valuation of internet startups. The research question is:

**How can two-sided markets theory be incorporated to valuation of internet startups?**

In order to answer the research question, three sub-questions will be addressed in the endeavor:

1 Is two-sided markets theory relevant to the majority of internet startups or just a few?

By answering the first sub-question we are able to first establish the relevance of two-sided markets theory.

2 How relevant is two-sided markets theory for valuation purposes?

3 What are the advantages and limitations of a two-sided markets approach compared to real option valuation?"

An explanation on why the sub-question was chosen is laid out in the next part.

## **1.4 Research Design**

The study takes on a deductive approach, where prior knowledge about internet startups from both theory and empirical work is used to locate identify gaps in the valuation research (Bryman & Bell, 2011). I then use on two-sided markets theory to address the gap. In order to incorporate the theory into valuation, I will draw on two common methodical frameworks within valuation theory. Due to the high level of uncertainty surrounding startups, probabilistic methods should be used (Abrams, 2010), which both of the chosen methods are.

Real Option Valuation will be used as it is favored by scholars in valuation of highly uncertain assets. First Chicago Method is the second method that will be used. First Chicago Method (FCM) is a modified version of DCF that incorporates multiple scenarios with the possibility to assign a probability to each scenario, suitable for startups where the future is highly uncertain (Abrams, 2010).

The reason for choosing First Chicago Method is because it is widely used by venture capitalists (2010) and it is similar to a textbook discounted cash flow method but has some favorable modifications with respect to uncertainty.

The research question is divided into three sub-questions listed in the Problem Statement section. They are structured in such a way that by answering the first question, I am able to establish whether the two-sided markets theory is relevant for the majority of internet startups or only a few. This will reveal whether the conclusion of this paper can be generalized to a broad specter of internet startups. The second sub-question answer most of the main research question and third sub-question allow us to reflect on how a two-sided markets approach compare to using a well-established ROV.

Some limitations need to be put in place to make the study feasible. The firms of interest are limited to startups even though this gap in the research apply to mature private and public firms as well. The ideal research design for this study might be a combination between what is being deployed and a case study. The case study would allow the study to fully demonstrate how the two-sided market framework can be combined with the two valuation methods. However, gaining access to sufficient financial information on internet startups is difficult due to secrecy. Thus, this research is limited to a theoretical approach.

## **PART II - THEORETICAL FRAMEWORK**

### **2.2 Internet Startups**

For convenience, we start with a definition of an internet firm. Rothaermel et al. define Internet firms as “pure Internet concerns that either compete in the business-to-consumer and/or business-to-business market to conduct e-commerce”. E-commerce is then defined as “any economic transaction where the buyer and seller come together through the electronic media of the Internet, form a contractual agreement concerning the pricing and delivery of particular goods or services, and complete the transaction through the delivery of payments and goods or services as contracted”. Note that the definition excludes firms that are part internet and part non-internet based like a retailer who has a physical store and a web store for instance.

#### **Environment**

In order to survive firms must adapt to its surroundings, and so the environment defines much of the characteristics of firms operating within it. We will start by looking at the environment that shapes how Internet startups operate.

The internet economy is a demand-side driven economies of scale environment, meaning that network effects is the key to achieve market power (Alstynne et al., 2016). Network effects are enhanced by technologies such as app development that can increase efficiency and help networks expand. Firms that manage to build larger networks than its competitors are able to offer greater value to its customers, which attracts more customers, which yields greater value for customers, which attracts more customers, and so on. This creates a feedback loop that produces monopolies according to Alstynne et al (2016).

Internet is an infrastructure that facilitates electronic communication and depends on different technologies to function. Markets that leverage electronic communication to perform primary functions like (1) matching buyer and seller and (2) facilitate a transaction, are called Internet markets (Bakos, 1998). This is a broad definition and would not be sufficient to determine market power of a specific firm (Baker, 2007). However, this study is mapping out a risk-profile on firms operating in Internet markets in general, not a specific Internet market.

Emerging Internet markets have created many new business opportunities and altered the environment in which firms operate (Lumpkin & Dess, 2004; Porter, 2001). Porter (2001) claims that the biggest impact of Internet has been allowing reconfiguration of existing industries due to more efficient communication and lower costs of doing business over the net.

Rifkin (2014) depicts the lower cost of doing business over Internet as the zero marginal cost phenomenon. Internet reduces variable cost and tilt cost structure to fixed cost (Porter, 2001; Rifkin, 2014). The explanation is that digital products and services are stored and distributed over the Internet through selling one e-book over the Internet has close to the same cost as selling thousands of the same book because the publisher does not have to make physical copies of the book. Firms operating over the Internet selling digital products and services has a large fix cost but close to zero marginal distribution cost.

As more and more goods and services edge towards digitalization and zero marginal cost so does the price that consumers pay (Rifkin, 2014). Startups today can launch goods and services to millions with just a credit card thanks to hosting services such as Amazon's EC2 (Anderson, 2009). Rifkin (2014) goes as far as to say that eventually this will create a paradigm shift away from capitalism.

The velocity at which the Internet environment is changing is high, requiring frequent adjustment to the business model of Internet firms (Wirtz *et al.*, 2010). A firm needs to stay innovative, or at a minimum, keep up with competition to survive. Firm innovation can be defined as a firm's ability to create new value propositions through its business model.

A business model captures the whole aspect of value creation of a firm, from what sources it uses for production, how it transforms sources into products and services, how it is delivered to the customer, and how revenue is generated from it. Thus, firm innovation encompasses both what value they give to customers and the process in which they achieve that (Schumpeter, 1938). The success if Internet firms is therefore not only dependent on the creation of customer value through their product or service but also on innovation in the form of process learning and capability creation (Liao *et al.*, 2009). Beyond the descriptive power,

it has been argued that firms can compete through their business models and that it can explain heterogeneity in firm performance. (Sanders & Boivie, 2004).

To sum it all up, low capital requirements for tapping into Internet markets creates opportunities for startups but also threats as a result of low entry barriers.

### Economics of Internet Firms

Internet firms are processing of information as oppose to processing resources which takes us from textbook economics of diminishing returns to increasing returns (Arthur, 1996).

Increasing returns are the tendency for that firms that get ahead to get further ahead and that firms that loses advantages are left further behind. Increasing returns are mechanisms that can exist within markets, firms, and industries and can entail a product, a firm or a technology.

The presence of increasing returns makes businesses behave differently.

There are three underlying factors that promotes an increasing returns environment according to Arthur (1996). Firstly, high-tech products are complicated to design and so R&D costs are relatively large compared to variable costs, and so large fixed cost are one influencing factor. Secondly, high-tech products need to be compatible with a network of users and so a product can approach a standard as it gains prevalence. Thirdly, these products are often difficult to use, which creates a lock-in effect. With increasing returns, a winner-take-all environment may also be present (Eisenmann, 2006). Therefore, firms can gain advantages by acquiring users early on before competitors emerge which in turn, promotes substantial spending on marketing.

The development in cloud computing in recent time has fundamentally changed the way information technologies are developed, deployed, scaled, updated, and paid for (Marston *et al.*, 2011). For the sake of this paper, I will not go in to technical details of cloud computing but stick to the business perspective of it. Cloud computing dramatically reduce cost of entry for firms that seeks to do business that requires high levels of computer power. This is because it eliminates the upfront by outsourcing the computing power to a cloud service provider as oppose to invest into inhouse computer power (servers) and bandwidth (internet speed). In turn, outsourcing of computer power also allows businesses to enter the market more quickly. The cloud is a flexible infrastructure that can be used for an infinite number of

businesses purposes. The flexibility and elimination of upfront cost that comes with cloud computing lowers barriers for innovation as seen in the case of what-used-to-be startup Youtube and Facebook for instance. Another important implication of cloud computing is scaling. It makes it easier for businesses to scale their services in response to demand. One of the main purposes of cloud computing is the ability scale resources up and down dynamically without manual interaction. Furthermore, as computer hardware advances it becomes more affordable for computer power, reducing the cost of scaling, and thus reducing variable costs for businesses who operate in the cloud. These features have led to new classes of applications such as interactive mobile applications.

One type which run on a cloud service is application-as-a-service (SaaS). Google Apps, Facebook, and Gmail are examples of SaaS, which is the most known type of application that run off of a cloud service. Cloud service providers that delivers infrastructure that makes SaaS possible are called Infrastructure-as-a-service (IaaS) and consist of known tech moguls such as Amazon, IBM, and Microsoft. Important to note is that SaaS and IaaS should not be confused with what is later introduced as platforms when I talk about two-sided markets.

Creating a new business involves considerable uncertainty due to not yet established work roles, lack of relationship with suppliers and buyers, base of influence, endorsement, and legitimacy (Chang, 2004). Furthermore, lack of resources to withstand sustain losses makes them more vulnerable. Such uncertainty makes investors hesitant to invest. To compensate for the uncertainty, startups tries to gain legitimacy. One way of achieving this is to team up with venture capitalists (VC). Studies show that VC funding has a significant explanatory power on IPO rates among startups.

## ***2.2 Two-sided Market Theory***

In 2003 Jean-Charles Rochet and Jean Tirole published a theory which say that most markets with network externalities are two-sided (2003). A network externality refers to the utility a user derive from participating in a particular network (Katz & Shapiro, 1985). In the literature, network externalities mostly refers to one specific externality, the utility derived from how many other users that participate on the network (McIntyre & Chintakananda, 2013; Rochet & Tirole, 2003).

A business can operate such a two-sided market through a platform/technology. In order to succeed, firms that operate platforms in these markets need to get users on both sides on board. Thus, constructing their business model to take advantage of network externalities on both sides while making money overall is crucial for survival (Rochet & Tirole, 2003). Two-sided and multi-sided markets are the same thing except for how many groups of customers are connected to the market. Some literature also uses the phrase multi-sided networks which is the same concept.

The most common definition of a two-sided market is characterized by two factors (Rysman, 2009). (1) There are two sets of agents who interact through an intermediary or platform, and (2) Decisions made by one set of the agents affect the other set of agents. The first characteristic can be buyers on one side and sellers on the other side. The second characteristic corresponds to network externalities, the action of buyers needs to affect the sellers and vice versa.

The two characteristics for a two-sided market can be applied to almost any market (Rysman, 2009). A grocery store that buys products from producers and sells them to a customer can be said to fit in this definition because the price paid on inventory affects the price to customers and the more customers the store has the more attractive it is for producers. This is not problematic according to Rysman. How important the two-sided characteristic of a market is to determine an outcome is what makes two-market theory relevant or not. To clarify, we will use two art galleries. One gallery sells copies of famous paintings and the second gallery sells one-of-a-kind pieces from local artists. The gallery that sells copies has access to a theoretically unlimited number of copies, so the producer of the paintings has little impact on the gallery's customers. The success of this gallery is not significantly dependent on the producer. The second gallery that sells unique paintings from local artists however, depends significantly on the performance of the local artists in order to have success with its customers. Hence, how attractive the paintings are and how many local artists there are in the area is crucial to the customer-side of this market.

A more narrow definition restricts two or multi-sided market to apply only when there is direct interaction between the agents on both sides like pricing decision (Hagiua & Wright,



2015). This means that if the firm makes the decision on prices, it is not considered a two-sided market. This paper will not make this distinction and stick with the former definition that requires a significant network effect.

To sum up, the relevance of two-sided market theory is determined by how strong the network effect is between agents. Network effects is a unique theory in itself but is so central in two-sided markets theory that it can be difficult to tell them apart. However, there is some differences.

What sets the two apart is that the two-sided market literature puts more emphasis on the action of market intermediaries in terms of pricing choices (2009). In a one-sided market, pricing is a function of elasticity of demand and marginal cost, while in a two-sided market with strong network effects, the pricing will also be affected by the elasticity of the response on the other side of the market. The video game market is commonly used to illustrate this. Buyers of a video game console is interested in how many games that are compatible with the console, thus they care how many developers who makes games to the particular console. Thus, it is important for the creator of the console to incentivize developers to make games compatible with their console. Pricing choices becomes important in order to incentivize the developers so that the console becomes attractive among gamers. The same thing goes the other way around, the demand for buying the console affects the demand for developing games by developers. So the pricing in the driver side and the passenger side of the market depends on a joint set of demand elasticity marginal cost on each side (Rochet & Tirole, 2003).

A low price on one side of the market attracts elastic customer on that side, which allows for higher price or an increased demand on the other side of the market. This growth effect is very attractive to firms and often leads to prices below marginal cost on one side of the market in order to increase price or increase demand on the other side (Rysman, 2009). Combined with the zero marginal cost phenomenon of many Internet firms (Rifkin, 2014), this can allow for no charge or even negative prices on one side. Social media platforms are examples where one side of the market, the users, enjoys no charge for using the service, subsidized by advertisers on the other side. In an operating system market like Windows the amount of applications available for Windows attracts customers to buy their products. To

maximize the supply of applications, Microsoft offers free support and no licensing charge to developers. Thus, price can be said to be negative because Microsoft spends money to assist developers for free.

Dynamic pricing makes sense in two-sided markets with network effects (Rysman, 2009). Penetration pricing in the beginning of the product life cycle helps a startup build a user base that can attract customers on the other side.

Whether a group of agents tends to stick with one firm's platform or use multiple platforms has important implication for choice of strategy (Armstrong, 2006). Market characteristics where agents choose to only use one platform is referred to as single-homing, and multi-homing is when agents use several platforms. These two characteristics can yield three combinations of outcome; (1) both groups single-homes, (2) one group single-homes and the other multi-homes, and (3) both groups multi-home. The second combination, where one group is single-homing and the other group multi-homing, can have important implications for market power and pricing. If group 1 is loyal to the platform and group 2 wants to reach group 1, they have no choice but to go with the platform of group 1's choosing. In other words, the firm has monopoly power.

Monopoly over access to a single-homing group can be leveraged to high prices on the multi-homing side (2006). However, when rivalry is present, the firm still needs to compete for the single-homers customers against competing firms. High profits from the multi-homing side will then be offset by low or even zero prices on the single-homing side.

Despite that the utility of consumers is maximized when everyone uses the same platform due to positive network externalities, multiple large networks coexists in many of these markets (Ambrus & Argenziano, 2009). This holds both in the presence of a monopolist who own multiple networks and in markets with strictly competing providers. This means that a single large network operating alone in a market is rare according to Ambrus and Argenziano. Furthermore, one market structure seems to be particular common (2009). The structure involves two competing platforms where one is cheaper and larger on one side of the market while the competing platform is cheaper and larger on the other side of the market. In connection with having monopoly over access to one side which was mentioned in the

previous paragraph, the two competing platforms profit from each side of the market and subsidize low prices to the other side.

Openness is an important strategic element to two-sided markets (Rysman, 2009) but is only discussed on other industries than Internet firms. A firm using a two-sided market model can to some extent choose how compatible their products or service is with competing platforms. For example, some store credit cards might only work in that store, or purchases in other store might not be eligible for credits for. We will discuss the relevance of openness strategy in the discussion part to see if it can be relevant to Internet firms risk-profile.

### Architecture

The architecture of the design of a two-sided platform determines the participation between the agent groups and therefore also the rules, such as pricing terms, rights and obligations (Bakos & Katsamakos, 2008). While the literature on two-sided markets has focused mostly on pricing, Bakos and Katsamakos observes that the design plays a key strategic role for intermediaries as well. Network effects across the sides of a market is in part constructed by investment by the intermediary, and so firms needs to decide on capital allocation to technologies that creates value for the participants on each side of the market. As an example, they highlight the allocation decision on how much search engine firm Google should spend technology that increase value for advertisers and how much to increase value for Web users. The network effects that results from a platform design are endogenous because they are determined by the investment strategy of the firm who operates the platform and are called network benefits.

### **2.3 First Chicago Method**

First Chicago Method (FCM) is a discounted cash flow (DCF) approach which incorporates several plausible outcome scenarios (Smith *et al.*, 2011). The scenarios can be good, moderate, bad or anything in between. The goal of using multiple scenarios is to mitigate the bias of only incorporating a success scenario used in the Venture Capital Method (VCM) and DCF.

Instead of limiting the analysis to one optimistic scenario, the FCM uses multiple probability-weighted scenarios to more reliably estimate the expected future cash flows. The expected cash flows are then discounted by a more realistic cost of capital, rather than the high rates used in the VC method. If the scenarios are properly weighted, the correct discount rate to be used should equal the actual cost of capital. One benefit of using probability-weighted scenarios is that it requires the analyst to think of the range of possible outcomes than can occur in uncertain markets, rather than just a best-case scenario.

In FCM a firm's value in each of the scenarios consist of two parts, present value (PV) of the terminal value (TV) and the future cash flows (CF). The present value of each scenario is then weighted by respective probabilities and summarized into the final value (Babiarz, 2016):

$$PV_i = \frac{TV_i}{(1+r)^h} + \sum_{t=1}^h \frac{CF_t^i}{(1+r)^t} \quad PV = \sum_{i=1}^3 p_i PV_i$$

Where “i” represents scenario index and “h” is the number of years into the future forecasted (usually expected exit/sale for venture capitalists). To fully explain the First Chicago Method the parts of DCF needs to be introduced next.

The main idea behind DCF valuation is that the value of assets is derived from its ability to generate cash flows in the future. This makes sense as ownership over an asset entails the claim to future cash flows, and so if one is to sell his/her claim, it is only fair to claim the value of those cash flows (Damodaran, 2007). There are several types of DCF methods and many of them adjust for risk differently (Smith et al., 2011). FCM adjust for risk through average cost of capital (WACC) while the most commonly used DCF used in introductory finance textbooks uses a risk adjusted discount rate (RADR) which combines WACC with a discount rate that compensate for the risky cashflows (2011). According to Hodder and Riggs (1985) the way FCM adjust for risk is better than RADR. With RADR the risk adjusted discount factor grows geometrically with time. Startups for instance can have higher risk in the beginning and lower risk in the future. The time value of money still applies though and should be discounted geometric increasing factor with time.

The WACC of startups can be difficult to estimate and usually consist of mostly a high cost of equity (Abrams, 2010). The cost of equity can be viewed in terms of what venture capitalists requires in return. Abrams suggest using a discount factor of 25%, which is consistent with empirical evidence on the success rate of VC funded startups.

The relative importance of terminal value assumed in a firm's total value differs between industries but is especially high for a typical high-tech firm (Lee & Louis, 2003). According to Lee and Louis, 125% of a typical high-tech firm's total value is derived from the terminal value for a forecasting period of 8 years. This means that majority of the value is derived from cash flows after 8 years. Reasoning on established economic theory, it would be safe to say that this is not less true for the average high-tech startup. As seen below (cash flows in first bracket and terminal value in second bracket), in addition to discounting the terminal value with the WACC, an assumption about the stable growth rate ( $g$ ) that the firms go into after the forecasting period (Penman, 2013).

$$DCF = \left[ \frac{FCFF_1}{1+WACC} + \frac{FCFF_2}{1+WACC^2} + \dots + \frac{FCFF_n}{1+WACC^n} \right] + \left[ \frac{FCFF_n \times (1+g)}{WACC-g} \times \frac{1}{1+WACC^n} \right]$$

The transition out of the forecasted period represents that the firm's high-growth phase is over and enters a steady state, thus we can use a constant growth rate. What could also be said is that it is assuming that the firm continue operations indefinitely and has no maturity date like cash flows derived from bonds and projects. DCF requires a significant amount of forecasting which can incur errors in practical use, however, most sophisticated valuation methods rely on forecasting and is nothing unique to this approach (Damodaran, 2005).

### Uncertainty

How uncertainty is accounted for in the FCM is covered above but in bits and pieces. For convenience, this will be briefly summarized. FCM treats uncertainty in two ways. First the cash flows are discounted based on WACC. Abrams (2010) suggest using a discount factor based on average success rate of VC investments, which is 25%. Secondly, the scenarios probability-weighted. The weight is something the analyst would have to determine based on how he/she perceive the probability of each scenario.

## **2.4 Real Option Valuation**

Real options are basically an extension of financial options to real assets as opposed to financial assets (Trigeorgis, 1996). Therefore, option theory on a more general basis will be addressed as well. The employment of ROV can be justified by the assumption that there is a possibility to abandon an investment if turns out to be bad, hence there is an option structure to the investment (Damodaran, 2005; Douglas, 2007; MacMillian, 2004). It provides a sophisticated framework for dealing with market risk, however, it does not deal with firm-specific risk which can be a substantial part of the risk profile of high-tech firms (Douglas, 2007; MacMillian, 2004).

### **Fundamentals**

Financial options give the owner (of the options) the right, but not the obligation, to buy or sell a financial asset for a certain price. The financial asset could for example be a stock, bond or other financial instruments and is referred to as the underlying asset. If the option gives the owner the right to buy the underlying asset, it is called a call option. An option with the right to sell is called a put option. When the owner of an option decides to take advantage of the right to buy or sell the underlying asset, it is referred to being exercised. When in time the owner can exercise the option depends on the type of contract. European options only allow the owner to exercise at a pre-specified date, while American options allow the owner to exercise at any point in time within a pre-specified date. The time between now and the expiration date is called time to maturity. Also, because financial options are the right, but not the obligation, to buy or sell an underlying asset, the owner is free to withstand from exercising the option and let it expire on the pre-specified date. This makes sense because the price of the underlying asset could be less than the agreed upon price in the option contract (exercise price), making the underlying asset cheaper to buy directly from the open market. The option itself has a price as well, which means that it is profitable for the owner to exercise the option if, and only if, the value of the underlying asset is more than the exercise price plus the price of the option. In a state where it is profitable for an owner to exercise is called “in the money”, in a state where it is unprofitable is called “out of the money”. When the value of the underlying asset is equal to the exercise price plus option price, it is “at the money”.

After the origin of financial options by Black and Scholes (1973) and Merton (1973) the application of option pricing extended on to real assets by Myers (1977). His argument was

that many corporate assets, growth opportunities in particular, could be viewed as call options. Real options can be translated into the right, but not an obligation, to take some action in the future (Dixit & Pindyck, 1995). They are “options” because they are rights but not obligations and they are “real” because they are embedded in a productive investment. Productive investment usually refers to investments in real assets but in real option literature also extended to investment in companies (equity stake). This is justified by saying that the liability of owning equity in a firm is limited to what is paid for the shares. Someone who owns a company or parts of it can never lose more than the initial investment unless he/she decides to invest more. This can be illustrated as a payoff structure where the potential loss is limited to the initial investment (option price) as seen in figure 1 below.

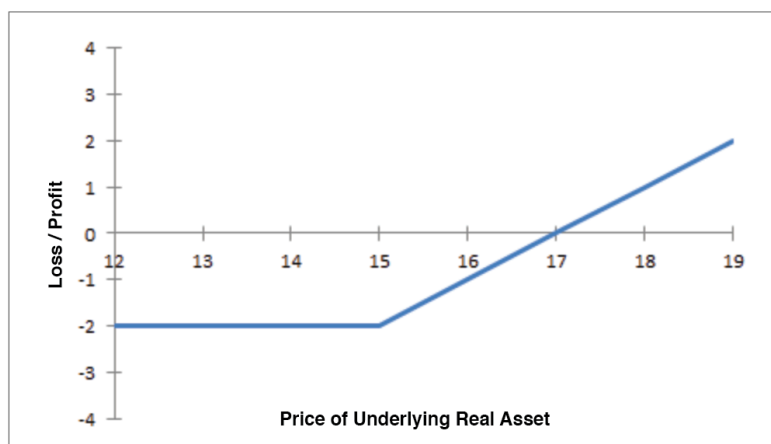


Figure 1: Call Option (buy) Payoff

The value of real options, like financial options, is an increasing function of risk. In finance risk is measured as volatility (Hull, 2012), and so the more volatile the value of the underlying asset is the more valuable the real option is. This means that risk is treated as a positive factor in ROV. The more the value of the underlying asset swings up and/or down the higher value is assigned to the real option. The reason for this is that in real option theory, higher market uncertainty can provide valuable growth opportunities for firms (McIntyre & Chintakananda, 2013).

Volatility can be modeled with a historic, based on historic volatility, or a subjective approach (Copeland & Antikarov, 2003). Whatever approach is used, it is important to understand that it is only a part of the risk that can be modeled. Risk is composed of three types of uncertainties; the known-knowns, the known-unknowns, and the unknown-unknowns

(Gustavsson, 2011). One cannot model for unknown-unknowns, precisely because they are unexpected (Penman, 2013). As oppose to known-unknowns which are events that are recognized as possible but the timing and magnitude are unknown.

Real options was initially coined to single investment project (Myers, 1977) and have since extended to aggregated company valuation by considering the firm as a portfolio of options (Kemper, 2009).

### Growth Options

In software (Kemper, 2009) and other markets with network effect (McIntyre & Chintakananda, 2013), ROV approach allow the valuation to capture the value of customer networks as growth options through a call option (Kemper, 2009). The option is the claim to a software firm's cash flows which is exercised if the customer network reaches a critical mass. Growth option has become a popular approach to value firms with products influenced by network effects (McIntyre & Chintakananda, 2013). The value of a growth option consist of the current assets plus opportunities for future growth (Miller & Modigliani, 1961). Future growth opportunities for a firm can be considered to be a growth option because a firm can use its current capabilities and resources to gain valuable access to future opportunities (McIntyre & Chintakananda, 2013).

With growth options the investment decision rule is extended so that a product should be released if the net present value plus growth option value equals or exceeds zero ( $NPV + G \geq 0$ ) (2013). Thus, even though the NPV of an investment or a product is negative, it could still make sense to invest if the growth option value (G) is large enough. Types of opportunities that are structured as a growth option is depicted as “stage-setting investments that allows firms to take on value-added follow-on activities or investments in the future”, such as technological patents, brand power, R&D knowledge, and licenses according to McIntyre & Chintakananda.

Releasing products early, ahead of competition, yields substantial market uncertainty and thus, high growth option value (2013). Lin and Kulatilaka (2007) have explained how firms can achieve high growth opportunities from early release of products through real option theory. Less studies have been done on potential benefits of delaying the release of a product



(McIntyre & Chintakananda, 2013). Materialization of the growth option value can be achieved when a firm pursue the growth opportunities while containing the downside risk.

### Deferral Options

Market uncertainty also make the option to defer taking action valuable. Firms can defer from releasing a product or making an investment, and at the same time hold on to the right to commit later in the future (Dixit & Pindyck, 1995). This allows firms to pursue high risk opportunities and postpone the commitment (exercise the option) when the market is less uncertain (McGrath, 1999). At high levels of uncertainty, firms will have difficulties with allocating optimal amount of resources to production, planning, and marketing. Which in turn, might result in large opportunity costs (McIntyre & Chintakananda, 2013). Hence, when firms commit to irreversible investments in uncertain markets they terminate the deferral option and lose the opportunity to make the investment at a later point in time when the markets become more favorable.

When a firm defer their commitment to an irreversible investment to sometime in the future when uncertainty is resolved, it is protecting itself from any downside risk and minimizes opportunity costs (2013). Also, a firm may save costs associated with developing the market if it defers the investment to after early movers. To sum up, the deferral option value of a given product is the value of deferring an early product release, being able to release the product in the future, and avoiding opportunity costs with respect to irreversible investment in market development (McGrath, 1999; McIntyre & Chintakananda, 2013). The more uncertain the market is, the higher the value of a deferral option ( $D$ ). In other words, a firm should commit to a product release when net present value minus value of deferral option is greater or equal to zero ( $NPV - D \geq 0$ ).

### Network Effects

The presence of network effects increases the value of a growth option ( $G$ ) by a factor ( $\alpha$ ) according to McIntyre & Chintakananda (2013). It acts as a multiplier ( $\alpha G$ ), resulting in a lower threshold ( $NPV + \alpha G \geq 0$ ) for committing to irreversible investment. This shift is the result of three factors from network effects, (1) it enables firms to use their initial userbase across multiple products, existing and future, in order to create a portfolio of growth options. (2) Firms that are ahead of competition in industries with high levels of network effect tend to

enjoy preemptive advantages which allow them to maintain growth option. And (3) firms may be able to steer the direction of future opportunities when they have a loyal customer base by selling new products, creating switching costs, and gaining the ability to charge higher prices. The main takeaway from the three factors is that high levels of network effects creates a winner-take-all environment which enhances growth options.

A winner-take-all environment incentivize firms to over-invest as an early mover in order to get ahead (2013). However, the cost of developing a network decreases over time and so late movers have advantages as well. Late movers can wait with product release until just before early movers get too far ahead, that way they can save costs and still be in the competition.

## PART III - DISCUSSION

In this section I will discuss the four sub-questions in order to answer our main research question “how can two-sided markets theory help analyze options embedded in unprofitable internet startups?”. The numbering 3.1, 3.2, 3.3 and 3.4 corresponds to the four sub-questions and for convenience the questions will be restated in each section of the discussion as well. In the last section (3.5) we will analyze options embedded in an internet startup through two-sided markets theory to demonstrate its usefulness.

### **3.1 Relevance of two-sided markets**

The sub-question discussed in this section is “is two-sided markets theory relevant to the majority of internet startups or just a few?”.

I believe two-sided markets theory can be applied to a wider range of internet firms with network externalities than what is covered by the current literature. Recall that the biggest difference between network effect and two-sided markets theory is the emphasis on the action of market intermediaries in terms of pricing choices (Rysman, 2009). By extending the theory to encompass a wider group of internet firms, we are able to analyze how more firms can improve monetization on network externalities through pricing action and choice of market.

Studies on two-sided markets have primarily focused on platforms that bring together buyers and sellers. On platforms like this, decisions made by agents on one side of the market affects the agents on the other side and vice versa. More contemporary studies have applied the theory on social networks as well (Haucap & Heimeshoff, 2014). For social network platforms however, the network externality is more of a one-way street, not so much vice versa.

In the case of Facebook for instance, I would argue that users are indifferent whether Facebook has a thousand advertisers, or just five hundred. Empirical studies have shown that many internet users even try to avoid advertisement through ad blockers (Vratonjic *et al.*, 2013). Advertisers on the other hand, care a great deal about how many users there are on the platform because it is relevant to how many people they can reach. Thus, advertisers are more

like a necessary evil that subsidizes free services. This means that we are already seeing an expansion of the definition from positive network externalities on both sides to positive on one side and negative on the other.

As pointed out by Rysman (2009), practically every business can be classified as a two-sided market if one look at the two criteria alone. Suppliers or labor could be classified as the other side of the market. However, it is the importance of the characteristics of a two-sided market that determines the relevance of the theory. This is the focus-point in this discussion.

Business models that subsidize users are becoming increasingly popular among internet startups in general (Bauer & Latzer, 2016; Evans, 2013), not just social networks. The subsidies have to come from somewhere. Thus, criteria (1) there are two sets of agents who interact through an intermediary or platform and (2) decisions made by one set of the agents affects the other set of agents, is of importance for internet startups in order to become profitable while they offer services for free. If the startup is already constructed as a two-sided market, the theory can provide analysis on how to improve monetization on the side that generate revenue. If the startup is not constructed as a two-sided market, the theory can help analyze agent groups that potentially can be connected with the existing user group in order to monetization. Hence, two-sided markets theory can prove useful as a tool to analyze the monetization options embedded in a larger part of the population of internet startups than just social networks.

I would counter an argument saying that this is not unique to internet firms, by arguing that internet firms have more possibilities than none-internet firms. Internet firms are not limited by geography, demographics and other restrictions. Also, it is easier for internet firms to achieve prices sufficient enough to subsidize the other side of the market because they have lower costs. This can be backed up by Rifkin's (2014) work on the zero marginal cost phenomenon. Furthermore, it makes sense from a perspective of Alstynne's (2016) new rules of strategy that claims that network effects is the key to achieve market power on the internet because it is a demand-side driven economies of scale environment.

To summarize and come to a conclusion on this discussion; the importance of the characteristics of a two-sided market determines the relevance of two-sided markets theory.

We are already seeing the theory extending to some groups of internet firms. Network effects is the key to market power, and so subsidizing customers makes a lot of sense in order to grow. It is more feasible for an internet firm to subsidize customers due to zero marginal cost. And lastly, possibilities of connecting agent groups into a two-sided market on the internet are greater than off the internet. Based on Rysman's (2009) threshold for the relevance of two-sided markets, the theory is relevant to internet based startups.

### ***3.2 Two-sided Markets in a Valuation setting***

The sub-question discussed in this section is “how relevant is two-sided markets theory for valuation purposes?”. This discussion will be approached from two angles, I will first show how it can be used alongside FCM and ROV. For ROV it is only price and volatility that needs to be calculated as a unique part related to our two-sided markets approach, and so the rest of ROV analysis will not be covered.

Two-sided markets theory can be useful to construct the scenarios in FCM. Recall that the purpose of this paper is to look at options that firms can actively pursue to achieve profitability, and so basing the scenarios on growth in users is not relevant. The theory tells us that the firm can either (1) add an agent group with network externalities with the existing agent groups, (2) it can replace an existing agent group if the platform is two-sided already, (3) it can redesign its platform, and (4) it can alter pricing. An analysis of the four choices will reveal what is feasible. Advertisers can always be connected to a platform that runs on a smartphone or a webpage, and so (1) will therefore always be feasible if not added already. There is a possibility that more than one agent group can be connected to the market, these are called multi-sided markets. Facebook is an example of something that has evolved into a multi-sided market with users, advertisers, and developers of apps that run on Facebook (Haucap & Heimeshoff, 2014). If the platform is already a two-sided market but (2), an agent group which would incur less costs or have a stronger purchasing power is identified, it might make sense to reconfigure the market to target this agent group instead in some cases. The startup could also (4) redesign its platform in a way that in a way that increases monetization through improved network effects.

Now, let's say that an analysis from a two-sided markets perspective reveal option (1), the startup could add an agent group to its platform which would improve monetization

significantly but incur higher risk. In the last discussion part, I will demonstrate such an example with a startup called Robinhood, who offers commission-free trading of stocks. For the sake of the argument, assume that the added agent group would double the revenue due to the price that the startup is able to charge this group. However, in order to connect the new agent group to the market the startup needs a certification to operate in this market. The expected likelihood that the startup is able to obtain such a certificate and succeed with acquiring a given number of customers in this market is 40%. If this was the best option an analyst could identify, this would have served as the best and only scenario in the popular venture capital method (VCM) used by many practitioners (Smith et al., 2011), but for the FCM it can be one of several if more scenarios are identified. Also, it will be weighted by its probability as oppose to exaggerating the discount rate in order to compensate for the uncertainty (2011).

When the analysis is finished, it reveals that option (1) yields the best-case scenario and is mutually exclusive. The mutually exclusive factor is just to simplify our case, adding an agent group to the market in practical does not necessary hinder the firm of doing other things as well. Continuing, the analysis also revealed that a combination of (2) and (3) is feasible if option (1) is not exercised but would yield less revenue with lower risk and a 70% probability of success. Hence, we have two scenarios for the FCM, one is option (1) and the second is a combination of option (2) and (3). In addition, the option to abandon/exit will of course also be present, and thus we have our third scenario. Now we have three scenarios, two of which are based on a two-sided markets analysis, that can be used in FCM. An analyst would then need to estimate the cash flows of each scenarios. This is not necessary as trivial as it was in this case where we said that it would double the revenue. Next, we construct some numbers from the scenarios so that we can move on to the FCM.

The same scenarios from the two-sided market analysis can be used to determine the inputs in a subjective approach to ROV. In the first stage we need to decide how to use the scenarios to calculate price and volatility of the underlying asset. FCM or a DCF method without a risk adjusted discount rate can be used. In the next section I will do a FCM valuation on an internet startup based on a two-sided markets analysis.

### **3.3 Two-Sided Markets Analysis on a Startup**

This section is for demonstrating the first discussion on an actual internet startup and is part of answering the first sub-question. A challenge with valuating a real startup is access to information and is the reason a case-study method was not used in this paper. As mentioned in the research design, I will need to make assumptions on most numbers regarding the startup and draw information about their business from their website. The numbers will be artificial but the information on their business model and how they make money will be accurate, which is the critical part for the purpose of demonstrating a two-sided markets analysis.

The startup is called Robinhood who's value proposition is to make investing available for everyone through commission-free trading of stocks and exchange-traded funds ("How Robinhood Makes Money," 2018). They subsidize the commission by earning interest accrual on customers' uninvested cash balance. Clearly the customers who enjoy commission-free trading can be considered as one side of the market. According to the website, there are two ways Robinhood makes money. First, the firm "earns revenue by collecting interest on the cash and securities in Robinhood accounts, much like a bank collects interest on cash deposits". From this statement it is reasonable to believe that Robinhood turns to banks in order to earn interest on the uninvested cash balance. This makes sense because there is a low risk involved with keeping cash in a bank account. Secondly, they charge \$6 per month for doubling customers buying power and access to trade after hours. The access to trading after hours part is difficult to understand and will be left out of the analysis. The double buying power is the same as margin trading, meaning that traders can borrow twice their balance for trading stocks for \$6 per month.

From a two-sided markets perspective, the Robinhood platform is a multi-sided market. We have trading customers on one side, banks on another side, and finally margin traders on the third side of the market. We start by looking at the network effects in play. Trading customers do not care how many banks or margin traders Robinhood have, or how much interest they receive on deposits. But there is a network effect in the way that banks and margin traders subsidize commission-free stock trading and the traders provide capital for banks and margin traders. Banks do not care how many trading customers or margin traders Robinhood have. A

simplified summary is that Robinhood monetize on banks and margin traders with the help of uninvested cash balances from regular customers.

For the numbers we will assume that Robinhood has 5 million trading customers, 100.000 margin traders and 4 banks associated with their platform. Furthermore, we assume that the average uninvested cash balance held by traders is \$200, interest rate on deposits with banks are all 0.5% annually, and the margin traders borrows \$100 million in total for stock trading. This means that the current revenue from banks is \$4.5 million ( $0.005 \times (5 \text{ million} \times 200) - 100 \text{ million}$ ) and for margin traders \$7.2 million ( $6 \times 12 \times 100.000$ ). Total revenue is therefore \$11.7 million. Cost are important and especially the break-even threshold for Robinhood. However, making assumptions on costs in numbers will gets us no further than if we just focus on maximizing revenues. An increase in revenues in the analysis is an increase in revenue in real life. But costs can be misleading because it can result in positive profits in the analysis but negative profits in reality and vice versa.

We will start with option (1) from the previous discussion section. Add an agent group to the market. Robinhood have trading customers with uninvested cash balances on one side, so potential agent groups to connect would be someone who is in need of capital. With revenue improvement in mind, we are looking for someone who is willing to pay more for capital than banks. Auto and consumer loans could be a good fit that would yield somewhere around 5% and 15% interest. For simplicity we only go with auto loans with 5% interest rate. The tradeoff is higher risk and pay-back period, thus part of the uninvested cash from customers would need to be held in banks to ensure liquidity. If we assume that the average pay-back of these loans are 90%. Then a 20% margin of the total uninvested cash balances needs to be allocated to a bank account and for margin traders. Of \$1 billion in total uninvested cash, a maximum of \$800 million ( $200 \times 5\text{mill} \times 0.8$ ) can be allocated to auto loans. Once again, we simplify and say that the defaults take place immediately so the revenue is ( $800 \times 0.9 \times 0.05$ ) which yields \$36 million in revenue. Revenue from banks is now \$0.5 million and the total revenue is \$43.7 million ( $36 + 0.5 + 7.2$ ). Acquiring auto loan customers is not as easy as depositing cash into a bank account so the probability of lending out all 800 million is considered to be 0.7.



Option (2) is to replace an agent group. The trading customers cannot be replaced because they provide the capital but the other agent groups can. Banks cannot be replaced completely either because they need to maintain liquidity. Robinhood is able to earn 4.5 cents per dollar occupied to auto loans while margin traders yield far less than 1 cent per dollar it occupies. It could make sense to eliminate margin trading and free up the 100 million to auto loans. However, margin traders attract regular traders to the platform and so they should not be eliminated.

Option (3) is to redesign the platform to enhance network effects and/or increase monetization. While this option is highly relevant it would require extensive insight into how the platform works. I'll give one example however on how this can be relevant. Let's say that Robinhood could replace margin traders with forex traders in option (2). This would make sense if forex brokerage is more profitable than margin trading on stocks. Some of the needed infrastructure for the trading platform is already there but the firm would need to add on a new interface for forex trading. While this option might be feasible, it is unclear what revenue it can bring in without doing research on the forex brokerage industry. Thus, we will not consider this option as a scenario

Two scenarios have been identified with the two-sided markets analysis, but we will only consider the option to add auto loans to the market. What has not been covered is user growth. The first, and best, scenario would increase the total annual revenue to \$43.7 million. The second scenario would be no changes and total annual revenue of \$11.7 million. With knowledge of costs, we can derive the cash flows. In the best-case scenario, costs of adding automobile loan to the platform need to be included in the first cash flow. For the second scenario, no extraordinary cost will occur the first year.

What is becoming clear by now is that it is difficult to proceed with translating the two-sided market analysis into cash flows without too much guessing when we do not have insights into the costs of the firm. This is a challenge that appraisers without access to financial statements will face with most internet startups (Damodaran, 2009). For internal usage or cases where the analyst has full access to financial information the analysis would perhaps be more fruitful. We continue our endeavor to translate our analysis into usable inputs for FCM and ROV analysis to get the full picture on how far we can get with limited information.

Next, growth rates remain for the two cases we have constructed. The two-sided markets analysis does not tell us any specific. However, it is reasonable to assume that revenue growth would be higher in the first years in the best-case scenario because the firm would be tapping into a new market. For the second case where everything is unchanged, a growth rate based on previous years would be a reasonable assumption. Here, we run into the same challenge as with the costs when the analyst has limited information. Issues with estimating costs and growth rates when financial information is scarce is not unique to a two-sided markets analysis but there are other solutions to do a valuation on startups in such situation. Turning to representative firms to make assumption is one approach (Damodaran, 2009). A classical approach to ROV where price and volatility of the firm is estimated using a replicating portfolio would also circumvent the costs and growth rate issue completely (Borison, 2005).

A worst-case scenario should also be represented but is not constructed by the two-sided markets analysis. The firm could face stagnating or negative growth rates in terms of users. Having information on the financial history of the firm will probably not help with estimating negative growth rates because it is less likely that a high-growth startup has experienced this yet.

To sum up the analysis, I was able to construct plausible scenarios including revenues and synergies based on the two-sided markets analysis. For an analyst with limited access to information it is impossible to reliably estimate costs and growth rates in order to derive the final cash flows.

### ***3.4 Advantages and Limitations***

The sub-question discussed in this section is “what are the advantages and limitations of a two-sided markets approach compared to real option valuation?”. To evaluate pros and cons of using two-sided markets approach I will compare it with using ROV because it is an established method.

It is impossible to reliably estimate costs and growth rates when information is scarce, as we saw in the previous discussion. Hence, the method is less useful for analysts with limited access to financial information about the firm.

Comparing the method to a ROV approach, one of the strongest argument for using ROV is that it captures the value of managerial flexibility (Dixit & Pindyck, 1995; MacMillian, 2004). The option to wait with budgeting decisions until the arrival of information that reveals whether the firm should expand, divest or abandon. Exogenous information variables such as demand, prices or costs would trigger budgeting decisions for example. I would argue that some of this flexibility is less relevant to internet firms' growth options. Recall from the Theory chapter how Amazon offers "on demand" cloud services. Internet firms do not have to invest in infrastructure to pursue growth options to the same degree as firms that operate in more traditional markets. With cloud services the capacity to grow is already there and it allows internet firms to pay per usage. If a growth option entail that the userbase of an internet firm will grow with millions of users in a short period of time, they do not need to invest in more powerful servers and more bandwidth. This capacity is already there with the cloud service provider. And if it is not, the cloud provider would have to invest, not the client (internet firms). Hence, the investment decision regarding production capacity is outsourced to cloud service providers. However, it is plausible that internet firms might have to hire more people to handle customer support and other things related to expansion. The bottom line is that the investment curve as a function of demand (success or failure) is significantly more linear for internet firms, rather than incremental which is the case for firms that are running their own IT infrastructure. Thus, the stage-setting investment characteristic of a growth option (McIntyre & Chintakananda, 2013) is missing in many internet firms.

A two-sided markets framework is demand-side driven and thus limit to the options explored to market related opportunities. Real Option Valuation on the other hand capture the value of successful business development opportunities which can be either technology or market driven (Yeo & Qiu, 2003). I would argue that option (3) redesigning the platform from the discussion in 3.2, capture some of the technology driven opportunities but to a limited extent only. It does not capture technology driver opportunities such as releasing completely new products or services. As seen with big internet firms such as Google and Amazon, creating ecosystems with several products allows to further utilize network effects and is not uncommon. Google leveraged the revenue from the search engine to release many other products such as Gmail, Google Docs, and acquire technologies such as YouTube, Android and so on. The question becomes, how relevant is new product releasement to startups with

little to no revenue. A line needs to be drawn between realistic and hypothetical managerial flexibility when using a subjective approach such as a two-sided markets framework. Unless the startup has sufficient revenue or funding, it is hard to justify that the new product release component of managerial flexibility is plausible enough to have any significant value.

Using two-sided markets as a framework for ROV requires us to take a subjective approach as mentioned earlier. This can be problematic if comparable firms exist that can be used to construct a replicating portfolio according to Borison (2005). There are many publicly traded internet firms but one should be careful to conclude that a classical approach with a replicating portfolio should be used rather than a subjective approach. Assuming that the price and volatility of an internet startup can be replicated by a portfolio of publicly traded internet firms contradicts the assumption that network effects creates a winner-take-all environment argued by Alstynne et al. (2016). Especially if the replicating firms are operating in the same market as the startup.

Having looked at the advantages and limitations of two-sided markets analysis in a valuation setting, it is time to move on to a conclusion and suggest future research.

## PART IV - CONCLUSION

### **4.1 Conclusion**

The objective of this thesis has been to study how two-sided markets theory can help analyze internet startups in a valuation setting in order to solve the profit dilemma. To accomplish this in a systematic way the following research question was developed:

**How can two-sided markets theory be incorporated to valuation of internet startups?**

The answer to this question was divided into four sub-questions in such way that the conclusion would consist of (1) generalizability, (2) connection between the two theories, two-sided markets and valuation, (3) practicality of connecting the two theories, and (4) advantages and limitations of doing so.

The conclusion is that a two-sided markets theory can be incorporated as an analytical framework to construct probability-weighted scenarios based on market opportunities. This is true for most internet startups but only when sufficient financial information is available. When financial information is limited the incorporation of two-sided markets theory can make estimation significantly unreliable. The advantages of incorporating a two-sided markets framework is that it allows the analyst to focus on revenue opportunities beyond user growth. The disadvantage is that it makes a ROV biased by forcing the subjective approach.

The strength of this conclusion must be interpreted in light of limitations of this study. To my best knowledge, this is the first attempt to use the two-sided markets theory for valuation purposes. Therefore, there is no foundation in the literature on this particular usage. Hopefully this paper can inspire others and more studies on incorporating two-sided markets theory to valuation will appear.

## **4.2 Future Research**

As seen in this paper, limited access to financial information on a firm hinders the incorporation of two-sided markets framework of yielding a comprehensive valuation. This paper was able to show how useful a two-sided markets approach can be in identifying and a range of options an internet startup has and rank them by revenue. However, it was not possible to derive realistic cash flows due to insufficient information about costs. This calls for a case study with sufficient data to show the usefulness of this approach in terms of deriving the cash flows and assess growth rates to be used when information is available.

Further, this paper has focused on startups which obviously limits the results to apply to such firms. Future research could attempt to apply and adapt the two-sided markets framework to publicly traded internet firms. The benefit of pursuing public firms is that financial statements are available.

Last, McIntyre and Chintakananda (2013) created a growth option model which incorporates the strength of network effects to increase the growth option value in a product release setting. It would be interesting to see future research attempt to create a similar model with a two-sided markets approach and not a product release. It might be that the only way to do this is to use price and volatility based on subjective estimates for the underlying asset.

## LIST OF REFERENCES

- Abrams, J. B. (2010). *Quantitative Business Valuation: A Mathematical Approach for Today's Professionals* (2 ed.): John Wiley & Sons.
- Alstynne, M. W. V., Parker, G. G., & Choudary, S. P. (2016). Pipelines, Platforms, and the New Rules of Strategy. *Harvard Business Review*, 94(4), 54-62.
- Ambrus, A., & Argenziano, R. (2009). Asymmetric Networks in Two-Sided Markets. *American Economic Journal: Microeconomics*, 1(1), 17-52.  
doi:<https://doi.org/10.1257/mic.1.1.17>
- Anderson, C. (2009). *Free: The Future of a Radical Price*.
- Aramand, M. (2008). Software products and services are high tech? New product development strategy for software products and services. *Technovation*, 22(3), 154-160. doi:<https://doi.org/10.1016/j.technovation.2007.10.004>
- Armstrong, M. (2006). Competition in two-sided markets. *RAND Journal of Economics*, 43(3), 668-691. doi:<https://doi.org/10.1111/j.1756-2171.2006.tb00037.x>
- Arthur, W. B. (1996). Increasing Returns and the Two Worlds of Business. *Harvard Business Review*. doi:[http://www.iwp.jku.at/born/mpwfst/02/BArthur/Arthur\\_B.pdf](http://www.iwp.jku.at/born/mpwfst/02/BArthur/Arthur_B.pdf)
- Babiarz, A. (2016). Methods of valuing investment projects used by Venture Capital funds financed with public funds. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, 428. doi:<https://doi.org/10.15611/pn.2016.428.01>
- Baker, J. B. (2007). Market Definition: An Analytical Overview. *Antitrust Law Journal*, 74(1), 129-173. doi:<http://www.jstor.org/stable/27897544>
- Bakos, Y. (1998). The Emerging Role of Electronic Marketplaces on the Internet. *Communications of the ACM*, 41(35-42). doi:<https://doi.org/10.1145/280324.280330>
- Bakos, Y., & Katsamakas, E. (2008). Design and Ownership of Two-Sided Networks: Implications for Internet Platforms. *Journal of Management Information Systems*, 25(2), 171-202. doi:<https://doi.org/10.2753/MIS0742-1222250208>
- Bauer, J. M., & Latzer, M. (2016). *Handbook on the Economics of the Internet*: Edward Elgar Publishing.
- Black, F., & Scholes, M. (1973). The pricing of options and corporate liabilities. *Journal of political economy*, 81(3), 637-654. doi:<https://doi.org/10.1086/260062>

- Blenko, M. W., Mankins, M., & Rogers, P. (2010). The Decision-Driven Organization. *Harvard Business Review*, 88(6), 55-62. doi:<https://hbr.org/2010/06/the-decision-driven-organization>
- Borison, A. (2005). Real options analysis: Where are the emperor's clothes? *Journal of applied corporate finance*, 17(2), 17-31. doi:<https://doi.org/10.1111/j.1745-6622.2005.00029.x>
- Bryman, A., & Bell, E. (2011). *Business Research Methods*. Oxford: Oxford University Press.
- Chang, S. J. (2004). Venture capital financing, strategic alliances, and the initial public offerings of Internet startups. *Journal of Business Venturing*, 19(5), 721-741. doi:<https://doi.org/10.1016/j.jbusvent.2003.03.002>
- Christensen, C., & Raynor, M. (2003). *The innovator's solution: Creating and sustaining successful growth*. Boston: Harvard Business School Press.
- Copeland, T., & Antikarov, V. (2003). *Real Options, Revised Edition: A Practitioner's Guide*. Irwin: McGraw-Hill.
- Cusumano, M. A. (2008). The Changing Software Business: Moving from Products to Services. *Computer*, 41(1). doi:<https://doi.org/10.1109/MC.2008.29>
- Damodaran, A. (2005). *The Promise and Peril of Real Options*. NYU Working Paper No. S-DRP-05-02. New York University - Stern School of Business.
- Damodaran, A. (2007). Valuation approaches and metrics: a survey of the theory and evidence. *Foundations and Trends in Finance*, 1(8), 693 – 784. doi:<http://dx.doi.org/10.1561/0500000013>
- Damodaran, A. (2009). Valuing Young, Start-up and Growth Companies: Estimation Issues and Valuation Challenges. doi:<https://dx.doi.org/10.2139/ssrn.1418687>
- Dixit, A. K., & Pindyck, R. S. (1995). *The options approach to capital investment*. Cambridge: MIT Press.
- Douglas, P. R. S. E. J. (2007). Valuing technology investments: use real options thinking but forget real options valuation. *International Journal of Technoentrepreneurship*, 1(1), 58-77. doi:<http://ssrn.com/abstract=1263754>
- Eisenmann, T. R. (2006). Internet Companies' Growth Strategies: Determinants of Investment Intensity and Long-term Performance. *Strategic Management Journal*, 27, 1183-1204. doi:<https://doi.org/10.1002/smj.567>



- Evans, D. S. (2013). Attention Rivalry Among Online Platforms *Journal of Competition Law & Economics*, 9(2), 313–357. doi:<https://doi.org/10.1093/joclec/nht014>
- Gustavsson, J. (2011). Rule of Thumb for Optimal Number of Runs in Monte Carlo Simulations. *The IUP Journal of Risk & Insurance*, 8(3), 37-50. doi:<https://ssrn.com/abstract=2061572>
- Hagiua, A., & Wright, J. (2015). Multi-sided platforms. *International Journal of Industrial Organization*, 43, 162-174. doi:<https://doi.org/10.1016/j.ijindorg.2015.03.003>
- Haucap, J., & Heimeshoff, U. (2014). Google, Facebook, Amazon, eBay: Is the Internet driving competition or market monopolization? *International Economics and Economic Policy*, 11(1), 49-61. doi:<https://doi.org/10.1007/s10368-013-0247-6>
- Hodder, J. E., & Riggs, H. E. (1985). Pitfalls in Evaluating Risky Projects. *Harvard Business Review*, 63(1), 128-135. doi:<https://hbr.org/1985/01/pitfalls-in-evaluating-risky-projects>
- How Robinhood Makes Money. (2018). Retrieved from <https://support.robinhood.com/hc/en-us/articles/208650436-Fees-on-Robinhood->
- Hull, J. (2012). *Hull, John. Risk management and financial institutions* (Vol. 733): John Wiley & Sons.
- Katz, M. L., & Shapiro, C. (1985). Network Externalities, Competition, and Compatibility. *The American Economic Review*, 75(3), 424-440. doi:<http://www.jstor.org/stable/1814809>
- Kemper, A. (2009). *Valuation of Network Effects in Software Markets: a Complex Networks Approach*: Springer Science & Business Media.
- Lee, C. M. C., & Louis, H. J. (2003). Choosing the Right Valuation Approach. *Journal of Accounting Research*, 407. doi:[https://www.researchgate.net/profile/Charles\\_Lee9/publication/272894294\\_Choosing\\_the\\_Right\\_Valuation\\_Approach/links/58177fa708aeb720f689aa9e.pdf](https://www.researchgate.net/profile/Charles_Lee9/publication/272894294_Choosing_the_Right_Valuation_Approach/links/58177fa708aeb720f689aa9e.pdf)
- Lev, B. (2001). *Intangibles: Management, and Reporting*. Washington, DC: Brookings Institution Press.
- Liao, J., Kickul, J. R., & Ma, H. (2009). Organizational Dynamic Capability and Innovation: An Empirical Examination of Internet Firms. *Journal of Small Business Management*, 47(3). doi:<https://doi.org/10.1111/j.1540-627X.2009.00271.x>
- Lin, L., & Kulatilaka, N. (2007). *Strategic Growth Options in Network Industries*: Emerald Group Publishing Limited.

- Lumpkin, G. T., & Dess, G. G. (2004). E-Business Strategies and Internet Business Models:: How the Internet Adds Value. *Organizational Dynamics*, 33(2), 161-173.  
doi:<https://doi.org/10.1016/j.orgdyn.2004.01.004>
- MacMillan, A. B. V. P. I. (2004). Making Real Option Really Work. *Harvard Business Review*. doi:<https://hbr.org/2004/12/making-real-options-really-work>
- Marston, S., Lia, Z., Bandyopadhyay, S., Zhang, J., & Ghalsasi, A. (2011). Cloud computing — The business perspective. *Decision Support Systems*, 51(1), 176-189.  
doi:<https://doi.org/10.1016/j.dss.2010.12.006>
- McGrath, R. G. (1997). A Real Options Logic for Initiating Technology Positioning Investments. *Academy of Management Review*, 22(4), 974.  
doi:<https://doi.org/10.5465/amr.1997.9711022113>
- McGrath, R. G. (1999). Falling forward: Real options reasoning and entrepreneurial failure. *The Academy of Management Review*, 24(1), 13-31.  
doi:<https://doi.org/10.5465/amr.1999.1580438>
- McIntyre, D. P., & Chintakananda, A. (2013). A real options approach to releasing “network” products. *The Journal of High Technology Management Research*, 24(1), 42-52.  
doi:<https://doi.org/10.1016/j.hitech.2013.02.007>
- Merton, R. C. (1973). Theory of rational option pricing. *Journal of economics and management science*, 141-183. doi:<http://www.jstor.org/stable/3003143>
- Miller, M. H., & Modigliani, F. (1961). Dividend policy, growth, and the valuation of shares. *the Journal of Business*, 34(4), 411-433. doi:<http://www.jstor.org/stable/2351143>
- Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), 147-175. doi:[https://doi.org/10.1016/0304-405X\(77\)90015-0](https://doi.org/10.1016/0304-405X(77)90015-0)
- Penman, S. H. (2013). *Financial Statement Analysis and Security Valuation*. New York: McGraw Hill.
- Penman, S. H., & May, G. O. (2009). Accounting for Intangible Assets: There is Also an Income Statement. *The Journal of Accounting, Finance, and Business Studies*, 45(3), 358-371. doi:<https://doi.org/10.1111/j.1467-6281.2009.00293.x>
- Petty, & Guthrie. (2000). Intellectual capital literature review Measurement, reporting and management.  
doi:<http://www.emeraldinsight.com/doi/pdfplus/10.1108/14691930010348731>
- Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, 79(3), 62-78.

- Rifkin, J. (2014). *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism*. St. Martin's Press.
- Rochet, J. C., & Tirole, J. (2003). Platform Competition in Two - Sided Markets. *Journal of the European Economic Association*, 1(4), 990-1029.  
doi:<https://doi.org/10.1162/154247603322493212>
- Rysman, M. (2009). The Economics of Two-Sided Markets. *Journal of Economic Perspectives*, 23(3), 125-143. doi:<https://doi.org/10.1257/jep.23.3.125>
- Sanders, G., & Boivie, S. (2004). Sorting things out: valuation of new firms in uncertain markets. *Strategic Management Journal*, 25(2), 167-186.  
doi:<https://doi.org/10.1002/smj.370>
- Schumpeter, E. B. (1938). English Prices and Public Finance. *Review of Economic Statistics*, 20, 21-37. doi:<https://doi.org/10.2307/1927645>
- Smith, J. K., Smith, R. L., & Bliss, R. T. (2011). *Entrepreneurial finance: strategy, valuation, and deal structure*. Stanford, CA: Stanford University Press.
- Trigeorgis, L. (1996). *Real options: Managerial flexibility and strategy in resource allocation*: MIT press.
- Vratonjic, N., Manshaei, M. H., Grossklags, J., & Hubaux, J.-P. (2013). *Ad-Blocking Games: Monetizing Online Content Under the Threat of Ad Avoidance*. Berlin: Springer.
- Wirtz, B. W., Schilke, O., & Ullrich, S. (2010). Strategic Development of Business Models: Implications of the Web 2.0 for Creating Value on the Internet. *Long Range Planning*, 42(3), 272-290. doi:<https://doi.org/10.1016/j.lrp.2010.01.005>
- Yeo, K. T., & Qiu, F. (2003). The value of management flexibility—a real option approach to investment evaluation. *International Journal of Project Management*, 21(4), 243-250.  
doi:[https://doi.org/10.1016/S0263-7863\(02\)00025-X](https://doi.org/10.1016/S0263-7863(02)00025-X)