VALUATION OF PRIVATE TECH COMPANIES – A CONCENTRATION ON DISRUPTIVE INNOVATIONS

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Abstract

The valuation of technology firms has always been a hot topic in the financial world. Among all the technology firms, disruptive innovations are particularly difficult to be valued. The development strategy and limited disclosure create complications for analysts. Traditional valuation approaches no longer provide accurate and explanatory results on tech disruptors.

Aiming at solving the valuation problem for tech disruptors, a new valuation framework is developed in the paper. At the beginning, the definition and impacts of disruptive innovation are presented. In chapter 3, the PEST ROAD analysis framework is developed as part of the valuation framework. The analysis framework focuses on analysing internal and external factors that drive the growth of the industry and the company. Coupled with the suggested valuation methods (i.e. DCF and real options), which are the other part of the valuation framework. The valuation framework forecasts the competition between the disruptor and the incumbents, and it estimates the embedded real options value that hasn't yet been activated.

In the case study of Airbnb, the valuation framework is demonstrated and applied. The result shows that nearly half of the entire value of Airbnb comes from its option of expanding into travel packages market. The importance of real options value is further urged in the discussion section, where we find out that DCF value is far from its implied valuation. The sensitivity analysis provides us the most sensitive value drivers of Airbnb, and the core status of the size of the user base is argued and generalized to other tech disruptors.

From the case study, we further notice the crucial role of real options plays in valuing private tech disruptors. The practicability of the suggested valuation framework is proved, and it is believed to be a valuable framework which facilitates the valuation process and improves the valuation accuracy. At the end, a core value driver of tech disruptors: the size of the user base, is discovered. It is a primary source of value for technology companies, and it could potentially to be used as another entry point of valuation.

Acknowledgement

I would like to take the chance to thank my thesis supervisor, Mr. Leonhardt Pihl. He has been consistently supporting me along my thesis writing process and steered me in the right direction whenever he thought I needed it.

I would also like to thank my wife Nicole. Her encouragement, patience, and well-cooked food have been my motivation towards excellence.

Table of Contents

1. Introduction

Technology has changed the way we live significantly within the last decades. So did the technology firms to the financial market. From 1997 to 2000, we experienced what we later called the "dot com bubble". The stock prices of technology firms raised dramatically during the period and fell at the same pace after the bubble burst. Nasdaq Composite, a stock market index that heavily weighted towards technology companies, had a roller coaster ride during and after the bubble period[1].

Figure 1 Nasdaq Composite, 1994 - 2016

The development strategy of those technology firms distinguished them from traditional companies. They were burning capital aggressively to acquire market shares, rather than developing step by step with healthy bottom lines[2]. Such strategy made the valuation of technology companies awfully difficult, and there wasn't any corresponding valuation framework that was mature and commonly accepted. Therefore, it was hard to tell whether the stocks were overvalued when the stock prices climbed rapidly.

Today, the valuation dilemma of technology firms hasn't changed much. Meanwhile, as we can observe from the Nasdaq Composite chart, we are facing another sprint of tech stock prices after the 2008 financial crisis. Do the current stock prices of the technology companies reflect their true values? Are we

[1] Yahoo Finance, http://finance.yahoo.com/echarts?s=%5EIXIC+Interactive#symbol=%5EIXIC;range=my
[2] Bottom line is the last line in an income statement, i.e. net income.

facing another dot com bubble? To answer these questions, we need to figure out whether the stocks are over-valued or not. Therefore, it is necessary to develop a valuation framework for technology companies.

There is a special kind among all the technology companies. They destroy current markets; they grow at a supersonic speed; they have a strong influence on the market; their valuations are more ambiguous than peers. They are disruptors.

The objective of this thesis is to come up with a valuation framework for technology disruptors and implement the framework for valuing the target firm: Airbnb.

1.1 Problem Statements

So as to reach the research objective mentioned above, there are certain questions that need to be answered throughout the study.

What is disruptive innovation? What distinguish companies running disruptive innovations from other firms in terms of valuation? By answering these question, we are expected to truly understand the definition of disruptive innovation and its unique features.

What composes an explanatory valuation framework for disruptive innovations? The knowledge gained from studying disruptive innovation will hopefully help us to identify the explanatory variables of the valuation and place them into the framework.

One key element of a valuation framework is the valuation method. What is (are) the most suitable method(s) for valuing disruptive innovations?

What is the value of Airbnb according to our valuation framework? If any, what are the possible explanations for the spread between our valuation and the implied price from investments? What are the most sensitive variables that drive the valuation of Airbnb?

Besides the primary research problems above, there are other problems arising during the process. Some examples might be: What is valuation? What are the traditional valuation frameworks and valuation methods? In which way does the valuation framework of disruptive innovations deviate from traditional firms? Why are the traditional framework and methods inappropriate for valuing disruptive innovations?

In the meantime, we must be able to answer the questions that are related to Airbnb, as they are essential premises of valuing the company. What is the business model of Airbnb? What are the stakeholders of Airbnb? What are the business risks of Airbnb?

Having answered these question will provide us a comprehensive overview of the topic and find a path towards our objective.

1.2 Delimitations

Valuation vs. Pricing:

As we stated earlier, the research objective is to develop a valuation framework for disruptive innovations, and then apply it to the target firm: Airbnb. Therefore, it is essential that we focus on the "valuation" part.

Despite "pricing" and "valuation" are being used by many analysts and investors Interchangeably, they vary in their nature. The valuation is determined by the interplay of a company's cash flows, risks, assets and growth. It is focusing on a company's capacity to generate and grow (potential) cash flows.

On the other hand, the price of an asset is a function of its demand and supply. The demand and supply are not solely determined by the corporate fundamentals or multiples, but more immediately by the market sentiments and incremental information. Market forces such as momentums and fads, and liquidity (illiquidity) can cause stock prices to have their own dynamics, which result in the gap between the prices and the values (A.Damodaran, 2016[3]).

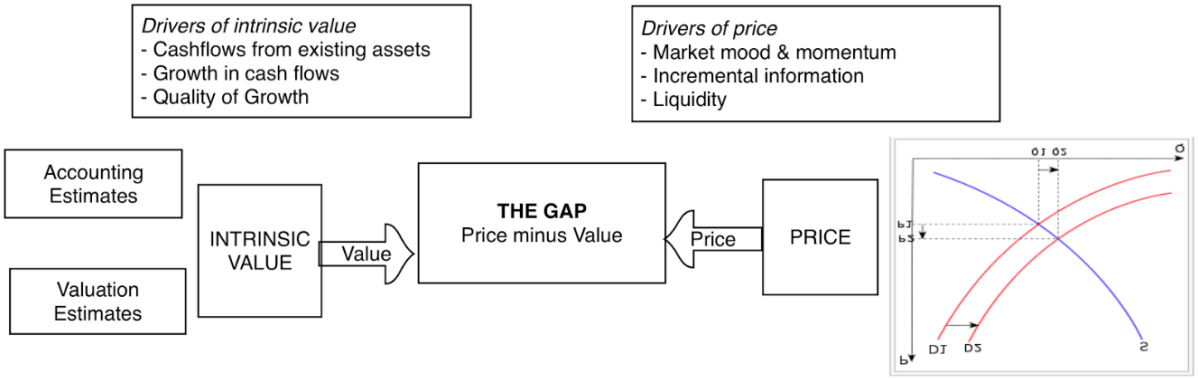

Figure 2 - An illustration of price-value gap

Source: Damodaran A.

More importantly, pricing techniques do not apply to disruptors, especially for young and private disruptors like Airbnb. According to the definition of pricing, the price of an asset is determined by the

[3] Aswath Damodaran, "Musings on Markets", http://aswathdamodaran.blogspot.dk/

market demand and supply. Therefore, the price of a public-listed disruptor is simply its market capitalization. It not even necessary to price it. On the contrary, private disruptors are only raising capital on the primary market. Getting to know the demand and supply of such companies are impractical.

Since gauging demand and supply is infeasible, comparative valuation method is normally used for pricing purpose. It firstly matches the target company with another comparable company that is identical or at least similar to the target company. Secondly, it compares the scale of the multiples between the two firms and then assigns a price to the target company (A.Damodaran, 2014[4]). It is called "comparative valuation", but in essence, it is rather a pricing technique. This is due to the fact that it is the price of the comparable firm and the comparison between the two that determine the value of the target company, not the cash flow generating ability of the company.

The problem is that we are simply unable to find a comparable firm for the first step of the comparative valuation process. Let's take Airbnb as an example. How can we ever compare Airbnb with Marriott or Facebook? Airbnb is an IT company in the hospitality industry, whereas Marriott is a hospitality company owning more than 4,000 physical properties and Facebook is an IT company in the social network industry. The disruptors, such as Airbnb, disrupt market incumbents and bring up a brand new market and value network. Therefore, disruptors are unique presences that never existed before. How can we find a truly comparable benchmark when the pricing target is so different than others?

Since the emphasis of the thesis is about valuation, not pricing, and the pricing techniques are not suitable for disruptive innovations, we will only incorporate valuation techniques/methods in the valuation framework and the valuation of Airbnb. In addition, it is after all the intrinsic value of the disruptive innovations that we are trying to measure here.

Disruptive (IT) innovations:

Although disruptive innovations can happen in any industry, they most likely adopt technology to disrupt the target market (Airbnb's lodging platform, Uber's taxing APP, Netflix's website and APP). More importantly, tech-disruptions are most likely to experience troubles with valuation, because they have less physical assets and their aggressive expansions cause negative cash flows. Hence, disruptive innovations using non-IT methods are ruled out in the development of valuation framework.

[4] Aswath Damodaran, "A Disruptive Cab Ride to Riches: The Uber Payoff", Musings on Markets, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1

1.3 Methodology

The thesis referred the "Research Onion" developed by Saunders et al. (2007) in research design. The research onion illustrates various stages that should be covered when developing a research methodology[5].

Data Collection: Literature and document review will be the data collection method of this paper. Relevant data will be collected via various financial reports, analysis, research papers, and academic publications.

Time horizon: This paper is a cross-sectional study in terms of the time horizon. Cross-sectional study is a type of observational study that engages the analysis of data collected at one specific point in time. Valuation and its techniques and framework evolve from time to time. It is therefore a must for the researchers/analysts to exclude the impact of time, in order to conduct a representative and meaningful analysis.

Research Choice: The thesis is conducted using mixed methods, i.e. a combination of both quantitative analysis and qualitative analysis. The valuation framework induction, Airbnb analysis and assumptions formulation belong to the qualitative analysis, whereas the Airbnb valuation and the sensitivity analysis part are quantitative analysis.

Research Strategies: The framework induction part of the thesis is trying to construct a valuation framework theory through the analysis of data. It is therefore a strategy called "Grounded Theory". Nonetheless, we are only using the concept of Grounded Theory, not its precise processes and steps, as the process extracts theories from extensive data which are not available in the study field. For the later analysis and valuation of Airbnb, we will conduct a case study, which will cover Airbnb from the top line to the bottom line and from market to stakeholders. The analysis of Airbnb will be used as a premise for our educated assumptions, and then the assumptions will work with the valuation framework and methods to deliver the final valuation of Airbnb.

Research Approach: The paper uses an inductive approach to develop the framework and deliver the valuation. The inductive approach starts with data gathering and observation, then the analyst will look for patterns in the data, and finally develop a theory upon the patterns and data. Inductive approach is also the most commonly used approach in the asset valuation and analysis process.

[5] Saunders, M., Lewis, P., & Thornhill, A. (2007). Research Methods for Business Students, (6th ed.) London: Pearson.

Data Type: Our data are to be collected from literature and documents, and therefore they are categorized as secondary data.

Valuation Tool: We will be using Microsoft Excel as the primary valuation and analysis tool. It is expected to demonstrate a clear and straightforward valuation process and visualized products.

2. Disruptive Innovation

The term "disruptive innovation" was coined by Clayton M. Christensen in a Harvard Business Review article "Disruptive Technologies: Catching the Wave" at the beginning of 1995. Now twenty years have passed, the term has been publicly recognized and spread all over the magazines and articles. Mr. Christensen's disruptive innovation theory points out that an established incumbent can face grave danger from a disruptor, even the company is serving its consumers and markets properly and profitably.

2.1 The definition:

According to Mr. Christensen's homepage, the definition of disruptive innovation is:

> *"Disruptive innovation, …, describes a process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors"*[6]

In his theory, a truly disruptive product or service should invade at the bottom of a market, i.e. a cheaper and/or inferior market that the market incumbents intentionally ignored. Subsequently, the disruptor moves upmarket to challenge the mainstream and high-end customer base of the market incumbents. The following figure elaborates the disruptive innovation model in Mr. Christensen's theory.

[6] Clayton M. Christensen, Disruptive Innovation, http://www.claytonchristensen.com/key-concepts/

The Disruptive Innovation Model

This diagram contrasts *product performance trajectories* (the red lines showing how products or services improve over time) with *customer demand trajectories* (the blue lines showing customers' willingness to pay for performance). As incumbent companies introduce higher-quality products or services (upper red line) to satisfy the high end of the market (where profitability is highest), they overshoot the needs of low-end customers and many mainstream customers. This leaves an opening for entrants to find footholds in the less-profitable segments that incumbents are neglecting. Entrants on a disruptive trajectory (lower red line) improve the performance of their offerings and move upmarket (where profitability is highest for them, too) and challenge the dominance of the incumbents.

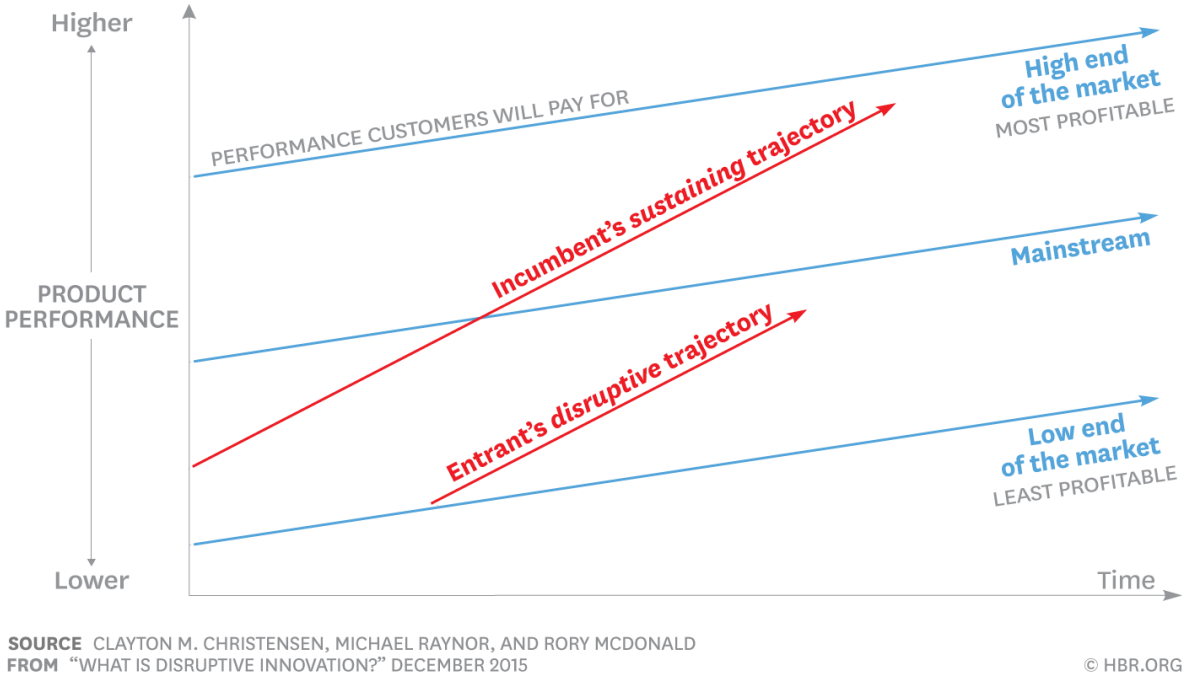

Figure 3 How disruptive innovation enters the market

However, the definition of disruptive innovation seems to be too narrow that Mr. Christensen refuses to call Uber (a remote taxi-hailing service firm) genuinely disruptive. The argument is that, Uber entered the mainstream market with an even better service than the incumbent companies, and moved subsequently to historically overlooked markets. It went exactly in the opposite direction that a disruptor in Mr. Christensen's standard should have gone[7].

Is Mr. Christensen right about Uber? Let's see some numbers and facts:

[7] Clayton M. Christensen, Michael E. Raynor and Rory McDonald, "What is disruptive innovation", Harvard Business Review, December 2015, https://hbr.org/2015/12/what-is-disruptive-innovation

Uber's implied valuation has reached 51 billion dollars 6 years after its birth, which is more than companies like General Motor, Ford, and Morgan Stanley[8]. The expansion of Uber is so rapid, and the disruption that Uber brings is massive. By the end of March 2015, Uber's market share of total paid rides in U.S. is nearly even with all taxis, limos and airport shuttles combined[9]. That's not even the end of the story. Uber has launched UberFresh, a same-day grocery delivery service, and UberEats, 10-minutes food delivering service. Uber is not just disrupting transportation industry, but also supermarkets, catering, delivering, all at the same time[10]. After having all the numbers and facts, it would be irrational to deny Uber as a disruptive innovation.

It is certain that companies like Uber do not fit into Mr. Christensen's theory of disruptive innovation. But in real life, what really important to the market incumbents are the threats that the disruptors possess, not the way that disruptors enter the market. Only following Mr. Christensen's theory to monitor the low-end new entries will cause market incumbents to overlook threats like Uber, who invades a higher end of the market. Similar applies to the investors. An investor cares the potential and the growth of a disruptive innovation, but not at all about the way it enters the market.

A truly useful and helpful definition of disruptive innovation should serve the purpose of identifying an innovation that carries a disruptive impact on the target market. Hence, we will be using a broader definition of disruptive innovation than Mr. Christensen characterized.

> *"A disruptive innovation is an innovation that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market leaders and/or alliances.[11]"*

[8] Uber's valuation is computed using its latest investment round, while the market capitalizations at 19th February of General Motor, Ford and Morgan Stanley are compared.
[9] Certify, "Sharing the Road: Business Travelers Increasingly Choose Uber", https://www.certify.com/infograph-sharing-the-road.aspx
[10] The Washington Post, "What the legendary Clayton Christensen gets wrong about Uber, Tesla and disruptive innovation", https://www.washingtonpost.com/news/innovations/wp/2015/11/23/what-the-legendary-clayton-christensen-gets-wrong-about-uber-tesla-and-disruptive-innovation/
[11] Wikipedia, "Disruptive Innovation", https://www.wikiwand.com/en/Disruptive_innovation

2.2 The impacts and Incumbents

Disruptive innovations have shown themselves more often after we entered the 21th century. While Uber and Airbnb might be the hottest disruptors recently, Apple is probably the most successful disruptor by turning mobile phones into a truly multifunction mobile computer.

In our everyday life, smartphones disrupted traditional cell phones, automobiles disrupted horse-drawn vehicles, Wikipedia disrupted traditional encyclopedias, and Augmented Reality is disrupting several markets simultaneously. Disruptive innovations are everywhere around us. They change the way things operates and the way we think and interactive. Consequently, our life is easier and more convenient with disruptive innovations. Therefore, disruptive innovation is no doubt something that consumers are delighted to embrace. On the other hand, the success stories of disruptive innovations can boost entrepreneurship among the general public.

Apparently, when there are new entrants, there must be leavers as well. Market incumbents are severely challenged by disruptive innovations. Unlike homogeneous competitions, the challenges from disruptors are rather heterogeneous. As mentioned in the definition of disruptive innovation, the innovation creates a new market and value chain, and consequently, disrupts the current market and value chain. Therefore, the incumbents couldn't eliminate such threats by simply improving its current products/services, which is what companies usually do to compete with each other under a homogeneous industry.

In order to beat disruptive innovations, the incumbents have to look for other solutions. They can, for instance, disrupt themselves so as to compete with the disruptor(s) in a homogeneous market. The truth is, sacrificing current revenue streams, the comfort of status quo, the cost of self-disruption, and the organizational cultural issues make the self-disruption decision tremendously difficult to carry out.

Alternatively, the incumbents can acquire the disruptor(s) at an early stage, or spin off a branch to compete with the disruptor(s) while the main body continue serving its current market. The former option is widely used by technology firms, such as Google, Apple, Facebook and Yahoo, to rule out potential competitions and boost product diversity. They have acquired hundreds of small companies at early stages, among which some well-known ones are Android, Siri, WhatsApp and Tumblr, respectively. Meanwhile, one textbook example of spin-off came from International Business Machines. IBM sent a team to Florida to develop a completely new product to fight personal computer revolution. The team successfully completed its objective and became the well-known IBM PC.

More importantly, before the incumbents can respond to the disruptors, they first need to realize the challenge. Sometimes the incumbents try too hard to answer the question: how to sell more current

products/services? And the consequence is that they often forget the true business that they are in and ignored the disruption that an innovative product can deliver.

Kodak's failure is a typical consequence of this fallacy. Kodak invented the first ever digital camera in 1975 called "Kodak DCS". However, due to the fear of losing its considerable profits from the current film business, Kodak held back the progressing of digital camera and let companies like Sony and Canon took the lead. Things kept getting worse and worse, and Kodak eventually filed bankruptcy in 2012. It was a lamentable living example which a market leading incumbent was disrupted by its own innovation. Kodak thought they were doing the film business, but the truth was that digital cameras were disrupting Kodak's true business: story-telling[12].

Incumbents have to adapt the market demand, even it requires the company to compete with its current business. In order to adapt the market demand, incumbents must first pay attention to monitor and analyse the market, and second to drop the current business bias and the "incumbent's dignity".

No matter which strategy the incumbents select to fight disruptors, it is quite different from the current daily operations. And it consumes extensive attention as well as efforts not only to implement the strategy but also to monitor and analyse the market trend. But with the right decision at a right time, it could lead the opportunities for greater market shares for some incumbents. The presence of disruptive innovation is, therefore, a double-edged sword, which its impacts are largely dependent on the reaction of the incumbents.

[12] Avi Dan, "Kodak Failed By Asking The Wrong Marketing Question", Forbes, 2012, http://www.forbes.com/sites/avidan/2012/01/23/kodak-failed-by-asking-the-wrong-marketing-question/#7b38c67b7dd7

3. Valuation Framework – Part 1

A framework is a basic structure of something. By following a specific framework, people should be able to achieve a predetermined objective. Therefore, a framework supports the user as a guide. A valuation framework is no exception. Literally, a valuation framework assists analysts to figure out the value of a particular asset. In our view, a solid valuation framework consists two major parts: the analysis framework and the valuation method(s). In this chapter, we will be discussing the first part of the valuation framework: Analysis Framework.

The analysis framework serves the purpose of understanding the underlying asset. It breaks a complex topic or objective into smaller parts so as to earn a clearer and more intuitive understanding. In our context, the analysis framework breaks a company into several major value drivers, and it is expected to provide us educated assumptions when it comes to the later valuation session.

3.1 Traditional Frameworks

Traditionally, analysts often first analyse the industry that the company is in. And then look into the financial statements of the company for company analysis. Porter's Five Forces framework is probably the most commonly accepted tool for conducting such fundamental analysis. The framework includes Five Forces, which are "Threat of new entrants", "Threat of substitute products or services", "Bargaining power of customers (buyers)", "Bargaining power of suppliers" and "Rivalry among existing competitors".

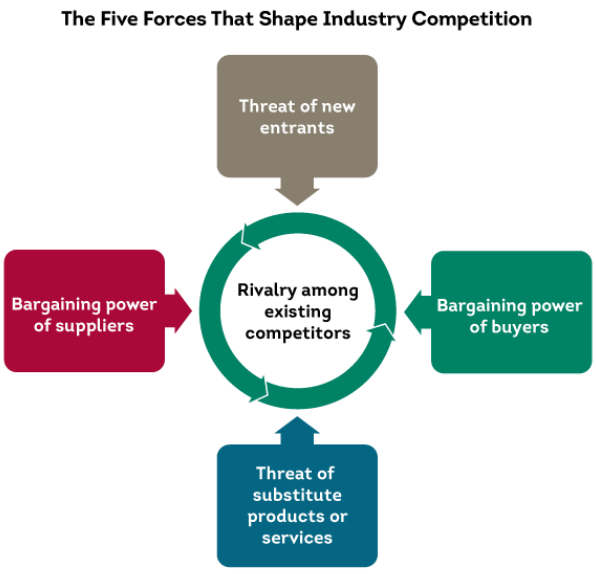

Figure 4 Porter's Five Forces Model

The framework was introduced by Michael Eugene Porter, a young associate professor at Harvard Business School, in 1979. It was his very first article for Harvard Business Review (HBR), and it was named "How Competitive Forces Shape Strategy." The model was aimed to measure the level of competition and the attractiveness of a specific industry. The economic attractiveness of an industry can be drained away via the rivalry among inside competitors, and it can also be bargained away by the powers of the suppliers and the buyers or be threatened by the new entrants or substitutes[13].

An attractive or less competitive industry typically experiences minor threats from substitute products and new market entries, while the bargaining powers of both suppliers and buyers are weak (i.e. the company remains a relatively stronger pricing power). Healthcare technology industry is an example of an attractive industry. It is because the products are difficult to find replacements, and the patent protections ensure strong pricing power of the producer. An unattractive industry, on the other hand, has unfavourable forces that drive down the overall profitability of the company. Retailing industry is an unattractive industry, as consumers can easily find identical products at other shops or supermarkets. The bargaining power of buyers, the low barrier to entry and the strong competition among the incumbents lead to a less profitable industry.

The Five Forces model not only caught huge repercussions in the academic world but also has been used by many practitioners ever since. The reputation of Mr. Porter went straight to the sky and he became the youngest professor in Harvard Business School. Professor Porter's work have been widely recognized and he is today the most cited scholar in economics and business field[14].

Despite the broad applications, Porter's Five Forces model suffered some critics as well. One popular criticism was that Porter did not provide any justification for the choice of the Five Forces, which made his model lacking validity (O'shaughnessy, 1984[15]; Speed, 1989[16]). In addition, the Five Forces model didn't incorporate the impact of time, which made it rather difficult to apply in highly competitive and dynamic markets. Because the situation could change so rapidly (Thyrlby, 1998[17]).

[13] Porter, M. E. (2008). The five competitive forces that shape strategy.
[14] Harvard Business School, Michael E. Porter, http://www.hbs.edu/faculty/Pages/profile.aspx?facId=6532
[15] O'shaughnessy, J. (1984). Competitive marketing: a strategic approach. Boston: Allen & Unwin.
[16] Richard J. Speed, (1989) "Oh Mr Porter! A Re-Appraisal of Competitive Strategy", Marketing Intelligence & Planning, Vol. 7 Iss: 5/6, pp.8 – 11
[17] Thurlby, B. (1998). Competitive forces are also subject to change. Management decision, 36(1), 19-24.

More importantly, Both Downes, L. (1997)[18] and Flower, E. (2004)[19] suggested additional forces other than the Five Forces model. They are "Globalization", "Digitalization" and "Deregulation".

Globalization is primarily caused by 1) lower trade barriers, 2) lower communication costs and 3) lower transportation costs, as well as 4) the spread of technology and 5) Information and Communication Technology Development (Bang and Markeset, 2012[20]). A high level of globalization forces regional companies to compete in an international environment, even if there aren't any import/export activities. Customers today have more and easier accesses to the foreign products and services. They can easily compare the global prices with local providers to make their purchase decisions. Therefore, the level of globalization in the country become a decisive factor in terms of the industrial profitability (Flower, E. 2004).

One direct consequence of the digitalization process is that companies no longer only face competitions inside the industry, but also across industries (e.g. physical shopping malls vs online shopping malls running by banks or credit card organizations). On the other hand, in order to survive the digitalization wave, companies have to become more dynamic and often have to change their business model. The level of digitalization determines the way rivals compete, and this process is continuous. Digitalization place uncertainties into the future market, where only the most adaptive and innovative entities survive.

Deregulation was a global phenomenon from 1970 to 2000. According to Downes (1997), the influences of governments shrank significantly in that period, due to the reducing regulations. The level of deregulation in an economy determines the barriers to entry and the threats of substitutes.

While globalization and digitalization are still influential factors today, deregulation is pretty much outdated. The increasing amount of moral hazards and frauds (e.g. Enron Scandal, Financial Crisis, Panama Paper, etc.) has placed more regulation onto governments' and organizations' agendas. As we can see, decisive forces for industrial analysis may come and go. Besides, some decisive forces might be especially important for some industries while might completely ignorable for some other industries.

Porter's Five Forces is no doubt a classic framework when we value a traditional, mature and static industry. Nonetheless, the continuous evolving global markets and the technological advances have

[18] Downes, L. (1997). Beyond Porter. Context Magazine.
[19] Flower, E. (2004). Competition, technology, and planning: preparing for tomorrow's library environment. Information Technology and Libraries, 23(2), 67.
[20] Bang, K. E., & Markeset, T. (2012). Identifying the Drivers of Economic Globalization and the Effects on Companies' Competitive Situation. IFIP Advances in Information and Communication Technology 384, 233.

changed the way we do business. Denning, S.(2012)[21] believed that the barriers to entry had been destroyed by the wave of globalization and digitalization, and that knowledge had become a commodity. These phenomena are still occurring. The Five Forces model is less effective in today's market where the buy-side takes in charge. Companies nowadays need more detailed and targeted analysis of the industry.

With the dynamic environment and the more segmented markets, it is necessary to develop a more targeted framework for any specific analysis purpose.

This is especially the case in our study, because disruptive innovations bring a new market and value chain with them, when they enter an industry. It is going to disrupt the current market. The current barriers to entry (under "threats of new entrants") can only block new entrants that deliver homogeneous products or services and have similar development paths.

Let's take taxi industry as an example. New taxi company always has a higher average cost per unit of cars in comparison with incumbent companies. This is primarily due to the economies of scale. Market incumbents have more cars and more customers, and this fact will allow incumbents to develop cost efficiency. Because the incumbents can order more cars in one order, can train more drivers at one time, can have more cars to run service checks, can better negotiate insurance contracts. Not to mention that the taxi operating license is rather expensive. Unless the new entrants have the extensive capital to build economies of scale, otherwise the new entrants would face higher costs when they deliver taxing services to its customer. In another word, the new entrants are not able to compete the incumbents at the same price level. So, according to the Five Forces model, the incumbents should be able to relax and enjoy a market of their own.

What happened next? Uber involved. Within a merely six years' time, Uber acquired nearly half of the total paid rides in U.S. Why didn't the barriers to entry block the development of Uber? Because Uber doesn't need cars to operate its business. The product that Uber delivers is heterogeneous. In other words, it is totally different with what incumbent taxing companies offer to the customers. Therefore, the barriers to entry in the taxi industry are not applicable to Uber.

The same thing is happening to other forces of the model. "Bargaining power of suppliers" is clearly an important force that could significantly affect a company's bottom line. But what about Uber? The reality is that Uber doesn't have ANY supplier. All Uber needs is a desk and a computer, so that they can develop

[21] Steve Denning, "What Killed Michael Porter's Monitor Group? The One Force That Really Matters", Forbes. http://www.forbes.com/sites/stevedenning/2012/11/20/what-killed-michael-porters-monitor-group-the-one-force-that-really-matters/#fca6fcd733c7

their software and provides it to their users. Even if another disruptor does have suppliers, the suppliers (who supply disruptive innovation) must be different with the current suppliers of the market (who supply current market products).

“Bargaining power of buyers”: Who are the buyers of Uber? The drivers? Or the riders? Uber’s income comes from the commissions of the rides. It is hard to define whether the revenue comes from the riders or the drivers.

From the above example, we can further notice that Mr. Porter’s Five Forces isn’t the most suitable framework when analysing disruptors. Therefore, I decided to design a customized analysis framework for disruptive innovations.

3.2 Customized Analysis Framework

After the careful investigation, there isn’t any relevant analysis framework that can be used to serve valuation purpose. Hence, an analysis framework needs to be built from scratch.

As we mentioned earlier, today’s business is more dynamic than before. And in our view, the situations of disruptive innovations are even more dynamic. Because it is naturally about a new market challenging an existing market. Therefore, general and static market factors such as supply chain and barriers to entry become irrelevant. Instead, we shall focus on the comparison between the disruptive innovation and the incumbents. We need to analyse and foresee the outcome of the battle (i.e how much market share can the disruptor get in the entire industry). On the other hand, we also need to analyse the total economic profit and the trend in the industry, which can be done by analysing the macro-environmental factors of the industry. After understanding both aspects, we have paved the way for the later application of the valuation methods.

Since the two aspects are respectively inside the battle and outside the battle, the two parts of the analysis framework for disruptive innovation can be named as Internal Analysis and External Analysis.

1. External Analysis:

This part of the analysis is the first session of our analysis framework. In this part, we are supposed to analyse the big picture: the macro environment of the industry.

Why is it necessary to analyse the macro environment when valuing disruptive innovations? Because disruptive innovations can't replace the industry, the society and the government (which is the macro environment). An industry exists because there is a particular demand. Taxi industry exists because people need a personal, private, fast and direct transportation. Any innovative product or service that can fulfil such demand is capable of replacing the current taxi market. But such products can never change the demand that forms the industry. (I guess it is not really necessary to discuss whether disruptive innovation can replace the society and the government).

The industry trends (or demand) and other macro-environmental factors are capable of setting a frame for the future development and economic profit of a disruptive innovation. They directly affect the growth, and hence, also the valuation of a disruptor. Therefore, it is necessary to conduct an external analysis about the macro environment.

A PEST analysis can be done for macro-environmental analysis.

PEST analysis is the most commonly accepted macro-environmental framework that consists four macro-environmental factors: "Political", "Economic", "Social" and "Technological"[22].

Political factors are primarily the intervention of the government. It could be trade control, environmental constraint, industrial subsidy and rent ceiling. Different countries have distinct needs and requirements to achieve political stability. Sometimes, even the same country may experience different policy orientations in different periods. Studying the political factors provides us an overview of the possible political policies in the future, which can either boost or harm the development of an industry.

Economic factors are economic growth, interest rates, exchange rates, inflation rate, disposable income, unemployment rate, etc. These factors can directly affect the labor input, the market size, the cost of capital and the importing/exporting ability of an industry.

[22] PEST Analysis, Wikipedia, https://www.wikiwand.com/en/PEST_analysis

Social factors are the cultural and demographic aspect of a society. It could be consumption pattern, propensity to consume, career attitude, safety requirement, age distribution, etc. A strong trend in social factors affects not only the demand for a company's product but also the overall demand in the industry.

Technological factors are research and development (R&D) activity, automation, technological shift and spillover, etc. It defines the barriers to entry and indicates the likelihood of potential disruptive/sustainable innovation. Moreover, the technological improvements are capable of changing the total market size. This is especially the case if the advanced technology can provide a low-cost solution to the current products and services. The intuition behind it is rather simple. The decline in price causes the supply curve shift to the right. The new market equilibrium, which is the intersection of the demand curve and the new supply curve, will be reached at a higher level of quantity.

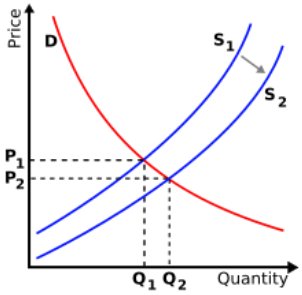

Figure 5: The demand and supply curves illustration

A PEST analysis in our context should solely focus on neither the incumbents' market nor the disruptive market, but the overall impacts to the industry trend, demand and supply. Because it is the future economic profits of the industry that we're trying to analyse. For instance, after careful analysis, we believe the size of the industry is 100 billion for now and it will increase 2 percent annually in the next five years. And the market share of the disruptor is 5% for now and will increase 1% in the next five years, which are the educated assumption that is derived from the internal analysis. With above numbers, we will be able to derive the future revenues of the disruptor in the forecasting period.

Micro-environmental factors:

Readers might want to ask: What about micro-environmental factors? Aren't they a part of the external analysis?

The answer is NO. In spite of the fact that micro-environmental factors are important components of a traditional external analysis, an analysis framework that is designed for disruptive innovation doesn't require any kind of micro-environmental factors. Because all of the micro-environmental factors (e.g. suppliers, distributors, competitors and customers) are market factors. Market factors are based on the current market and value chain, which is disrupted by the disruptors. The disruptor is going to replace the entire current market and value chain. Therefore, the current market factors don't have any influence on the value of a disruptive innovation.

Let's again take Uber as an example. Uber is primarily disrupting the taxi industry. Does the current market competition between "Nord Cab" and "Syd Taxi" affect the valuation of Uber? Do the power and the number of car suppliers affect the valuation of Uber? Absolutely No. Do the market customers affect the valuation of Uber? Not exactly. Because Uber have both drivers (partners) and riders as their customers and users of their app. This sort of relationship is far more ambiguous than the rider-taxi relationship in the traditional taxing industry. Solely analysing the rider-type customers in the taxing industry will lead to a valuation that is a lack of rigor. Instead, the customer analysis should be conducted on the business model of Uber, which is part of the internal analysis.

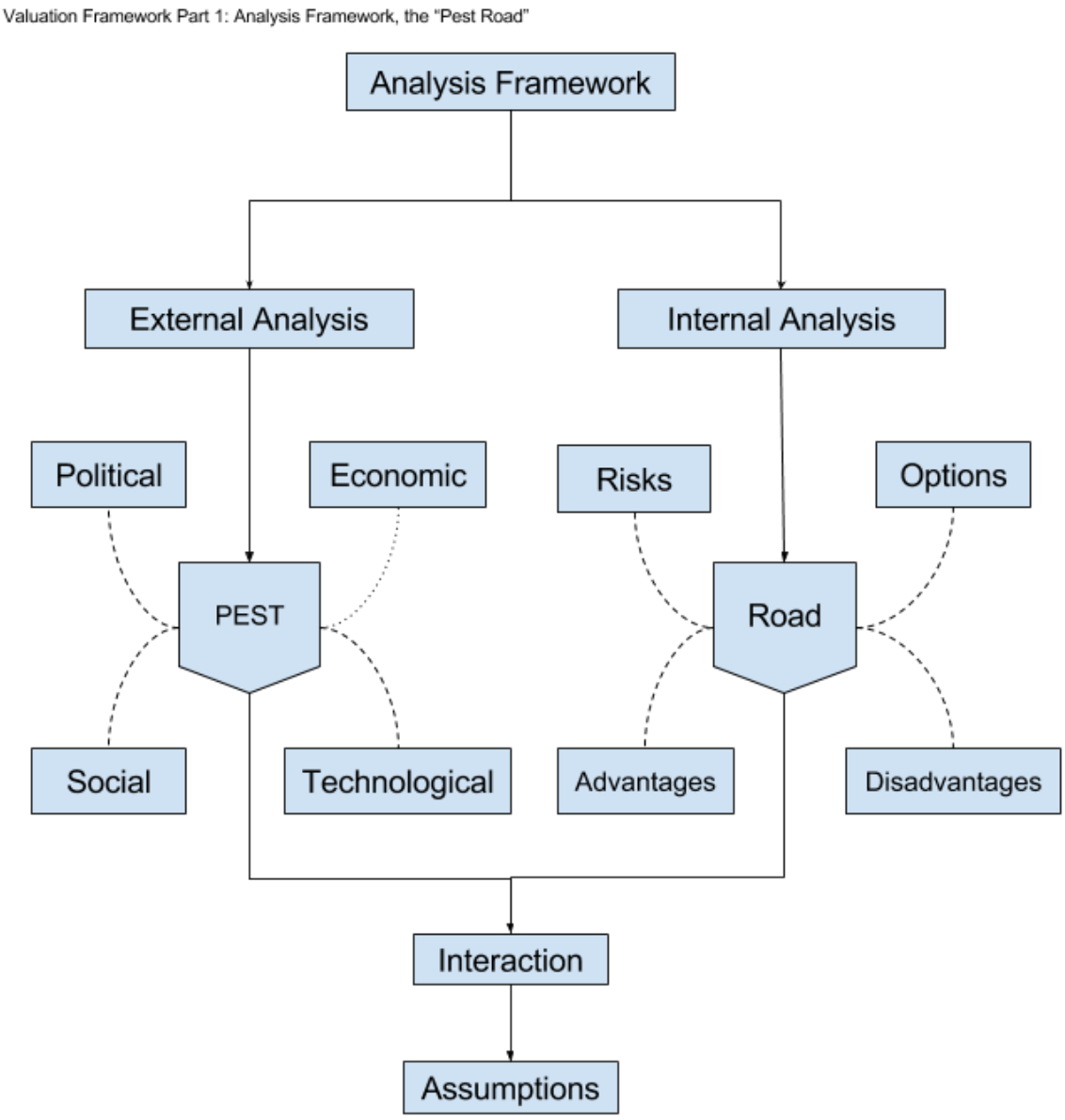

Figure 6: The PEST ROAD analysis framework

2. Internal Analysis

Internal analysis is the other part of our analysis framework. In this part, we are supposed to analysis the inside factors which affect the valuation of the disruptor. In order to perform the internal analysis, I designed a "ROAD" model.

The "ROAD" model includes "Risks", "Options", "Advantages" and "Disadvantages". While the "Advantages", "Disadvantages" and "Risks" determine the competitiveness of a disruptor and its likely position in the battle with the incumbents, the "Options" are the unique value driver of the disruptor.

"Risks" are the business risks that the disruptor may own. Business risks are the unfavourable uncertainties that could lead to inadequate profits or even losses. Typical business risks involve strategic risks, financial risks, operational risks, regulatory risks and reputational risks. For a disruptor, it is very likely that the regulatory risk and survival risk represent a large share of all the risks. Because disrupting a current market is apparently damaging the vested interests of the market stakeholders. The possible political influences of the stakeholders and the social instability (e.g. large unemployment) can give rise to stricter regulations against the disruptors. Disruptive innovations such as Uber, Lyft, Airbnb and Bitcoin are all banned in some countries and areas, as they either threatened the local businesses and employments or the monopoly power of the government. In the meantime, survival risk is the other risk category that is especially applicable for disruptors. This risk category was touched by Aswath Damodaran in 2014[23], who is a globally-renowned professor in finance and valuation specialist. In common practice, we assume the target asset to be a "going concern", which mean it will last in perpetuity. However, due to the contrariety of the products, the conflict of interest between the disruptor and the incumbents are much more intensive than traditional competitions. The incumbents would do whatever it takes to eliminate the threats from disruptors, before the disruptors take over their market. The survival risk of the disruptor is therefore significantly higher than standard companies. Survival risk becomes a crucial factor when we value a disruptor. Various kind of risks may affect either the cash flows or the discount rates that directly link to the intrinsic value of a disruptor.

"Options", unlike the risks, are the bright side of uncertainties, which are the favourable uncertainties. Options, in finance, are the rights but not the obligations to enter a trade of a particular underlying assets or instruments[24]. Applying the option theory to the business decision makings gives us "real options", which are the rights but not the obligation to undertake particular business initiatives[25]. It can be an option to defer an investment or to expand/abandon a project. Real options provide value to a disruptor by providing more options in the future.

[23] Aswath Damodaran, A Disruptive Cab Ride to Riches: The Uber Payoff, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1
[24] Options, Wikipedia, https://www.wikiwand.com/en/Option_(finance)
[25] Real Options, Wikipedia, https://www.wikiwand.com/en/Real_options_valuation

Let's take a look into one kind of real option for the disruptors. In accordance with Professor Aswath Damodaran's theory[26], disruptive innovation has two levels of disruption. The first level disruption happens in the market which the disruptor entered at the beginning (e.g. Uber's first level disruption happens at taxi industry). After the disruptor succeeds its first level disruption, its technology and customer base will allow the disruptor to enter new and potentially even larger markets in the future (e.g. Uber's driverless mobile, UberEats, etc.). The possible cash flows from the business in the potential (second level) markets are part of the real option value of succeeding the primary market.

The "Options" is the core part of analysing and valuing a disruptor. Unlike traditional and mature companies, who are relative more static, the customer base and technological advantages of the disruptors encourage the disruptors to be agile and expansible. Hence, the value of real options is no longer ignorable for disruptors. The fact is that, private technology firms with large customer base are often acquired at enormous premiums (e.g. Endomondo acquired by Under Armour, WhatsApp acquired by Facebook). The only possible explanation to the enormous premiums, according to our view, are that the real options of acquiring such companies allow the acquirer to undertake its strategic plan. The value of the real options is huge enough to pay for the premiums at acquisition.

"Advantages" and "Disadvantages" are the comparative advantages and disadvantages that a disruptor has to the market incumbents. One thing we must keep in mind is that this comparison is far more than just financial and operational comparison, it is more about the comparisons between business models and value chains. In other words, it is the disruptor representing the new market to compare with the incumbents representing the old market. The advantages and disadvantages of the two markets essentially become part of the advantages and disadvantages of the disruptor and the incumbents. Advantages and disadvantages are crucial factors, as they directly affect the competition between the disruptor and the incumbents. These two factors predict the process and outcome of the disruption, and by working with the external factors and the internal risks, they are expected to come up with the intrinsic value of the disruptor.

At first glance, the ROAD model seems to be similar to the SWOT analysis, which is a popular framework for identifying the Strengths, Weaknesses, Opportunities and Threats of an organization or project. The truth is, SWOT analysis covers both internal analysis and external analysis (Strengths and Weaknesses are

[26] "A Disruptive Cab Ride to Riches: The Uber Payoff", Aswath Damodaran, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1

internal factors, Opportunities and Threats are external factors), while our ROAD model is designed for internal analysis only. The external opportunities and threats have been embedded in our PEST analysis. The combination of the PEST analysis and the ROAD analysis represents the complete external and internal analysis for disruptors.

In addition to that, Risks and Options factors of our ROAD model are specially designed for disruptive innovations, and they are not incorporated in the traditional SWOT analysis. The role of the risks is less significant in traditional industries because the industry is more static and mature. Since the risks are not decisive value drivers inside traditional industries, it is not necessary to discuss the risks of a traditional organization separately. On the other hand, companies inside traditional industries are less agile than the disruptors. They have fixed business models as well as target customers. Options are less valuable to them, as it takes massive braveness, efforts and capital to discover options and to steer the company away from its routine. But the disruptors have no routine. There are so many branches along the development path, and they provide disruptors with many valuable options.

The risks and options factors with traditional competitions are not incremental factors that drive the values of companies. That is why they are important only to the disruptive innovations and capable of distinguishing the ROAD analysis from the SWOT analysis.

Interaction:

While the PEST model determines that total size of the economic profits in an industry, the ROAD model contains major value drivers of the disruptor that determines how much the disruptor can extract from the entire pool.

Together, the two analyses will tell us the overall qualitative aspect of the valuation of a disruptor, which will be the source of the assumptions used in the later quantitative part.

4. Valuation Framework – Part 2

After the qualitative analyses are done, we need to convert what we have learnt into more intuitive results, i.e. numbers.

4.1 Traditional Valuation Methods

Traditional valuation methods can be divided into two categories: absolute methods and comparable methods (aka relative methods).

Absolute methods:

Discounted Cash Flow models, Dividend Discount models and Asset based models are categorized as absolute methods, as they rely on mathematical calculations rather than price observations.

The core concept of a Discounted Cash Flow (DCF) model is the time value of money. Estimating and discounting future values (FVs) to present values (PVs) and then sum all the PVs to arrive at the net present value (NPV), which is taken as the value of an asset. DCF model is the most popular valuation method among all. According to a study conducted by Imam, Barker, and Clubb (2008)[27], approximately 60% of the financial analysts in the United Kingdom has a strong inclination of using DCF models for valuation purpose. But the limited financial disclosure, often negative earnings and the potential uncertainties make the DCF valuation of disruptors rather challenging.

More importantly, DCF is not capable of capturing all the future cash flows of a disruptor. Because analysts can only estimate the cash flow growth from existing products and services. Disruptor's source of cash flows can change dramatically once its business model changes. As we all know, disruptors are young and they expand aggressively. The advanced technology and the substantial amount of users they own give them the possibility (probably also the ambition) to enter potential markets[28]. Entering potential markets is unquestionably reforming the entire business model of the company, and it enriches the source of future cash flows. The present values of potential sources of cash flows are hidden from the DCF chart, as the analyst is incapable of knowing the exact timing, place, background and market information that

[27] Imam, S., Barker, R., & Clubb, C. (2008). The use of valuation models by UK investment analysts. European Accounting Review, 17(3), 503-535.

are related to the new market entering. The uncertainty about the source of future cash flows fundamentally kills the time value of cash flows.

The Dividend Discount Model (DDM) is similar to the Discounted Cash Flow model in terms of discounting future cash flows to the present. The difference is that the cash flows that DDM uses are future dividends of the company, and the discount factor is the cost of equity rather than the cost of capital. This model is very rarely used for disruptive innovations. Because only public-listed companies pay dividends to their shareholders. It is very likely that the disruptor will use every single penny on the expansion.

Asset-based Models are typically used in situations where the assets of a company represent future cash flows. Therefore, companies that have a large share of tangible assets (e.g. natural source firms), or companies that own extensive marketable assets (e.g. financial firms), are suitable for asset-based valuation. The problem of using asset-based models on disruptors is that the disruptors mostly don't require many tangible or marketable assets to develop itself.

To sum up, none of the three methods are not capable of capturing the entire value of disruptive innovations. While the DDM and the asses-based models are completely irrelevant, the DCF model can only capture part of the value.

Comparable Methods:

Comparable valuation methods determine the price of an asset by comparing it with the market prices of other assets that share similar metrics. The methods rely on the use of performance multiples. A multiple is a ratio between two variables. The most popular multiple being used is Price to Earnings (P/E) ratio (Imam, S., Barker, R., & Clubb, C. (2008), while analysts may also employ other multiples such as P/EBITA and EV/EBITA[29] when they feel necessary.

The disruptors are, as mentioned earlier, completely new players in the markets. It is not possible to match the disruptors with another similar company. In addition, the comparable methods use benchmark's market price to determine the price of the target asset. It is a pricing technique instead of a valuation technique.

[29] P/EBITA=Price to Earning Before Interest, Tax and Amortization; EV/EBITA=Enterprise Value to Earnings Before Interest, Tax and Amortization.

Since none of the traditional methods can appropriately and entirely measure the worth of disruptive innovations, it is necessary to develop a method on our own.

4.2 Customized Valuation Methods

The fundamental problem of valuing disruptive innovation lies with its potential options, especially the option to enter potential markets. Therefore, we decided to apply real options valuation method to capture this part of value, which is temporarily outside of the current business model. On the other hand, we expect a DCF model to capture the intrinsic value that is inside the current business model. Such combination shall be able to deliver a comprehensive valuation of disruptive innovations.

4.2.1 Discounted Cash Flow model

Valuing disruptive innovation using discounted cash flow model is no doubt a challenging task, but it is nonetheless the only feasible method to capture the value of current business scope.

$$Enterprise\ Value = \sum_{t=1}^{n} \frac{Cash\ Flow_t}{(1 + discount\ rate)^t} + \frac{Terminal\ Value}{(1 + discount\ rate)^n}$$

Figure 7: Equations of Discounted Cash Flow model

The 1st step of conducting a DCF valuation for disruptive innovation is to select the right cash flow. Free Cash Flow for the Firm (FCFF) is a commonly accepted cash flow for DCF valuations. FCFF could be calculated in various ways, depending on the business model and the availability of data. One way of calculating FCFF is that:

$$FCFF = Net\ income + Interest\ Expense - Net\ Capital\ Expenditures - Net\ changes\ in\ Working\ Capital - Tax\ Shield\ on\ Interest\ Expense$$

While $Net\ Capital\ Expenditures = Capital\ Expenditures - Depreciation\ \&\ Amortization$

It becomes apparent to us that companies running disruptive innovations cannot be valued by using FCFF, as they don't provide complex financial disclosures for valuation purpose. Therefore, at this stage of the

valuation process, it is important for the analysts to find all the relevant cash flows and select the cash flow which can best describe the performances of a disruptor.

The 2nd step of a DCF valuation is to estimate the future cash flows in the forecasting period. The length of forecasting periods varies from 1 to 10 or even 20 years. It depends on the growth of the target company. The higher growth a company exhibits, the longer forecasting periods it requires. Because fast-growing companies are very likely to continue its momentum in the coming years. If we are valuing such companies with a short period, we would underestimate its value. After defining the forecasting period, we should estimate the selected cash flow within the period. The estimation depends on the historical performances of the company as well as analysts' judgment about the company and the industry.

The 3rd step is to derive the discount rate. Weighted Average Cost of Capital (WACC) is the most popular kind of discount rate, as the effects of both equity and debt are proportionately weighted.

$$WACC = \frac{E}{E+D} * K_e + \frac{D}{E+D} * K_d * (1-t)$$

K_e = cost of equity

K_d = cost of debt

E = value of a firm's equity

D = value of a firm's debt

E + D = total value of a firm's financing (equity and debt)

E/V = percentage of financing that is equity

D/V = percentage of financing that is debt

T = corporate tax rate

The tricky parts are the derivation of the cost of equity and the cost the debt. For the cost of equity, the famous Capital Asset Pricing Model (CAPM) is built for such purpose. It determines the theoretical appropriate rate of return that is required by general investors.

$$CAPM: \qquad K_e = r_f + \beta(r_m - r_f) + liquidity\ premium$$

K_e = cost of equity (aka required rate of return)

r_f = risk-free rate

r_m = the return of the market portfolio

$r_f - r_m$ = risk premium

β = asset beta.

Liquidity premium = the extra required rate of return that compensates the illiquidity of the asset.

Despite the fact that liquidity premium is not a part of the classic CAPM model, empirical evidence has shown that the investors often require extra compensation when investing in illiquid assets[30]. The equity of a disruptor is certainly an illiquid asset because there isn't any public market for the equity. The investors of a disruptor would not be able to trade their shares as freely and fairly as they do with public-listed companies. It is therefore necessary to compensate the investors for the inconvenience and the opportunity cost.

Asset beta measures how much an asset's price moves against the price of the market portfolio. In short, a beta being less than 1 means that the asset is more stable than the market portfolio, while a beta being higher than 1 indicates that the asset is more volatile than the market. Normally, we can use the equation: $Beta = \frac{Covariance\ (ra,rm)}{Variance(rm)}$ to find the value of the asset beta. However, there is no historical returns of the disruptors, as they are not public-listed yet. Hence, the only way is to find a comparable beta from a company that shares similar risks and volatilities.

$$Cost\ of\ debt = riskfree\ rate + default\ premium$$

The cost of debt is the effective rate that a company pays its debt. If not being disclosed, analysts may add up the risk-free bond rate with the specific default premium of the company to derive the cost of debt. The risk-free bond is a particular bond whose duration matches the term structure of the debt. Although it is a common practice to embed warrants into the venture debt[31] to lower the direct interest rate, but we are not considering this situation. Because it will only cause our calculation to be less rigor. Such structure significantly increases the complexity of the capital structure. We must be able to know the complete

[30] Vriborg Petersen, C., & Plenborg, T. (2010). Financial Statement Analysis: Valuation, Credit Analysis and Executive Compensation. Prentice-Hall.

[31] Venture debt is a special kind of debt provided by lenders to start-ups and growing companies, who doesn't have positive cash flows to be granted normal debt.

details about the terms of the debt, so as to be able to measure the extra cost of debt from the embedded warrants (which should be added on top of the direct interest rate). The limited financial disclosures of private companies are certainly not enough for analogous calculations. Theoretically speaking, no matter what kind of structures it is, the implied cost of debt shall be the same. Because the cost of debt should always reflect the credit risk of the borrower, which is the default premium in our method.

Another thing worth noticing is that we need to get the after-tax cost of debt when calculating the WACC. The intuition is to correctly incorporate the effect of tax shield[32] on the WACC.

After having the WACC, we can proceed to the 4th and the last step of the process, which is to discount and sum all the cash flows. The discounting of cash flows from forecasting horizon is rather straight forward. For year N, we simply divide the estimated cash flow of year N with the discount factor of year N.

$$Discount\ factor = (1 + discount\ rate)^N$$

$$Terminal\ Value = \frac{Cash\ Flow_{n+1}}{(discount\ rate - growth\ rate)}$$

The discounting of the terminal value employs the same concept of Gordon Growth Model. The target asset is assumed to exist in perpetuity. This assumption is commonly recognized as the "going-concern" assumption. The terminal value captures the future value of an asset on a certain date after the asset enters into a stable growth stage.

After summing up all the discounted cash flows (i.e. the present values), the number derived is exactly the intrinsic value of the company. We are not required to proceed the process to deduct the debt or to divide the result with the number of shares outstanding, as we are not aiming to get the equity value nor the Earning Per Share (EPS).

4.2.2 Real Options Valuation model

Background:

The term "real options" was first introduced by Stewart Myer in 1977, which was four years later after the launching of Black-Scholes option pricing model. Real options theory expanded rapidly after its birth. According to many scholars, real options have the capabilities to improve the capital budgeting processes

[32] A tax shield is a reduction in taxable income that results from claiming allowable deductions (e.g. depreciation, amortization and mortgage interest)

of companies, and thereby, enhance the decision making of the management. Myers (1984[33]) stated that the traditional DCF valuation might still fail in measuring strategic applications, even though the DCF analysis was properly employed. In that case, managements sometimes select to conduct a project which has a lower net present value (from DCF analysis), based on their experiences and gut feelings for strategic plans. It is often the case that projects with higher flexibilities and strategic values have lower or even negative paper values, if it is valued by cash flows solely[34]. The real options theory is built to quantify the flexibilities and strategic values of companies and projects. It is capable of filling the gap between financial (cash flows) and strategic analyses[35], and bring transparency to the decision makings.

Definition:

As we all know, an option is a financial derivative that gives the holder the right, instead of the obligation, to trade a particular asset at a predetermined price before/at a specified date (depends on the type of the option).

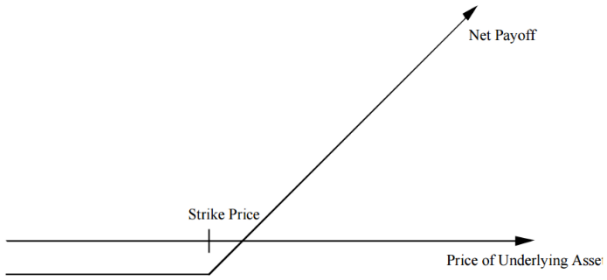

Figure 7: An illustration of the payoff of a call option

Above is the payoff diagram of a call option. A call option gives the holder the right to buy the asset at the strike price. Therefore, the net payoff of a call option is negative, when the value of the underlying asset is lower than the strike price. The option holder would not exercise the option at such price level. The payoff of the option increases when the price of the underlying asset increases. The net payoff becomes positive after the asset price overtakes the sum of the strike price and the cost of the option. The higher the asset price is, the more net payoff there will be for the holder.

[33] Myers, S. C. (1984). Finance theory and financial strategy. Interfaces, 14(1), 126-137.
[34] Smit, H. T. J., & Trigeorgis, L. (2004). Corporate Finance and Strategic Planning: A Linkage. Princeton University Press.
[35] Aarle, R. (2013). A Real-Options approach to company valuation.

On the other hand, a put option gives the holder the right to sell the underlying assets at a predetermined strike price. If the price of the underlying asset stays higher than the strike price, the option holder will not exercise the option. The net payoff of the put option is therefore negative and will expire worthlessly. Nonetheless, when the price of the underlying asset falls below the strike price, the option will be exercised and the spread between the two prices will be claimed by the holder[36]. The characteristics of a put option are summarized in the graph below.

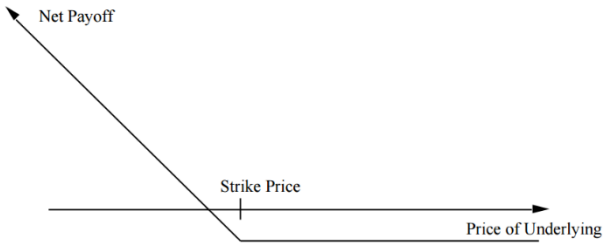

Figure 8:An illustration of the payoff of a put option

Myers (1977[37]) defined a real option as a right, whose value rests on the uncertain prices of underlying assets. The topic caught many scholars' interests and thousands of theories bloomed afterwards. Among all the definitions, Amram and Kulatilaka (2000) provided a definition that is both clear and straightforward:

"Viewed narrowly, the Real-Options approach is the extension of financial option-pricing models to the valuation of options on real (that is, non-financial) assets. More broadly, the Real-Options approach is a way of thinking that helps managers formulate their strategic options, the future opportunities that are created by todays' investments[38]"

The definition of Amram and Kulatilaka speaks out the essence of real options theory, that it is the extension of financial option pricing model to value real assets. It is the right to undertake particular business initiatives inside the organization. The initiatives can be expanding a project, or, in contrary, contracting the project as well as abandoning and deferring it. The value of the real options are the

[36] Damodaran, A. (2005). The promise and peril of real options.
[37] Myers, S. C. (1977). Determinants of corporate borrowing. Journal of financial economics, 5(2), 147-175.
[38] Amram, M., & Kulatilaka, N. (2000). Strategy and shareholder value creation: The real options frontier. Journal of Applied Corporate Finance, 13(2), 15-28.

flexibilities that embedded in the real options. The real options let companies take advantage of the future uncertainties.

Let's take a fictional example to have a closer look into a real option.

Brazil produces both kind of coffee beans (Arabica and Robusta) while Kenya produces only Arabica. Today, 100% of the global coffee drinkers prefer Arabica instead of Robusta. A coffee production company called Mestle built its factory in Brazil. Mestle produces only Arabica, as no one on earth like Robusta. What kind of real option does Mestle have? Mestle has the right/opportunity to produce Robusta immediately when the consumers change their taste for coffee (which is a future uncertainty). On paper, the decision of building the factory in Brazil was more expensive (lower net present value) than building it in Kenya. However, Mestle acquired the right of immediate production of Robusta when they built their factory in Brazil. The option gives Mestle the right to produce Robusta without building a second factory in another country. In other words, Mestle "bought" a call option, which allows Mestle to buy a stock called "Robusta Production" at a lower-than-market price (because no further factory establishment cost is required). Therefore, when we value a company like Mestle, it is necessary that we incorporate the value of real options. It is exactly the value of real options that distinguish companies like Mestle from other companies (who built their factor in Kenya).

The value of a real option is intangible until the holder exercises it. A decision that has real options embedded may not be as attractive as others at first glance, but it provides a choice that could bring future benefits.

Real Options for Disruptive Innovations:

Disruptive Innovations, especially technological disruptive innovations, came from nowhere and there aren't any pioneers in their business field. To determine the future of a well-structured and mature company is tough enough, let alone the future of tech disruptors. The number of uncertainties that lie in front of disruptors is numerous. The uncertainties are too difficult to be valued using traditional methods.

Amram and Kulatilaka (2000) defined in their broad view of real options: the real options approach is a way of thinking that helps decision makers to formulate strategic plans. McGrath and MacMillan (2000[39])

[39] McGrath, R. G., & MacMillan, I. C. (2000). The entrepreneurial mindset: Strategies for continuously creating opportunity in an age of uncertainty (Vol. 284). Harvard Business Press.

also indicated that real option reasoning is a thought process for start-ups and companies that employ entrepreneurial spirits to search for opportunities.

Therefore, real options thinking/reasoning is (or should be) widely employed by disruptors, so as to manage the uncertainties. It is more than necessary to turn unfavourable uncertainties into the ally of the company, or at least, to be able to reduce the negative impacts when unfavourable uncertainties come along. The real options way of thinking is helpful for any kind of company, and extremely crucial for disruptors. Since the disruptors employ the real options thinking when they develop their company, it becomes apparent that we MUST apply real options valuation when we value these companies. It allows the analysts to dig into the true math that is hidden under the surface.

Types of Real Options:

Trigeorgis (1988[40]) depicted the classification of real options in a figure. Real options that generate clear cash flows and don't incorporate strategic values, are usually defined as simply options. On the other hand, real options with strategic values embedded and doesn't generate (clear) cash flows, are defined as compound options.

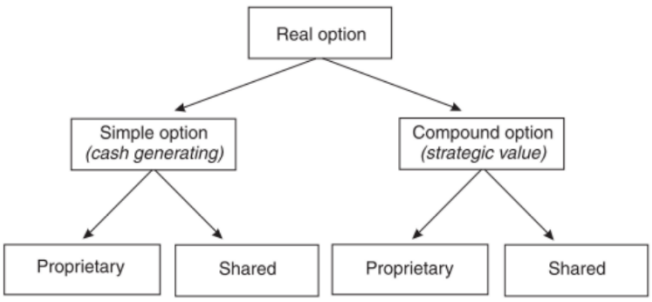

Figure 9:The classification of real options; Source: Trigeorgis (1988)

For both simple options and compound options, there are two further categories. While proprietary options are only held and exercisable by one company, shared options are opportunities that are jointly held by several competing companies or sometimes the whole industry.

[40] Trigeorgis, L. (1988). A conceptual options framework for capital budgeting. Advances in Futures and Options Research, 3(3), 145-167.

Aarle (2013) concluded on the basis of Trigeorgis (1988) and Triantis (1999[41]) and made following definitions:

"Flexibility Real-Options, i.e. all-Real-Options without strategic value. These Real-Options are only concerned with one project, can not initiate new projects and are related to a company's current activities / assets in place. More technically, these Real-Options are generally simple options with a clear payoff (exercising leads to a clear and measurable cash inflow). Over time, as uncertainty resolves, it becomes clear whether these Real-Options should be executed or not."

"Strategic Real-Options, i.e. all Real-Options with strategic value. These Real-Options can initiate new projects. These new projects can be either related to one or more projects currently undertaken, or may be strategic opportunities not related to any project/assets in place at all. These Real-Options are growth options, where companies position themselves favourably to potentially exercise profitable growth options in the future, by for example investing in research and development, IT expertise, brand name recognition and other sources of competitive advantages. More technically, these Real-options are generally compound options, where potential future payoff (future cash inflows) is unclear at the time of execution."

	Flexibility Real Options	Strategic Real Options
Option type	Simple Options	Compound Options
Project-wise	Existing project	New projects
Cash-generating-wise	Clear	Unclear

Above table is our conclusion on the basis of Aarle (2013) and gives the readers a straightforward picture of the characteristics of the two kinds of options. While strategic real options are benefiting the company as a whole (and thereby enhancing all future projects), flexibility real options benefits one single project or activity. Some examples of strategic and flexibility options can be found from the table below.

[41] Triantis, A. J. (1999). A View Through a Real Options Lens. Real Options and Business Strategy: Applications to Decision-Making, 39–58

Industry	Growth option	Flexibility option
Pharmaceuticals	Research and development	Outsource production or sales
Oil & gas	Lease blocks	Delay production
Power	Global expansion	Peak generating plants
Computer hardware	New model under brand name	Assembly configuration
Financial services	IT infrastructure	Abandon service or divest
Airline	Aircraft delivery options	Contingency rights
Real estate	Undeveloped land	Redevelop with adjusted mix
Telecommunications	Mergers and acquisitions	Re-deploy assets
Internet	Marketing investments	Outsource services

Table 1: Examples of growth and flexibility options in different industries

Source: Aarle 2013

Copeland and Antikarov (2001[42]) defined five types of real options, which can be categorized under flexibility options:

1. Option to defer gives its holder the opportunity to defer a project. It is usually an American call option because the holder can exercise the option any time in prior to the expiration. Projects are typically analysed and valued based upon the expected cash flows and discount rates at the time of the analysis. And the expected cash flows and discount rates change over time. Hence, so does the net present value of the project. A project that yields negative or low net present value today may have positive and higher net present value in the future. This type of option is particularly useful when the project can only be taken by only one company (due to e.g. patents and other barriers to entry) (Damodaran A., 2005)
2. Option to abandon gives its holder the opportunity to sell or close down a project. A company can choose to abandon a project if the expected cash flows do not measure up to estimates. The company can exercise the option when the discounted future cash flows are lower than the liquidation/abandonment value of the project. It creates value for companies by limiting the downside losses. Unlike the option to defer, the option to abandon is an American put option.
3. Option to contract gives the holder the opportunity to scale down a project. The holder can exercise the option when the future perspective turned unfavourable. Option to contract is similar to option to abandon in every sense, but with a partial effect.
4. Option to expand gives the holder the option to place further investments into an existing project. The option is in the money when the future perspectives of the project improve. It is an American call option.

[42] Copeland, T. E., Antikarov, V., & Copeland, T. E. (2001). Real options: a practitioner's guide (p. 4). New York: Texere.

5. Option to extend gives the holder the option to extend the life of a project.

In our opinion, the option to expand and the option to extend under Copeland and Antikarov (2001) are rather similar. Although the focus of the two options is different (one on further investment, the other on further life), they both scale up the project and increase the total output of the project. Hence, we believe it is appropriate to call both of them "option to expand".

In real life, a project often has a more complicated design of options. Copeland and Antikarov (2001) further classified real options by type of combination of options.

1. Switching options allow the project to be managed dynamically, i.e. the project can be turned on and off at any time. The company can shut down the operation partially or entirely, when conditions turned unfavourable, and reinitiate/expand the operating activity when outlook improves. It is also called option to expand or contract.
2. Compound options are options on options. In other words, compound options derive their values from other options instead of from the underlying assets. A compound option can be a call on call (CoC), a put on put (PoP), a call on put (CoP) and a put on call (PoC) (Damodaran.A, 2005). Brealey, Myers, and Allen (2012[43]) made a classic example of a compound real option: A company is considering its investment in "Mark I". When they valuing the option to build "Mark I", they should also take into account the option to further develop a successor "Mark II". The option to develop "Mark II" is namely a compound option. More specifically, it is a call on call option.
3. Rainbow options are options that derive their own value from multiple sources of uncertainty. In any simple options, the price of the underlying asset is the only source of uncertainty. An example of rainbow option can be: the value of the option to develop the oil reserve that owned by the company relies on both the oil price and the quantity of the oil reserve (Damodaran.A., 2005)

Copeland & Antikarov (2001) further indicated that there are often mixtures of complicated real options in reality. In their study, many real world cases exhibited compound rainbow options, i.e. options that derive their value from numerous previous options. In reality, project expansion always has multiple stages, with each stage representing a premise option for later stages. The valuation of compound options can grow progressively more difficult with more options added into the option chain (Damodaran 2005). The difficulty of valuation would increase exponentially when "rainbows" enter the stage. In that sense,

[43] Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2012). Principles of corporate finance. Tata McGraw-Hill Education.

Damodaran (2005) suggested using a conservative approach (i.e. simple options valuation models) as a floor on the value, rather than "wreck the valuation on the shoals of estimation error".

Trigeorgis (2005[44]) additionally coined corporate growth options, which target the strategic value of real options. In his theory, corporate growth option is another version of an option to expand, which has significant strategic importance and sets the path for potential opportunities for the company. Early investments such as R&D, strategic acquisition and information technology network, are the prerequisites in a chain of interrelated business projects. These investments may not generate much value in term of direct cash flows, instead, it gives the company to exploit future opportunities.

Nonetheless, the value of strategic/growth options is rather difficult to measure. Not only the future developments but also the cash flows it may generate or empower are unclear. Although strategic/growth options are mentioned in some literature, the way to cope with them remains vague (Aarle, 2013). It is probably due to the fact that there is still no consensus about using real options theory to the strategic/growth opportunities (Borison, 2005[45]). After considering that corporate growth option is another version of the option to expand, we believe it is appropriate to measure the value of such option in the option to expand. Both corporate growth option and expand option increase the output of the company by a certain amount of upfront cost. Corporate growth option is, in essence, an option to expand, just with longer time to maturity and the fact that it initiates new projects instead of expanding existing projects.

For disruptors, corporate growth options provide entry for their second level disruption[46] in the future. We suggest using the option to expand to capture the value of second level disruption of a disruptor.

In the primary market (i.e. first level disruption), we believe the option to expand, the option to contract and the option to abandon are more relevant to disruptors. The dynamic nature of disruptors provides them with flexibilities to control their expansions. On the other hand, the option to defer is usually irrelevant for them, as they don't have the advantage to wait and see.

[44] Trigeorgis, L. (2005). Making use of real options simple: An overview and applications in flexible/modular decision making. The Engineering Economist, 50(1), 25-53.
[45] Borison, A. (2005). Real options analysis: where are the emperor's clothes?. Journal of applied corporate finance, 17(2), 17-31.
[46] Second level disruption: entering and disrupting another market beside its primary market.

Hence, we suggest using simple flexibility options (the option to expand, contract and abandon) to measure the real option value of disruptive innovation.

Determinants of Real Options Valuation:

There are five determinants that drive the value of a (real) option.

1. Spot value of the underlying assets: In a call option (e.g. the option to expand), the holder has the option to initiate a business initiative at a fixed price. Therefore, the increase in the spot value of the initiative makes the call option more valuable. On the contrary, put options allow its holders to sell at a fixed price, the increase of spot value will, therefore, decrease the value of the option.
2. Strike price is the "fixed price" in options. In the case of calls, the increase of the strike price increases the cost of the initiative and thereby decrease the option value. On the other hand, in the case of puts, the increase in the fixed price allows the holder to sell at a higher price, which directly increase the value of the put option.
3. Volatility of the value of the underlying assets: A high volatility of the value of the underlying asset means a high value of the options. It does sound a bit counter-intuitive at the very beginning because high volatility always means high risk in normal situations. But that is not the case for options. In options, the holder has limited downside risks. The highest amount that the holder can lose is the price of the option. With limited downside risks and unlimited upside profits, it makes sense for the holder to embrace higher volatility.
4. Time to expiration: A longer time to expiration always means a higher value of the option, while other determinants remain fixed. Because the value of the underlying asset will have more time to move around. Additionally, for a call option holder who pays a fixed price at expiration, the present value of the cost decreases as the time to expiration prolongs. It, in turn, increases the value of the option (Damodaran, 2005).
5. Risk-free rate: When risk-free rate increases, the present value of the future "fixed price" decreases. Therefore, a call option holder will pay a lower PV for the "fixed price" while a put option holder will receive a lower PV for the "fixed price". Consequently, the increase in the risk-free rate increase the value of call options but decrease the value of put options.

Normally, there is also another determinant: dividend payment. Nonetheless, it is not part of the study, since it is more relevant for financial options instead of real options.

Damodaran (2005) summarized following table:

Factor	*Call Value*	*Put Value*
Increase in underlying asset's value	Increases	Decreases
Increase in Strike Price	Decreases	Increases
Increase in variance of underlying asset	Increases	Increases
Increase in time to expiration	Increases	Increases
Increase in interest rates	Increases	Decreases

Methods of Real Options Valuation:

There are three major methods that are used for real option valuation: Black-Scholes Model, Monte Carlo Simulation, and Binomial Lattices.

$$C(S,t) = N(d_1)S - N(d_2)Ke^{-r(T-t)}$$
$$d_1 = \frac{1}{\sigma\sqrt{T-t}}\left[\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)\right]$$
$$d_2 = d_1 - \sigma\sqrt{T-t}$$

Figure 10: Black-Scholes formula for call options

The Black-Scholes model was introduced by Fischer Black and Myron Scholes in 1973. A partial differential equation was established to estimate the price of an option over time. The valuation of options is easy to apply with Black-Scholes formula, as the analysts only need to insert the determinants into the formula so as to derive the value. However, there have been many critics. Borison (2001[47]) believed that the formula is way too simple and non-intuitive. "Where the Black and Scholes formula is used, it is usually seen as a quick and easy way to arrive at a rough value for simple investment opportunities." Moreover, the Black-Scholes formula was designed to value European-styled options rather than American-styled options. Its compatibility with real options, which are always American-styled options (as they can be exercised any time prior to the expiration), is still worth debate.

The Monte Carlo method simulates the possible movements of the price of the underlying asset. It is designed to deal with complicated options with multiple uncertainties (Borison and Triantis, 2001). These options have been difficult to deal with using binomial lattices and Black-Scholes model.

Despite the Monte Carlo model has been adjusted for American-styled options by the least-squares approach of Longstaff and Schwartz (2001[48]), we believe binomial lattices is a better choice for our study.

[47] Triantis, A., & Borison, A. (2001). Real options: state of the practice. Journal of Applied Corporate Finance, 14(2), 8-24.
[48] Longstaff, F. A., & Schwartz, E. S. (2001). Valuing American options by simulation: a simple least-squares approach. Review of Financial studies, 14(1), 113-147.

The judgment bases on two reasons: 1) Binomial lattices provide straightforward and more intuitive processes and results than Monte Carlo does. 2)The complex nature of Monte Carlo makes it more suitable for compound options, not our simple options. Binomial lattices form a diagram which represents various possible paths that the price of the underlying asset may follow over the life of the option (Hull, 2009[49]). The price of the underlying may move up and down in each step with probability ρ and size μ and

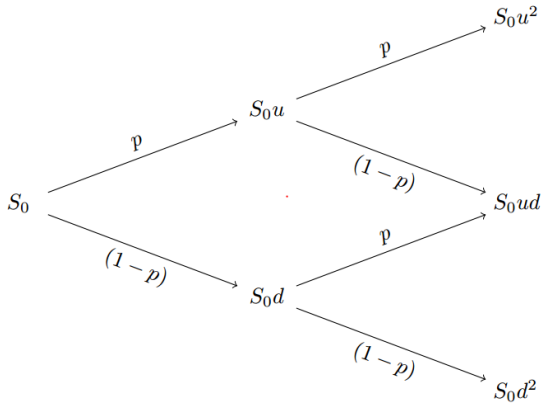

Figure 11: Illustration of a two-step binomial lattices

probability (1- ρ) and size d, respectively. The reason why it is called binomial lattices is due to the fact that there are two value derivations for each node. The model was constructed by Cox, Ross and Rubinstein (1979[50]) and it has been widely used afterwards. Block (2007[51]) conducted a research with Fortune 1000 companies, and the results showed that 40% of all real options users primarily applied binomial lattices, 22.5% applied Monte Carlo and 2.5% used Black-Scholes model. The popularity of binomial lattices was evident.

The steps of conducting real option valuation using binomial lattices (Cox et al., 1979):

1. Measuring the spot price, exercise price, volatility and delta-t (equal to $\frac{Time\ to\ expiration}{Periods}$)
2. Calculating upside and downside size factors using volatility and delta-t:
   $u = e^{\sigma\sqrt{\Delta t}}$ $d = e^{-\sigma\sqrt{\Delta t}} = 1/u$
3. Deriving risk-neutral probability: $p = \frac{e^{r\Delta t} - d}{u - d}$
4. Multiply the spot prices with upside or downside size factors to arrive next period (node) spot prices (forward till end).

[49] Hull, J. C., Options, Futures, and Other Derivatives (2009).
[50] Cox, J. C., Ross, S. A., & Rubinstein, M. (1979). Option pricing: A simplified approach. Journal of financial Economics, 7(3), 229-263.
[51] Block, S. (2007). Are "real options" actually used in the real world?. The engineering economist, 52(3), 255-267.

5. Using Call option: Max(S-K, 0) OR Put option: Max(K-S, 0) to derive option values at end nodes.
6. Working backward to derive the option value for each previous node (backward till beginning) (Most real options are American-styled, therefore it is necessary to monitor the value of early exercises at each node)
7. The final and single value at the very beginning of the binomial tree is the value of the option.

Real Options as complements:

There appeared to be an unspoken rule that DCF and real options are mutually exclusive in valuation (Putten and MacMillan, 2004[52]). However, DCF analysis was not designed to capture values that are not yet observable in the operating activities, while real options valuation would also need a floor where the extra flexibilities can build on. Myers (1977) discussed that the value of a company could be divided into two parts: the present value of operating assets, and the present value of growth opportunities. Putten and MacMillan (2004) further believed that DCF and real options should be integrated. They defined project value as a combination of net present value (NPV), adjusted option value (AOV) and abandonment value (ABV). Both AOV and ABV are real options. Hence, it is believed that real options and DCF analysis together can provide a more comprehensive and accurate valuation.

[52] Van Putten, A. B., & MacMillan, I. C. (2004). Making real options really work. Harvard business review, 82(12), 134-142.

5. Case Study: the analysis

In order to perform a solid analysis of the internal and external factors, it is our first job to understand the business that Airbnb has been doing.

5.1 The Story

It all started on the 22nd September 2007. One of the co-founders and the current Chief Product Officer of Airbnb, Joe Gebbia, wrote an email to Brian Chesky, his roommate and classmate at Rhode Island School of Design. In the email, Joe expressed his great idea to Brian, which was to rent their apartment to the participants of a coming conference in the city. They provided the visitors with inflatable beds and cereal during the 4 days' period. Several months later, the last co-founder, Nathan Belcharczyk joined Airbnb. Afterwards, they started working on the idea of helping people to list, find and rent lodgings on their website. Things weren't that great at the very beginning that all the angel investors they met refused to invest and they had to sell cereal boxes for living. But thing changed at the time when they were invited to join an incubator called "Y Combinator" on the January 2009. The founders received 20,000 dollars seed investments and some training as well. Three months later they caught the attention of Sequoia Capital, which is a famous venture capital firm who invested in Apple, Google, Oracle, PayPal, YouTube, Yahoo and Whatsapp. Despite the investment from Sequoia Capital was merely 600,000 dollars, the participation of Sequoia Capital brought Airbnb to the front stage.

In the next six years, Airbnb managed to attract 6 rounds of investments with a total capital injection of $3.89 billion[53]. Today there are more than 2 million lodgings in 190 countries being listed on Airbnb, and the total number of lodgers has exceeded 60 million[54]. The implied price of Airbnb from the latest round of financing is $25.5 billion. According to the Fortune[55], Airbnb is currently the third largest unicorns[56] on the planet, right after Uber and Xiaomi.

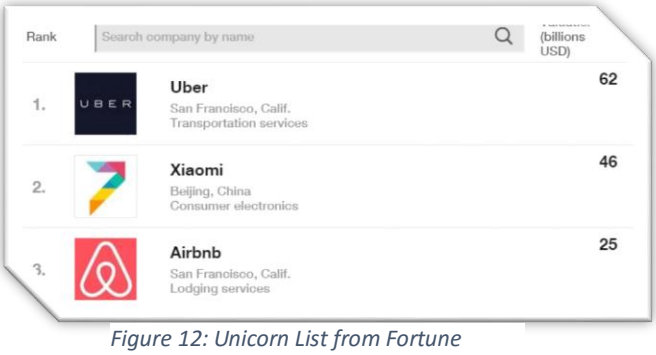

Figure 12: Unicorn List from Fortune

[53] Airbnb Overview, CrunchBase, https://www.crunchbase.com/organization/airbnb#/entity
[54] About us, Airbnb, https://www.airbnb.com/about/about-us
[55] The Unicorn List, Fortune, http://fortune.com/unicorns/
[56] Unicorns are the private companies that worth more than $1 billion or more.

5.2 Business Model

"The business model is an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all interrelated architectural, co-operational, and financial arrangements designed and developed by an organization, as well as all products and/or services the organization offers based on these arrangements that are needed to achieve its strategic goals and objectives."

– Al-Debei et al (2008)[57]

We can thus see that business models describe the rationale of how an organization creates, delivers, and captures value[58]. Before we dig into the business model of Airbnb, we shall first know how exactly Airbnb provides its services.

A typical and successful Airbnb reservation process:

1. The hosts list out their property on the website of Airbnb with details such as pricing, apartment rules, etc.
2. Airbnb sends a freelance photographer to take high-quality photos of the property.
3. The lodger searches for preferred property to stay on the Airbnb site.
4. Message conversation between the lodger and the host via Airbnb (can be omitted, but required by some hosts).
5. The lodger makes a reservation and the host confirms it.
6. The lodger stays at the property and Airbnb transfer the amount to the host's account.

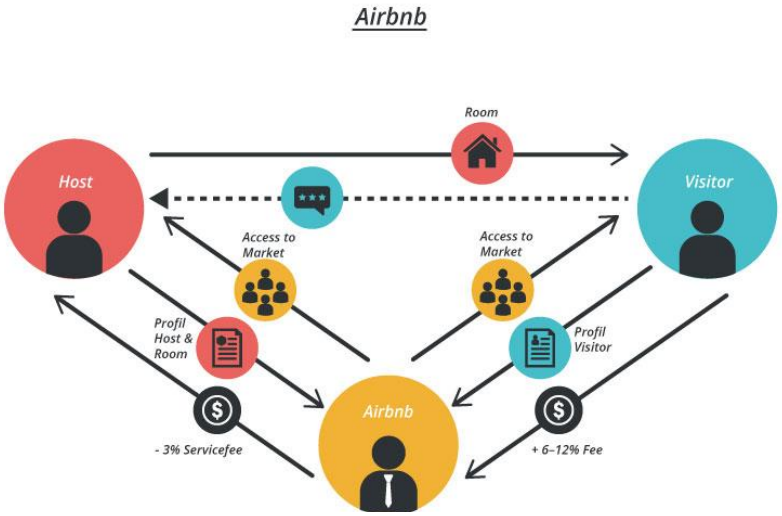

Figure 13: How Airbnb Works

Source: Business Model Toolbox

[57] Al-Debei, M. M., El-Haddadeh, R., & Avison, D. (2008). Defining the business model in the new world of digital business. In Proceedings of the Americas Conference on Information Systems (AMCIS) (Vol. 2008, pp. 1-11).
[58] Osterwalder, A., & Pigneur, Y. (2010). Business model generation

According to Osterwalder, A., & Pigneur, Y. (2010), there are 9 building blocks of a business model. They are Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partners and Cost Structures. This way of developing and/or documenting business models are known as Business Model Canvas. Above 9 building blocks belong to 4 major categories: Infrastructure, Offering, Customer and Finance.

1. Customer Segments

> *"The Customer Segments Building Block defines the different groups of people or organizations an enterprise aims to reach and serve"*
>
> *– Osterwalder, A., & Pigneur, Y. (2010)*

Traditionally, the definition of customer is very close to consumer or buyer. The customers of a manufacturing company are simply people who buy their products. Nowadays the definition of a customer has expanded widely. A customer in a sharing economy like Airbnb has become similar to users and partners.

Airbnb provides an online platform that matches lodgers with the hosts, and then take commissions on both sides. It is clearly that both parties are the customers of Airbnb.

To be more specific, lodgers are those who:

People who love traveling;

People who want to have comfortable stay with local feelings;

People who want to stay with a cheap price;

Hosts are those who:

People who want to earn extra money by renting out their spare properties/rooms;

People who love meeting new people;

Airbnb is therefore a multi-sided platform that serves two interdependent customer groups. The company can only survive when both groups exist.

2. Value Propositions

"The Value Propositions Building Block describes the bundle of products and services that create value for a specific Customer Segment."

–Osterwalder, A., & Pigneur, Y. (2010)

Since the valuation propositions can be different with various customer segments, it is necessary to discuss one segment at a time.

For hosts, Airbnb creates value by:

Allowing the utilization of spare room(s) and properties to generate income;

Providing up to $1 million insurance for the damage to the property and the third-party.

For lodgers, Airbnb creates value by:

Facilitating the reservation process;

Offering cheap solutions for stays;

Offering authentic and local experiences.

3. Channels

"The Channels Building Block describes how a company communicates with and reaches its customer Segments to deliver a Value Proposition"

–Osterwalder, A., & Pigneur, Y. (2010)

According to the Business Model Canvas, channels have five phases.

i. Awareness: This stage is about raising customer awareness of company's products/services. Airbnb primarily uses TV commercials, social networks advertisements and its own referral system to promote its product and to reach their customers.

ii.-v. Evaluation, Purchase, Delivery and After sales: The reason for placing these four phases together is because they are all achieved via the same channels: Airbnb website and mobile apps. Evaluation is a stage where the customers evaluate a company's value proposition. Airbnb as a matchmaker, the evaluation is largely dependent on the

customers' experiences over the offering of the other customer group. The website and the mobile app of Airbnb give the customers the possibility of leaving their reviews for their experiences. As an information technology company, the purchase, delivery and after sales phases are integrated into the website and mobile app of Airbnb as well.

4. Customer Relationships

"The Customer Relationships Building Block describes the types of relationships a company establishes with specific Customer Segments"

–Osterwalder, A., & Pigneur, Y. (2010)

The customer relationships in Airbnb is a mixture of co-creation, self-service and personal assistance. As stated in the Business Model Canvas theory (Osterwalder, A., & Pigneur, Y., 2010), co-creation is beyond the traditional customer-vendor relationship. One example is YouTube. The uploaders are solicited to create contents for the consumptions of other users. Airbnb shares the same customer relationships as YouTube, as the hosts provide contents (staying property) to other users (lodgers). The co-creation relationship essentially shifts part (or entire) of the company-customer relationships to a customer-customer relationship.

The remaining part of the customer relationships in Airbnb belongs to self-service and personal assistance. Both the (potential) lodgers and hosts can find Q&A and solution center on both the website and the app when they have questions. In this way, the customers can find necessary means to help themselves. On the other hand, the customers can reach Airbnb by the email function that is embedded in the mobile app or on the website.

5. Revenue Streams

The Revenue Streams Building Block represents the cash a company generates from each Customer Segment (costs must be subtracted from revenues to create earnings)

–Osterwalder, A., & Pigneur, Y. (2010)

Revenue streams are the arteries of a business model. As there are two distinguish customer segments, it is necessary to define the revenue streams separately.

For hosts: Airbnb charges 3% commission upon every booking.

For lodgers: Airbnb charges 6-12% commission upon every booking.

It becomes clear that Airbnb's revenue streams come from recurring fees, and no one-time transaction revenues at all. Such structure ensures fast market penetration, as there isn't any registration or listing fee. Simultaneously, it provides considerable and solid revenues after the number of daily bookings get expanded.

6. Key Resources

> *"The Key Resources Building Block describes the most important assets required to make a business model work." –Osterwalder, A., & Pigneur, Y. (2010)*

The key resources are the fundamental premises to generate and deliver the value propositions, to develop customer relationships, to reach the market and to earn cash flows. Key resources can be categorised into four: physical, intellectual, human and financial.

Physical category contains physical assets such as manufacturing machines, properties, plants and equipment (PP&E). Retailers, Real Estates and logistics kind of companies heavily rely on the physical resources.

The intellectual category includes patents, brands, franchise, technological know-how, copyrights, database, etc. Intellectual resources have become more important than ever.

Human stays at the center of every business. Personal networks and knowledge are notably important for companies in financial services and pharmaceutical industry.

Financial resources such as cash and stock options. Some companies embed financial resources into the business model to either attract key employees (e.g. offering stock options in the contract) or develop products (e.g. borrowing capital for development).

As to Airbnb, intellectual and human resources are indeed crucial. The Airbnb platform is completely digital and nothing could happen without it. Furthermore, the customer listings (database) are key resources for attracting reservations. Apart from that, the skilled employees have the technological know-how of developing and maintaining the platform. They are crucial resources of Airbnb, as they can hardly be replaced.

7. Key Activities

The Key Activities Building Block describes the most important things a company must do to make its business model work"

–Osterwalder, A., & Pigneur, Y. (2010)

The most important activities for Airbnb are product development and network development & management. Airbnb first needs to develop its website and app platform continuously, so as to provide a more convenient, effective and user-friendly experience. At the same time, developing and managing lodger and host network are essential activities, as these two parties are the cores of Airbnb's business. The size of the customer pool and the travelling/receiving attitudes are some target areas that require marketing and management.

8. Key Partners

"The Key Partnerships Building Block describes the network of suppliers and partners that make the business model work"

–Osterwalder, A., & Pigneur, Y. (2010)

There are many kinds of partnerships that companies may enter. It can be horizontal partnership with competitors, vertical alliance with suppliers/buyers, and joint ventures to develop new business, etc. Due to Airbnb's platform strategy, the core partners are naturally lodgers and hosts. They are both customers and partners, as their supply and demand fulfil each other. Unlike common business partnerships which are meant to improve each other's business (e.g. to form economies of scale or to reduce risks), Airbnb will not be able to run its business without the presence of this partnership.

Apart from this, investors such as Sequoia Capital are essential partners as well. Their capitals allow Airbnb to fund its daily operations and activities (e.g. marketing, networking and acquisition).

9. Cost Structure

"The Cost Structure describes all costs incurred to operate a business model"

–Osterwalder, A., & Pigneur, Y. (2010)

Cost can happen at any part of the business. It can be marketing costs, R&D costs, customer services costs and so on. The major costs in Airbnb's business model can be categorised as Technological running & development costs, Salaries to employees, and Marketing and Management costs.

The first category is the cost of developing and managing the Airbnb platform, while the second category is the periodical cost that is paid to both permanent employees and freelance photographers, and the last category is the cost of developing and managing the customer networking (incl. marketing).

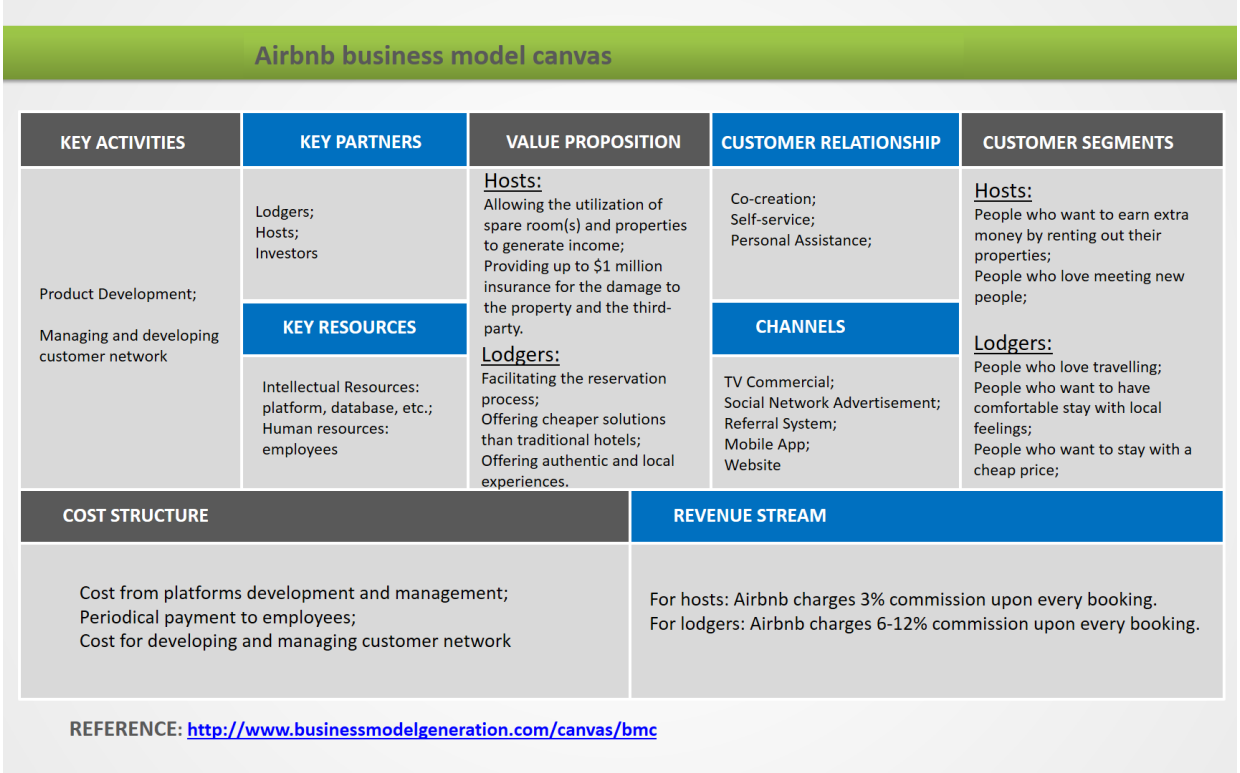

Figure 14: Summarized Airbnb Business Model Canvas

5.3 Internal Analysis

5.3.1 Risks

Airbnb has passed its critical tests, after having stunning growths in recent years. According to the Airbnb website and the Wall Street Journal[59], the estimated nights booked and annual revenue of Airbnb doubled in 2015 (78 million and $900 million respectively).

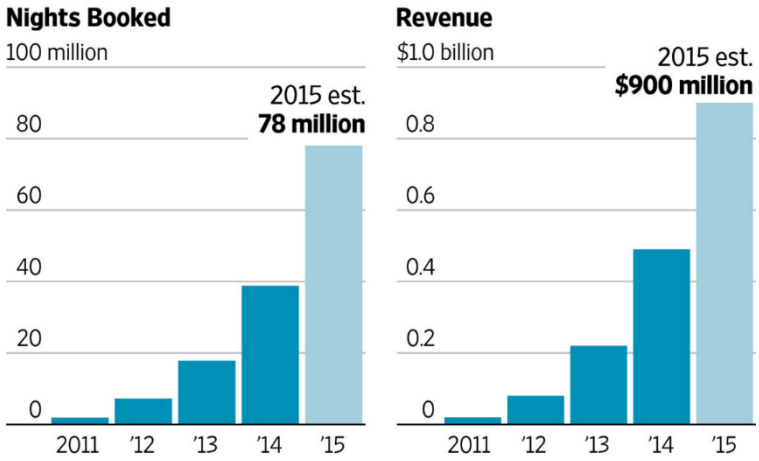

Figure 15: Airbnb estimates 2015.
Source: Airbnb, The Wall Street Journal

The estimated current level of revenue of Airbnb has reached 50% of the world's largest hotel chain: InterContinental Hotels Group[60]. In addition, the numbers of properties listed on Airbnb reached 2 million, which is notably higher than the 698,000 rooms of InterContinental Hotels Group. More importantly, according to Bloomberg[61], a source inside Airbnb claimed that the company would exhibit positive bottom line in 2016. On the other hand, Airbnb is a fully equity-funded company where no debt or fixed commitments exist. And Airbnb has proved their access to capital from many rounds of financing.

All the information is pointing in one direction, that Airbnb has gained proper market position and it is about to turn itself into a quite profitable company. Therefore, we have reasons to believe that survival risk is not going to be huge for Airbnb. In that sense, we assume that there is 10% chance that Airbnb will fail completely. Due to the fact that Airbnb is a platform provider who doesn't possesses many physical assets, we would assume the liquidation value will be zero if Airbnb fails.

[59] The Wall Street Journal, "Airbnb Raises Over $100 Million as It Touts Strong Growth", http://www.wsj.com/articles/airbnb-raises-over-100-million-as-it-touts-strong-growth-1448049815
[60] Yahoo Finance, http://finance.yahoo.com/q/ks?s=IHG+Key+Statistics
[61] Bloomberg, The Sharing Economy Doesn't Share the Wealth, http://www.bloomberg.com/news/articles/2016-04-06/the-sharing-economy-doesn-t-share-the-wealth

Just like its unicorn brother Uber, Airbnb is also facing regulatory risks. Since the founding of Airbnb, there have been quite some serious incidents happened inside the lodges (e.g. Prostitution, Killing, Fraud, and Addict[62]). These problems created some public concern over short-term rentals in many countries. After the continuous amelioration of the rules and the introduction of host insurance, the short-term rental giant is improving its service standards and public recognition.

More importantly, unlike the difficult situation of Uber, Airbnb didn't catch much attention from hotel industry incumbents. In the "Proposition F" referendum, which happened in late 2015, Airbnb was facing a proposal of introducing a stricter law against short-term rentals in San Francisco. However, the referendum proponents "Share better San Francisco" organization only received 25,000 dollars from Hotel Association of New York City and 49,000 dollars from American Hotel & Lodging Association. The number was completely incomparable with the 8.38 million dollars that Airbnb spent on the campaign. The significant gap of the capitals directly led to a favourable result for Airbnb[63]. The attitude of the hotel incumbents over Airbnb can be observed from a talk of Christopher Nassetta, the current CEO of Hilton. *"I strongly do not believe that they are a major threat to the core value proposition we have". "I do believe that strongly, as I said that there is every ability for us to coexist,"* he said[64]. The "wait and see" attitude of the hotels leaves Airbnb some place to breathe since they only face governmental pressures.

Until today, Airbnb has reached reconciliation with 28 municipal or governmental entities, and Airbnb is now responsible for charging either occupancy tax or travel tax from lodgings[65]. Despite the increase in the price level due to the taxes, Airbnb is officially legal in these 28 cities and countries. This has been a breakthrough for Airbnb, and it tells us that the regulatory barrier is easing for Airbnb. Although there have also been concerns over the actions that Airbnb manages its finance in Ireland and Jersey in the Channel Islands (which is known as a tax heaven), such tax-avoidance measures are not implemented only by Airbnb, but by also many other companies like Uber, Google and Apple. The recent Panama Paper has revealed numerous people and companies that are involved in tax avoidance behaviours. If there is going to be new regulations against tax heavens, it's going to affect every single international company. It is not making sense to solely adjust the value of Airbnb for this kind of potential regulations. Hence, we would

[62] Fox News, "10 incredible Airbnb horror stories", http://www.foxnews.com/travel/2014/05/08/10-incredible-airbnb-horror-stories.html
[63] The Paper, "San Francisco Airbnb referendum: money politics or the broader evolution of capitalism", http://www.thepaper.cn/newsDetail_forward_1406896
[64] CNN Money, "Hilton: We're not scared of Airbnb", http://money.cnn.com/2015/10/28/investing/airbnb-hilton-hotels/
[65] Airbnb, "In what areas is Occupancy Tax Collection and Remittance by Airbnb available?", https://www.airbnb.com/help/article/653/in-what-areas-is-occupancy-tax-collection-and-remittance-by-airbnb-available?locale=en

conclude that regulatory risks are definitely there for Airbnb, but it is not going to threaten the value of Airbnb significantly.

5.3.2 Advantages and Disadvantages

Before discussing the advantages and disadvantages of Airbnb to the market incumbents, we first need to know who are the incumbents that Airbnb is challenging. Hotels are probably the first thing that comes to our mind when we talk about the market that Airbnb is disrupting. Is this the truth?

Exhibit 1: What accommodations are Airbnb users substituting away from? A variety of accommodations, with less than half coming from hotels.

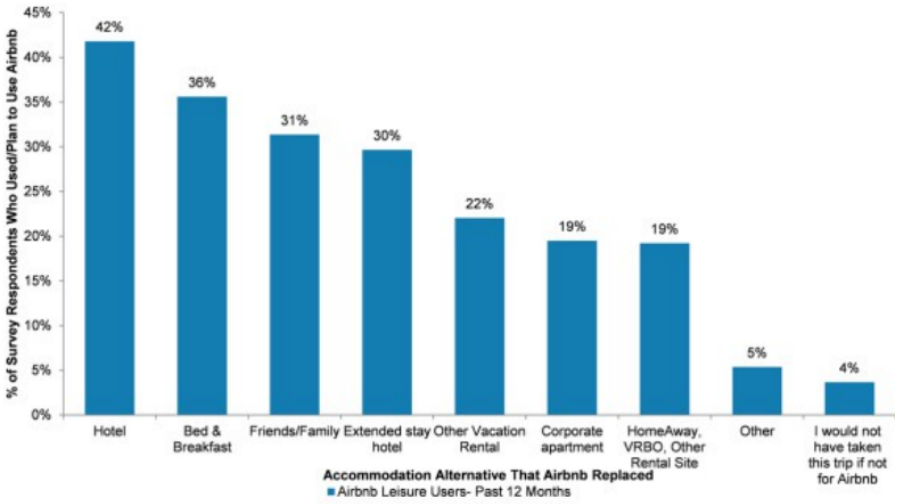

Figure 16: What accommodations did Airbnb replace? Source: AlphaWise, Morgan Stanley Research

According to a recent research conducted by Morgan Stanley[66], less than half of the Airbnb lodgings replaced hotel accommodations. Lodgers, who would have selected other accommodation types like Bed & Breakfast, Friends/Family and extended stay, contributed considerable stays with Airbnb as well. In the meantime, the research also indicated that only 7% of the Airbnb lodgers stayed one night while the number was 25% in hotels. Approximately 70% of the hotel business came from corporate demand while Airbnb focused on non-hotel, leisure and longer duration stays. Even with the bull case (best scenario) of Airbnb, Morgan Stanley's hotel demand and supply model shows a merely 20 basis points negative impact

[66] Morgan Stanley Research, "Internet, Lodging, Leisure and Hotels: Global Insight: Who Will Airbnb Hurt More - Hotels or OTAs"

on annual hotel occupancy and a 70 basis points reduction in annual RevPAR growth (revenue per available room). Therefore, the negative impact from Airbnb on the hotel industry is limited by the differentiated target groups.

But can Airbnb penetrate into business travelling? Very unlikely. The same research studied the reasons for not adopting Airbnb. Among those who have heard about Airbnb, privacy and safety concerns are the primary reasons for not staying in an Airbnb lodge. These concerns are believed to be important to business travellers. In addition, corporate travellers place high priority to the amenities of their stays, such as restaurants, loyal programs and business centers. It is very unlikely that the private lodges of Airbnb will be able to compete with hotels in these fields.

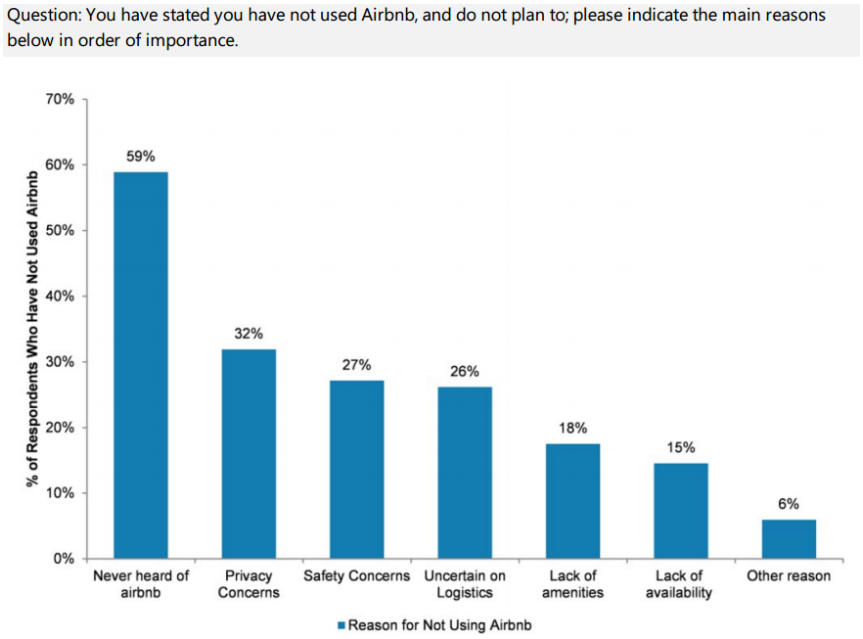

Figure 17: Reasons for Not Using Airbnb. Source: Morgan Stanley

Due to the differentiate target audiences, Airbnb and hotels are capable to co-exist without disrupting each other. Furthermore, even if we assume that Airbnb will be able to threaten the business of hotels in the future, this risk is still manageable for the hotels. Why? Because hotels can always choose to collaborate with Airbnb. We must keep in mind that Airbnb doesn't own any physical rooms, and they are only a platform that matches lodgers and hosts. Essentially speaking, Airbnb is an Online Travel Agency (OTA) like Priceline Group and Expedia Inc[67]., but with a different kind of inventory. Hotels could choose to list their rooms on Airbnb when they feel their corporate demand are cannibalized by Airbnb. At that

[67] Priceline Group owns: Booking.com, Priceline.com, Agoda, etc. Expedia Inc. owns: Expedia.com, Hotels.com, Trivago, etc.

time, hotels and Airbnb will enter co-competition, where they compete with each other on pricing power and cooperate on making a bigger pie for both.

Then, who are challenged directly by Airbnb after all? The answer has revealed itself: the OTAs. Both Airbnb and OTAs are listing properties on their sites and apps, and charge commission fee with each single booking. According to Morgan Stanley's survey, 80% of the bookings of Priceline and Expedia came from leisure demand. This fact has also been proved by the U.S. Travel Association that 89% of the total bookings of OTAs are leisure stays[68]. By having the same target market, Airbnb and OTAs are no doubt direct competitors. People who used to book stays with Bed & Breakfast and other leisure accommodations via OTAs are very likely to embrace Airbnb. And the competition will get more intense if Airbnb successfully entered a collaboration with hotels. Both the customers and the inventories of the OTAs are will be disrupted by Airbnb.

Now, let's talk about the advantages and disadvantages of Airbnb compare to the incumbents: OTAs.

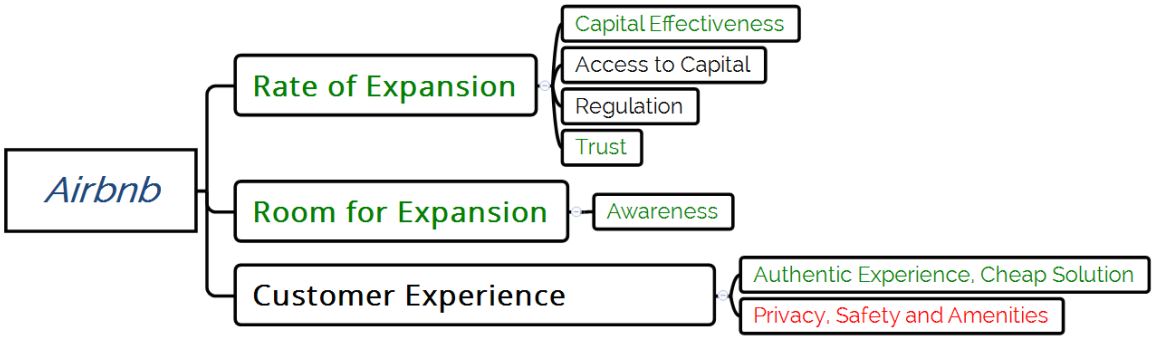

Figure 18: Airbnb Advantages and Disadvantages

We designed above figure to present the advantages and disadvantages of Airbnb. When making the comparison, it is important that we focus on the market penetration aspect. Because it is the future market share of Airbnb that helps us to measure its intrinsic value. In the figure, we use green colour to emphasize the advantages, red colour to emphasize the disadvantage and black for neutral factors.

1. Rate of Expansion:

   In this part, we consider the advantages and disadvantages that have impacts on how fast Airbnb can grow. Capital effectiveness determines the impact of spending capital on market penetration. It is considered as an advantage of Airbnb, based on the loyalty and commission level of Airbnb.

[68] U.S. Travel Association, "U.S. Travel Answer Sheet", 2013

According to MarketWatch[69], more than 73% of Airbnb customers (lodgers) were at least "Very Satisfied" while the number is 50% for Booking.com (part of Priceline) and 54% for Hotels.com (part of Expedia). Since the customers are more satisfied, they are more likely to repeat its bookings with Airbnb in the future. By that, the customer lifetime value becomes higher for each single customers acquired by Airbnb. Hence, the much higher satisfaction rate of Airbnb allows Airbnb's marketing efforts to be more effective than others.

On the other hand, the total commission level of Airbnb is 9-15% (3% for hosts + 6-12% for lodgers), which is lower than the 12-18% commission of OTAs[70]. It means that, at the same price level, the hosts receive more revenue by listing their properties on Airbnb instead of OTAs. Therefore, the ability to attract inventories is an advantage of Airbnb. A large inventory provides a wide range of choices to the lodgers, from locations to prices, from belfries to castles. Lodgers are more likely to find their preferred accommodations on Airbnb, and hence, stack up the number of bookings.

Access to capital is another important part of the expansion rate. We believe that Airbnb and major OTAs (Priceline and Expedia) are at the same level when we talk about their access to capital. Airbnb has shown its access to capital by raising 1.6 billion U.S. Dollar in 2015 in two rounds of financing. Its rapid growth will support its future financing opportunities if they will need further capital. Priceline and Expedia are both public-listed companies with solid revenue streams and bottom lines. Raising equity and/or debt are not likely to be problematic for both parties. Therefore, it is difficult to determine which party has better access to capital.

A common belief of Airbnb is that regulations are hindering the progress of the sharing economy giant. Regulations are slowing the expansion of Airbnb, however, like we mentioned earlier, Airbnb has reached agreements with 28 cities/countries, and Airbnb is officially recognized short-term rental platform in these places. Uber's market acquisition progress was even faster than Airbnb, despite the much tougher regulations and bans it faced. Therefore, we have the reason to believe that the regulatory problems could be worked out by Airbnb. In the meantime, regulations are protecting Airbnb from outside threats (e.g. Priceline and Expedia) of entering the private property-sharing market. The regulations make the market less attractive for now, and therefore, the outside threats may wait until the regulations become friendlier before they enter the market. Regulations function

[69] MarketWatch, "Airbnb poses long-term threat to online travel sites like Priceline", http://www.marketwatch.com/story/airbnb-poses-long-term-threat-to-online-travel-sites-like-priceline-2015-06-23
[70] Morgan Stanley Research, "Internet, Lodging, Leisure and Hotels: Global Insight: Who Will Airbnb Hurt More - Hotels or OTAs"

as a uterus for Airbnb. It on the one side limits the growth of the infant (Airbnb), but on the other side protect the infant (Airbnb) from an unfavourable external environment, such as bacteria (competition). When the infant (Airbnb) grow bigger and bigger, the uterus (regulations) is no longer capable of holding the infant (Airbnb). Airbnb will be mature and prepared when the regulatory protection ends its mission. Consequently, we view regulation as a neutral factor.

Trust is the last but not least advantage of Airbnb. In a sharing economy, trust is everything. Hosts need to be able to trust the lodgers, that they are not conducting illegal activities or damages to the property and so on. Lodgers need to be able to trust the hosts, that they are honest describing the property and are kind when dealing with people. It is not always the case in a loosely-regulated marketplace like sharing economy. The information asymmetry between the parties provides incentives for one to cheat on the other. Sometimes it happens without any intentional behaviour. A survey conducted by Nielsen[71] shows 70% of the consumers trust online reviews, and they are the most trusted sources besides the word-of-mouth. Therefore, it is a premise that a sharing platform has established a well-structured review system and has accumulated a considerable amount of reviews, before it is recognized as a reliable platform and started to display momentum.

Airbnb has come through the trust-earning stage and showed significant growth. The number of total nights booked reached 10 million in June 2012[72], which was 10 times higher than it was 15 months earlier[73]. Last year, a source of Reuters indicated that the number of nights booked of Airbnb for 2015 alone was expected to be 80 million, beating the estimation of 61 million from investment bank Piper Jaffray[74].

The trust that Airbnb established among customers is believed to be able to accelerate the market penetration of Airbnb in the future. Furthermore, if OTAs decide to enter private lodging market sometime in the future, it would take them years to establish necessary trust that is required to form a competitive scale. Hence, the trust would function as a shield that helps Airbnb to defend its territory.

[71] Nielsen, “GLOBAL CONSUMERS' TRUST IN 'EARNED' ADVERTISING GROWS IN IMPORTANCE”, http://www.nielsen.com/us/en/press-room/2012/nielsen-global-consumers-trust-in-earned-advertising-grows.html
[72] Reuters,” Airbnb Celebrates Record Growth With 10 Million Guest Nights Booked”, http://www.reuters.com/article/idUS84470+19-Jun-2012+MW20120619
[73] Airbnb Blog, http://blog.airbnb.com/airbnb-celebrates-1000000-nights-booked/
[74] Reuters, “Exclusive: Airbnb to double bookings to 80 million this year – investors”, http://www.reuters.com/article/us-airbnb-growth-idUSKCN0RS2QK20150928

2. Room for Expansion

The Morgan Stanley research shows only 12% of travellers have tried Airbnb, and almost 60% of the respondents who never tried Airbnb is due to the fact that they never heard about Airbnb. A low level of awareness is not an advantage of Airbnb per se, however, it does promise a greater potential of Airbnb. By having a low level of awareness, Airbnb is very likely to experience a lasting and more sustainable growth in the coming decade in comparison with Priceline and Expedia, who have already acquired a considerable market share.

3. Customer Experience

Lodgers' interests on authentic experiences and cheaper solutions easily differentiate themselves from others who value more about privacy, safety and amenities. In the mind of an Airbnb lodger, a unique, social and cultural immersive travel experience is more important. Or, they can also be interested in the cheaper prices of Airbnb. Morgan Stanley finds that the average price per room night is $100, which is cheaper than the hotel average $115. Therefore, Airbnb has the advantage to attract budget travellers and people who love authentic experiences, however, it also faces difficulties of attracting privacy, safety and amenities oriented travellers.

The well-divided and targeted customer group gives Airbnb the opportunity of fast expansion, as the product of Airbnb is entirely their taste. However, a negative consequence is that it also gives Airbnb a ceiling of expansion. Because the needs of some other groups can hardly be fulfilled by the product of Airbnb.

Nonetheless, we believe that travellers' concerns over privacy and safety will be reduced along with the growth of Airbnb. Because Airbnb will constantly seek for improvements and gain recognitions from various regulatory entities. It will, therefore, enlarge the potential pool of Airbnb lodgers.

5.3.3 Options

"Don't go to Paris. Don't tour Paris. And, please, don't do Paris… Live in Paris."

"Wherever you go, don't go there…Live there."

April 2016, Airbnb launched a new banner video at the top of its global homepage. Above language were quoted from the video. Airbnb is clearly trying to change the way people travel. They encourage travellers

to live as a local. Cook at a local "home", workout in a local park, take a bath at a Japanese bathhouse (of course, only when you visit Japan) and participate local festivals.

"Travel has gotten a little sick . . . No matter what you're doing, you're usually doing things that locals would never do" said the co-founder and CEO of Airbnb, Brian Chesky. Traditional tourist behaviours such as taking selfies and pictures at monuments and crowded sightseeing tours are outdated and give no joy, in his view.

Airbnb since its birth has been trying to build trust, communication and connection between people. The improving trust and connection, in couple with the growing user base and advanced technologies have prepared Airbnb for new market entries. Now they seem to have the option to expand its business to tour operator market.

Airbnb started a market test of its travel packages in San Francisco since the end of 2015. The package cost $500 and included 3-5 days' accommodation, airport transportation with Lyft (a competitor of Uber), meals (at local eateries) and outings (e.g. walking tours, parties, skydiving). At the same time, Airbnb is expecting hosts to provide more local recommendations and guidebooks for the travellers[75], which are believed to be able to enhance travellers' feeling of "living in the city". According to Chesky, 86% of the Airbnb are expecting "living as a local". The local experiences provided local people are therefore expected to help Airbnb disrupting current tourism industry. This opportunity is to be viewed as an option to expand for Airbnb.

5.4 External Analysis

In the external analysis, we analyse the future trends of the online travel industry that are affected by political, economic, social and technological factors.

Political:

Globalization is changing our life. Less and less trade control and border control have facilitated and encouraged the growth of tourism, and this phenomenon is expected to last at least in the coming decade. Online travel as an important and emerging part of the tourism value chain, naturally benefits from the bullish tourism industry.

[75] Fortune, Airbnb Pushes Into Tourism With Travel Recommendations and Guidebooks, http://fortune.com/2016/04/19/airbnb-travel-recommendations/

However, the globalization of politics is expected to damage the political stability. As a consequence of globalization, politics sometimes take place in an international manner. Many countries are having increasing concerns and therefore interventions on others. It has led to greater political conflicts among nations. The conflicts of nations often burst into wars and terrorism, which ignites the conflicts even further. The conflict spiral is significantly threatening the political stabilities of countries that are involved. From the Gulf War to 911, to Iraq War, to Syrian War, to the various terrorist attacks around the globe (such as Egypt and France), these events have tremendous negative impacts on tourism. World Trade and Tourism Council (WTTC) recently conducted a study on 32 counties which had been affected by terrorist attacks from 2001 to 2014. The study shows that the number of tourists of a city averagely recover to the pre-attack level after 13 months[76]. Besides that, WTTC also found out that it takes 27 months for tourism to recover from political turmoil.

Based on the above consideration, we believe that the negative and positive aspects of politics will offset each other, which leave us with a neutral impact of politics.

Economic:

Global economic growth affects the growth of every single industry, online travel is no exception. According to the World Economic Outlook of International Monetary Fund (IMF), the global economic growth in 2015 was around 3.1%, while they expected the number raise to 3.4% and 3.6% in 2016 and 2017 respectively[77]. Due to the modest and uneven recovery, the global economy is expected to continue this growth. Therefore, we will use 3.37%, which is the average growth, as the expected global economic growth at the valuation stage.

[76] Telegraph, "13 months: how long it will take Paris to recover", http://www.telegraph.co.uk/travel/destinations/europe/france/paris/articles/13-months-how-long-it-will-take-Paris-to-recover/

[77] International Monetary Fund, WORLD ECONOMIC OUTLOOK, http://www.imf.org/external/pubs/ft/weo/2016/update/01/pdf/0116.pdf

In the meantime, emerging markets such as China are gaining in terms of personal disposable income. According to National Bureau of Statistics of China, the real disposable income per capita increased 7.4% (after deducting the inflation), which is higher than the 6.9% GDP growth in China[78]. Such pattern could also be found in 2013 and 2014, where the growth of disposable income outperformed the growth of GDP. More disposable income increases people's leisure demand, especially travelling. A report of China National Tourism Administration showed 20% Year-over-year growth in outbound travels of Chinese citizens in the last few years[79]. More importantly, the Chinese outbound travellers spent $215 billion in 2015, a shocking 53% increase from $140 billion in 2014, according to WTCC[80]. That is probably why the Danish newspaper Børsen on 29th April 2016 urged the importance of attracting Chinese tourist to visit Denmark in its article *"Kinesiske turister skal lokkes til Danmark[81]"*.

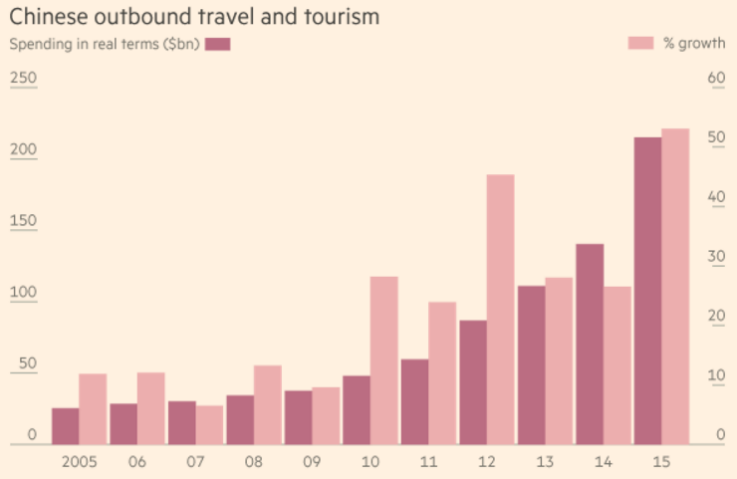

Figure 19: Chinese outbound travel and tourism. Source: WTTC

China is expected to lead emerging markets as the main driving force of tourism, and therefore, we can expect the growth of global tourism industry to outperform the growth of the general economy.

Social:

The aging population can be seen as a driving force of the growth of tourism. Today, the aging population is no longer a problem that is only faced by Scandinavian countries and Japan, it is happening everywhere

[78] National Bureau of Statistics of People's Republic of China, http://www.stats.gov.cn/tjsj/zxfb/201601/t20160119_1306083.html
[79] China National Tourism Administration, http://www.cnta.com/xxfb/xwlb/201601/t20160119_758473.shtml
[80] Financial Times, "Chinese tourism spending leaps 53% in a year", http://www.ft.com/cms/s/3/62ef31e4-eb92-11e5-888e-2eadd5fbc4a4.html#axzz47LZ21N26
[81] Børsen, "Kinesiske turister skal lokkes til Danmark", http://cms.borsen.dk/nyheder/avisen/artikel/11/140156/artikel.html

beside middle east and Africa. People who are older than 60 years old already occupy 15.5% of the total Chinese population[82], and by 2050, this number is estimated to be one-third of the total Chinese population. Another research of WTCC showed that 50%-60% of the tourism market were occupied by elderly people[83]. This result is not surprising at all, since elderly people are typically wealthier and freer than young people. Therefore, the ageing population is believed to have a positive effect on the tourism industry, and thereby, boost online travel as well.

Besides the growth of the entire tourism industry, travellers are more intended to book their rooms online as well. Priceline, as a dominant player among all the online travel agencies, demonstrated 26% year over year growth in revenue and 34% rise in its total bookings[84]. On the other hand, mobile bookings as a new trend of making reservations have caught serious attention. According to Booking.com, which is the most valuable brand under the Priceline Group, it experienced 160% increase in mobile bookings in 2013[85]. All these numbers are telling us that booking travels online is a strong trend that is happening around us. Hence, we have reasons to believe that online travel industry will grow at a faster pace than general tourism industry.

Technical:

As mentioned in the Morgan Stanley report, Airbnb's price level is 15% lower than hotels. Airbnb as the new technology in the online travel industry is capable of attracting more lodgers and thereby enlarging the entire pie. We have illustrated this effect using the demand and supply curve in the earlier part.

In the meanwhile, another emerging force that could potentially make impact on tourism is virtual reality (VR). While some people are concerning the threat of VR may have on the tourism, we see VR as an appetizer or trailer before tourism (the main dish). The VR experiences, such as 360 degrees Paris view, barely give people initial visual ideas of how these places are like. VR is no doubt a significant innovation, but it is not sufficient to cheat our senses and make people believe that they are actually there. We cannot touch, smell, and live in Paris. Inside VR, we cannot eat "Boeuf Bourguignon" or "escargot" in a street restaurant and talk to local people. Nevertheless, the pleasant flavour of the VR experience would

[82] Peopl.cn, http://politics.people.com.cn/n/2015/0612/c1001-27143289.html
[83] Net Ease, http://money.163.com/12/0911/15/8B4NFUSF00253B0H.html
[84] Forbes, Strong Growth Abroad Lifts Priceline's Results, http://www.forbes.com/sites/greatspeculations/2014/08/18/strong-growth-abroad-lifts-pricelines-results/#293f23e437f2
[85] Booking.com, Booking.com's Mobile Bookings Grow 160% in 2013, http://news.booking.com/bookingcoms-mobile-bookings-grow-260-in-2013

strengthen our will of travelling to the place by person. VR experience would be a catalyst that boosts people's desire of travelling. It works just like any other travel documentaries and foreign culinary shows. Therefore, the advancement of VR is essentially pushing the growth of tourism.

6. Valuation and Results

6.1 DCF Valuation

$$Intrinsic\ Value = \sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{n+1}}{WACC - g} \times \frac{1}{(1+WACC)^n}$$

Our DCF Valuation can be divided into two parts. The first part is to derive the Free Cashflow for the Firm (FCFF), and the second part is to discount the FCFFs and the terminal value to the present using the cost of capital.

FCFFs:

The first step of computing the FCFFs is to derive the overall global market size of online lodging market. According to a research conducted by Morningstar, the market share of Airbnb in online lodging is 7.25% in 2015. And we know that the estimated revenue of Airbnb in 2015 is $900 million. Therefore, we can divide 900 million by 7.25% to arrive at the overall market size.

Overall Market Size = 900/7.25% = $12.4 billion

Secondly, we need to project the growth of the online lodging industry and the growth of the market share of Airbnb in the forecasting period. Since Airbnb is growing fast and its market penetration is still at a rather low level, we believe that a forecasting period of ten years will help to make the valuation more accurate.

Now we need to estimate the growth of the overall online lodging market in the forecasting period. In the study, we use global economic growth and global traveller arrivals as the base rate of the growth of online lodging, and on top of that, we have incremental online lodging tendency that measures travellers' increasing tendency of booking lodgings online instead of offline and it works as a multiplier.

*Growth of Online lodging market = (Economic Growth + Traveller Arrivals Growth) * Incremental Online Lodging Tendency*

As discussed earlier, the estimated global economic growth is 3.37% and it is used as the economic growth within the forecasting period of 10 years.

The average annual growth of traveller arrivals was 3.8% in the period 2005-2014 and 4.37% in the period 2011-2014, showed by World Tourism Organization (UNWTO)[86]. Due to the strong momentum of the rising tourism that we analysed in the previous section, it is reasonable to use the most recent growth rate (i.e. 4.37%) to estimate the traveller arrivals growth in the forecasting period. However, we must deduct the global economic growth rate to arrive the "net growth of traveller arrivals". The report of International Monetary Fund (IMF) shows 3.4% of global economic growth in the same period[87]. Therefore, it leaves 0.97% net growth.

A research of PricewaterhouseCoopers (PwC) shows 32% of bookings of lodging industry happens online today[88]. As a result of the recent fast growing online lodging market and the widely spreading mobile bookings, it is believed that booking lodgings online will further gain its importance. Therefore, we assume that 63% of total bookings of lodgings will happen online after 10 years, which represents 7% annual growth.

Growth of Online lodging market = (1 + 3.37% + 0.97%)(1+7%) – 1 = 11.64%*

Multiplying the base market growth with the increasing preference of online bookings, we arrive at 11.64% annual growth of the online lodging market.

According to the revenue streams which presented by Wall Street Journal, Airbnb exhibited 107% growth in the last three years. As our analysis earlier, we strongly believe that Airbnb is capable of fast expansion and has a considerable room to expand the business. Its customer satisfaction, trust and capital provide competitive advantages when competing with OTAs. Nonetheless, its shortage of amenities, privacy and safety could consequently cause the market acquisition to slow down after having a considerable level of market share. In addition, Bloomberg mentioned that Airbnb is going to deliver a positive bottom line at the end of 2016, which means the investment in marketing and developing will decrease in terms of its

[86] World Tourism Organization, Tourism Highlights 2015, http://www.e-unwto.org/doi/pdf/10.18111/9789284416899
[87] International Monetary Fund, http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/weorept.aspx?pr.x=21&pr.y=15&sy=2006&ey=2016&ssd=1&sort=country&ds=.&br=1&c=001%2C110%2C163%2C200&s=NGDP_RPCH&grp=1&a=1
[88] PwC, How can hotels achieve the right kind of growth in a digital age? A toolkit for fighting commoditisation, http://pdf.pwc.co.uk/how-can-hotels-achieve-the-right-kind-of-growth.pdf

revenue. Hence, we assume that the market share of Airbnb in global online lodging will be 25% after 10 years[89], and the growth rate displays diminishing return of scales in the forecasting period.

The next step of computing FCFFs is to convert revenues to profits. According to analyst estimation, Airbnb's operating loss is approximately $150 million in 2015[90]. It consequently leads to -16.67% operating margin for 2015. In our view, Airbnb will enter steady state after the forecasting period and reach 35% operating margin, which is similar to Facebook and Priceline. This assumption is due to the fact that Airbnb is a technology firm like Facebook and Priceline, which does platform business. Major operating expenses of Airbnb is to create the infrastructure of providing services. Therefore, the amounts of operating expenses shall decrease over time since Airbnb only need to maintain its infrastructure instead of building it. In addition, the operating margin of 2016, which is the first year in the forecasting period, is set to 0.1% in order to meet the internal source of Bloomberg, which we mentioned earlier and claimed that Airbnb will turn into positive operating income in 2016.

As a result of the previous rapid expansion, we expect the net operating losses to deduct the corporate income tax for Airbnb in the coming three years. Afterwards, the tax rate is expected to pick up and reach 40% at the end of the period. This level of the tax rate is what we observed from mature technology firms such as Airbnb.

The last step before getting into the FCFFs is measuring reinvestments. We employed the sales-to-capital ratio that Professor Aswath Damodaran often applies on valuing technology firms[91]. The higher the ratio, the less reinvestment is required to support the growth of a company. According to Prof. Damodaran, the median value of the sales-to-capital ratio is 2.5 for technology firms. We believe the platform business of Airbnb allows Airbnb to expand with less capital in comparison with general technology firms. Hence, we set the ratio to 3. The reinvestment each year is calculated by dividing incremental revenue by the ratio.

After everything is done, the FCFFs become rather apparent to us. By subtracting the after-tax operating income by the reinvestment, we have found the Free Cashflow for the Firm.

[89] Similar to the market share of Priceline today without business bookings.
[90] Fortune, Here's how Airbnb justifies its eye-popping $24 billion valuation, http://fortune.com/2015/06/17/airbnb-valuation-revenue/
[91] Aswath Damodaran, Musing On Markets, http://aswathdamodaran.blogspot.dk/2013/10/twitter-announces-ipo-valuation.html

(in millions)	Base Year	1	2	3	4	5	6	7	8	9	10	Terminal year
Overall market	$12,413.79	$13,859.23	$15,472.97	$17,274.61	$19,286.03	$21,531.66	$24,038.77	$26,837.79	$29,962.73	$33,451.53	$37,346.56	$41,695.12
Share of market (gross)	7.25%	11.69%	15.02%	17.51%	19.38%	20.79%	21.84%	22.63%	23.22%	23.67%	25.00%	25.00%
Annual Revenue	$900.00	$1,619.80	$2,323.36	$3,025.08	$3,738.36	$4,475.97	$5,250.28	$6,073.57	$6,958.24	$7,917.06	$9,336.64	$10,423.78
Operating margin	-16.67%	0.10%	3.978%	7.856%	11.733%	15.611%	19.489%	23.367%	27.244%	31.122%	35.00%	35.00%
Operating Income	-$150.00	$1.62	$92.42	$237.64	$438.63	$698.75	$1,023.22	$1,419.19	$1,895.73	$2,463.96	$3,267.82	$3,648.32
Tax rate	0.00%	0.00%	0.00%	0.00%	16.00%	20.00%	24.00%	28.00%	32.00%	36.00%	40.00%	40.00%
- Taxes	$0.00	$0.00	$0.00	$0.00	$70.18	$139.75	$245.57	$397.37	$606.64	$887.03	$1,307.13	$1,459.33
After-tax operating income	-$150.00	$1.62	$92.42	$237.64	$368.45	$559.00	$777.65	$1,021.82	$1,289.10	$1,576.94	$1,960.69	$2,188.99
Sales/Capital Ratio	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	$3.00
- Reinvestment	153.33	$239.93	$234.52	$233.91	$237.76	$245.87	$258.10	$274.43	$294.89	$319.60	$473.19	$362.38
Free Cash Flow to the Firm		-238.31	-142.10	3.73	130.69	313.13	519.54	747.39	994.21	1257.33	1487.50	1826.61

Figure 20: Estimated FCFFs of Airbnb

Discounting:

Weighted Average Cost of Capital (WACC), which is one of the most common discounting methods, can be structured as such:

$$WACC = \frac{NIBD}{(NIBD + E)} * r_d * (1 - t) + \frac{E}{(NIBD + E)} * r_e$$

Where:

NIBD represents “Market value of net interest-bearing debt”

E represents “Market value of equity”

r_d represents “Required rate of return on NIBD”

r_e represents “Required rate of return on equity”

t represents “Corporate tax rate”

In our case, Airbnb is fully equity-funded as doesn’t carry debt of any kind. It makes the WACC calculation rather simple. We can simply assign zero to the net interest-bearing debts.

$$WACC = \frac{0}{(0 + E)} * r_d * (1 - t) + \frac{E}{(0 + E)} * r_e$$

Therefore, WACC essentially becomes the cost of equity capital, i.e.:

$$WACC = \frac{E}{E} * r_e = r_e$$

To estimate the cost of equity capital, we use the adjusted Capital Asset Pricing Model.

$$CAPM: \qquad r_e = r_f + \beta_e(r_m - r_f) + liquidity\ premium + regulation\ premium$$

Let’s start with finding the first element of the CAPM model: the risk-free rate.

As the name suggests, the risk-free rate is the rate of return of theoretical zero risk investments. It is common practice to apply U.S. government bond as a proxy for the risk-free rate. In our case, we selected the U.S. 10-year government bond to match the 10 years' forecasting period of Airbnb, which is 1.74%[92].

The next element is the beta. As Airbnb is a private company, it is not possible to calculate the beta using historical correlation with the stock market. Therefore, we select to find the beta of Airbnb via established study. Professor Aswath Damodaran of New York University School of Business created a database of total betas by U.S. sectors[93]. We believe that an average beta (0.835) between Technology sector (0.99) and Hotel sector (0.68) is a true representative of Airbnb beta.

R_M is the rate of return of the market portfolio, and we will arrive at market risk premium by subtracting the risk-free rate from the market portfolio return. According to the databank of Professor Aswath Damodaran[94], the market risk premium in the United States in 2015 is 6.12%. We will proceed our calculation with this number.

One special piece of our CAPM model is the liquidity premium. As presented in the earlier section, liquidity premium is set to compensate the investors for investing in illiquid assets. The equity shares of Airbnb can only be traded on the primary market because Airbnb hasn't been public listed yet. Therefore, the investment is more illiquid in comparison with public-listed companies. Petersen and Plenborg (2012) recommend using a liquidity premium between 3-5% for illiquid stock[95]. We will use a liquidity premium of 4% for Airbnb. Because Airbnb is approaching its initial public offering and this coming exit option provides Airbnb more liquidity than other private firms, yet still being more illiquid than public firms.

The other special piece is the regulation premium. Regulatory risks can have negative impacts on the both the top line and the bottom line of the company. Therefore, it is necessary to compensate the investors for taking extra regulatory risks of their investments. As a result of the recent favourable regulations towards Airbnb, it is appropriate to set 2% extra cost of capital for the regulatory risks.

Hence:

$$r_e = r_f + \beta_e(r_m - r_f) + liquidity\ premium = 1.74\% + 0.835 * 6.12\% + 4\% + 2\% = 12.85\%$$

[92] Bloomberg, USGG10YR:IND, http://www.bloomberg.com/quote/USGG10YR:IND
[93] Aswath Damodaran,Total Betas by Sector (for computing private company costs of equity) – US, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/totalbeta.html
[94] Aswath Damodaran, Historical Implied Equity Risk Premiums, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/implpr.html
[95] Vriborg Petersen, C., & Plenborg, T. (2010). Financial Statement Analysis: Valuation, Credit Analysis and Executive Compensation. Prentice-Hall.

Meanwhile, we believe it is appropriate to assume that the cost of capital will gradually decrease in time and reach 8% at steady state. This assumption rests on that: 1) Airbnb becomes more mature and gain cheaper access to capital. 2) potential IPO would reduce the liquidity premium.

$$Intrinsic\ Value = \sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{n+1}}{WACC - g} \times \frac{1}{(1+WACC)^n}$$

$$Terminal\ Value = \frac{FCFF_{n+1}}{WACC - g}$$

The last thing that we need to estimate is the terminal growth rate (g). It represents the growth of Airbnb in perpetuity. The growth rate must be sustainable enough to make sure that the company will last perpetually. Therefore, we believe the global economic growth is an idea proxy for the terminal growth rate, i.e. 3.37%

By having all the numbers, we can simply plug it into the formula of intrinsic value.

		1	2	3	4	5	6	7	8	9	10	Terminal year
Free Cash Flow to the Firm		-238.31	-142.10	3.73	130.69	313.13	519.54	747.39	994.21	1257.33	1487.50	1826.61
Terminal value											22832.67	
Present value of FCFF		-211.18	-111.58	2.60	81.09	174.32	261.15	341.37	415.27	483.37	529.49	
Present value of terminal value											8127.55	
Cost of capital	12.85%	12.85%	12.85%	12.85%	12.15%	11.45%	10.75%	10.05%	9.35%	8.65%	8.00%	
Discount Factor		1.13	1.27	1.44	1.61	1.80	1.99	2.19	2.39	2.60	2.81	

Figure 21: Airbnb DCF Valuation

PV of cash flows during next 10 ye	$1,965.89
PV of terminal value	$14,043.28
Value of operating assets	$16,009.17
Probability of failure	10%
Intrinsic value of operating assets	$14,408.25

As we can observe from the above figure, the final intrinsic value of Airbnb is adjusted for the survival risk of 10%. After all the DCF valuation done, the intrinsic value of Airbnb is $14.41 billion.

6.2 Real Options Valuation

As mentioned in the theory part of real options, gauging the spot price, the exercise price, the volatility and the delta-t are the first steps of a binomial lattice option pricing model.

Spot Price:

The spot price is the present value of future positive cash flows from the expansion. Therefore, it is necessary to apply DCF for estimating the spot price. According to Reuters[96], estimated total bookings of Airbnb in 2015 is 80 million. The Global Independent Travel Report 2015[97] shows approximately 75% of the Europeans and 90% of the Americans travelled independently (Independent Travel means travelling without guided tours), which leave an average 17.5% (*from 1-(75%+90%)/2*) of the European and American tourists select guided tours instead of independent travel. Since the Airbnb travellers book their accommodation online with Airbnb instead of traditional tour providers, we believe they are to a certain degree more "independent" than European and American average. Therefore, we assume that percentage to be lower (15% of the Airbnb travellers need guided tours). Multiplying 80 million booking with this percentage gives us "number of bookings that need guided tours (packages)".

$$Total\ Bookings * \%\ of\ Bookings\ that\ want\ guided\ tours = Number\ of\ bookings\ that\ need\ guided\ tours$$

We further assume that the "% of bookings that want guided tours" remain the same for the forecasting period, while total bookings increase at the same rate of the revenue that we estimated earlier. In the meanwhile, the market penetration of the new tour package in "Number of bookings that need guided tours" is expected to start with 3% and end with 30% at the end of the forecasting period. The high market penetration is based on the fact that it is inside penetration. Attracting own customers to try out a new product is easier than acquiring new customers. Multiplying the market penetration rate with "Number of bookings that need guided tours" give us the annual package bookings.

$$Annual\ Package\ Bookings = Number\ of\ bookings\ that\ need\ guided\ tours * Market\ Penetration$$

Finally, annual revenue from travel packages can be computed by multiplying "annual package bookings" with "Package Price" and "Commission Rate".

[96] Reuters, Exclusive: Airbnb to double bookings to 80 million this year – investors, http://www.reuters.com/article/us-airbnb-growth-idUSKCN0RS2QK20150928
[97] Mafengwo & China Tourism Academy, Global Independent Travel Report 2015, http://bigfile31.mafengwo.net/M00/E2/C1/wKgBs1Z8yv2ANwWyAGeZQ_PQRuc178.pdf

The package price tested in San Francisco is $500 per person and $750 for two people. Due to the fact that there isn't any information about "number of people per booking" with Airbnb, we have to assume two people per booking is a standard size. Consequently, the price will be $750 and it shall increase at the same rate as the risk-free rate (i.e. 1.74%). As to the commission rate, we believe Airbnb is going to follow its rate from accommodation bookings, i.e. 12% in average.

In Millions	BASE (2015)	1	2	3	4	5	6	7	8	9	10	Terminal year
Airbnb annual bookings	80.00	143.98	206.52	268.90	332.30	397.86	466.69	539.87	618.51	703.74	829.92	926.56
% of bookings that want guided tours	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Number of bookings want guided tours	12.00	21.60	30.98	40.33	49.84	59.68	70.00	80.98	92.78	105.56	124.49	138.98
Market penetration		0.03	0.06	0.09	0.12	0.15	0.18	0.21	0.24	0.27	0.30	0.30
Total Package Bookings		0.65	1.86	3.63	5.98	8.95	12.60	17.01	22.27	28.50	37.35	41.70
Package price	750.00	763.05	776.33	789.84	803.58	817.56	831.79	846.26	860.98	875.97	891.21	906.71
commission fee	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Revenue		59.33	173.15	344.06	576.78	878.25	1257.73	1726.98	2300.52	2995.95	3994.02	4536.67
Cost of capital	12.85%	12.85%	12.85%	12.85%	12.15%	11.45%	10.75%	10.05%	9.35%	8.65%	8.00%	
PV of revenues		52.57	135.97	239.40	357.85	488.91	632.20	788.79	960.91	1151.76	1421.72	
Terminal Value	97984.14											
PV of terminal value	34878.57											
Sum of PVs	41108.65											

Figure 22: Airbnb Spot Price Valuation

Using the same cost of capital and the discount mechanism as DCF, the present value of future cash flows is estimated to be $41.1 billion, which is out spot price.

Exercise (Strike) Price:

In a call option, the exercise price is the cost of exercising the options. In other words, it is the present value of negative cash flows in the future.

Expanding into travel packages and guided tour market would naturally cost marketing and administrative expenses. However, we believe the operating margin will be better than the first several years after the launching of Airbnb, since the technology has been mature and the users have been attracted. In the meantime, it is also reasonable to assume that the new market will have a similar margin as the lodging service of Airbnb, as Airbnb acts only as a platform for both markets. Therefore, we assume the operating margins will start at -16.67% (which is the 2015 level in the DCF valuation in chapter 6.1) and end at 35% (which is the terminal year level in chapter 6.1).

By multiplying the estimated revenues (operating incomes) from the spot price calculation with (1-operating margins), we have derived the operating expenses.

$$Operating\ Expense = Operating\ Income * (1 - Operating\ Margin)$$

Again, we use the cost of capitals to discount the expenses to present values and then sum them with the PV of the terminal value. As we can observe from the figure, the exercise price is therefore $32.18 (billion)

	1	2	3	4	5	6	7	8	9	10	Terminal Year
Operating Incomes	69.215	202.013	401.405	672.911	1024.625	1467.348	2014.807	2683.940	3495.273	4659.692	5292.777
Operating Margin	-16.67%	0.10%	3.98%	7.86%	11.73%	15.61%	19.49%	23.37%	27.24%	31.12%	35.00%
Operating Expenses	80.75	201.81	385.44	620.05	904.40	1238.28	1622.14	2056.79	2543.01	3209.49	3440.30
Cost of capital	12.85%	12.85%	12.85%	12.85%	12.15%	11.45%	10.75%	10.05%	9.35%	8.65%	8.00%
PVs of costs	71.558	158.468	268.193	384.698	503.470	622.424	740.911	859.108	977.629	1142.455	
Terminal Value	74304.642										
PV of terminal value	26449.582										
Sum of PVs (costs)	32178.496										

Figure 23: Airbnb Exercise Price Valuation

Volatility:

Volatility is the uncertainty about the future cash flows and it is measured as standard deviation. Airbnb's history is less than a decade and provides very limited financial disclosure. Using adjusted historical standard deviation of the technology industry is believed to provide a more accurate result. In our case, we analysed the daily standard deviation of the 69 information technology firms (who are S&P 500 constituents) in the last five years (from 12/05/2011 to 12/05/2016)[98], and then annualized the standard deviation by multiplying the daily standard deviation with the square root of 252[99] to arrive annual standard deviation. The result shows 17.86% annual volatility and we believe that the volatility of Airbnb would be slightly higher than those public listed firms, because Airbnb is still a private company. Hence, the volatility is estimated to be 20% for Airbnb.

Delta-T(Δt):

Delta-T is a premise for calculating upside and downside size factors and it can be expressed as: $\frac{Time\ to\ expiration}{Periods}$. In the Airbnb case, we assumed five years' time to expiration. Because in the near future, Airbnb's unique business model allow it to introduce travel packages to existing users without competing with others. However, in the long run, other "me-too" players may enter Airbnb's market and exploit the value of the option and leave nothing for Airbnb. Correspondingly, we also assumed five periods where the management of Airbnb can reconsider their plan with the option. In that sense, it leaves us a delta-t of 1.

Upside and Downside factors:

[98] S&P Dow Jones Indices, S&P 500 Information Technology, http://us.spindices.com/indices/equity/sp-500-information-technology-sector

[99] There are 252 trading days in average in a year.

Upside factor "μ" and downside factor "d" decide incremental changes to the price of the underlying assets between nodes.

$$\mu = e^{volatility*\sqrt{\Delta t}} = Exp\big(20\% * Sqrt(1)\big) = 1.2214$$

$$d = \frac{1}{\mu} = 0.8187$$

Risk-neutral probabilities:

Risk neutrality probabilities "p" is the probability of an upward move and (1-p) is the probability of a downward move.

$$p = \frac{e^{r*\Delta t} - d}{u - d} = \frac{Exp(1.74\% * 1) - 0.8187}{1.2214 - 0.8187} = 0.4938$$

Forming the tree:

In this step, we are to multiply the spot price with the upside and downside factors to derive spot prices in the next period, and we shall continue doing that until five periods end.

					111.74585
				91.489762	
			74.905482		74.905484
		61.327422		61.327423	
	50.210646		50.210647		50.210647
41.109		41.109001		41.109001	
	33.657203		33.657203		33.657203
		27.556187		27.556187	
			22.561098		22.561098
				18.471465	
					15.123156

Figure 24: Binomial Calculation of Asset Price

Backward option value calculation:

Now we need to derive the value of the option at the end nodes and trace back to the present.

The option holder can't wait anymore because that is already the last period before the option expires. If the option is in the money, the holder will exercise it immediately to collect profit. If the option is out of the money, then the holder will let the option to expire, since exercising the option in that circumstance is not profitable.

After having the option value in the last nodes, it is time to backtrack the option value to the very first node. The formula of calculating option values is:

Spot	Strike	Option
111.7458	32.18	79.5658
74.90548	32.18	42.7255
50.2106	32.18	18.0306
33.6572	32.18	1.4772
22.5611	32.18	-9.6189
15.1232	32.18	-17.0568

Figure 25: Option Values at end nodes

$$C_{t,t} = e^{-r\Delta t}(C_{t+1,t+1} * p + C_{t+1,t} * (1 - p))$$

In the formula, $C_{t+1,t+1}$ and $C_{t+1,t}$ are the upside and downside nodes after $C_{t,t}$. By multiplying the option values from these nodes with the probability of an upside and downside move, we can get the future option value of having two future possibilities. Nonetheless, we must discount the future option value to time t, since there is time value of money as well. We can multiply the future option value with $e^{-r\Delta t}$, which is the risk-free discount rate, to arrive the spot option value at time t. In our case, we need to repeat the process for five times to get to the original option value. As we can observe from the figure, the option to expand brings $13.56 billion to Airbnb.

										S(5,5):	111.7458
										C(5,5):	79.5678
								S(4,4):	91.4898		
								C(4,4):	59.8668		
						S(3,3):	74.9055			S(5,4):	74.9055
						C(3,3):	43.8280			C(5,4):	42.7275
				S(2,2):	61.3274			S(4,3):	61.3274		
				C(2,2):	30.7860			C(4,3):	29.7045		
		S(1,1):	50.2106			S(3,2):	50.2106			S(5,3):	50.2106
		C(1,1):	20.7853			C(3,2):	19.1332			C(5,3):	18.0326
S(0,0):	41.1090			S(2,1):	41.1090			S(4,2):	41.1090		
C(0,0):	13.5615			C(2,1):	11.7519			C(4,2):	9.4861		
		S(1,0):	33.6572			S(3,1):	33.6572			S(5,2):	33.6572
		C(1,0):	6.9861			C(3,1):	4.9601			C(5,2):	1.4792
				S(2,0):	27.5562			S(4,1):	27.5562		
				C(2,0):	2.5801			C(4,1):	0.7178		
						S(3,0):	22.5611			S(5,1):	22.5611
						C(3,0):	0.3483			C(5,1):	0.0000
								S(4,0):	18.4715		
								C(4,0):	0.0000		
										S(5,0):	15.1232
										C(5,0):	0.0000

Figure 26:14 Binomial Tree

7. Discussion

Almost immediately after looking at the valuation results, we can observe that the intrinsic value achieved from DCF valuation ($14.1 billion) is not capable of explaining the entire implied valuation of $25.5 billion that is derived from the latest financing round. We further select two major value drivers of Airbnb, the overall market growth rate, and the market share that Airbnb will command after the forecasting period, to study their impacts on the DCF valuation. As the figure illustrates, the valuation of Airbnb from DCF will only exceed its implied valuation when both factors increase 33% on our base value (25% market share and 11.64% growth rate).

			Overall Market Growth Rate		
		11.64%	12.8%	14.1%	15.5%
	25.0%	14.41	15.79	17.45	19.46
Market	27.5%	15.82	17.34	19.16	21.34
Share	30.3%	17.37	19.04	21.05	23.47
	33.3%	19.07	20.91	23.12	25.78

Figure 27: Scenarios of reaching implied valuation

Then, can both factors display such increase? Not that probable. We divide the overall market growth into economic growth, additional tourism growth and incremental online lodging tendency, when we estimate the overall market growth rate. The estimates for all three parts come from solid data and is therefore reasonably reliable. It is possible that the overall market growth rate exhibits some peaks among the periods, which may reach 15.5%. But it is not likely that the rate can remain at 15.5% level for the entire forecasting period.

On the other hand, the OTA industry has two large incumbents: Priceline and Expedia. Two firms together share approximately 40% of global online accommodations in 2015, and both of them are showing convincing growth year over year. It is both difficult and costly for Airbnb to fight with them for more shares. This is especially the case because: 1) Airbnb has the disadvantages in terms of privacy, safety and amenities. 2) competition would further reduce the bottom line, which in return, decrease the overall valuation. Therefore, reaching 33.3% global shares after 10 years instead of 25% is not that likely to happen.

More importantly, above two conditions (market share and market growth) must both be met at the same time so as to reach the $25.5 billion valuation. Hence, we are confident that the DCF valuation alone is not capable of explaining the value of Airbnb.

Combining the intrinsic value and the option value of Airbnb give us a valuation of $28 billion, which is 2.5 billion higher than the implied valuation. Where does the 2.5-billion-dollar spread comes from?

While most of our assumptions have solid grounds, the revenue per travel package booking and the time to expiration of the option may need further information. The former is the product of the average price of travel packages per booking and the commission rate for travel packages. More data about the number of people per booking and the planned sales price of the packages will make the sales price per booking more accurate. In addition, it is also possible that Airbnb will introduce a different commission rate for travel packages. Together, the sales price per booking and the commission rate change the revenue per travel package booking, which eventually impact the spot price of the option.

The latter (time to expiration) has a notable impact on the option value. The value of the option would be lower, if Airbnb has less time to decide whether and when they should enter the new market.

Nonetheless, our valuation is considered rather conservative. We follow Professor. Damodaran's suggestion to make the option pricing model simpler and more straightforward. Moreover, we adjust the cost of capital on the basis of liquidity and regulatory premium, which significantly reduce the value of Airbnb. Furthermore, the potential synergy effect between lodging service and travel package service is not incorporated in the valuation. It is possible that the travel package service will not only benefit from the technology setup and the user base of Airbnb, but also capable of attracting new customers for the lodging service in return. This value is not incorporated in the valuation because: 1) It is outside of the scope of the study, 2) It is difficult to measure the exact amount of value that it would provide, 3) We try to stay conservative and not overdraw the future potential, which may bring valuation bubbles.

In summary, despite lacking of data in a few assessments, our valuation stays inside the safe line and it is meant to establish an explanatory and meaningful "floor" for the valuation. It will not surprise us if Airbnb enters an Initial Public Offering this year with a valuation that is slightly higher than our valuation (say $30 billion). In the meantime, since the spot price of the option to expand exceed the strike price (i.e. an in-the-money option), it is reasonable to believe that we will see Airbnb launching its new travel package service anytime soon.

8. Sensitivity Analysis

In order to get to know the most direct endogenous value drivers of Airbnb, a sensitivity analysis is conducted upon the valuation. “Global Online Lodging Market Share”, “WACC”, “Inside Travel Package Share”, “Operating Margin” and “Time to Expiration” are selected as the internal value drivers. Other factors such as overall market size and travellers’ preference of travel packages are considered exogenous and therefore uncontrollable.

The sensitivity analysis is conducted using scenarios. While our valuation serves as the base case, a best case of 20% upward adjustment and a worst case of 20% downward adjustment on value drivers tell us their impacts on the total valuation of Airbnb. The greater impact they make on the total valuation, the more sensitive they are to the valuation. The adjustments are made by keeping all other value drivers fixed and therefore the impact on the valuation solely come from the change of the specific value driver.

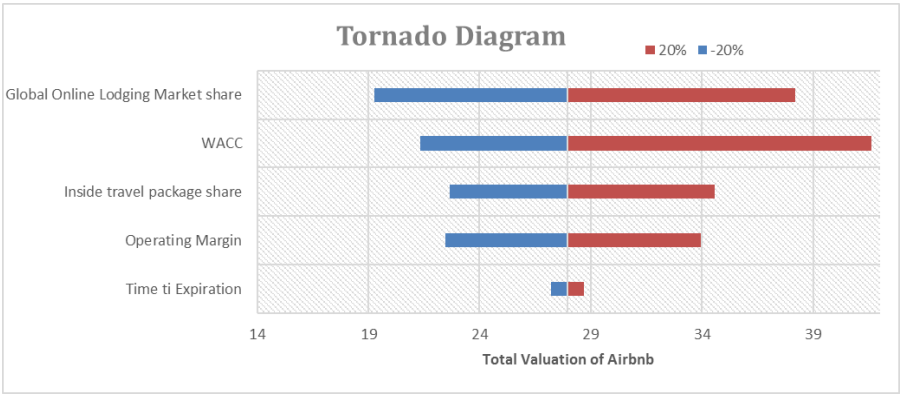

Figure 28: Sensitivity Analysis (Tornado Diagram)

As the figure illustrates, the global online lodging market share of Airbnb and the cost of capital (WACC) are the most sensitive value drivers of Airbnb. While the former has a balanced impact on the valuation, the impact of the latter has a longer right tail. It means that the WACC has a higher impact of raising the valuation than reducing the valuation. This is a common phenomenon for the WACC because a large part of the present value of a company comes from the terminal value. When calculating the terminal value, we have the discount rate (WACC) at denominator (see formula).

$$Terminal\ Value = \frac{Cash\ Flow_{n+1}}{(discount\ rate - growth\ rate)}$$

The growth rate doesn’t change along with the discount rate. Therefore, the change to the denominator is greater, when the discount rate falls and gets closer to the growth rate. The total value of Airbnb

increases when the discount rate falls. Hence, the impact of the WACC is stronger at increasing the value of Airbnb. The discount rate (WACC) is used not only in the DCF analysis, but also in measuring the spot and exercise prices of the binomial lattices. Therefore, it is intuitive that it plays such an important role at valuation.

The global online lodging market share is a fundamental value driver of Airbnb's valuation. It directly links to the top line and the bottom line of the firm and thereby makes its impact on the DCF valuation. Furthermore, the market share in the primary market helps Airbnb in attracting existing users to try out other products of the firm. In our case, the market share in the primary market provides the option to expand into a second market: travel packages. It is the customer source of the travel packages service. In the valuation process, we used "Airbnb annual bookings", which is a numerical representation of the market share in the primary market, to carry out the calculation of the spot price for option pricing. Therefore, it has a strong impact on both DCF and the real option valuation.

"Inside travel package share" directly impact the cash flows from the option (which affects both spot and exercise prices of the option), while "operating margin" has command on the profitability on the primary market and it determines the exercise price of the option. These two factors have considerable influences on the valuation as well.

At last, the "time to expiration" is one factor that concerns the calculation of the real option. Its significance in option pricing is supposed to be much stronger than we have observed from the figure. It allows the option holder to wait for the best opportunity of exercising. Nonetheless, the option in our case is an in-the-money option. Unlike out-of-the-money options, which the holders HAVE TO wait for a long time and expect the spot price will overtake the exercise price in the period so that they can get the profit. An in-the-money option holder (Airbnb) can exercise the option (enter the travel packages market) and claim the profit right now. Since waiting is not a must for Airbnb, the length of waiting (time to expiration) no longer make a huge difference in the value of the option. In the meanwhile, "time to expiration" doesn't affect the value from DCF analysis. No wonder why it makes so little difference in the total valuation.

To sum up, Airbnb would need to focus on gaining more market share in its primary market as well reducing its cost of capital, so as to get a higher valuation and thereby to receive more from the potential financing rounds and the IPO.

8.1 Finding

From our sensitivity analysis, we have found that the market share of the primary market is the most sensitive value driver for Airbnb (besides the "forever important WACC"). What is the market share? The more people that use Airbnb as their online accommodation solution, the more market share Airbnb will get. Thus, we can say that the size of the user base is the core value driver of Airbnb. We further believe that this finding can be applied to all the tech disruptors. The more users a tech disruptor has, the higher chance the company can introduce new products/services to them. That is a primary source of the option value to expand.

Today, Google is building its ecosystem (Gmail, Search, Android, YouTube, etc.), Apple is building its ecosystem (IPhone, iPad, iCloud, Apple Pay.), every tech firm else is building its own ecosystem. We've seen many billion-worth acquisitions (such as WhatsApp) that doesn't make (much) direct cash flows on its own. But the user base that is acquired provided the acquirer the opportunity of cross-selling. For private tech disruptors, they seek to expand into a second market and thereby selling new products/services to their existing users. For public tech firms, they develop and acquire new products, so that the existing users of each product get the chance of buying other products in the ecosystem. The more users and products a company has, the more valuable the company becomes.

The subsidy battle between Uber and Didi[100] in China is exactly a battle for users. From time to time, Uber and Didi send subsidy promo codes to their users. The size of the subsidies varies from 30% of the fare to 100%. Both Uber and Didi burn billions of dollar each year in China just to fight for users. The value of users to technology firms is, therefore, evident. It not only improves the top lines of tech disruptors in the primary market, but also embed future opportunities in a secondary or even a tertiary market.

[100] Didi is a rival of Uber and it is the No.1 taxi hailing service app in China.

9. Conclusion

The PEST ROAD analysis framework that was developed in the early sections provided us all we need to value a technology disruptor like Airbnb. Its comprehensive and targeted coverage of a tech disruptor have been supporting us on our way of making educated assumptions, which are valuable inputs at the valuation stage. The PEST ROAD model takes external analysis to understand the macro environmental factors that drive the future trend of the industry, and then the "Advantages" and "Disadvantages" from the internal analysis help to locate the disruptor into the industry. Together, they are meant to estimate the market share of the disruptor in a specific industry that is exhibiting a certain trend. Meanwhile, "Risks" are unique value drivers for disruptors, since they typically face visible regulatory and survival risks. Taking these risks into account helps in terms of discounting the value of the disruptor. Finally, "Options" define potential business initiatives that have been embedded in the firm but not activated yet. For disruptors, it is often the option to expand that adds on top of the intrinsic value from operating activities and completes the valuation of the disruptor.

In the valuation methods section, we studied the theory of DCF and option pricing models. We also identified the most suitable option pricing model (i.e. binomial lattices) for valuing technology disruptors. At the valuation stage, we used information generated from the analysis to make best possible assumptions. In our valuation of Airbnb, the intrinsic value of operating activities worth $14.11 billion, while the option to expand worth $13.56 billion. If we valued Airbnb in a traditionally way, we would have missed almost half of its valuation. It's self-evident that real options play crucial roles at valuing technology disruptors.

In the discussion, we were convinced that DCF valuation alone was not capable of generating the implied valuation from the latest financing round of Airbnb. The significance of real options valuation for disruptors was, therefore, further enhanced. In addition, the spread between our valuation and the implied valuation was presented and discussed.

In the sensitivity analysis, several key value drivers were found and discussed. The importance of the size of the user base was urged in the finding. We further argued the general applicability of the finding on other tech disruptors.

In summary, the developed analysis framework has been proved to be helpful, practical and explanatory. It provides a guidance for the valuation process of private tech disruptors, and it improves the valuation accuracy as well. Meanwhile, the significant role of real options in valuing tech disruptors has been demonstrated, and the size of the user base is a core value driver for disruptive innovations.

Additional research may focus on developing a generalized theory about how the size of the user base impacts the valuation of tech disruptors as well as a quantitative approach that gauging the valuation of tech disruptors by using the size of the user base.

Bibliography:

Literatures:

1. Aarle, R. (2013). A Real-Options approach to company valuation.
2. Al-Debei, M. M., El-Haddadeh, R., & Avison, D. (2008). Defining the business model in the new world of digital business. In Proceedings of the Americas Conference on Information Systems (AMCIS) (Vol. 2008, pp. 1-11).
3. Amram, M., & Kulatilaka, N. (2000). Strategy and shareholder value creation: The real options frontier. Journal of Applied Corporate Finance, 13(2), 15-28.
4. Bang, K. E., & Markeset, T. (2012). Identifying the Drivers of Economic Globalization and the Effects on Companies' Competitive Situation. IFIP Advances in Information and Communication Technology 384, 233.
5. Block, S. (2007). Are "real options" actually used in the real world?. The engineering economist, 52(3), 255-267.
6. Borison, A. (2005). Real options analysis: where are the emperor's clothes?. Journal of applied corporate finance, 17(2), 17-31.
7. Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2012). Principles of corporate finance. Tata McGraw-Hill Education.
8. Copeland, T. E., Antikarov, V., & Copeland, T. E. (2001). Real options: a practitioner's guide (p. 4). New York: Texere.
9. Cox, J. C., Ross, S. A., & Rubinstein, M. (1979). Option pricing: A simplified approach. Journal of financial Economics, 7(3), 229-263.
10. Damodaran, A. (2005). The promise and peril of real options.
11. Downes, L. (1997). Beyond Porter. Context Magazine.
12. Flower, E. (2004). Competition, technology, and planning: preparing for tomorrow's library environment. Information Technology and Libraries, 23(2), 67.
13. Hull, J. C., Options, Futures, and Other Derivatives (2009).
14. Imam, S., Barker, R., & Clubb, C. (2008). The use of valuation models by UK investment analysts. European Accounting Review, 17(3), 503-535.
15. Longstaff, F. A., & Schwartz, E. S. (2001). Valuing American options by simulation: a simple least-squares approach. Review of Financial studies, 14(1), 113-147.
16. McGrath, R. G., & MacMillan, I. C. (2000). The entrepreneurial mindset: Strategies for continuously creating opportunity in an age of uncertainty (Vol. 284). Harvard Business Press.
17. Myers, S. C. (1977). Determinants of corporate borrowing. Journal of financial economics, 5(2), 147-175.
18. Myers, S. C. (1984). Finance theory and financial strategy. Interfaces, 14(1), 126-137.
19. O'shaughnessy, J. (1984). Competitive marketing: a strategic approach. Boston: Allen & Unwin.
20. Osterwalder, A., & Pigneur, Y. (2010). Business model generation
21. Porter, M. E. (2008). The five competitive forces that shape strategy.
22. Richard J. Speed, (1989) "Oh Mr Porter! A Re-Appraisal of Competitive Strategy", Marketing Intelligence & Planning, Vol. 7 Iss: 5/6, pp.8 – 11
23. Saunders, M., Lewis, P., & Thornhill, A. (2007). Research Methods for Business Students, (6th ed.) London: Pearson.
24. Second level disruption: entering and disrupting another market beside its primary market.
25. Smit, H. T. J., & Trigeorgis, L. (2004). Corporate Finance and Strategic Planning: A Linkage. Princeton
26. Thurlby, B. (1998). Competitive forces are also subject to change. Management decision, 36(1), 19-24.

27. Triantis, A. J. (1999). A View Through a Real Options Lens. Real Options and Business Strategy: Applications to Decision-Making, 39–58
28. Triantis, A., & Borison, A. (2001). Real options: state of the practice. Journal of Applied Corporate Finance, 14(2), 8-24.
29. Trigeorgis, L. (1988). A conceptual options framework for capital budgeting. Advances in Futures and Options Research, 3(3), 145-167.
30. Trigeorgis, L. (2005). Making use of real options simple: An overview and applications in flexible/modular decision making. The Engineering Economist, 50(1), 25-53.
31. University Press.
32. Van Putten, A. B., & MacMillan, I. C. (2004). Making real options really work. Harvard business review, 82(12), 134-142.
33. Vriborg Petersen, C., & Plenborg, T. (2010). Financial Statement Analysis: Valuation, Credit Analysis and Executive Compensation. Prentice-Hall.

Internet Sources:

34. Yahoo Finance, http://finance.yahoo.com/echarts?s=%5EIXIC+Interactive#symbol=%5EIXIC;range=my, Accessed 10/02/16
35. Aswath Damodaran, “Musings on Markets”, http://aswathdamodaran.blogspot.dk/, Accessed 10/02/16
36. Aswath Damodaran, “A Disruptive Cab Ride to Riches: The Uber Payoff”, Musings on Markets, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1, Accessed 10/02/16
37. Clayton M. Christensen, Disruptive Innovation, http://www.claytonchristensen.com/key-concepts/, Accessed 10/02/16
38. Clayton M. Christensen, Michael E. Raynor and Rory McDonald, “What is disruptive innovation”, Harvard Business Review, December 2015, https://hbr.org/2015/12/what-is-disruptive-innovation, Accessed 10/02/16
39. Certify, “Sharing the Road: Business Travelers Increasingly Choose Uber”, https://www.certify.com/infograph-sharing-the-road.aspx, Accessed 10/02/16
40. The Washington Post, “What the legendary Clayton Christensen gets wrong about Uber, Tesla and disruptive innovation”, https://www.washingtonpost.com/news/innovations/wp/2015/11/23/what-the-legendary-clayton-christensen-gets-wrong-about-uber-tesla-and-disruptive-innovation/, Accessed 10/02/16
41. Wikipedia, “Disruptive Innovation”, https://www.wikiwand.com/en/Disruptive_innovation, Accessed 10/02/16
42. Avi Dan, “Kodak Failed By Asking The Wrong Marketing Question”, Forbes, 2012, http://www.forbes.com/sites/avidan/2012/01/23/kodak-failed-by-asking-the-wrong-marketing-question/#7b38c67b7dd7, Accessed 25/02/16
43. Harvard Business School, Michael E. Porter, http://www.hbs.edu/faculty/Pages/profile.aspx?facId=6532, Accessed 25/02/16
44. Steve Denning, “What Killed Michael Porter's Monitor Group? The One Force That Really Matters”, Forbes. http://www.forbes.com/sites/stevedenning/2012/11/20/what-killed-michael-porters-monitor-group-the-one-force-that-really-matters/#fca6fcd733c7, Accessed 25/02/16
45. PEST Analysis, Wikipedia, https://www.wikiwand.com/en/PEST_analysis, Accessed 25/02/16
46. Aswath Damodaran, A Disruptive Cab Ride to Riches: The Uber Payoff, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1, Accessed 25/02/16
47. Options, Wikipedia, https://www.wikiwand.com/en/Option_(finance) , Accessed 25/03/16
48. Real Options, Wikipedia, https://www.wikiwand.com/en/Real_options_valuation, Accessed 25/03/16
49. “A Disruptive Cab Ride to Riches: The Uber Payoff”, Aswath Damodaran, http://aswathdamodaran.blogspot.dk/2014/06/a-disruptive-cab-ride-to-riches-uber.html?m=1, Accessed 25/03/16

50. Airbnb Overview, CrunchBase, https://www.crunchbase.com/organization/airbnb#/entity, Accessed 25/03/16
51. About us, Airbnb, https://www.airbnb.com/about/about-us, Accessed 25/03/16
52. The Unicorn List, Fortune, http://fortune.com/unicorns/, Accessed 25/03/16
53. The Wall Street Journal, "Airbnb Raises Over $100 Million as It Touts Strong Growth", http://www.wsj.com/articles/airbnb-raises-over-100-million-as-it-touts-strong-growth-1448049815, Accessed 25/03/16
54. Yahoo Finance, http://finance.yahoo.com/q/ks?s=IHG+Key+Statistics, Accessed 25/03/16
55. Bloomberg, The Sharing Economy Doesn't Share the Wealth, http://www.bloomberg.com/news/articles/2016-04-06/the-sharing-economy-doesn-t-share-the-wealth, Accessed 25/03/16
56. Fox News, "10 incredible Airbnb horror stories", http://www.foxnews.com/travel/2014/05/08/10-incredible-airbnb-horror-stories.html, Accessed 25/03/16
57. The Paper, "San Francisco Airbnb referendum: money politics or the broader evolution of capitalism", http://www.thepaper.cn/newsDetail_forward_1406896, Accessed 25/03/16
58. CNN Money, "Hilton: We're not scared of Airbnb", http://money.cnn.com/2015/10/28/investing/airbnb-hilton-hotels/, Accessed 25/03/16
59. Airbnb, "In what areas is Occupancy Tax Collection and Remittance by Airbnb available?", https://www.airbnb.com/help/article/653/in-what-areas-is-occupancy-tax-collection-and-remittance-by-airbnb-available?locale=en, Accessed 25/03/16
60. Morgan Stanley Research, "Internet, Lodging, Leisure and Hotels: Global Insight: Who Will Airbnb Hurt More - Hotels or OTAs" , Accessed 25/04/16
61. U.S. Travel Association, "U.S. Travel Answer Sheet", 2013, Accessed 25/04/16
62. MarketWatch, "Airbnb poses long-term threat to online travel sites like Priceline", http://www.marketwatch.com/story/airbnb-poses-long-term-threat-to-online-travel-sites-like-priceline-2015-06-23, Accessed 25/04/16
63. Morgan Stanley Research, "Internet, Lodging, Leisure and Hotels: Global Insight: Who Will Airbnb Hurt More - Hotels or OTAs" , Accessed 25/04/16
64. Nielsen, "GLOBAL CONSUMERS' TRUST IN 'EARNED' ADVERTISING GROWS IN IMPORTANCE", http://www.nielsen.com/us/en/press-room/2012/nielsen-global-consumers-trust-in-earned-advertising-grows.html, Accessed 25/04/16
65. Reuters," Airbnb Celebrates Record Growth With 10 Million Guest Nights Booked", http://www.reuters.com/article/idUS84470+19-Jun-2012+MW20120619, Accessed 25/04/16
66. Airbnb Blog, http://blog.airbnb.com/airbnb-celebrates-1000000-nights-booked/, Accessed 25/04/16
67. Reuters, "Exclusive: Airbnb to double bookings to 80 million this year – investors", http://www.reuters.com/article/us-airbnb-growth-idUSKCN0RS2QK20150928, Accessed 25/04/16
68. Fortune, Airbnb Pushes Into Tourism With Travel Recommendations and Guidebooks, http://fortune.com/2016/04/19/airbnb-travel-recommendations/, Accessed 25/04/16
69. Telegraph, "13 months: how long it will take Paris to recover", http://www.telegraph.co.uk/travel/destinations/europe/france/paris/articles/13-months-how-long-it-will-take-Paris-to-recover/, Accessed 25/04/16
70. International Monetary Fund, WORLD ECONOMIC OUTLOOK, http://www.imf.org/external/pubs/ft/weo/2016/update/01/pdf/0116.pdf, Accessed 25/04/16

71. National Bureau of Statistics of People's Republic of China, http://www.stats.gov.cn/tjsj/zxfb/201601/t20160119_1306083.html, Accessed 25/04/16
72. China National Tourism Administration, http://www.cnta.com/xxfb/xwlb/201601/t20160119_758473.shtml, Accessed 25/04/16
73. Financial Times, "Chinese tourism spending leaps 53% in a year", http://www.ft.com/cms/s/3/62ef31e4-eb92-11e5-888e-2eadd5fbc4a4.html#axzz47LZ21N26, Accessed 06/05/16
74. Børsen, "Kinesiske turister skal lokkes til Danmark", http://cms.borsen.dk/nyheder/avisen/artikel/11/140156/artikel.html
75. Peopl.cn, http://politics.people.com.cn/n/2015/0612/c1001-27143289.html, Accessed 06/05/16
76. Net Ease, http://money.163.com/12/0911/15/8B4NFUSF00253B0H.html, Accessed 06/05/16
77. Forbes, Strong Growth Abroad Lifts Priceline's Results, http://www.forbes.com/sites/greatspeculations/2014/08/18/strong-growth-abroad-lifts-pricelines-results/#293f23e437f2, Accessed 06/05/16
78. Booking.com, Booking.com's Mobile Bookings Grow 160% in 2013, http://news.booking.com/bookingcoms-mobile-bookings-grow-260-in-2013, Accessed 06/05/16
79. World Tourism Organization, Tourism Highlights 2015, http://www.e-unwto.org/doi/pdf/10.18111/9789284416899, Accessed 06/05/16
80. International Monetary Fund, http://www.imf.org/external/pubs/ft/weo/2015/01/weodata/weorept.aspx?pr.x=21&pr.y=15&sy=2006&ey=2016&ssd=1&sort=country&ds=.&br=1&c=001%2C110%2C163%2C200&s=NGDP_RPCH&grp=1&a=1, Accessed 06/05/16
81. PwC, How can hotels achieve the right kind of growth in a digital age? A toolkit for fighting commoditisation, http://pdf.pwc.co.uk/how-can-hotels-achieve-the-right-kind-of-growth.pdf, Accessed 10/05/16
82. Fortune, Here's how Airbnb justifies its eye-popping $24 billion valuation, http://fortune.com/2015/06/17/airbnb-valuation-revenue/, Accessed 10/05/16
83. Aswath Damodaran, Musing On Markets, http://aswathdamodaran.blogspot.dk/2013/10/twitter-announces-ipo-valuation.html, Accessed 10/05/16
84. Bloomberg, USGG10YR:IND, http://www.bloomberg.com/quote/USGG10YR:IND, Accessed 10/05/16
85. Aswath Damodaran,Total Betas by Sector (for computing private company costs of equity) – US, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/totalbeta.html, Accessed 10/05/16
86. Aswath Damodaran, Historical Implied Equity Risk Premiums, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/implpr.html, Accessed 10/05/16
87. Reuters, Exclusive: Airbnb to double bookings to 80 million this year – investors, http://www.reuters.com/article/us-airbnb-growth-idUSKCN0RS2QK20150928, Accessed 10/05/16
88. Mafengwo & China Tourism Academy, Global Independent Travel Report 2015, http://bigfile31.mafengwo.net/M00/E2/C1/wKgBs1Z8yv2ANwWyAGeZQ_PQRuc178.pdf, Accessed 10/05/16
89. S&P Dow Jones Indices, S&P 500 Information Technology,http://us.spindices.com/indices/equity/sp-500-information-technology-sector, Accessed 14/05/16

Appendices:

Airbnb DCF Valuation Sheet

(in millions)	**Base Year**	**1**	**2**	**3**
Overall market	$12,413.79	$13,859.23	$15,472.97	$17,274.61
Share of market (gross)	7.25%	11.69%	15.02%	17.51%
Annual Revenue	$900.00	$1,619.80	$2,323.36	$3,025.08
Operating margin	-16.67%	0.10%	3.978%	7.856%
Operating Income	-$150.00	$1.62	$92.42	$237.64
Tax rate	0.00%	0.00%	0.00%	0.00%
- Taxes	$0.00	$0.00	$0.00	$0.00
After-tax operating income	-$150.00	$1.62	$92.42	$237.64
Sales/Capital Ratio	3.00	3.00	3.00	3.00
- Reinvestment	153.33	$239.93	$234.52	$233.91
		1	**2**	**3**
Free Cash Flow to the Firm		-238.31	-142.10	3.73
Terminal value				
Present value of FCFF		-211.18	-111.58	2.60
Present value of terminal value				
Cost of capital	12.85%	12.85%	12.85%	12.85%
Discount Factor		1.13	1.27	1.44

4	**5**	**6**	**7**	**8**	**9**	**10**	**Terminal year**
$19,286.03	$21,531.66	$24,038.77	$26,837.79	$29,962.73	$33,451.53	$37,346.56	$41,695.12
19.38%	20.79%	21.84%	22.63%	23.22%	23.67%	25.00%	25.00%
$3,738.36	$4,475.97	$5,250.28	$6,073.57	$6,958.24	$7,917.06	$9,336.64	$10,423.78
11.733%	15.611%	19.489%	23.367%	27.244%	31.122%	35.00%	35.00%
$438.63	$698.75	$1,023.22	$1,419.19	$1,895.73	$2,463.96	$3,267.82	$3,648.32
16.00%	20.00%	24.00%	28.00%	32.00%	36.00%	40.00%	40.00%
$70.18	$139.75	$245.57	$397.37	$606.64	$887.03	$1,307.13	$1,459.33
$368.45	$559.00	$777.65	$1,021.82	$1,289.10	$1,576.94	$1,960.69	$2,188.99
3.00	3.00	3.00	3.00	3.00	3.00	3.00	$3.00
$237.76	$245.87	$258.10	$274.43	$294.89	$319.60	$473.19	$362.38
4	**5**	**6**	**7**	**8**	**9**	**10**	**Terminal year**
130.69	313.13	519.54	747.39	994.21	1257.33	1487.50	1826.61
						39451.70	
81.09	174.32	261.15	341.37	415.27	483.37	529.49	
						14043.28225	
12.15%	11.45%	10.75%	10.05%	9.35%	8.65%	8.00%	
1.61	1.80	1.99	2.19	2.39	2.60	2.81	

PV of cash flows during next 10 years =	$1,965.89
PV of terminal value	$14,043.28
Value of operating assets	$16,009.17
Probability of failure	10%
Intrinsic value of operating assets	$14,408.25

Airbnb Spot Price DCF Sheet:

In Millions	BASE (2015)	1	2	3
Airbnb annual bookings	80.00	143.98	206.52	268.90
% of bookings that want guided tours	15%	15%	15%	15%
Number of bookings want guided tours	12.00	21.60	30.98	40.33
Market penetration		3%	6%	9%
Total Package Bookings		0.65	1.86	3.63
Package price	750.00	763.05	776.33	789.84
commission fee	0.12	0.12	0.12	0.12
Revenue		59.33	173.15	344.06
Cost of capital	12.85%	12.85%	12.85%	12.85%
PV of revenues		52.57	135.97	239.40
Terminal Value	97984.14			
PV of terminal value	34878.57			
Sum of PVs	41108.65			

4	5	6	7	8	9	10	Terminal year
332.30	397.86	466.69	539.87	618.51	703.74	829.92	926.56
15%	15%	15%	15%	15%	15%	15%	15%
49.84	59.68	70.00	80.98	92.78	105.56	124.49	138.98
12%	15%	18%	21%	24%	27%	30%	30%
5.98	8.95	12.60	17.01	22.27	28.50	37.35	41.70
803.58	817.56	831.79	846.26	860.98	875.97	891.21	906.71
0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
576.78	878.25	1257.73	1726.98	2300.52	2995.95	3994.02	4536.67
12.15%	11.45%	10.75%	10.05%	9.35%	8.65%	8.00%	
357.85	488.91	632.20	788.79	960.91	1151.76	1421.72	

Airbnb Exercise Price DCF Sheet

	1	2	3	4	5
Operating Incomes	69.215	202.013	401.405	672.911	1024.625
Operating Margin	-16.67%	0.10%	3.98%	7.86%	11.73%
Operating Expenses	80.75	201.81	385.44	620.05	904.40
Cost of capital	12.85%	12.85%	12.85%	12.85%	12.15%
PVs of costs	71.556	158.468	268.193	384.698	503.470
Terminal Value	74304.642				
PV of terminal value	26449.582				
Sum of PVs (costs)	32178.494				

6	7	8	9	10	Terminal Year
1467.348	2014.807	2683.940	3495.273	4659.692	5292.777
15.61%	19.49%	23.37%	27.24%	31.12%	35.00%
1238.28	1622.14	2056.79	2543.01	3209.49	3440.30
11.45%	10.75%	10.05%	9.35%	8.65%	8.00%
622.424	740.911	859.108	977.629	1142.455	