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Preferred securities in early stage start-up financing and their impact on valuation

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I. Introduction

The extraordinary expansion of economic activity and the evolution of entrepreneurship through history brought to the massive figure of today's 30.2 million businesses registered in the U.S. alone and millions of new businesses established every year globally, the financial system evolved accordingly, developing a system of financing for all the types, stages and forms of businesses. New contracts and financial instruments are born every day to serve businesses and investors in different activities, from multinational companies forming a joint venture and injecting capital in the new company through a capital increase to a small business opening a new business unit and raising debt through a loan from a local bank, from an established company operating in a mature market raising debt through a bond issuance to a start-up developing new technologies for an unexplored market raising equity from an angel investor[1]. In the past economic activity has always had the distinction between established activities that would generate stable cash flows and new risky "ventures" like merchant and maritime expeditions, the first category has always been financed with debt as it often could collateralize existing assets and repay loans with a continuous stream of cash flows, while the second category, for example a maritime expedition, would yield a single cash flow at the end of the venture that could either be positive or negative depending on the expedition outcome. Investments with these characteristics have always required different forms of financing, the presence of equity financing and rudimentary venture capital in addition to debt already in the Mesopotamian civilization shows that the financial system at that time had already developed securities that revealed to be similar to the ones used in today's venture capital. A merchant venture exploring new territories, as well as a start-up developing new software applications don't have assets to collateralize and their businesses have an extremely variable range of outcomes, these activities require financing arrangements that would take into account the risky characteristics of the business and would manage the absence of collateral, therefore the use of traditional debt financing is avoided in favour of new forms of equity financing like profit sharing contracts. These rudimentary forms of financing laid the foundation for the evolution of venture capital financial contracts towards today's complex preferred securities issued in the investment rounds led by venture capital firms, forms equity financing with features of debt and superior governance and cash flow rights. The characteristics of venture capital generated interest in research from a theoretical perspective because it "encompasses the extremes of many corporate finance challenges: uncertainty, information asymmetry, and asset intangibility. At the same time, from an empirical and policy perspective, venture capital has had a disproportionate impact, even though only 0.2% of all firms receive venture funding" (Kaplan 2016). Venture capital plays a central role in economic development as it acts in support of innovation and advancement in technology, as confirmed by Kaplan and Lerner (2009) that in their study found that roughly 50% of the "entrepreneurial" IPOs in recent years are venture-backed, this success is only part of the success of venture-backed firms as IPOs represent only a small fraction of successful exits, as shown in the graph in **Appendix 1**. Recent literature ranges from studies on financial contracting and governance such as the studies of Kaplan and Stromberg (2003, 2004) to risk and return analyses such as the studies of Cochrane (2005) and Korteweg and Nagel (2016), as well as studies on the relation between the

[1] Private investors that actively invest in new ventures, often in the early stages

financial contracting system of venture capital and return characteristics of the asset class like the study of Cummings (2008). While traditional literature has been primarily focused on Venture capital investments as an asset class and on the governance aspect preferred securities' superior rights, the real practice characterized by high valuations and exotic preferred securities recently brought different scholars to question the impact of venture capital financing on the capital structure and valuation of the company and to develop methodologies to model the variable cash flow rights arising from the complex provisions typical of venture capital financing contracts. Metrick and Yasuda formally treated Venture Capital as a branch of corporate finance in their manual "Venture Capital and the finance of innovation" (2010), where they developed a framework for the valuation of VC investments that combines financial contracting and contingent claims models; Gornall and Strebulaev (2018) had the same approach in their study, in which they performed a valuation of 135 U.S. unicorns[2] using a similar model and found that the securities used in venture capital strongly influence other investor classes and the overall valuation of the firm, highlighting the misuse of post-money valuation metric by showing that the "fair value" of the securities issued in VC rounds is deeply different from the value resulting from post-money valuation. This study, in line with this branch of research, aims to explain the impact of venture capital financing on the value of common securities and on the overall valuation of the firm through an analysis of the characteristics and the valuation of the preferred securities issued in these investment rounds, in particular the study analyses a standard early stage[3] financing contract. The analysis is conducted on the Series A term sheet proposed by the "Angel Capital Association", the largest association of angel investors in the United States, and consists in the valuation of the securities arising from a hypothetical financing round with the model developed by Metrick and Yasuda and the comparison with the value reported in post-money valuation, the results are then explained through an analysis of the complex incentive and protection mechanisms behind the design of these securities. The results of the study are in line with the results obtained by Gornall and Strebulaev in their study and are consistent with previous literature on the topic.

II. Literature review

i. History

Financial contracts have their roots thousands of years ago when the Mesopotamian civilizations firstly experienced the practice of trade and entrepreneurship in a system that resembled the free market. These civilizations experienced the growth of trade activity and the consequent needs in terms of financing and contractual practice that resulted in the first appearance of letters of credit and forms of equity financing, as well as derivatives like forward contracts in the form of baked clay vessels enclosing clay tokens, where the terms were written as markings on the surface of the vessels sealed by the marks of a witness. As trading activity grew and new trading routes were discovered, new forms of entrepreneurship and trading started to spread, figures such as merchant-adventurers would require capital for extremely risky ventures with no assets as collateral and high volatility in the potential outcomes, while merchants operating in stable and overflowing

[2] "Venture capital backed companies that have been valued over $1 billion" Gornall and Strebulaev (2018)
[3] Generally in this stage the business is less than three years old

markets would require more traditional credit arrangements. This evolution of the economic system brought innovation in the financial system as well, in particular during the Sumerian dominance before the XXIIIrd century B.C.E.. In this period the "Karu", merchant guilds, overtook the governing body for commercial affairs, once in the hands of political and religious leaders, and designed an organization described as a mix between a chamber of commerce, commercial bank, and venture capital firm. These guilds became the usual setting for lending activity, acting like real commercial banks, where the "tamkarun", members of the organization, acted as lenders and loan officers at the same time. Karu practiced the first forms of joint ventures and a "rudimentary form of venture capital", in this system the merchant-capitalists tamkarun would enter into contracts that stipulate that the financing party would receive a share of the profits upon conclusion of a trade expedition and the merchant would not be paid in a negative scenario, designing the first form of preferred security and giving birth to the limited partnership. New forms of venture capital contracts were introduced in the ancient Islamic civilizations, where different economic actors, such as trading agents and caravan merchants, would be financed through the so called "Mudaraba" contract. This contract states that "Profits are shared by the two parties; the share of each party is determined by mutual agreement. Losses, if any, are borne by the owner of the capital; the entrepreneur may not be compensated for his labour though.", designing a typical venture capital arrangement where there is a passive investor and an active partner, with downside protection for the investor and profit sharing incentive in case of a positive outcome for the entrepreneur. We will observe again venture capital activity in the financing of maritime expeditions, characterized by the presence of information asymmetry and the absence of limited liability, although trade friendly countries like England had already introduced forms of limited liability for trade guilds in the XVth century. The maritime industry built a structured system of contracts with protection for the investor and profit sharing in case of positive outcome: In case of a successful expedition the shipowner and the captain would get a 20% of the "carried" cargo, designing the first form of "carried interest", while the penalty for diverting the cargo was trial and execution, in place to reduce information asymmetry. The use of equity financing has always been preferred to debt for the funding of entrepreneurial ventures, but we will observe its widespread use after the introduction of limited liability and joint-stock companies in major economies in XIXth century and the birth and expansion of large publicly owned corporations. The traditional common stock issued by large corporations would work for these well established companies as they would generate stable cash flows and own significant physical assets that would make investor bear a low risk, while risky ventures were still financed by wealthy families in forms of private equity investments. Only in the beginning of XXth century the advancement in technology and strategic role of innovation brought some of these families to introduce new vehicles for equity financing such as the swedish fund "Investor AB" founded by the Wallemberg family and the "EM Warburg & Co." founded by Eric Warburg, other families to expand their investments in new industries like the Rockefeller family with their first airline investments. During the war the need for advancement in military technology pushed the US government to increase public funding for Research and Development through the allocation of extra funding to elite universities and the institution of secret laboratories like the "Radio Research Laboratory" at Harvard University. This ecosystem evolved and

expanded, creating opportunities also for commercial applications and private investments, and resulted in the self-proclaimed first venture capital firm, the "American Research & Development Corporation", founded by the Harvard Business School professor Georges Doriot in 1946, considered the "father of venture capital", "In its 25-year existence as a public company, ARD earned annualized returns for its investors of 15.8 percent" (Fenn, Liang, and Prowse 1998) in a context where public funding was still the main source of investments in new technologies. The U.S. is considered a proxy for venture capital activity because since its inception it has always had the largest share of global VC investments, counting around half of the global investments, while today venture capital has spread globally with the emergence of new leading countries in the industry like Israel, UK, Canada, and northern and central Europe, bringing the U.S. share to an approximate 38%[4] in 2019. As previously mentioned, investment in new technologies and research was primarily led by the government, that increased its effort in the development of venture capital firms with the Small Business Act of 1958 and the institution of "Small Business Investment Companies" (SBICs), private investment companies that "still exist today and share many characteristics of modern VC firms" (Metrick and Yasuda 2010). The introduction of Limited partnerships in the 60s boosted venture capital investments but we will observe the emergence of venture capital as an asset class with consistent flows of private capital only in the 70s with the financing of personal computing and the semiconductor industry and the relaxation of investment rules for U.S. pension funds (1979). This ecosystem evolved to today's new economy, where start-ups pioneering new markets and developing new technologies need massive amounts of capital to fuel innovation, resulting in the $1.5 trillion invested in venture capital deals globally from 2010 to 2019[5], with $194 billion invested in 2019 only and the impressive growth of venture capital as an asset class, that today represents 36% of private equity investments[6]. Moreover, the exceptional performance of venture capital as an asset class tracked by several industry indexes that outperformed the market has generated both academic and general interest in the asset class, highlighting also the critical issues surrounding the performance and valuation metrics of the venture capital industry, this topic will be discussed in the next section.

ii. The asset class

Tracking the return of venture capital has proven to be an extremely complex practice as it involves the construction of a database of private information: information on private firms, contracts of financing underlying the investment rounds, investment funds reporting and deal information. One of the main issues in the analysis of venture capital investments is related to the use of pre and post-money valuation in transaction reporting, the issue has been highlighted by different scholars, such as Metrick and Yasuda and Gornall and Strebulaev, and is the main focus of this study. The effects of the use of this metric pose challenges to the construction of a reliable performance index for the industry, as noted by Kaplan in his study of 2016: "There is an important additional caveat in measuring valuations. They do not reflect the impact of transaction terms, instead simply reporting the "pre" or "post-money" valuation, which is defined as the product of the nominal

[4] Source: OECD Statistics
[5] Source: Crunchbase.com
[6] Source: PwC "Private Equity trend report 2019"

price per share paid in transaction times the number of shares outstanding (typically, assuming all shares are converted into common stock) before and after the transaction." The two main historical providers of private investment data that includes data from both venture capital funds and portfolio companies are VentureXpert (VX), a division Thomson Reuters, with data from 1961 and Venture Source (VS), a division Dow Jones, with data from 1994. Today the three main data providers that offer granular private investment data including venture capital investments are Burgiss Private I, Cambridge Associates (CA) and Preqin. New platforms have started providing high quality data on private investments, such as Pitchbook, focused on private equity investments, and Crunchbase, focused on venture capital investments. The discontinuation of Thomson Venture Economics (TVE) in favour of an integration to the Thomson Reuters platform "For reasons likely related to poor quality data" (Kaplan, 2016) shows the difficulty to obtain reliable data in this industry and justifies the massive data mining and legal information standardization that Gornall and Strebulaev had to perform to obtain data for their study on valuations as they hired "three lawyers and three law school students to extract and code these data and at least one lawyer (two in most cases and three in more complicated cases) analysed all COIs (Certificates of incorporation)." (Gornall and Strebulaev, 2018). Sand Hill Econometrics, historically one of the main providers of a structured venture investment index, combined the databases of VentureSource and Venture Economics, adding information from other industry sources, from its own base of consulting clients (LPs in VC funds) and from exhaustive searching of Web resources, and developed a final database with over 17,000 companies and more than 60,000 financing rounds. Index data is available from 1988 to 2008 and, as shown in the graph in **Appendix 2**, the index had an average 12.8% annualized return, while the Nasdaq index (the value-weighted index of all Nasdaq stocks) had a 7.9% return over the same time span. An alternative approach to the Sand Hill Econometrics Index is to base the database construction on funds data , combining their returns in an industry index. The most successful attempt has been made by Cambridge Associates U.S. Venture Capital Index, that is built on more than 75% of the funds raised by venture capital firms since 1981. As shown in **Appendix 3** The Cambridge Associates Index averaged 16.2% versus the 12.8 % of the Sand Hill Econometrics Index and 7.9% the Nasdaq index. Metrick and Yasuda (2010) note that "The relationship between the Sand Hill Index (SHE) and the Cambridge Associates Index (CA) seems backward: the net-return index (CA)—which is computed after fees and carried interest are subtracted out—should be lower than the gross-return index (SHE). However, here the opposite is true, with the CA index exceeding the Sand Hill Index by 3.4 percentage points over the common subperiod." (Metrick and Yasuda, 2010). They attribute the explanation of this phenomenon to the data collection, which induces survivor bias, where "survivors" have a better chance of showing up in the data, and this bias causes an overestimate of industry returns. Furthermore, additional biases are possible because valuation information might be missing for non random reasons. Thus, we think of the CA index as representing an upper bound on the net returns to VC." (e.g., if the portfolio companies performed poorly)" (Metrick and Yasuda 2010). These indexes are also affected by the exit status of companies that are considered still "private" but have ceased their activities, Metrick and Yasuda refer to this bias as "zombie company" problem. Metrick and Yasuda perfectly explain the valuation problems, highlighted by Gornall and Strebulaev and in the next sections of

this study, criticizing the Sand Hill Econometrics index for its conservativism in the way it computes venture capital returns. “To understand how conservatism could occur, we must go a little deeper into the SHE methodology. Each month, SHE takes a snapshot of all portfolio companies for all VCs. As discussed earlier, there are several challenges in estimating the value of nontraded companies, and SHE handles these problems with several careful methods. Because VCs do not own 100 percent of these companies, the next step is to estimate the value of the VCs’ portion of each company. This is tricky and the task is made more difficult because SHE does not have access to the details of each transaction. Thus, it is necessary to make an assumption about the form of VC ownership, and SHE assumes that VCs have proportional (common-stock) ownership of these firms. This assumption is conservative, because virtually all VCs own some form of preferred stock, which has valuation advantages over common stock.” (Metrick and Yasuda 2010) The previous statement shows that the stake attributed to funds is incorrect because of the presence of preferred securities, therefore their relative valuation and the overall valuation of the firm, highlighting the strong influence of superior rights in the valuation of venture capital investments. These returns are calculated as periodic returns for each month in the Sand Hill Econometrics method and each quarter in the Cambridge Associates method, and multiplied to arrive at a compound return for the whole time period, a standard procedure for computing asset returns as it is typically used for stocks, bonds, bank deposits, as well as for the return measurements of mutual funds, hedge funds, and other portfolio managers. “Although this calculation is reasonable for the whole VC industry, it does not seem reasonable when applied to a single VC fund.” (Metrick and Yasuda 2010) In VC funds capital is invested in different years of the fund, often with a long lap between an investment and another, therefore “it can be misleading to treat all these years equally when computing returns.” Giving an equal weight to annualized returns each year could be misleading, therefore the Internal Rate of Return (IRR) is a more reasonable approach as it effectively weights equally every dollar invested, even though with high returns the annualization of monthly or quarterly IRR will be misleading for the implicit assumption of reinvestment of the proceeds. Another weakness of IRR reporting is the absence of a distinction between realized and unrealized investments. Venture capital funds often have a significant fraction of unrealized investments in their portfolios, the IRR treats them as a positive cash flow in the final period, while the capital gain is effectively unrealized and has no monetary effect. “The IRR calculation will essentially just reflect the subjective valuation of these unrealized investments” (Metrick and Yasuda, 2010), this reported valuation is almost always the post-money valuation, also used as a proxy to calculate funds returns as noted by Gornall and Strebulaev in their study. The IRR is more reliable as the investments are realized, in fact, the IRR is “particularly misleading in the first few years of a fund” while it grows in the last years of the fund, resembling a J shape in a graphical representation. This plot, shown in **Appendix 4**, is called a “J-curve” or a “hockey stick”. Venture Capital firms use a “value multiple” to represent the performance of their funds, this measure is called by different names such as investment multiple, realization ratio, absolute return, multiple of money. The multiple is often referred as “Gross Value Multiple” (GVM) and it is defined as the sum of the realized value multiple and unrealized value multiple as it includes both realized and unrealized investments in its calculation. This gross value multiple (GVM) is calculated as follows:

Gross value multiple (GVM)= [Total distributions to LPs[7]+ value of unrealized investments + carried interest]/invested capital

Where the carried interest is a performance fee paid to the fund management (GPs) that is based on the excess capital returned to the investors (LPs), it is added to the gross value multiple to give a clear representation of the "Gross performance" of the funds. This methodology attenuates but doesn't eliminate the distortion caused by post-money valuation as the numerator includes not only the investments that had an effective monetary effect, that can be considered at "fair value"[8], being already exited, but also unrealized investments that, as noted by Gornall and Strebulaev (2018), are reported at post-money valuation and their value is not adjusted for the presence of superior cash flow rights. The tracking of venture capital returns reveals the complexity of determining the real value of an investment that involves the typical securities used in venture capital financing, these securities are designed to yield different outcomes at different stages and performance of the company and require a specific analysis and pricing methodology as discussed in the next sections.

iii.Venture capital financing

The high level of risk and information asymmetry of "R&D intensive firm" investments, where at the early stage of the financing there is a "low probability of success" (DiMasi et al. 1991, 2013) "but high payoffs conditional on success" (Grabowski, Vernon, and DiMasi 2002) and that "often have long gestation periods" (DiMasi, et al., 1991; Nanda and Kerr, 2015), can be compared to venture capital investments as start-ups often have similar "R&D intensity" and processes, while at the same time they require methods of financing with the same characteristics. The nature of these investments creates adverse selection due to the uncertainty about payoff potential and moral hazard due to the uncertainty about commercial viability of the project, this volatility in the project outcomes creates the need for unique financing arrangements that differ from traditional debt and equity financing securities. Different scholars have treated the pecking-order of preferred ways to finance R&D projects, the standard argument places internal cash as the first solution (Brown, Fazzari and Petersen, 2009), equity is then preferred to debt because there are no assets in place to use as collateral and "as the probability of success of the R&D declines, the efficacy of debt as a disciplining device declines"(Thakor and Lo, 2016), the pecking order designed by Myers and Majluf (1984) doesn't apply to R&D intensive firms. The "empirically-documented underinvestment in R&D" (Brown and Lerner 2010) confirms the unique financing needs of R&D intensive and innovation driven companies, Thakor and Lo (2016) express the need of a " hypothetical arbitrator who is able to extract a binding pre commitment from the firm's insiders to make costly ex post payouts from their personal wealth endowment (thereby effectively relaxing the firm's limited liability constraint)" and define a mechanism that involves "a put option on the firm's value that has a digital option attached such that the firm's insiders are long in the option and outside investors are short in the option over some range of firm values, whereas insiders are short in the option and

[7] Limited Partners are the investors of the fund, they provide capital and pay management fees and carried interest to General Partners (i.e. fund managers)

[8] "fair value" intended as a valuation that prices in the superior cash flow rights of preferred securities, the same denotation is given to the term by Gornall and Strebulaev (2018)

outside investors are long in it for all other firm values", where these options function as "a bilateral insurance contract between investors and insiders, enabling them to protect each other against undesirable outcomes". We can frame the "arbitrator" role into venture capitalists, as their methods of financing often involve the use of complex preferred securities, that design an incentive for insiders in an upside scenario and protection for investors in a downside scenario, a mechanism that resembles the "bilateral insurance contract" designed by Thakor and Lo. As shown in the graph in **Appendix 5,** this "Arbitrator" role of venture capitalists is confirmed by the increasingly strong presence venture capital investments in the biotech and pharma industry, historically the emblematic example of R&D intensive industries where innovation takes place in large corporate R&D departments financed internally. The average unicorn in the sample of the study of Gornall and Strebulaev has eight share classes with extremely different features, in fact, "the distinguishing characteristic of VC financings is that they allow VCs to separately allocate cash flow rights, board rights, voting rights, liquidation rights, and other control rights" (Kaplan and Stromberg, 2003). The presence of superior cash flow and liquidation rights makes it difficult to compare these securities with the standard "common stock" often issued by traditional companies, even the preferred stock that we observe in public companies is usually issued with dividend preference rather than liquidation preference, redemption rights and convertible features. The financing arrangements used in venture capital range from debt-like equity securities, such as redeemable preferred, to complex forms of preferred stock, such as participating convertible preferred, these securities have dramatically different payoffs in downside scenarios in comparison to common stock as the rights issued to the investor often involve liquidation preferences and redemption rights, therefore the pricing of these securities requires a specific valuation framework that takes into account the features contained in the contract, that can be considered as "embedded options". The valuation requires the translation of these legal provisions into intelligible financial instruments in terms of pricing as a first step, then the pricing of these instruments with option pricing techniques with the appropriate modifications to processes and parameters that reflect the nature of the underlying. This path starts from the definition of exit payoff functions of these securities, described in section iv, and ends in a modified version of Black and Scholes (1973) that references the different frameworks and applications of contingent claims models, as discussed in section v and vi.

iv. Term sheets and VC securities valuation

Metrick and Yasuda in their book "Venture capital and the finance of innovation" create a framework to determine the value of these securities. Term sheets[9], pre-contractual documents that "describe the basic structure of a transaction and provide a set of protections against expropriation", are the starting point to construct a valuation framework for these complex securities. The legal provisions contained in these documents define the features of the securities issued in the investment round and act as a guideline for the final contract. Metrick and Yasuda start their analysis by constructing the exit diagram, a simple graphical representation of the value of a security against the value of the whole firm at the time of the exit of the investment, the payoff is modelled on the basis of cash flow and liquidation rights contained in the contract,

[9] "Term sheets are preliminary contracts designed as a starting point for the more detailed negotiations required for the contract." Metrick and Yasuda 2010

resulting in the typical graphical representation of option payoffs on the basis of the underlying security strike price. These diagrams are constructed with the exit value of the company on the x-axis and the exit payoff of the security on the y-axis where the expiration date is unknown, it is then straightforward to construct the “exit equations”. These equations allow them to replicate these functions as portfolios of options by adding (or subtracting) a fraction of a call option at every point that the slope changes, with strike price equal to the corresponding point on the x-axis and the fraction equal to the change in slope at that point, they call this process “ reading the exit diagrams”. After the construction of these “exit equations”, the pricing of the options contained in the replicating portfolios requires case specific modifications to the traditional model developed by Black & Scholes (1973), this aspect will be covered in section vi after an introduction of contingent claims models and their application to convertible securities in the next section.

v. Contingent claims models

The use of option pricing techniques developed by Black and Scholes (1973) for the valuation of complex capital structures in the domain of corporate finance has been tackled by different scholars, starting from the techniques used in the valuation of corporate debt securities developed by Merton (1974) and the extensions to model safety covenants developed by Black & Cox (1976), these techniques are more generally defined as contingent claims models. Scholars like McDonald and Siegel (1985, 1986) and Brennan and Schwartz (1985) have then extended these models by developing the real options model, that opened new frontiers to the classical "NPV driven" managerial decision making processes, then extended by Dixit and Pindyck (1994) in the context of R&D financing. These techniques and models find a perfect application in the realm of innovation financing, such as new drugs development and corporate R&D, to then find a natural application to start-up investments. Different scholars, such as Metrick and Yasuda (2010) and Gornall and Strebulaev (2018), have tackled the issue of start-up financing securities valuation by referencing to contingent claims models existing in literature to create their own modified version to value venture investments, this "approach is close to the common practice of option-adjusting corporate bonds or mortgage-backed securities to determine underlying risk prices."(Kupiec and Kah, 1999; Stroebel and Taylor, 2009). the approach of Metrick and Yasuda and the modifications that they apply to the traditional B&S model to value preferred securities are covered in the next section.

vi. Option-pricing and Random Expiration

Metrick and Yasuda start from the traditional example of convertible preferred stock, a typical security used in VC transactions, that can be modelled as a bond plus an embedded call option. However, unlike standard call options, this embedded option will have a forced exercise in the case of an IPO or sale of the company, and would expire worthless if the company goes out of business. To replicate these outcomes we can think of an option that has a 50% probability of forced expiration in five years and 50% probability of forced expiration in 10 years, we can price these two options with the Black and Scholes formula and price the combination as the expected value of these two standard call options. This logic can be applied to an option that can have possible forced expiration in any number of dates, Metrick and Yasuda report the example of a company where

every month the board decides for the company's sale, liquidation or IPO with the same exit probability each month. If we consider a 10-year period then any option on this company will have 120 possible expiration dates, each with a 1/120 probability of happening, we can then price the combination as the expected value of 120 European call options with expiration 1 month, 2 month, up to 10 years and price them with the Black-Scholes formula. If we take this process to the limit the option will have a continuous-time probability of forced expiration and infinite expiration dates and the value of the option would be calculated as an integral of the probability of expiration for any given date multiplied by the Black-Scholes value of the call option with that expiration. They call these options with unknown expiration "random-expiration" options and suggest their use because in venture capital and private equity the investor doesn't know the exit time of the investment ex-ante, thus the random expiration better explains the uncertainty of exit time. These options have a probability q of forced expiration (that Gornall and Strebulaev call "exit rate λ" in their paper) and derive from this probability the expected holding period H=1/q, this forced expiration is random and uncorrelated with the performance of the firm and the market. To determine the probability of a forced expiration at any time T the instantaneous probability of expiration q is multiplied by the probability that the option is still alive at that time $exp(-qT)$, yielding a probability of $qexp(-qT)$, which is also the probability distribution function for the exponential distribution. The time of expiration of the option is then exponentially distributed with density:

$$f^t(T) = qexp(-qT)$$

Where q is the exit rate (called λ by Gornall and Strebulaev) and the expected Holding period (i.e. average exit time) H is:

$$H = 1/q$$

The price of the option is then represented by the following equation:

$$\int_0^\infty [S * N(d1) - Xe^{-rT} * N(d2)]qexp(-qT)dT$$

These assumptions allow me to price the options used to replicate the payoff functions, in practice I used the web tool VCVtools developed by Metrick and Yasuda to price the random expiration calls. Random expiration is used by Gornall and Strebulaev (2018) as well in their study as they state "As in contingent claim models, we assume that X(t) evolves according to a geometric Brownian motion with volatility σ that grows at the risk-free rate rf under the pricing measure. This assumption is foundational to many areas of corporate finance and asset pricing. The time to exit is independent of X(t) and exponentially distributed, T ~ EXP(λ), where λ is the exit rate (and 1/λ is the average exit time)", where λ resembles the q mentioned by Metrick and Yasuda.

vii. Post-money valuation

The main metric of valuation used "also by sophisticated finance professionals" (Gornall and Strebulaev, 2018) for VC backed companies is post-money valuation, "the equivalent of market capitalization for public

companies" (Metrick and Yasuda, 2010), calculated as P=OPP*fully diluted share count, where OPP stands for original purchase price, the price per share paid at the time of the transaction, and the fully diluted share count is the number of shares outstanding after the financing. "VC-backed companies issue a variety of shares with different terms, which means that these shares have different values and a formula like Post-money valuation, where all classes are assumed to have the same value, cannot be used" (Agarwal, Barber, Cheng, Hameed, and Yasuda 2017). Preferred and convertible securities have superior cash flow rights and downside protection that increase their value at the expenses of other investor classes, this phenomenon generates difficulties in tracking the industry performance as previously discussed and generates doubts on the valuations of venture backed companies, as investigated and demonstrated by Gornall and Strebulaev (2018), that found that post-money as a metric to value the company after the investment yields on average a 48% overvalued figure that doesn't reflect the real value to all investor classes. These results open an intense debate as "mutual fund filings show even more clearly the prevalence of treating post–money valuations as fair values. Almost all mutual funds hold all of their stock of VC-backed companies at the same price, they have earned large mark-to-market returns on their venture capital investments" (Agarwal, Barber, Cheng, Hameed, and Yasuda, 2017). Gornall and Strebulaev state that "equating post–money valuation with fair valuation overlooks the option-like nature of convertible preferred shares and overstates the value of common equity, previously issued preferred shares, and the entire company", confirming the importance of the use of a valuation technique that values the impact of the features of preferred securities on other investor classes and on the overall valuation of the company.

viii. The standard Series A financing term sheet of the Angel capital association and its impact on firm valuation

This study uses the contingent claims model and option pricing techniques developed by Metrick and Yasuda in the book "Venture Capital and the finance of innovation" (2010) with insights from the studies of Kaplan and Stromberg (2003) and Gornall and Strebulaev (2018) to value the securities of a hypothetical company after a Series A round conducted with the contractual terms of the standard Series A financing term sheet (**Appendix 6**) proposed by the "Angel Capital Association", the largest American association of angel investors groups. An early stage financing contract is representative of the basic effect of the presence of preferred securities in the capital structure, an analysis on the first issuance of preferred securities shows with evidence the influence of these contracts on valuation and seniority of common stock even on a starting level, where capital requirements are low and exits are far ahead. Moreover, interest in early stage financing has been growing significantly in the past few years as an increasing share of venture capital deals are early stage, the graph in **Appendix 7** shows the stage breakdown of U.S. deal activity by number of deals, deals under $1 million and between $1 and $5 million represented on average 41% of the deals in the past 10 years, even though the investment size ($ billion) is on average 11% of the total, as shown in **Appendix 8**, while the graph in **Appendix 9** shows the strong increase in the average deal size for early stage investments. Angel investments have increased as well in the past few years as also stated by Wilson and Silva (2013) because of "The rise of "individualized entrepreneurial finance": Angels, group of angels, crowdfunding platforms and

the like" (Kaplan 2016). The term sheet simulates an investment of $750,000 from an "alliance of angels" in a hypothetical company that has already common stock and employee stock options in its capital composition, the investment round involves the issuance of " Series A preferred stock" and warrants. The study uses the "reading the exit diagrams" technique to model the cash flow rights arising from the contractual terms mentioned in the term sheet and construct the options portfolio that replicates the "exit equation" of the security, the options are then priced with a modified version of traditional option pricing models. This process yields an option-adjusted value to different investor classes that is then compared with the value as a share of post-money valuation and the total valuation of the company is compared with the post-money valuation reported in the term sheet. The methodologies of Metrick and Yasuda used in this study yield a result in line with the study of Gornall and Strebulaev, even if with different magnitude, confirming the similarity of the models and the consistency of the results. The methodology, parameters and results of the study will be discussed in the next chapters.

III. Methodology and parameters

i.The model

The capitalization table in **Appendix 10** shows the company's capital structure before and after the investment on a fully diluted basis, that assumes that all preferred stock is converted and the options and warrants exercised. The share capital is composed of common stock, preferred stock, stock options and warrants issued to the investor, these securities have different cash flow rights and option-like features to model in their payoff functions. To price these securities I use the model developed by Metrick and Yasuda, I construct the exit equations of the different investor classes on the basis of the cash flow rights arising from the contractual terms contained in the term sheet and replicate these piecewise linear functions as a portfolio of calls and binary calls. Then I use Black and Scholes formula and binomial option pricing to price the stock options and the warrants and the web tool VCVtools developed by Metrick and Yasuda to price random expiration options. For simplicity of the calculations I consider the aggregate value of the securities as a percentage of the value of the company, this methodology allows to simplify the calculations and to give an "option-adjusted value" to different investor classes.

ii. Contractual terms modelling

a. Series A Preferred

The term sheet reports the issuance 731,250 Series A preferred stocks at an aggregate purchase price[10] (APP) of $750,000, which represents the price paid for all the securities purchased and in this case is equal to the total investment because the investor buys only one class of securities, resulting in an OPP=$1.0256. the reported post-money valuation of the company is $2,750,000 and, as reported in the term sheet, the warrants offered to the investor increase the figure to $2,937,383. The " Series A Convertible Preferred" payoff function can be directly derived from the provisions in the term sheet, the section "liquidation preference", that "tells

[10] Defined as APP=OPP*number of shares issued to the investor, it represents the aggregate price paid by the investor for the ownership, so the full amount of the investment

an investor where he stands in the capital structure hierarchy" (Metrick and Yasuda, 2010), reports the cash flow rights of this security: "1x participating preferred"[11] indicates that the security is a participating convertible preferred (PCP). The PCP is designed to give the investor the right to "receive an amount equal to one time (1x) the Purchase Price, plus any declared and unpaid dividends, prior to the payment of any sums to any other equity security holders" (Liquidation preference), "in the event of (i) a liquidation, dissolution, or winding up of the Company" (Deemed liquidation event). The "participating" nature of the security allows the investor to participate in the proceeds paid to common stock as if it was converted. Kaplan and Stromberg (2003) found that "an automatic conversion provision is present in 95% of the financing rounds". Even though the threshold is set in terms of minimum proceeds, for the calculation I consider the QPO at company value V=$25,000,000, the price per share at this value with the current capital structure is $8.73, 8.5 times higher than the round price. This is a consistent and generous assumption considering the price multiple median of 3 found by Kaplan and Stromberg in their study, while using a price threshold is more in line with the industry practice. The 8.5 price multiple assumption is in line with the findings of Metric and Yasuda, that analysed the distribution of Gross Value Multiples (GVM) for first round investments after an IPO and M&A exit and found that a cumulative 53,6% of first round investments exited through IPO have a GVM of 5 or higher. "Upon the liquidation or exit of a participating convertible preferred, investors receive both the principal amount of the preferred stock as they would in an investment of straight preferred and the common stock promised under the conversion terms. As a result, participating convertible preferred is better categorized as a position of straight preferred stock and common stock." (Kaplan and Stromberg 2003). Kaplan and Stromberg in their study, as well as Metrick and Yasuda in their book, construct the PCP payoff as a combination of redeemable preferred (RP) and common stock (C) with a drop on the QPO threshold, finding the payoff functions of these securities is useful to construct the payoff function of the PCP as a combination of RP+C. The redeemable preferred is a security that allows the investor to redeem a multiple of the initial investment with seniority to other investors (Liquidation preference), without granting conversion to common stock, the payoff is then "very similar to the required repayment of principal at the maturity of a debt claim… Unlike a debt claim, however, the company cannot force the VC to exercise the redemption right." (Kaplan and Stromberg, 2003). The redeemable preferred exit equation is then the following:

$$RP = min(V; APP)$$

where V is the value of the company, APP (Aggregate purchase price) is the liquidation value, as it represents the value of the investment, thus the basis for the multiplication with the liquidation preference that yields liquidation value, in this case the same as the APP for the presence of a 1x liquidation preference. The graph in **Appendix 11** shows the payoff function of the RP, note that the function has a drop at the QPO threshold as I am considering the liquidation preference of the PCP that will be lost after conversion. The graph shows that the liquidation preference gives the investor 100% cash flow rights on the company until the company is

[11] "A 2X or 3X liquidation preference requires that the investor is paid back double or triple, respectively, their original investment before any of the other (junior) equity claims are paid off" Metrick and Yasuda 2010

capable of repaying a multiple of the investment while keeping the governance on the hands of the entrepreneur.

Common stock (C) has a linear exit equation that in this case is shaped by the liquidation preference of the RP, so it can be written as the following:

$$C = \max\left(I/P * (V - APP); 0\right)$$

Where I is the value of the initial investment and P is the post-money valuation, resulting in I/P as the percentage of the company owned by the investor. As shown by the equation and the graph in **Appendix 12** the presence of liquidation preference shapes the common stock payoff function as an option where the underlying spot price is I/P*V and the strike price is I/P*APP. I can then write down the exit equation of the PCP as follows:

$$PCP = min(V; APP) + \max\left[I/P * (V - APP); 0\right]$$

This equation holds until the automatic conversion into common stock is triggered at the QPO threshold, where the payoff function becomes the same as common stock:

$$PCP = I/P * V$$

At the point of automatic conversion the liquidation preference expires and the APP is redistributed among investors, causing a drop in the payoff function for the PCP and a jump for the other security classes. The graph in **Appendix 13** shows the payoff function of the PCP without the warrants exercised.

b. Warrants

To have a clear representation of the varying slope of payoff functions I have to take into account the issuance of common stock produced by the exercise of the warrants and its dilution effects on other security classes. In fact, while the shares underlying the stock options are already issued, so we can already consider them in the capital composition, the exercise of the warrants dilutes the other shareholders and modifies the slope of their payoff functions. The warrants are issued at a share price of K = $1,0256 and I will assume that they have expiration in 5 years, then I can price them as American call options with expiration in 5 years. The payoff of the shares underlying the warrants is modified by two factors: the presence of the PCP liquidation preference and the immediate retention of proceeds from the capital increase arising from the warrant exercise price. The purchase of 182,813 Warrants at $1.0256 per share represents an investment of I = $187,493, the warrant holders retain a share (I/P) of the proceeds from the capital increase (I) and their cash flow rights are reduced by the Series A liquidation value (APP). The strike price should be then adjusted for the value of the company that verifies this condition:

$$I/P * (V - APP + I) > I$$

The warrants are optimally exercised at company value V = $3,499,890 that yields an adjusted strike price of K = $3,499,890/2,864,063 = $1.222. The graph in **Appendix 14** shows the point of intersection between the

payoff function of Series A investor without the warrant and the payoff with the warrants exercised, confirming the optimal intersection point at V = $3,499,890. The table in **Appendix 15** shows the percentage ownership of different investor classes before and after the exercise, highlighting the dilution of other investor classes

c. Payoff functions and replicating portfolios

From the calculations in the previous sections we obtain three critical points: at V = $750,000 the initial investment of the preferred stock would be entirely redeemed, so the ownership percentage on exit proceeds changes on this point, thus the slopes of the payoff functions change, at V = $3,499,890 the conversion of the warrants changes again the slope of the other functions and at the point of the QPO (V = $25,000,000) the automatic conversion of the PCP triggers a drop for the preferred stock and a jump for the other securities. These critical points represent the value of the company where the changes in cash flow rights influence the potential exit proceeds sharing (i.e. ownership percentage of the company), causing a variation in the slope of the payoff functions as shown in the table in **Appendix 16**, while the graph in **Appendix 17** shows how these variations affect the exit equation for all the investor classes. Then I replicate the payoff function as a portfolio of calls C(K), that are used to model the varying slope, and binary calls BC(K), that allow me to replicate the drop and the jumps, the price S is represented by the company value V, while the strike prices K are the critical points. The Series A preferred retains 100% of the company value until the liquidation value is reached at the critical point V = $750,000 where the slope (ownership percentage of the company) decreases from 100% to 27.3%, at the critical point V = $3,499,890 the share decrases to 25.5% for the warrant exercise dilution and at the critical point V = $25,000,000 the automatic conversion into common stock causes the loss of liquidation preference, at this point the liquidation value of $750,000 is redistributed among all investors classes on the basis of their ownership, the payoff function of the Series A investor would then drop 74.5%*750,000 = $558,510 (a 25.5% of the amount remains to the investor as it represents his ownership percentage of the company, thus the share of potential exit proceeds). the exit equation can be then replicated as follows:

$$V(series\ A) = V - (100\% - 27.3\%) * C(750{,}000) - (27.3\% - 25.5\%) * C(3{,}499{,}890) - (100\% - 25.5\%) * 750{,}000 * BC(25{,}000{,}000)$$

The common stock starts having claims on 37.3% of the value of the company at the critical point V = $750,000; its stake will be then diluted to 34.9% upon exercise of the warrants at V = $3,499,890 and at V = $25,000,000 the automatic conversion for the Series A investor would cause a jump of 34.9%*$750,000= $261,865. The portfolio that replicates the exit equation can be then written as follows:

$$V(common) = 37.3\% * C(750{,}000) - (37.3\% - 34.9\%) * C(3{,}499{,}890) + 34.9\% * 750{,}000 * BC(25{,}000{,}000)$$

where C(K) is a call and BC(K) is a binary call with strike price K used to construct the replicating portfolio and will be priced in the next section, the equations of warrants and stock options will be treated in section iv.

iii. Option pricing

a. Parameters

For the analysis I priced two call options with strike prices K = $750,000 and K = $3,499,890 and a binary call option with strike price K = $25,000,000 with random expiration. For the risk free rate I estimated the six months average from August 2019 to February 2020 average of the one year US treasury yield that results in Rf= 1.63%, I decided to keep this parameter calculated to February 2020 as it is not affected by the interest rate cut occurred in march 2020 following the covid-19 pandemic emergency, while the stock price is the company's post-money valuation after the financing S = $2,937,383. Metrick and Yasuda suggest an exit rate q = 0.2 for early stage rounds, as they found that on average early stage financing rounds generate an exit in five years, Gornall and Strebulaev suggest $\lambda = 0.25$ as their study is conducted on a sample of mature companies, as they have reached $1 billion in valuation, that have issued capital in later investment rounds so the time to exit should be shorter, I will use the parameter suggested by Metrick and Yasuda considering that we are valuing a Series A investment that should represent the first round of investment in a real world case. I use 0.9 as volatility parameter, as suggested by Metrick and Yasuda (2010a), Metrick and Yasuda (2010b) and Gornall and Strebulaev (2018), this assumption is in line with the findings of Cochrane (2005), that estimates the annualized volatility of VC investment returns at 0.89, and with Ewens (2009) and Korteweg and Sorensen (2010) that got volatility estimates between 0.88 and 1.3.

b. Pricing

With the VCV tool, a web tool developed by Metrick and Yasuda to value random expiration calls, I obtained the following call prices C(K): C($750,000) = $2,468,654 and C($ 3,499,890) = $1,625,701, while the binary call BC($25,000,000) = $0.01. By inserting these values into the replicating portfolios I obtain a value to Series A preferred investors of $V(series\ A)$ = $920,729 against the value as a share of post-money valuation of $749,970 and a value to Common stock investors of $V(common)$ = $884,627 against the value as a share of post-money valuation of $1,025,600, these results will be discussed more in detail in chapter IV.

iv. Employee stock options and warrants

The Warrants and options I am considering have an underlying security that has a different payoff function than a simple stock as previously observed. The strike price K=$1,0256 would yield a loss for both the option and the warrant, the warrants are optimally exercised at the adjusted strike price K = $1.22, as calculated in the previous section. The adjusted strike for the options results in K = $1.22. As previously mentioned this strike price takes into account the liquidation preference of the Series A preferred and the retention of proceeds from the capital increase for the warrants. The option and warrant holders' exit equations are shaped by the jump at the QPO threshold for effect of the automatic conversion of the Series A, so to replicate their payoff I have to add a Random expiration binary call option to model the jump, that is 33.2%*$750,000 = $248,772 for the option and 6.4%*$750,000 = $47,872 for the warrant. The replicating portfolio of the exit equations are the following:

$$V(options) = 950{,}000 * EC(1.22) + 33.2\% * 750{,}000 * BC(25{,}000{,}000)$$

$$V(warrants) = 182{,}813 * AC(1.22) + 6.4\% * 750{,}000 * BC(25{,}000{,}000)$$

Where AC and EC stand for American call and European call.

a. Parameters

In start-ups it is common practice to assign 5 years of vesting divided into four years of step vesting and one year of cliff vesting, for simplicity of the calculations and to standardize this case study I consider the employee stock options as European call options and the warrants as American call options with expiration in 5 years. As previously discussed I use 0.9 as a volatility parameter and risk free rate Rf=1.63%, I use then these parameters to value the American option with a binomial tree approach and the European option with the Black and Scholes Formula.

b. Pricing

The values found are AC=$0.70 for the American call, found through the binomial pricing model, that suggests the optimal exercise of the warrant in year 5, and EC=$0.69 for the European Call, found through the Black and Scholes pricing formula. The replicating portfolio of the option holders and warrant holders payoff have value $V(options)$ =$656,323 against the value as a share of post-money valuation of $974,320 and $V(warrants)$ =$129,165 against the value as a share of post-money valuation of $187,493.

IV. Results

The table in **Appendix 18** shows the valuation of the different security classes deriving from the calculations, that I call "fair value", the same name that Gornall and Strebulaev use in their study. As observable in the table the fair value of the company is 11.8% lower than the reported post-money valuation, this result is lower than the average 48% found by Gornall and Strebulaev on 135 US unicorns. Options and warrants have a different price from the post-money valuation by nature because they are derivatives, so the difference is justified, even though "many employees use post–money valuation as a reference when valuing their common stock or option grants, which can lead them to dramatically overestimate their wealth" (Gornall and Strebulaev, 2018). Repullo and Suarez (1998) design an optimal start-up contract that could be "roughly replicated using warrants", whose exercise price would allow the financer to obtain a positive net payoff over a controlled "range of final returns", in fact, in this case warrants guarantee a higher payoff to initial financers (being an early-stage contract) considering the future financings needed in "continuation states". The exit equations of common stock and Series A preferred are strongly influenced by the presence of varying cash flow rights, so the difference from post-money valuation fully explains the different value to investor classes arising from the contractual features of these securities. Common stock is undervalued by 13.7%, while Series A preferred is overvalued by 22.8% , the Series A overvaluation is lower than the 30% to 53% range found by Gornall and Strebulaev (2018), the difference with the results of this study can be fully explained by the stage of the companies analysed in the sample. The study of Gornall and Strebulaev is carried over unicorns, that normally have had a number investment rounds, so these companies normally have a higher relative number of preferred shares issued and more investor classes with different cash flow rights and seniority, thus the valuation of

common stock results lower and the valuation of preferred stock higher. The “hypothetical company” object of this study is a company in “early stage” that issues the first round of a preferred security that has only 1x liquidation rights, while this provision can be higher for a significant share of deals as stated in “The Dow Jones Report”, the study finds that about 25% of all deals contain an excess liquidation preference, with about 70 percent of these preferences being 2X or less, also Kaplan and Stromberg (2003) confirm the widespread use of these features in VC investments, finding that redemption provisions are present in 78.7% of the sample 119 companies from 14 VC firms of their study and have a typical maturity of 5 years, the case in this study only has 1x liquidation preference, while the analysis of Gornall and Strebulaev is conducted on a sample of companies that could have issued securities with higher liquidation multiples, therefore the average overvaluation of these securities could result higher for the effect of these outliers. As also shown in the graph in **Appendix 17** these securities are structured to lower the downside risk for the investor by protecting the investment in negative scenarios while keeping the governance and the effective ownership of the company in the hands of the founders and creating an incentive for the entrepreneur that, by bringing the company to IPO, would trigger the automatic conversion for the investor that would lose his cash flow rights in favour of the entrepreneur. The Series A preferred stock is structured to create a monetary incentive for the owners of common stock, in this case the entrepreneur, by giving away cash flow rights when the company reaches a certain performance in terms of company value and by retaining superior rights when the company has a lower performance. Different scholars have explained the use of these securities and their incentive and protection structure: The use of automatic conversion provisions is explained by Black and Gilson (1998) that argue that “the effect of these provisions is to require the VCs to give up their superior control, board, voting, and liquidation rights if the company attains a desired level of performance. Upon such performance, the VCs retain only those rights associated with their ownership of common stock. If the company does not deliver that performance, the VCs retain their superior control rights” and Kaplan and Stromberg (2003) add “this provides the entrepreneur an incentive to perform in addition to the monetary incentive” , while Aghion and Bolton (1992) show that the external financing capacity generated by the higher profitability decreases the conflicts of interest and is positively correlated to higher entrepreneur control rights. The right of redemption and downside protections are used to “screen for good entrepreneurs”, as Ross (1977) and Diamond (1991) show in their studies on investor liquidation rights, while Repullo and Suarez (1998) in their study on optimal financing for R&D intensive firms confirm the need of downside protection for these type of investments, arguing that ”the non-zero final returns in the case of project abandonment” (i.e. liquidation preference) are optimal to compensate the initial financer and would then “explain the debt-like component of convertible preferred”. Dewatripont and Tirole (1994) conduct an analysis on cash flow rights and show that “when performance is poor the party in control should have a cash flow claim that is concave in performance (such as debt), while when performance improves more control should be transferred to a holder of a convex cash flow claim (such as equity).” The study of Cummings (2008) indicates “ that strong VC control rights are associated with a higher probability of acquisitions and a lower probability of IPOs and write-offs. The data indicates that VC board control and the right to replace the founding entrepreneur as CEO are associated with

a 30% greater likelihood of an acquisition", causing VC funds to favour higher cash flow rights in exchange higher control rights. These incentive and protection mechanisms based on the performance of the company are called "staging" and play a central role in the venture capital industry (Sahlmann, 1990), "staging is implemented through multiple financing rounds that are negotiated only once the need for additional funding arises" (Gompers, 1995), therefore, investment at "later stages" has often a higher impact on the valuation of common stock and explains the overvaluation found by Gornall and Strebulaev, investment in companies at late stages often involves large investment rounds with generous valuations in place to allow the retention of control by the entrepreneur, resulting in a more aggressive negotiation on superior rights of the preferred stock.

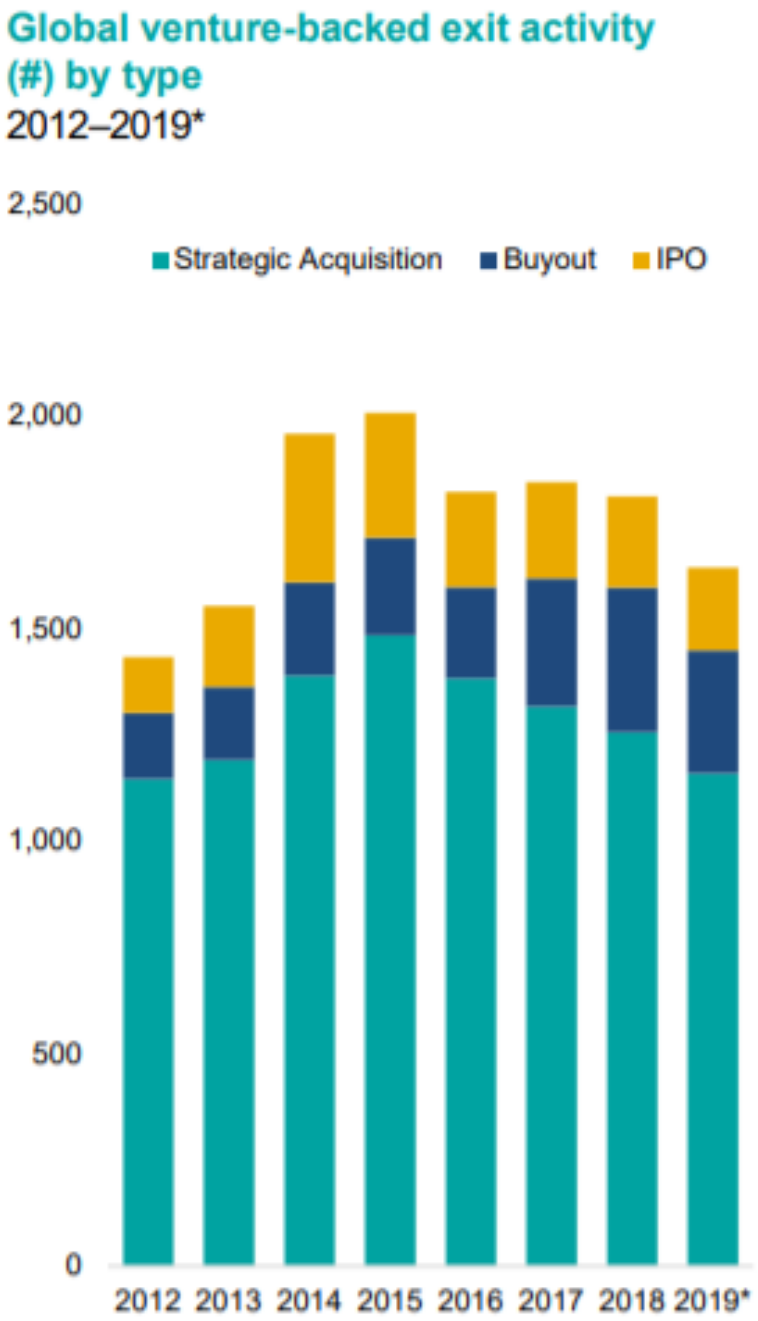
V. Conclusion

"Venture capital is an increasingly important intermediary, able to transform capital into new firms and innovations in an apparently highly productive manner. This intermediary is attracting increasing interest by policymakers and investors, but the availability of data as well as the consistency of the academic findings using these data are still lacking." (Kaplan, 2016) As exhaustively stated by Kaplan venture capital is playing an increasingly central role in the financing of innovation with exceptional results simply shown by the fact that the first 5 companies for market capitalization in the S&P 500 are venture capital backed and they represent roughly 20% of the index, while, as stated by Kaplan and Lerner (2009) roughly 50% of the "entrepreneurial" IPOs in recent years are venture-backed. The exceptional performance has also been tracked by Sand Hill Econometrics and Cambridge Associates indexes, that in the years from 1988 to 2008 outperformed the market. In recent years entrepreneurship and innovation have attracted a growing interest at a corporate, academic and institutional level also for its important role in economic development and growth, even though venture investments have always been a driver for economic development through history with clear examples such as the economic expansion of Mesopotamian civilizations through the financing of new trading routes discoveries, the prosperity of Islamic civilizations for their trading expertise supported by a contracting system that favoured investment in new merchant ventures and the economic growth generated by maritime expeditions in XIVth, XVth and XVIth centuries, risky ventures financed at a state level or from wealthy individuals with a system of contracting that laid the foundations for today's contracts used in venture capital deals. These investments, characterized by high risk and information asymmetry always involved the use of equity in various forms, often with complex contracting behind, in place to protect the investor from the undesirable outcome and incentivize the entrepreneur to overperform. The emergence of venture capital as an asset class and relative industry practices have raised questions at an academic level with numerous studies on the topic from different perspectives. The most criticized practice is the use of post-money valuation as a proxy for the valuation of venture capital investments, as it is a linear metric that doesn't take into account the presence of preferred securities and their superior cash flow rights. The use of post-money valuation has been criticized by different scholars such as Metrick and Yasuda (2010) in the context of an analysis of the venture capital industry and the construction of a framework for valuation and risk return assessment of the asset class, Kaplan (2016) in his risk return analysis, where he attributes the unreliability of industry index data to the use of post-money valuation for the investments reported by venture capital funds and finally

Gornall and Strebulaev (2018), that found the top 135 U.S. unicorns, many of them publicly listed and some of them notorious in the public press for sky-rocketing valuations, to be extremely overvalued in VC and mutual funds reporting, as well as in mentions by the financial press. This study, with a similar approach developed by Metrick and Yasuda that involves security design and contingent claims models, attempts to value the securities of a hypothetical company after a financing round conducted under the guidance of the standard Series A financing term sheet proposed by the "Angel Capital Association". The growing size and share of early stage investments and the lack of studies on early stage financing that use contingent claim models make it hard to compare the results obtained as they are in line with the findings of Gornall and Strebulaev, even though they have a lower magnitude, fully explained by the difference in the samples and the characteristics of securities issued in early stage financing, that often have lower liquidation preferences and less cash flow rights as in "early stage" the companies require a "clean" capital structure for future investment rounds. Different scholars have explained the presence of superior rights with the need of a security design that involves protection mechanisms for the investor, that bears high risk and needs protection for its investment in exchange for governance rights (venture capital deals involve only minority stakes and tend to avoid strong dilution of the entrepreneur stake), as well as incentive mechanisms for the entrepreneur, such as automatic conversion provisions that increase the valuation of common stock with the loss of liquidation preference by preferred stock in case of IPO, that in most of the cases is the exit that generates the highest returns. Another empirical explanation for the use of such securities comes from the industry practice, funding projects that require large investments and will not generate profit for years without taking control of the company requires the funds to apply unjustifiably high valuations, as shown recently in the financial press for example with the story behind WeWork, and to give up a higher control stake in favour of superior cash flow rights. The use of these securities is explained by the mechanisms previously mentioned, while the influence of these securities on valuation has been barely explored, as exhaustively highlighted by Gornall and Strebulaev, Metrick and Yasuda, and Kaplan and confirmed also in the results of this study. The use of more reliable valuation techniques and reporting metrics would generate more reliable data and create the basis for more academic research on the topic, as also recommended by Kaplan, while this fast growing industry will be surely a green field for new research and valuation practices as it has been for the innovative ideas that revolutionized our economic system in recent years.

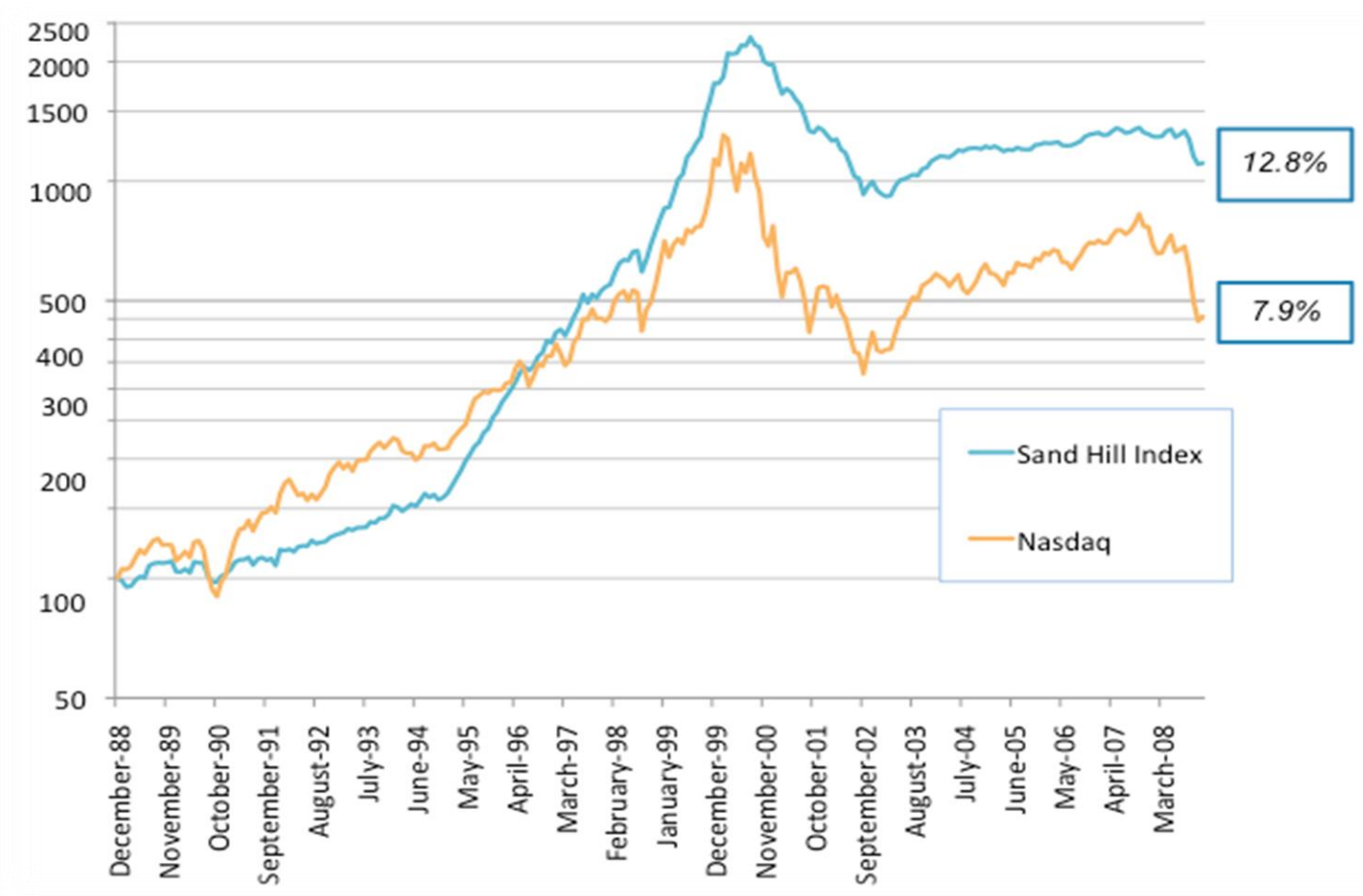
VI. Appendices

i. Appendix 1



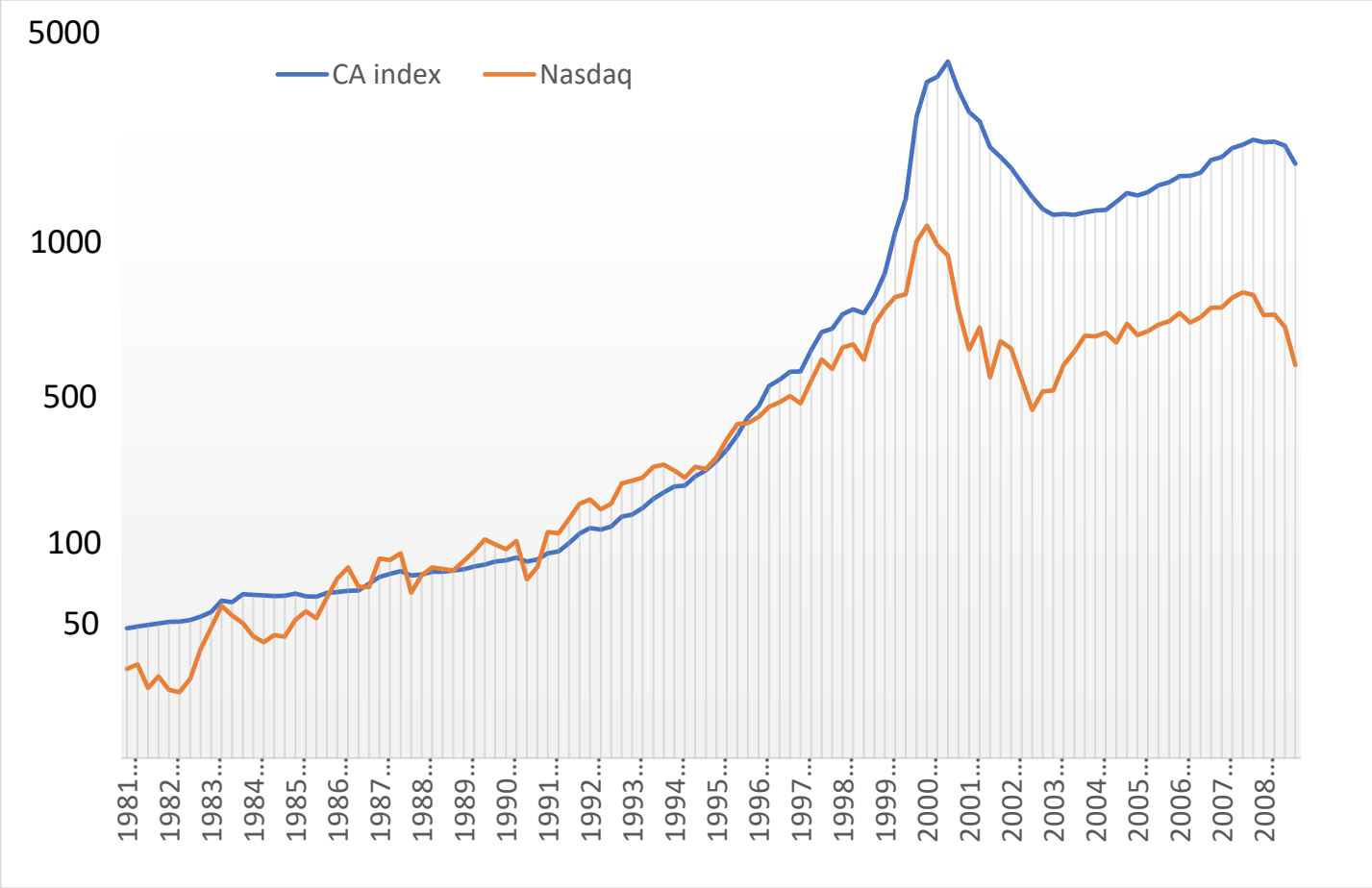
Source: KPMG Venture Pulse 2019

ii. Appendix 2



Sources: Sand Hill Econometrics (SHE), the Center for Research in Security Prices (CRSP).

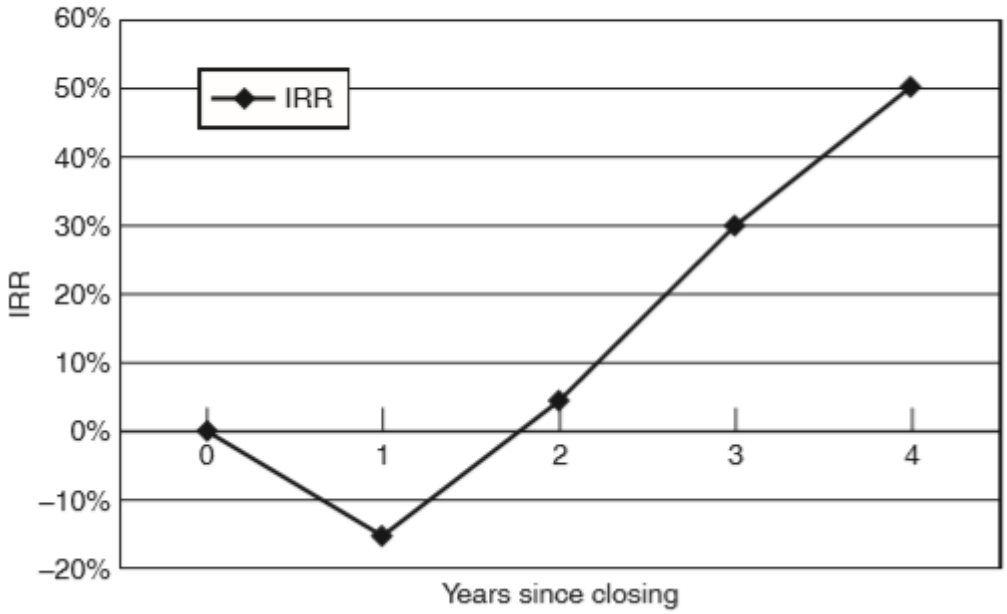
iii. Appendix 3



Sources: Cambridge Associates (CA), the Center for Research in Security Prices (CRSP).

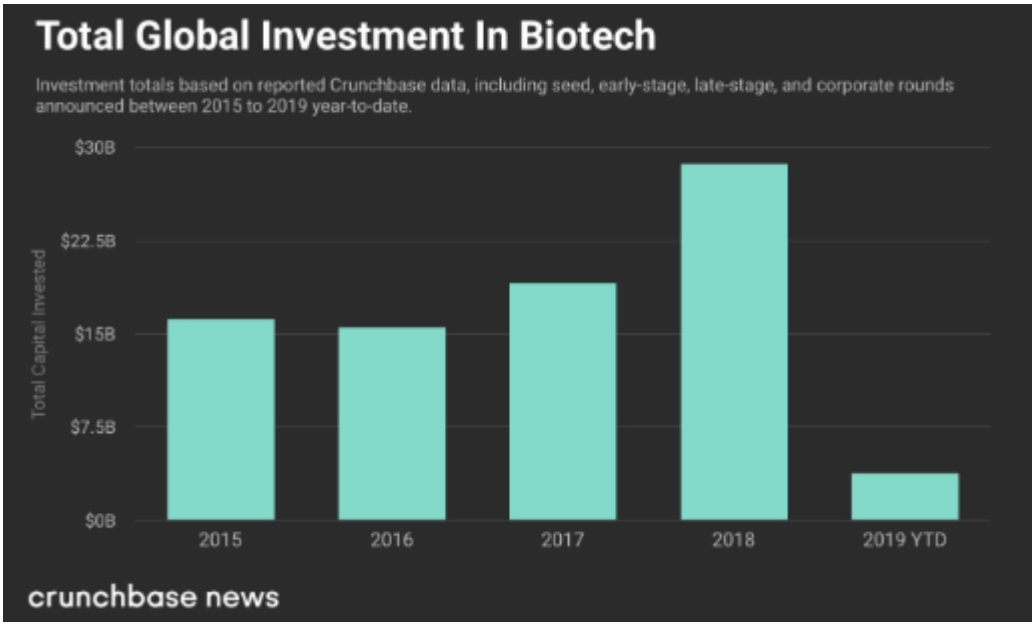
iv. Appendix 4

THE J-CURVE/HOCKEY STICK PATTERN OF RETURNS



Source: Venture Capital and the finance of innovation, Metrick and Yasuda 2010

v. Appendix 5



Source: Cruchbase, March 2019

vi. Appendix 6

Draft Term Sheet for Alliance of Angels

This draft term sheet, by Dan Rosen, CEO Dan Rosen & Associates, is for use by Alliance of Angels members as a starting point in negotiating seed stage deals. The AoA lead investor is noted as <<AoA Investors>> in the document. Each party in such deals should seek appropriate legal counsel. Except for the section titled "Exclusivity," this term sheet does not create a legally binding obligation on any person or entity.

Company name	Acme, Inc
Location	<<Company Address>>
Type of Entity	Washington State C Corporation
Type of Equity	Series A Preferred Stock
Size of Offering	$750,000
Minimum to close	$500,000
Closing	On <<Date>> ("the Closing Date") or when minimum to close is committed
Valuation	
Pre-money	$2,000,000
Post-money	$2,750,000
Price per share	$1.0256
Investors	Various members of the Alliance of Angels, who are Accredited Investors acting on their own account, and/or other Accredited Investors only (as defined in SEC Rule 501)

Comment [DR1]: Some prefer Delaware incorporation. Washington state and Delaware have parallel laws, but Delaware has greater case law and therefore better protection for company Directors.

Comment [DR2]: At times, Angels are asked to buy either common stock or S-Corp stock. Common makes sense in a limited situation: where an experienced entrepreneur has put lots of their own money into a company and you trust (based on experience with that individual) that they will treat investors well. S Corps cannot give preferred shares and should be avoided.

Comment [DR3]: Might also want to specify a latest close date for the round. If not met, it forces the company to come back to investors.

Investor Incentives Investors who invest by the Closing Date will receive the following incentive:

Discount or Warrants 25% Warrant Coverage

Stock Options The company will increase the authorized pool of options prior to the financing to bring the total unallocated options to at least the following percent

Total Unallocated options 24% in the post money

New options issued 200,000

Pre and Post-Financing Capitalization (assuming all shares issued)

	Pre-Financing		Post Financing	
Type of stock	**Number of shares**	**% Fully Diluted**	**Number of shares**	**% Fully Diluted**
Common	1,000,000	51%	1,000,000	35%
Stock Options Granted	250,000	13%	250,000	9%
Pre-financing Stock Options Avail	500,000	26%	500,000	17%
New Stock Options	200,000	10%	200,000	7%
Series A Pfd Stock			731,250	26%
Warrants			182,813	6%
Total Shares	1,950,000	100%	2,864,063	100%

Comment [DR4]: Discounts or Warrants are an incentive to invest. If granted, it is almost always one or the other, but not both. They must be considered with the price per share as to their reasonableness to current market conditions. It is, of course, cleaner to just lower the price per share, but often there are reasons (e.g. a higher priced friends and family round) not to do so.

Comment [DR5]: With warrant coverage, the post money will technically be higher than the pre-money plus the amount invested, because these shares are issued. In reality, given that the warrants are usually priced the same as the shares issued, they are "out of the money" and therefore do not actually effect the post money.

Comment [DR6]: The unallocated option pool depends largely on the state of the company's current management team and positions that still need to be filled. This usually ranges from about 10% to 25%, and must be considered in the post-money cap table, not the pre-money cap table.

Comment [DR7]: Note that the post money price is more than the pre-money + new money, because of the warrants, which go into the post.

Terms of the Series A Stock

Liquidation Preference	**1x participating preferred.** The Series A Preferred shall receive an amount equal to one times (1x) the Purchase Price, plus any declared and unpaid dividends, prior to the payment of any sums to any other equity security holders in the event of (i) a liquidation, dissolution, or winding up of the Company; or (ii) "Change in Control," which means a merger or consolidation (other than one in which the stockholders of the Company own a majority by voting power of the outstanding shares of the surviving or acquiring corporation) and a sale, lease, transfer, or other disposition of all or substantially all of the assets of the Company. Thereafter, all of the proceeds shall be ratably distributed to the holders of Preferred and Common Stock, on an as converted basis.
Dividends	**Dividends only when declared, and not cumulative.** The holders of Series A Preferred will be entitled to receive dividends only when and if declared by the Board and in preference to holders of Common Stock.
Voting Rights	Except as set forth in "Protective Provisions" below, the Series A Preferred shall vote together with the Common Stock on an as converted to Common Stock basis, and not as a separate class
Board Participation	The holders of a majority of the Series A Preferred shall be entitled to elect one member of the board of directors, who shall initially be _____. At the time of the closing of this financing, the board of directors shall be 5 members: 1 from management, 1 from Series A, and 3 independent directors acceptable to both common and Series A directors. The Series A director shall be compensated with stock options on a standard basis.
D&O Insurance	Prior to the closing, the company shall obtain a Directors & Officers insurance policy that is at least $1M.

Comment [DR8]: In the past, it was often argued that Angels should not request 1x participating preferred without a cap, because larger follow-on rounds would then get the same. While a small angel round doesn't change the "liquidation overhang," a large VC round might. Capping the liquidation preference in future, larger rounds does make sense.

Comment [DR9]: In the past, it was often argued that Angels should not request 1x participating preferred without a cap, because larger follow-on rounds would then get the same. While a small angel round doesn't change the "liquidation overhang," a large VC round might. Capping the liquidation preference in future, larger rounds does make sense.

Comment [DR10]: Cumulative dividends do make sense in the case of a redemption provision, as outlined below.

Comment [DR11]: Depending on the circumstances, having all of the directors selected by the closing might not be possible. This could read that within XXX days of closing, with the agreement of the Series A director, this can be delayed.

Comment [DR12]: Note that five is an arbitrary number and should be adjusted to the circumstances. The goal is to provide excellent guidance to the entrepreneur and bring the investors' knowledge to bear. Often an initial board of 3 is sufficient.

Comment [DR13]: It is also reasonable that the Series A director be on compensation committee and must agree to executive compensation.

Comment [DR14]: This amount is a minimum, but generally adequate for a seed stage company. If there is a large amount of investment, real property, or intellectual property, it should be more.

Comment [DR15]: This amount is a minimum, but generally adequate for a seed stage company. If there is a large amount of investment, real property, or intellectual property, it should be more.

Conversion Rights	The holders of the Series A Preferred shall have the right to convert the Series A Preferred into shares of Common Stock at any time. The initial conversion rate for the Series A Preferred shall be 1-for-1, subject to adjustment as indicated below.
Automatic Conversion	The Series A Preferred shall automatically be converted into Common Stock, at the then applicable conversion rate, upon: (i) the closing of a firmly underwritten public offering of not less than $25,000,000 (before payment of underwriters' discounts and commissions) (a "Qualified IPO); or (ii) the written consent of holders of the majority of the outstanding preferred stock.
Antidilution Rights	**Broad based weighted average.** The conversion price of the Series A Preferred will be subject to proportional adjustment for stock splits, stock dividends, and the like, and to adjustment on a broad-based weighted average basis for issuances at a purchase price less than the then-effective conversion price, subject to customary exclusions.
Founder's Stock Right of Repurchase	Common stock owned by any founder with more than 2% of the post financing equity is subject to the right of repurchase by the company at the lower of (a) the fair market value (FMV) at the time of agreement or the FMV at the time of repurchase; or (b) $0.01 per share (if no FMV has been determined), if the founder leaves the company within the first four years. Such a right expires over four years on a monthly basis after the Initial Closing (2.083% per month for 48 months).
Protective Provisions	The consent of the holders of a majority of the outstanding Series A Preferred shall be required to: (i) amend the Articles of Incorporation in a manner that would alter, change, or repeal any of the rights, preferences, privileges or restrictions of the Series A Preferred so as to adversely affect the Series A Preferred (it being understood that the authorization or issuance of shares of a new series of preferred stock that is senior to or pari passu with the Series A Preferred will not be deemed to adversely affect the Series A Preferred if the rights, preferences, privileges or restrictions of the Series A Preferred are not otherwise affected); (ii) increase the total number of authorized shares of Series A Preferred by more than 10%; (iii) approve a sale or merger of the Company.
Drag Along	If the Company's Board of Directors and a majority-in-interest of the

Comment [DR16]: This percentage can be modulated depending on the circumstances; 2-10% is the reasonable range..

Comment [DR17]: This is an important term that is often missing in Angel term sheets. In essence, it converts the founders shares to restricted shares. Having 100% of the founders' shares subject to right of repurchase is a term that can be negotiated. Depending on the state of the company and the value contributed to date, and the value of the founder to the company, this number can be set at less than 100%. However, sufficient shares should be subject to this right to ensure that the founders are bound to the company.

Note that sometimes the founders have invested capital as well as sweat equity. In those cases, the "purchased shares" should be excluded from this provision.

Comment [DR20]: Some favor a 60% or 2/3rd vote. While more protective of investors, it can put a company into a position where it can't move forward.

Rights	holders of Series A Preferred and Common approve a Change of Control Transaction or issuing New Securities, each Holder agrees (i) to vote all shares held by such Holder in favor of such Change of Control Transaction or issuing New Securities, and (ii) to sell or exchange all shares of Common Stock then held by such Holder pursuant to the terms and conditions of such a transaction.
Registration Rights	The holders of Series A Preferred will be entitled to receive registration rights *pari passu* with and substantially the same as any registration rights granted to holders of equity securities of the Company in the next round of financing of the Company.
Rights of First Offer	**Keep pro rata share.** Each Investor who purchases at least $25,000 of Series A Preferred will have a right of first offer, subject to certain limitations, to purchase its pro rata portion of any new equity securities offered by the Company, subject to standard exclusions. The right of first offer will terminate immediately prior to the earliest to occur of: (i) the Company's initial public offering; (ii) such time as the Company otherwise becomes subject to the reporting provisions of the Securities and Exchange Act of 1934, as amended; or (ii) a Change in Control. This right expires for any investor who does not exercise this right at each opportunity.
Proprietary Information and Inventions Agreements	The Company will cause each person previously, now, or hereafter employed or engaged as a consultant to enter into an acceptable proprietary information and inventions agreement.
Information Rights	The Company will share with the <<AoA Investors>> (i) audited annual financial statements no later than 90 days after the end of each fiscal year, (ii) unaudited quarterly financial statements no later than 45 days after the end of each quarter and a comparison of such quarter's results with the results projected by the Company's annual budget, (iii) unaudited monthly financial statements no later than 30 days after the end of each month and a comparison of such quarter's results with the results projected by the Company's annual budget, and (iv) an annual budget for the upcoming fiscal year promptly following approval by the Board. <<AoA Investors>> will be entitled to standard rights to inspect the properties and the books and records of the Company at reasonable times and upon reasonable notice to the Company. The obligation of the Company to furnish such information and to permit such inspection will terminate at the earliest of such time as the Company consummates a Qualified IPO, becomes subject

Comment [DR18]: In order to ensure flexibility and rapid decision making, once a majority of the common and preferred A shareholders agree to a decision, getting the others to agree is a meaningless exercise. So, notification, rather than the complete vote is all that is required. This term can be important in WA law, where if not otherwise specified, the number is 2/3 and not a simple majority.

Comment [DR19]: In order to ensure flexibility and rapid decision making, once a majority of the common and preferred A shareholders agree to a decision, getting the others to agree is a meaningless exercise. So, notification, rather than the complete vote is all that is required. This term can be important in WA law, where if not otherwise specified, the number is 2/3 and not a simple majority.

Comment [DR21]: Best practice is that the Company CEO sends out a quarterly letter or holds a meeting with investors at least quarterly to update them on progress, plans, and future financings. General rule – no surprises.

Comment [DR22]: Audits can be expensive, especially for a company that is early in its development. It is OK to allow the board to waive this requirement for a period of time.

Comment [DR23]: Audits can be expensive, especially for a company that is early in its development. It is OK to allow the board to waive this requirement for a period of time.

Comment [DR24]: Some favor making this 120 days to save money.

to the reporting provisions of the Securities Exchange Act of 1934, as amended, or the closing of a Change of Control.

Investor's Counsel — Company agrees to pay $5,000 (or $5,000 per each $1M, or fraction thereof, raised) for Investors' Counsel expenses to review this term sheet and ensure that the final agreement reflects the terms agreed.

Redemption Rights ***(used only if the Company is or might be a "lifestyle business")*** — After five years, if not previously converted, the Series A Preferred Stock is to be redeemed in three equal successive annual installments beginning <<Date>>. Redemption will be at the purchase price plus a <<4-12%>>% per annum cumulative return.

Comment [DR25]: This is a term that is particularly useful for an Angel deal, where capital requirements are low and anticipated cash flow might be high. In those cases, the entrepreneurs might choose to award themselves high salaries and bonuses, stripping the company of cash (which could go to dividends) and find that a sale is less attractive. The investors need a mechanism to force this issue.

In growth investments, this kind of hammer might cause the company to not invest in growth to ensure that they can meet the redemption provision, so it must be used carefully.

Comment [DR26]: This percentage needs to be adjusted for the circumstances. It needs to be sufficient to give the investor a reasonable return, if the entrepreneur wants to maintain the business as a "lifestyle business," but not so high as to make the company ill-liquid.

Due Diligence — The transactions contemplated by this Term Sheet are subject to the satisfactory completion of due diligence by each Investor.

Expiration of Letter: — This letter expires at 5 p.m., Pacific Daylight Time, <<Date>>, unless the Company executes it below and returns an original or faxed executed version to <<AoA Investors>> by that time.

Exclusivity: — From the date of acceptance of this Memorandum of Terms until the earliest to occur of (a) consummation of the financing, (b) the formal termination of negotiation by both <<AoA Investors>> and Company or (c) <<Date>>, the Company will not directly or indirectly solicit, initiate or participate in any discussions or negotiations with, or encourage or respond to any inquiries or proposals by any persons, company or group other than the Investors, concerning any financing or sale of the Company without prior approval of <<AoA Investors>>. The Company will promptly notify <<AoA Investors>> if any person, company or group seeks to initiate any other discussions or negotiations and contemplated in the immediately preceding paragraph, makes any proposal or inquiry, or requests any information with respect to any proposed financing or sale of the Company.

Comment [DR27]: This provision is not generally recommended nor necessary. This is not generally part of an angel term sheet, but some more sophisticated Angels do not want their terms "shopped" to others. It is included for completeness.

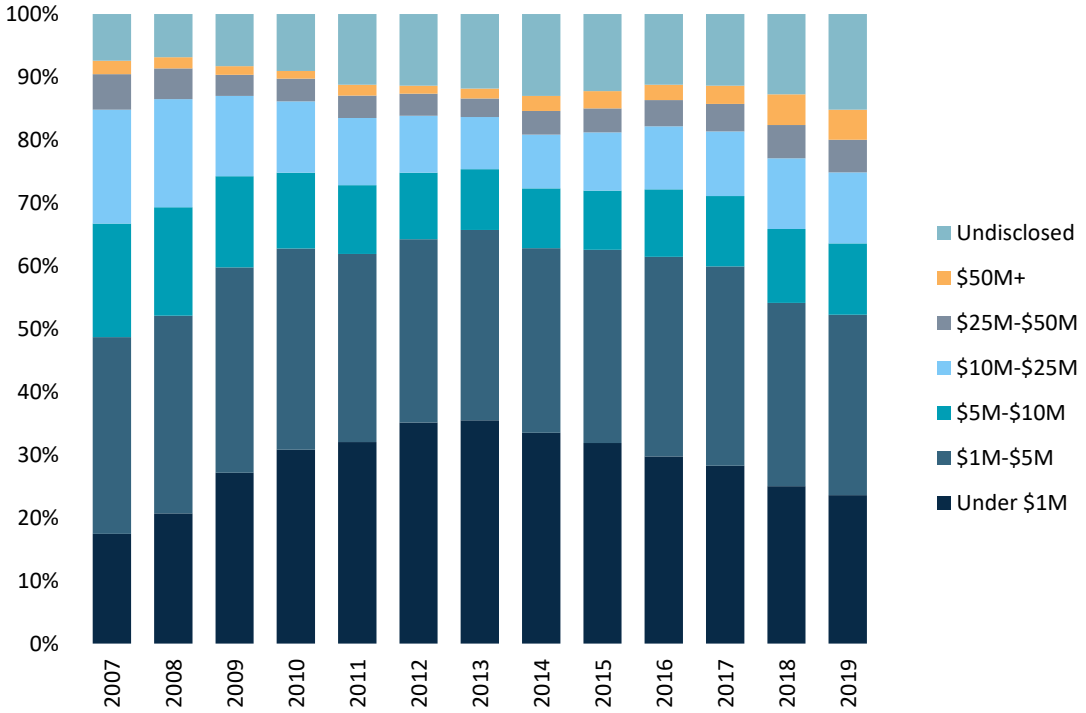
Confidentiality: — This term sheet is confidential to the parties and is for the use of the Company's management and their advisors. Accordingly, the information contained in this document may not be disclosed to any third party or used

to facilitate negotiations with any third party without <<AoA Investor>>'s and the Company's prior approval.

Not an Offer This Term Sheet is not a complete description of the financing and does not constitute either an offer to sell or an offer to purchase securities.

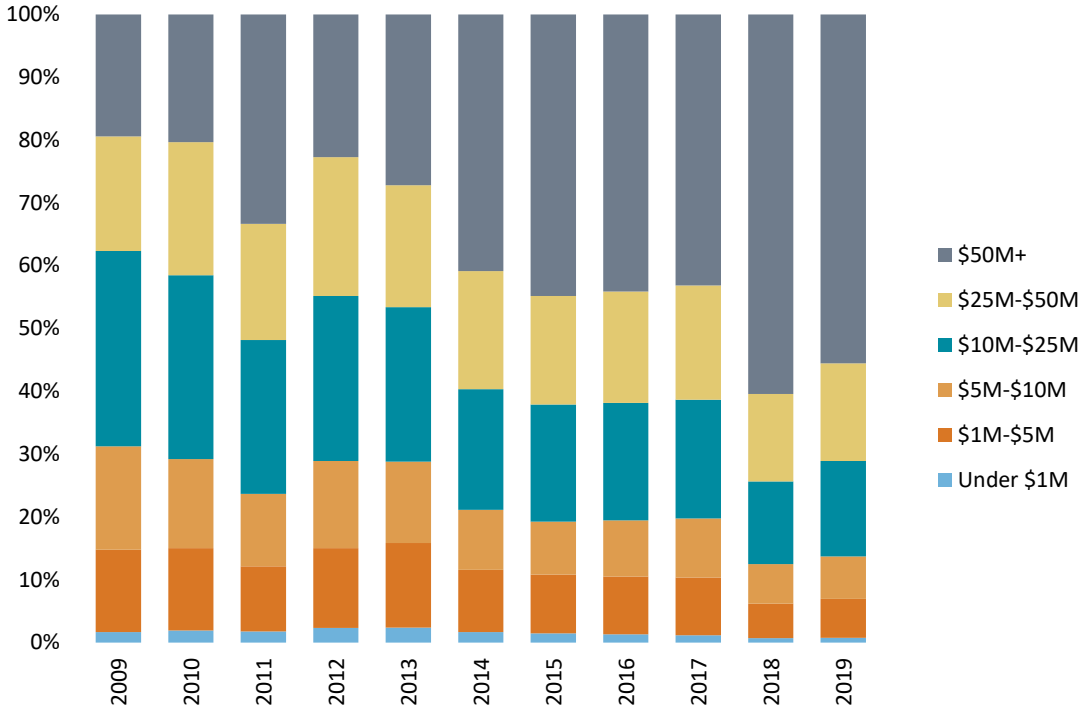
On Behalf of the Company:	**On Behalf of the Investors:**
_____	_____
Name of Company	Investor Group (if applicable)
_____	_____
Signature	Signature
_____	_____
Name	Name
_____	_____
Phone	Phone
_____	_____
Email	Email

vii. Appendix 7



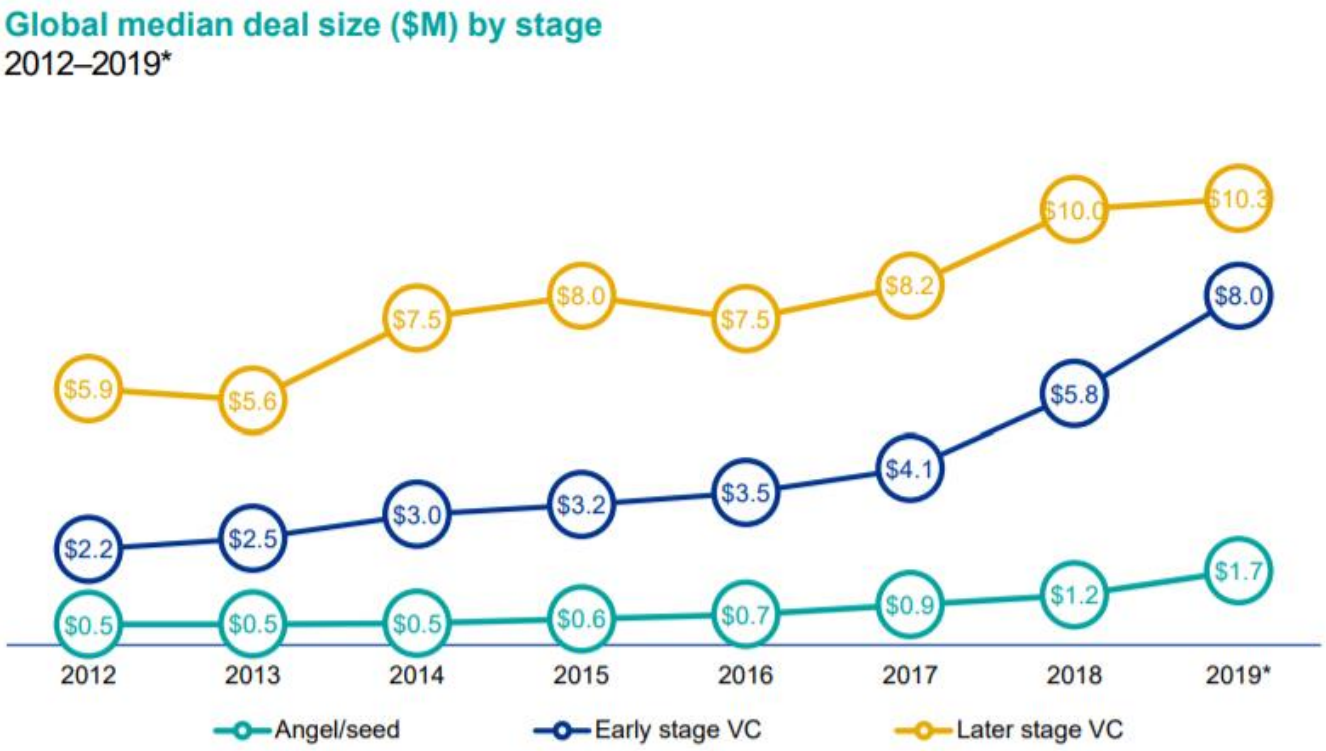
Source: *PitchBook and National Venture Capital Association, Venture Monitor*

viii. Appendix 8



Source: *PitchBook and National Venture Capital Association, Venture Monitor*

ix. Appendix 9

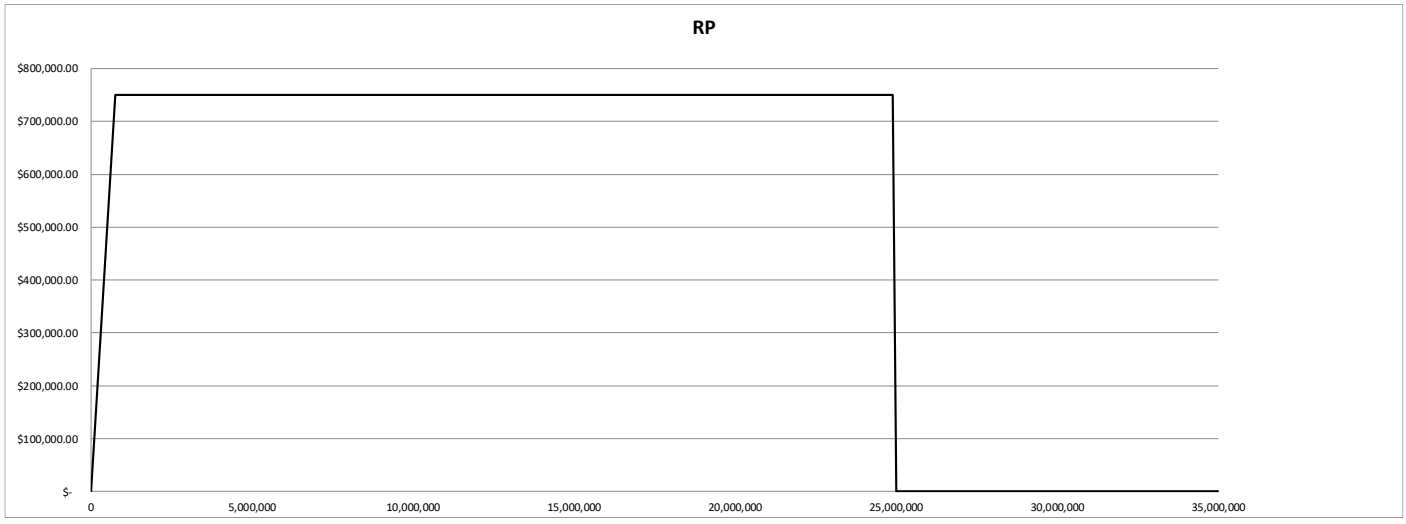


Source: KPMG Venture Pulse 2019

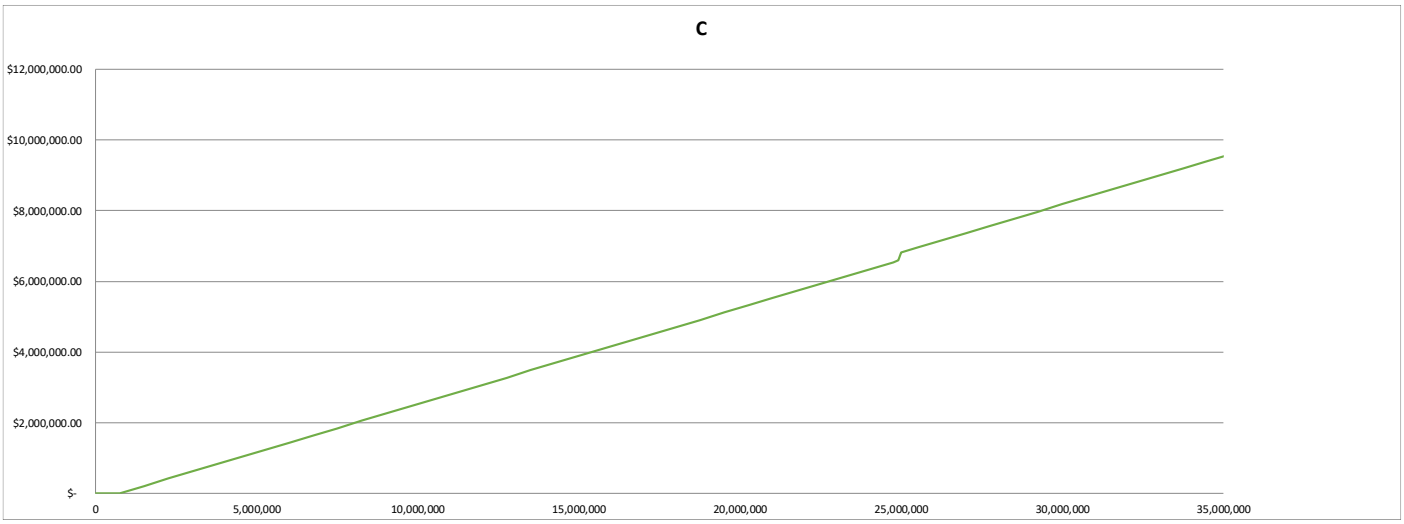
x. Appendix 10

Type of stock	Pre-Financing Number of shares	% Fully Diluted	Post-Financing Number of shares	% Fully Diluted
Common	1,000,000	*51%*	1,000,000	*35%*
Stock Options Granted	250,000	*13%*	250,000	*9%*
Pre-financing Stock Options	500,000	*26%*	500,000	*17%*
New Stock Options	200,000	*10%*	200,000	*7%*
Series A Pfd Stock			731,250	*26%*
Warrants			182,813	*6%*
Total Shares	**1,950,000**	***100%***	**2,864,063**	***100%***

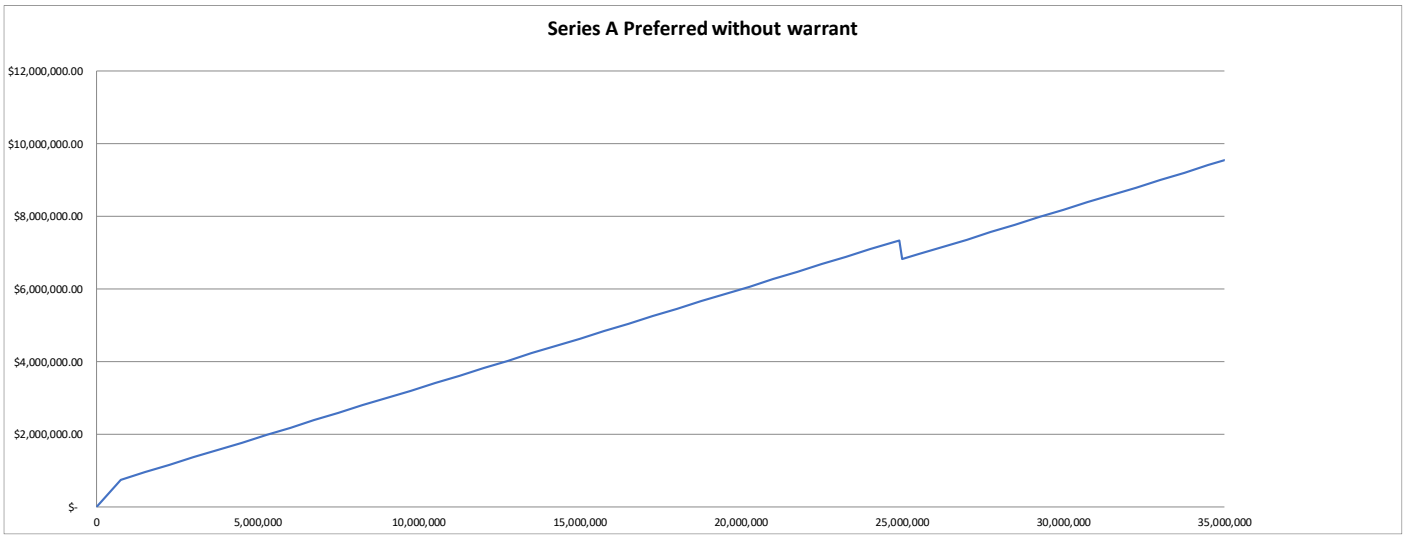
xi. Appendix 11



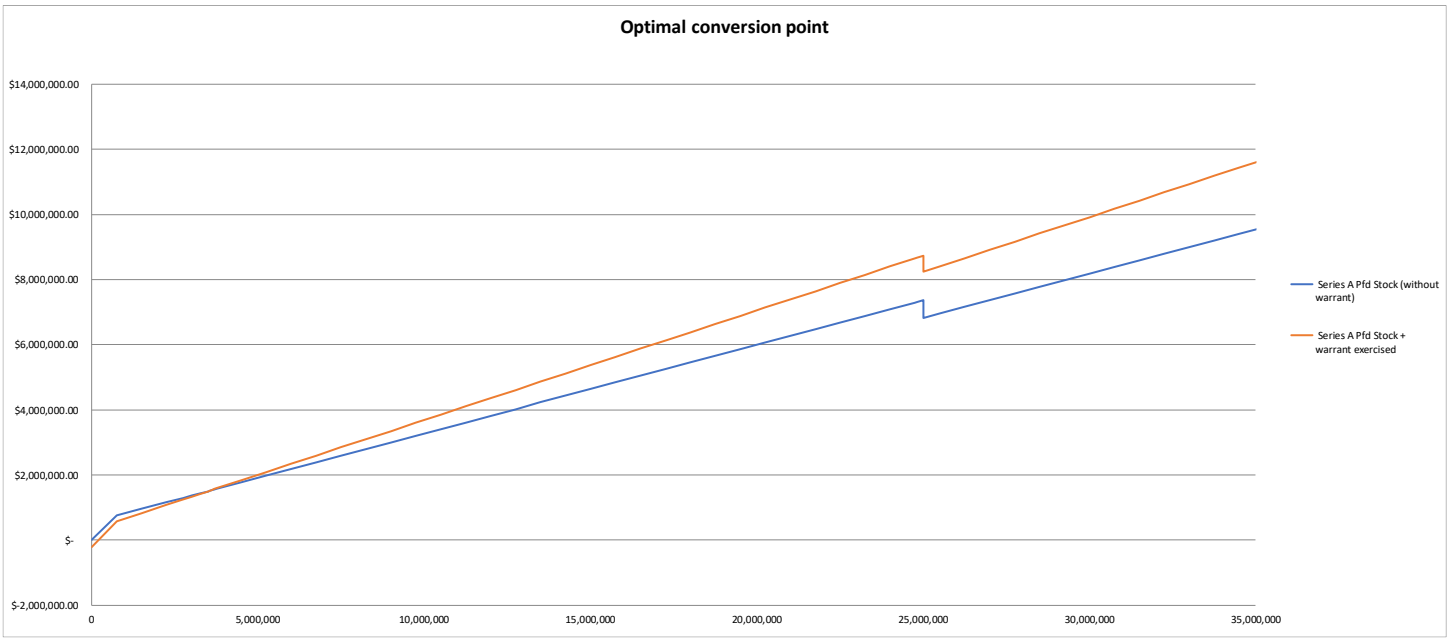
xii. Appendix 12



xiii. Appendix 13



xiv. Appendix 14



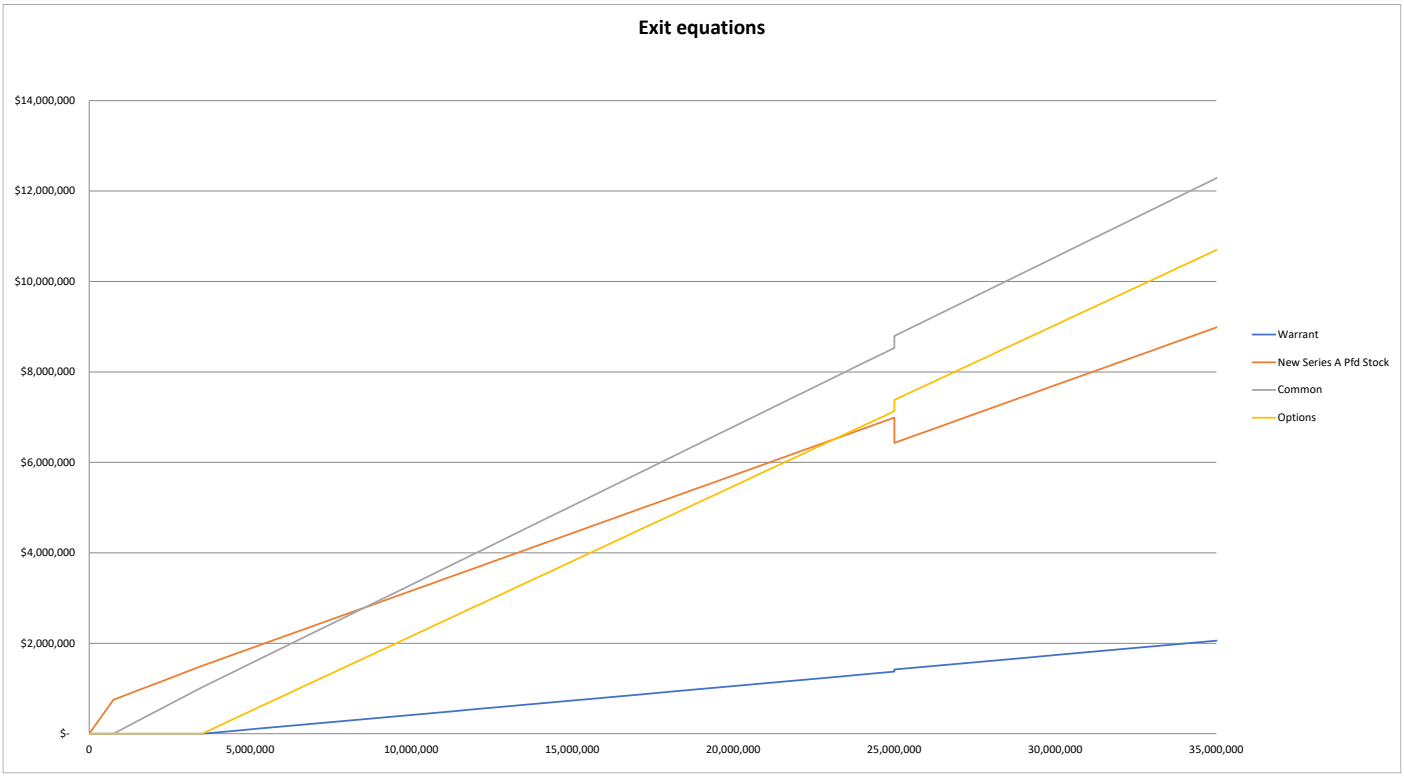
xv. Appendix 15

	Pre exercise		Post exercise	
Type of stock	**Number of shares**	**% Fully Diluted**	**Number of shares**	**% Fully Diluted**
Common	1,000,000	*37%*	1,000,000	*35%*
Stock Options Granted	250,000	*9%*	250,000	*9%*
Pre-financing Stock Options	500,000	*19%*	500,000	*17%*
New Stock Options	200,000	*7%*	200,000	*7%*
Series A Pfd Stock	731,250	*27%*	731,250	*26%*
Warrants	182,813		182,813	*6%*
Total Shares	**2,681,250**	***100%***	**2,864,063**	***100%***

xvi. Appendix 16

	0-$750,000	$750,000-$3,499,890	$3,499,890-V	$25,000,000
Series A Pfd Stock	100%	27.3%	25.5%	$ (558,511)
Common	0%	37.3%	34.9%	$ 261,866
Stock Options Granted	0%	9.3%	8.7%	$ 65,466
Pre-financing Stock Options	0%	18.6%	17.5%	$ 130,933
New Stock Options	0%	7.5%	7.0%	$ 52,373
Warrants	0%	0.0%	6.4%	$ 47,872

xvii. Appendix 17



xviii. Appendix 18

Type	Fair Value	Post-money	Delta
Series A Pfd Stock	$ 920,730	$ 749,970	22.8%
Common	$ 884,627	$ 1,025,600	(13.7%)
Options	$ 656,324	$ 974,320	(32.6%)
Warrants	$ 129,166	$ 187,493	(31.1%)
Total	$ 2,590,846	$ 2,937,383	(11.8%)

VII. References

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VIII. Summary

i. Introduction

The characteristics of venture capital generated interest in research from a theoretical perspective because it "encompasses the extremes of many corporate finance challenges: uncertainty, information asymmetry and asset intangibility. At the same time, from an empirical and policy perspective, venture capital has had a disproportionate impact, even though only 0.2% of all firms receive venture funding" (Kaplan 2016). Venture capital plays a central role in economic development as it acts in support of innovation and advancement in technology, as confirmed by Kaplan and Lerner (2009) that in their study find that roughly 50% of the "entrepreneurial" IPOs in recent years are venture-backed, this success is only part of the success of venture backed firms as IPOs represent only a small fraction of successful exits. Recent literature ranges from studies on financial contracting and governance such as the studies of Kaplan and Stromberg (2003, 2004) to risk and return analyses such as the studies of Cochrane (2005) and Korteweg and Nagel (2016), as well as studies on the relation between the financial contracting system of venture capital and return characteristics of the asset class like the study of Cummings (2008). While traditional literature has been primarily focused on Venture capital investments as an asset class and on the governance aspect preferred securities' superior rights, the real practice characterized by high valuations and exotic preferred securities recently brought different scholars to question the impact of venture capital financing on the capital structure and valuation of the company and to develop methodologies to model the variable cash flow rights arising from the complex provisions typical of venture capital financing contracts. Metrick and Yasuda formally treated Venture Capital as a branch of corporate finance in their manual "Venture Capital and the finance of innovation" (2010) , where they developed a framework for the valuation of VC investments that combines financial contracting and contingent claims models; Gornall and Strebulaev (2018) had the same approach in their study, in which they performed a valuation of 135 U.S. unicorns[12] using a similar model and found that the securities used in venture capital strongly influence other investor classes and the overall valuation of the firm, highlighting the misuse of post-money valuation metric by showing that the "fair value" of the securities issued in VC rounds is profoundly different from the value resulting from post-money valuation. This study, in line with this branch of research, aims to explain the impact of venture capital financing on the value of common securities and on the overall valuation of the firm through an analysis of the characteristics of the preferred securities issued in these investments, in particular the study analyses a standard early stage[13] financing contract. The analysis is conducted on the Series A term sheet proposed by the "Angel Capital Association", the largest association of angel[14] investors in the United States, and consists in the valuation of the securities arising from the hypothetical financing round with the model developed by Metrick and Yasuda and the comparison with the value reported in post-money valuation, the results are then explained through analysis of the complex incentive and protection mechanisms behind the design of these securities. The results of the study are in line

[12] "Venture capital backed companies that have been valued over $1 billion" Gornall and Strebulaev (2018)
[13] Generally in this stage the business is less than three years old
[14] Angels are individual investors that generally invest in the early stage of the company

with the results obtained by Gornall and Strebulaev in their study and are consistent with previous literature on the topic.

ii. Literature review

The financing arrangements used in venture capital range from debt-like equity securities, such as redeemable preferred, to complex forms of preferred stock, such as participating convertible preferred, these securities have dramatically different payoffs in downside scenarios in comparison to common stock as the rights issued to the investor often involve liquidation preferences and redemption rights, therefore the pricing of these securities requires a specific valuation framework that takes into account the features contained in the contract, that can be considered as "embedded options". The valuation requires the translation of these legal provisions into intelligible financial instruments in terms of pricing as a first step, then the pricing of these instruments with option pricing techniques with the appropriate modifications to processes and parameters that reflect the nature of the underlying. Metrick and Yasuda in their book "Venture capital and the finance of innovation" create a framework to determine the value of these securities. Term sheets[15], pre-contractual documents that "describe the basic structure of a transaction and provide a set of protections against expropriation", are the starting point to construct a valuation framework for these complex securities. The legal provisions contained in these documents define the features of the securities issued in the investment round and act as a guideline for the final contract. Metrick and Yasuda start their analysis by constructing the exit diagram, a simple graphical representation of the value of a security against the value of the whole firm at the time of the exit of the investment, the payoff is modelled on the basis of cash flow and liquidation rights contained in the contract resulting in the typical graphical representation of option payoffs on the basis of the underlying security strike price. These diagrams are constructed with the exit value of the company on the x-axis and the exit payoff of the security on the y-axis where the expiration date is unknown, it is then straightforward to construct the "exit equations". These equations allow them to replicate these functions as portfolios of options by adding (or subtracting) a fraction of a call option at every point that the slope changes, with strike price equal to the corresponding point on the x-axis and the fraction equal to the change in slope at that point, they call this process " reading the exit diagrams". To price the resulting replicating portfolio of calls and binary calls Metrick and Yasuda start from the traditional example of convertible preferred stock, a typical security used in VC transactions, that can be modelled as a bond plus an embedded call option. However, unlike standard call options, this embedded option will have a forced exercise in the case of an IPO or sale of the company, and would expire worthless if the company goes out of business. To replicate these outcomes we can think of an option that has a 50% probability of forced expiration in five years and 50% probability of forced expiration in 10 years, we can price these two options with the Black and Scholes formula and price the combination as the expected value of these two standard call options. This logic can be applied to an option that can have possible forced expiration in any number of dates, Metrick and Yasuda report the example of a company where every month the board decides for the company's sale, liquidation or IPO with the same exit probability each

[15] "Term sheets are preliminary contracts designed as a starting point for the more detailed negotiations required for the contract." Metrick and Yasuda 2010

month. If we consider a 10-year period then any option on this company will have 120 possible expiration dates, each with a 1/120 probability of happening, we can then price the combination as the expected value of 120 European call options with expiration 1 month, 2 months, up to 10 years and price them with the Black-Scholes formula. If we take this process to the limit the option will have a continuous-time probability of forced expiration and infinite expiration dates and the value of the option would be calculated as an integral of the probability of expiration for any given date multiplied by the Black-Scholes value of the call option with that expiration. They call these options with unknown expiration "random-expiration" options with a probability q of forced expiration (that Gornall and Strebulaev call "exit rate λ" in their paper) and derive from this probability the expected holding period H=1/q, this forced expiration is random and uncorrelated with the performance of the firm and the market. To determine the probability of a forced expiration at any time T the instantaneous probability of expiration q is multiplied by the probability that the option is still alive at that time $exp(-qT)$, yielding a probability of $qexp(-qT)$, which is also the probability distribution function for the exponential distribution. The time of expiration of the option is then exponentially distributed with density:

$$f^t(T) = qexp(-qT)$$

Where q is the exit rate (called λ by Gornall and Strebulaev) and the expected Holding period (i.e. average exit time) H is:

$$H = 1/q$$

The price of the option is then represented by the following equation:

$$\int_0^\infty [S * N(d1) - Xe^{-rT} * N(d2)]qexp(-qT)dT$$

These assumptions allow me to price the options used to replicate the payoff functions, in practice I used the web tool VCVtools developed by Metrick and Yasuda to price the random expiration calls.

iii. The study

The main metric of valuation used "also by sophisticated finance professionals" (Gornall and Strebulaev, 2018) for VC backed companies is post-money valuation, "the equivalent of market capitalization for public companies" (Metrick and Yasuda, 2010), calculated as P=OPP*fully diluted share count, where OPP stands for original purchase price, the price per share paid at the time of the transaction, and the fully diluted share count is the number of shares outstanding after the financing. This study uses the contingent claims model and option pricing techniques developed by Metrick and Yasuda in the book "Venture Capital and the finance of innovation" (2010) with insights from the studies of Kaplan and Stromberg (2003) and Gornall and Strebulaev (2018) to value the securities of a hypothetical company after a Series A round conducted with the contractual terms of the standard Series A financing term sheet proposed by the "Angel Capital Association", the largest American association of angel investors groups, and compare it to the reported post-money valuation.

Type of stock	Pre-Financing Number of shares	% Fully Diluted	Post-Financing Number of shares	% Fully Diluted
Common	1,000,000	*51%*	1,000,000	*35%*
Stock Options Granted	250,000	*13%*	250,000	*9%*
Pre-financing Stock Options	500,000	*26%*	500,000	*17%*
New Stock Options	200,000	*10%*	200,000	*7%*
Series A Pfd Stock			731,250	*26%*
Warrants			182,813	*6%*
Total Shares	**1,950,000**	***100%***	**2,864,063**	***100%***

As shown in the capitalization table above, the share capital after the round is composed of common stock, preferred stock, stock options and warrants issued to the investor, these securities have different cash flow rights and option-like features to model in their payoff functions.

Draft Term Sheet for Alliance of Angels

This draft term sheet, by Dan Rosen, CEO Dan Rosen & Associates, is for use by Alliance of Angels members as a starting point in negotiating seed stage deals. The AoA lead investor is noted as <<AoA Investors>> in the document. Each party in such deals should seek appropriate legal counsel. Except for the section titled "Exclusivity," this term sheet does not create a legally binding obligation on any person or entity.

Company name	Acme, Inc
Location	<<Company Address>>
Type of Entity	Washington State C Corporation
Type of Equity	Series A Preferred Stock
Size of Offering	$750,000
Minimum to close	$500,000
Closing	On <<Date>> ("the Closing Date") or when minimum to close is committed
Valuation	
Pre-money	$2,000,000
Post-money	$2,750,000
Price per share	$1.0256
Investors	Various members of the Alliance of Angels, who are Accredited Investors acting on their own account, and/or other Accredited Investors only (as defined in SEC Rule 501)

Comment [DR1]: Some prefer Delaware incorporation. Washington state and Delaware have parallel laws, but Delaware has greater case law and therefore better protection for company Directors.

Comment [DR2]: At times, Angels are asked to buy either common stock or S-Corp stock. Common makes sense in a limited situation: where an experienced entrepreneur has put lots of their own money into a company and you trust (based on experience with that individual) that they will treat investors well. S Corps cannot give preferred shares and should be avoided.

Comment [DR3]: Might also want to specify a latest close date for the round. If not met, it forces the company to come back to investors.

Investor Incentives Investors who invest by the Closing Date will receive the following incentive:

Discount or Warrants 25% Warrant Coverage

Stock Options The company will increase the authorized pool of options prior to the financing to bring the total unallocated options to at least the following percent

Total Unallocated options 24% in the post money

New options issued 200,000

Pre and Post-Financing Capitalization (assuming all shares issued)

	Pre-Financing		Post Financing	
Type of stock	**Number of shares**	**% Fully Diluted**	**Number of shares**	**% Fully Diluted**
Common	1,000,000	51%	1,000,000	35%
Stock Options Granted	250,000	13%	250,000	9%
Pre-financing Stock Options Avail	500,000	26%	500,000	17%
New Stock Options	200,000	10%	200,000	7%
Series A Pfd Stock			731,250	26%
Warrants			182,813	6%
Total Shares	1,950,000	100%	2,864,063	100%

Comment [DR4]: Discounts or Warrants are an incentive to invest. If granted, it is almost always one or the other, but not both. They must be considered with the price per share as to their reasonableness to current market conditions. It is, of course, cleaner to just lower the price per share, but often there are reasons (e.g. a higher priced friends and family round) not to do so.

Comment [DR5]: With warrant coverage, the post money will technically be higher than the pre-money plus the amount invested, because these shares are issued. In reality, given that the warrants are usually priced the same as the shares issued, they are "out of the money" and therefore do not actually effect the post money.

Comment [DR6]: The unallocated option pool depends largely on the state of the company's current management team and positions that still need to be filled. This usually ranges from about 10% to 25%, and must be considered in the post-money cap table, not the pre-money cap table.

Comment [DR7]: Note that the post money price is more than the pre-money + new money, because of the warrants, which go into the post.

Terms of the Series A Stock

Liquidation Preference	**1x participating preferred.** The Series A Preferred shall receive an amount equal to one times (1x) the Purchase Price, plus any declared and unpaid dividends, prior to the payment of any sums to any other equity security holders in the event of (i) a liquidation, dissolution, or winding up of the Company; or (ii) "Change in Control," which means a merger or consolidation (other than one in which the stockholders of the Company own a majority by voting power of the outstanding shares of the surviving or acquiring corporation) and a sale, lease, transfer, or other disposition of all or substantially all of the assets of the Company. Thereafter, all of the proceeds shall be ratably distributed to the holders of Preferred and Common Stock, on an as converted basis.
Dividends	**Dividends only when declared, and not cumulative.** The holders of Series A Preferred will be entitled to receive dividends only when and if declared by the Board and in preference to holders of Common Stock.
Voting Rights	Except as set forth in "Protective Provisions" below, the Series A Preferred shall vote together with the Common Stock on an as converted to Common Stock basis, and not as a separate class
Board Participation	The holders of a majority of the Series A Preferred shall be entitled to elect one member of the board of directors, who shall initially be _____. At the time of the closing of this financing, the board of directors shall be 5 members: 1 from management, 1 from Series A, and 3 independent directors acceptable to both common and Series A directors. The Series A director shall be compensated with stock options on a standard basis.
D&O Insurance	Prior to the closing, the company shall obtain a Directors & Officers insurance policy that is at least $1M.

Comment [DR8]: In the past, it was often argued that Angels should not request 1x participating preferred without a cap, because larger follow-on rounds would then get the same. While a small angel round doesn't change the "liquidation overhang," a large VC round might. Capping the liquidation preference in future, larger rounds does make sense.

Comment [DR9]: In the past, it was often argued that Angels should not request 1x participating preferred without a cap, because larger follow-on rounds would then get the same. While a small angel round doesn't change the "liquidation overhang," a large VC round might. Capping the liquidation preference in future, larger rounds does make sense.

Comment [DR10]: Cumulative dividends do make sense in the case of a redemption provision, as outlined below.

Comment [DR11]: Depending on the circumstances, having all of the directors selected by the closing might not be possible. This could read that within XXX days of closing, with the agreement of the Series A director, this can be delayed.

Comment [DR12]: Note that five is an arbitrary number and should be adjusted to the circumstances. The goal is to provide excellent guidance to the entrepreneur and bring the investors' knowledge to bear. Often an initial board of 3 is sufficient.

Comment [DR13]: It is also reasonable that the Series A director be on compensation committee and must agree to executive compensation.

Comment [DR14]: This amount is a minimum, but generally adequate for a seed stage company. If there is a large amount of investment, real property, or intellectual property, it should be more.

Comment [DR15]: This amount is a minimum, but generally adequate for a seed stage company. If there is a large amount of investment, real property, or intellectual property, it should be more.

Conversion Rights	The holders of the Series A Preferred shall have the right to convert the Series A Preferred into shares of Common Stock at any time. The initial conversion rate for the Series A Preferred shall be 1-for-1, subject to adjustment as indicated below.
Automatic Conversion	The Series A Preferred shall automatically be converted into Common Stock, at the then applicable conversion rate, upon: (i) the closing of a firmly underwritten public offering of not less than $25,000,000 (before payment of underwriters' discounts and commissions) (a "Qualified IPO); or (ii) the written consent of holders of the majority of the outstanding preferred stock.
Antidilution Rights	**Broad based weighted average.** The conversion price of the Series A Preferred will be subject to proportional adjustment for stock splits, stock dividends, and the like, and to adjustment on a broad-based weighted average basis for issuances at a purchase price less than the then-effective conversion price, subject to customary exclusions.
Founder's Stock Right of Repurchase	Common stock owned by any founder with more than 2% of the post financing equity is subject to the right of repurchase by the company at the lower of (a) the fair market value (FMV) at the time of agreement or the FMV at the time of repurchase; or (b) $0.01 per share (if no FMV has been determined), if the founder leaves the company within the first four years. Such a right expires over four years on a monthly basis after the Initial Closing (2.083% per month for 48 months).
Protective Provisions	The consent of the holders of a majority of the outstanding Series A Preferred shall be required to: (i) amend the Articles of Incorporation in a manner that would alter, change, or repeal any of the rights, preferences, privileges or restrictions of the Series A Preferred so as to adversely affect the Series A Preferred (it being understood that the authorization or issuance of shares of a new series of preferred stock that is senior to or pari passu with the Series A Preferred will not be deemed to adversely affect the Series A Preferred if the rights, preferences, privileges or restrictions of the Series A Preferred are not otherwise affected); (ii) increase the total number of authorized shares of Series A Preferred by more than 10%; (iii) approve a sale or merger of the Company.
Drag Along	If the Company's Board of Directors and a majority-in-interest of the

Comment [DR16]: This percentage can be modulated depending on the circumstances; 2-10% is the reasonable range..

Comment [DR17]: This is an important term that is often missing in Angel term sheets. In essence, it converts the founders shares to restricted shares. Having 100% of the founders' shares subject to right of repurchase is a term that can be negotiated. Depending on the state of the company and the value contributed to date, and the value of the founder to the company, this number can be set at less than 100%. However, sufficient shares should be subject to this right to ensure that the founders are bound to the company.

Note that sometimes the founders have invested capital as well as sweat equity. In those cases, the "purchased shares" should be excluded from this provision.

Comment [DR20]: Some favor a 60% or 2/3rd vote. While more protective of investors, it can put a company into a position where it can't move forward.

The extract of the term sheet above reports the issuance 731,250 Series A preferred stocks at an aggregate purchase price[16] (APP) of $750,000, that represents the price paid for all the securities purchased and in this case is equal to the total investment because the investor buys only one class of securities, resulting in an OPP=$1.0256. the reported post-money valuation of the company is $2,750,000 and, as reported in the term sheet, the warrants offered to the investor increase the figure to $2,937,383. The " Series A Convertible Preferred" payoff function can be directly derived from the provisions in the term sheet, the section "liquidation preference", that "tells an investor where he stands in the capital structure hierarchy" (Metrick and Yasuda, 2010), reports the cash flow rights of this security: "1x participating preferred"[17] indicates that the security is a participating convertible preferred (PCP). The provisions in the section "Automatic Conversion" define the threshold in which the investor converts automatically to common stock and loses its liquidation preference, in this case the threshold is "the closing of a firmly underwritten public offering of not less than $25,000,000" that we will call QPO (Qualified Public Offering) threshold. Kaplan and Stromberg in their study, as well as Metrick and Yasuda in their book, construct the PCP payoff as a combination of redeemable preferred (RP) and common stock (C) with a drop on the QPO threshold, finding the payoff functions of these securities is useful to construct the payoff function of the PCP as a combination of RP+C. The redeemable preferred is "very similar to the required repayment of principal at the maturity of a debt claim… Unlike a debt claim, however, the company cannot force the VC to exercise the redemption right." (Kaplan and Stromberg, 2003). The redeemable preferred exit equation is the following:

$$RP = min(V; APP)$$

Common stock (C) has a linear exit function that in this case is shaped by the liquidation preference of the RP, so it can be written as the following:

$$C = \max\left(I/P * (V - APP); 0\right)$$

Where I is the value of the initial investment and P is the post-money valuation, resulting in I/P as the percentage of the company owned by the investor. The presence of liquidation preference shapes the common stock payoff function as an option where the underlying spot price is I/P*V and the strike price is I/P*APP. I can then write down the exit equation of the PCP as follows:

$$PCP = min(V; APP) + \max\left[I/P * (V - APP); 0\right]$$

This equation holds until the automatic conversion into common stock is triggered at the QPO threshold, where the payoff function becomes the same as common stock:

$$PCP = I/P * V$$

[16] Defined as APP=OPP*number of shares issued to the investor, it represents the aggregate price paid by the investor for the ownership, so the full amount of the investment

[17] "A 2X or 3X liquidation preference requires that the investor is paid back double or triple, respectively, their original investment before any of the other (junior) equity claims are paid off" Metrick and Yasuda 2010

At the point of automatic conversion the liquidation preference expires and the APP is redistributed among investors, causing a drop in the payoff function for the PCP and a jump for the other security classes. The warrants are issued at a share price of K = $1,0256 and I will assume that they have expiration in 5 years, then I can price them as American call options with expiration in 5 years. The payoff of the shares underlying the warrants is modified by two factors: the presence of the PCP liquidation preference and the immediate retention of proceeds from the capital increase arising from the warrant exercise price. The exercise of the warrants dilutes the other shareholders and modifies the slope of their payoff functions, the purchase of 182,813 Warrants at $1.0256 per share represents an investment of I = $187,493, the warrant holders retain a share (I/P) of the proceeds from the capital increase (I) and their cash flow rights are reduced by the Series A liquidation value (APP). The strike price should be then adjusted for the value of the company that verifies this condition:

$$I/P * (V - APP + I) > I$$

The warrants are optimally exercised at company value V = $3,499,890 that yields an adjusted strike price of K = $3,499,890/2,864,063 = $1.222. From the previous calculations we obtain three critical points: at V = $750,000 the initial investment of the preferred stock would be entirely redeemed, so the ownership percentage on exit proceeds changes on this point, thus the slopes of the payoff functions change, at V = $3,499,890 the conversion of the warrants changes again the slope of the other functions and at the point of the QPO (V = $25,000,000) the automatic conversion of the PCP triggers a drop for the preferred stock and a jump for the other securities. The payoff functions' slope changes are reported in the following table.

	0-$750,000	$750,000-$3,499,890	$3,499,890-V	$25,000,000
Series A Pfd Stock	100%	27.3%	25.5%	$ (558,511)
Common	0%	37.3%	34.9%	$ 261,866
Stock Options Granted	0%	9.3%	8.7%	$ 65,466
Pre-financing Stock Options	0%	18.6%	17.5%	$ 130,933
New Stock Options	0%	7.5%	7.0%	$ 52,373
Warrants	0%	0.0%	6.4%	$ 47,872

The Series A preferred and the common stock exit equations can be then replicated as follows:

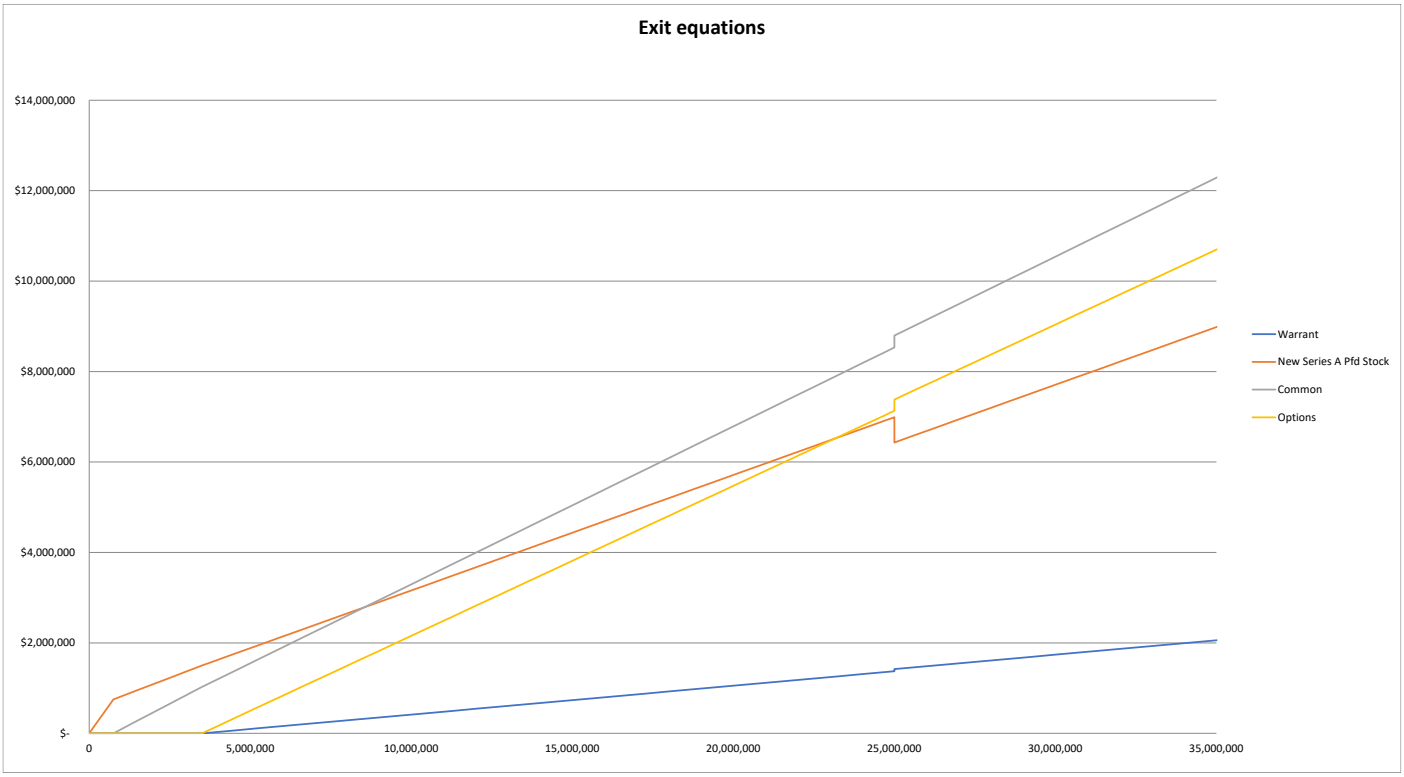
$$V(series\ A) = V - (100\% - 27.3\%) * C(750{,}000) - (27.3\% - 25.5\%) * C(3{,}499{,}890) - (100\% - 25.5\%) * 750{,}000 * BC(25{,}000{,}000)$$

$$V(common) = 37.3\% * C(750{,}000) - (37.3\% - 34.9\%) * C(3{,}499{,}890) + 34.9\% * 750{,}000 * BC(25{,}000{,}000)$$

$$V(options) = 950{,}000 * EC(1.22) + 33.2\% * 750{,}000 * BC(25{,}000{,}000)$$

$$V(warrants) = 182{,}813 * AC(1.22) + 6.4\% * 750{,}000 * BC(25{,}000{,}000)$$

The following Graph reports the exit equations for different investor classes:



AC and EC stand for American call and European call and C(K) is a call and BC(K) is a binary call with strike price K used to construct the replicating portfolio. For the analysis I priced two call options with strike prices K = $750,000 and K = $3,499,890 and a binary call option with strike price K = $25,000,000 with random expiration. For the risk free rate I estimated the six months average from August 2019 to February 2020 average of the one year US treasury yield that results in Rf= 1.63%, I decided to keep this parameter calculated to February 2020 as it is not affected by the interest rate cut occurred in march 2020 following the covid-19 pandemic emergency, while the stock price is the company's post-money valuation after the financing S = $2,937,383. Metrick and Yasuda suggest an exit rate q = 0.2 for early stage rounds, as they found that on average early stage financing rounds generate an exit in five years, Gornall and Strebulaev suggest $\lambda = 0.25$ as their study is conducted on a sample of mature companies, as they have reached $1 billion in valuation, that have issued capital in later investment rounds so the time to exit should be shorter, I will use the parameter suggested by Metrick and Yasuda considering that we are valuing a Series A investment that should represent the first round of investment in a real world case. I use 0.9 as volatility parameter, as suggested by Metrick and Yasuda (2010a), Metrick and Yasuda (2010b) and Gornall and Strebulaev (2018), this assumption is in line with the findings of Cochrane (2005), that estimates the annualized volatility of VC investment returns at 0.89, and with Ewens (2009) and Korteweg and Sorensen (2010) that got volatility estimates between 0.88 and 1.3. With the VCV tool, a web tool developed by Metrick and Yasuda to value random expiration calls, I obtained the following call prices C(K): C($750,000) = $2,468,654 and C($ 3,499,890) = $1,625,701, while the binary call BC($25,000,000) = $0.01. By inserting these values into the replicating portfolios we obtain a value to Series A preferred investors of $V(series\ A)$ = $920,730 against the value as a share of post-money valuation of $749,970 and a value to Common stock investors of $V(common)$ = $884,627 against the value

as a share of post-money valuation of $1,025,600. The values found are AC=$0.70 for the American call, found through the binomial pricing model, that suggests the optimal exercise of the warrant in year 5, and EC=$0.69 for the European Call, found through the Black and Scholes pricing formula. The replicating portfolio of the option holders and warrant holders payoff have value $V(options)$ =$656,324 against the value as a share of post-money valuation of $974,320 and $V(warrants)$ =$129,165 against the value as a share of post-money valuation of $187,493. The fair value of the different securities are reported in the following table:

Type	Fair Value	Post-money	Delta
Series A Pfd Stock	$ 920,730	$ 749,970	22.8%
Common	$ 884,627	$ 1,025,600	(13.7%)
Options	$ 656,324	$ 974,320	(32.6%)
Warrants	$ 129,166	$ 187,493	(31.1%)
Total	$ 2,590,846	$ 2,937,383	(11.8%)

iv. Results and conclusion

As observable in the table the fair value of the company is 11.8% lower than the reported post-money valuation, this result is lower than the average 48% found by Gornall and Strebulaev on 135 US unicorns. Options and warrants have a different price from the post-money valuation by nature because they are derivatives, so the difference is justified, even though "many employees use post–money valuation as a reference when valuing their common stock or option grants, which can lead them to dramatically overestimate their wealth" (Gornall and Strebulaev, 2018). Common stock is undervalued by 13.7%, while Series A preferred is overvalued by 22.8% , the Series A overvaluation is lower than the 30% to 53% range found by Gornall and Strebulaev (2018), the difference with the results of this study can be fully explained by the stage of the companies analysed in the sample. The study of Gornall and Strebulaev is carried over unicorns, that normally have had a number investment rounds, so these companies normally have a higher relative number of preferred shares issued and more investor classes with different cash flow rights and seniority, thus the valuation of common stock results lower and the valuation of preferred stock higher. The "hypothetical company" object of this study is a company in "early stage" that issues the first round of a preferred security that has only 1x liquidation rights, while this provision can be higher for a significant share of deals as stated in "The Dow Jones Report", the study finds that about 25% of all deals contain an excess liquidation preference, with about 70 percent of these preferences being 2X or less, also Kaplan and Stromberg (2003) confirm the widespread use of these features in VC investments, finding that redemption provisions are present in 78.7% of the sample 119 companies from 14 VC firms of their study and have a typical maturity of 5 years, the case in this study only has 1x liquidation preference, while the analysis of Gornall and Strebulaev is conducted on a sample of companies that could have issued securities with higher liquidation multiples, therefore the average overvaluation of these securities could result higher for the effect of these outliers. Preferred securities are structured to lower the downside risk for the investor by protecting the investment in negative scenarios while keeping the governance and the effective ownership of the company in the hands of

the founders and creating an incentive for the entrepreneur that, by bringing the company to IPO, would trigger the automatic conversion for the investor that would lose his cash flow rights in favour of the entrepreneur. The use of automatic conversion provisions is explained by Black and Gilson (1998) that argue that "the effect of these provisions is to require the VCs to give up their superior control, board, voting, and liquidation rights if the company attains a desired level of performance. Upon such performance, the VCs retain only those rights associated with their ownership of common stock. If the company does not deliver that performance, the VCs retain their superior control rights" and Kaplan and Stromberg (2003) add "this provides the entrepreneur an incentive to perform in addition to the monetary incentive" , while Aghion and Bolton (1992) show that the external financing capacity generated by the higher profitability decreases the conflicts of interest and is positively correlated to higher entrepreneur control a rights. Another empirical explanation for the use of such securities comes from the industry practice, funding projects that require large investments and will not generate profit for years without taking control of the company (VC funds always own minority stakes to keep control in the hands of founders), this practice requires the funds to apply unjustifiably high valuations, as shown recently in the financial press with the story behind WeWork, and to give up a higher control stake in favour of superior cash flow rights. The use of more reliable valuation techniques and reporting metrics would generate more reliable data and create the basis for more academic research on the topic, as also recommended by Kaplan, while this fast growing industry will be surely a green field for new research and valuation practices as it has been for the innovative ideas that revolutionized our economic system in recent years.