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Toward a Corporate Finance Theory for the Entrepreneurial Firm.

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ABSTRACT

Corporate finance for the entrepreneurial firm is fundamentally different from that of the traditional firm. The standard problems and solutions to both investment and financing are reformulated in this paper. The formulation is intended to capture two distinguishing features of entrepreneurial finance: 1) Although new ventures yield negative returns on average, they are in aggregate welfare increasing for the economy, after considering their positive externalities. 2) Due to new ventures' lack of consistent cash flows, which precludes the use of debt, the debt versus equity financing choice is replaced by the choice between the entrepreneurs' desire for wealth versus control; taking "a larger slice of a smaller pie," or "a smaller slice of a larger pie."

Toward a Corporate Finance Theory for the Entrepreneurial Firms

I. Introduction

Wealth of a nation derives from economic growth. Entrepreneurial success is the engine. This is especially true for the developed economies whereas, in contrast, developing economies can still generate growth through copying and catching up. Over the long run, economies whose culture encourages entrepreneurship, with qualities such as risk taking, independence, and tolerance of failure, have more entrepreneurial activities and thus grow faster than their counterparts.

Finance, in particular the availability of money for investing in entrepreneurial ventures, and financial management, the strategic use of the funds in both investing and financing, play vital roles in initiating and fostering entrepreneurial activities, from the provision of nutrients in the incubator (seed money and crowdfunding) to delivery in the birth of a new public company (IPO).

In want of a corporate finance theory for entrepreneurial firms, extant corporate finance theory, which was developed for prototypical firms, is the only alternative available to practitioners and researchers of these enterprising young firms. The 'one size fits all' corporate finance theory is rationalized on the grounds that the fundamental principles underlying the extant theory are so basic to all firms that it is indeed the general theory of corporate finance. Some attempts have been made to give the extant theory more of a twist toward entrepreneurial firms by emphasizing the greater importance of agency and information issues. However, since these are the standard bearers of the extant theory, the attempt is akin to a repackaging (old wine in a new bottle).

Is there a need for a different theory of corporate finance, one that is more suitable for the entrepreneurial firm? This paper addresses the question in three parts. Section 2 explains that extant corporate finance theory fails because its determinants lose most of their relevance in the environment of entrepreneurial firms. In section 3, issues that are unique or more germane to the entrepreneurial firms are discussed. Sections 4, based on the issues uncovered in the previous section, speculates on some possible corporate finance models for the entrepreneurial firms. The influence of behavioral considerations is discussed. Section 6 concludes.

II. Extant Financial Theory: View from the Entrepreneurial Firm

This section takes a critical examination of the workhorses of the extant financial theory; capital structure theory, dividend theory, and the NPV rule; and their relevance to entrepreneurial firms.

First we describe the attributes of entrepreneurial firms analyzed in this paper. We exclude the majority of small businesses because they are in existing industries. While the founding family or individuals maybe ‘entrepreneurial’ in that they quit their jobs and invested all their savings in their new businesses, extant corporate finance theory is still applicable. Typical factors such as information, transaction costs, and agency issues (from business partners) may be exacerbated in small businesses; nevertheless, the same principles and solutions apply.

The key premise underlying our definition of a firm as entrepreneurial is that the firm, or the new industry it may help create, has the potential to add significantly to the wealth of the economy. The entrepreneurial firm creates new sources of wealth from new products, new markets, and new applications, and pulls in new users and consumers by uncovering hitherto unknown states of nature, solutions to known and unknown human and social problems, and altering the allocation of individuals’ time, lifestyles, and the nature of jobs.

Table 1 differentiates the entrepreneurial firm from the conventional firm. It sets a high bar for the entrepreneurial firms: negative average NPV for all firms and under uncertainty. Given that we previously specify entrepreneurial activities grow the economy, it must necessarily be the case that individual firms in the aggregate may not be able to privately capture all the private and public benefits of their investments, the difference representing externalities that benefit a broader segment of the economy. They are the unintended benefits from new states created out of the realization of uncertainty. For instance, take the ubiquitous smart phone. Although the original idea was to create a portable handheld small phone, it was not expected to become a commerce and payment system, a game system, a camera and album, a device for social networking, a home security monitor, and a library. It spawned other businesses, which the early investing firms could not capture or share. It even replaced a previous generation’s innovations: location tracking via GPS, portable music and video devices, the Palm Pilot, and now even credit cards. Society is also better off in ways unexpected: farmers in less developed countries can find current spot prices for their farm products and be freed from having to deal with expropriating middlemen who monopolize price information; medical

diagnoses can be made from photo images by far away specialists; educational materials may be made available without having to be near a well stuffed physical library; and, at very low transaction costs, it enable all sorts of transactions including very low price items (e.g., soda) that would not have been practical before. An economy with high participation of entrepreneurship must also necessarily be more dynamic. This means that although some new businesses may be created from new uses, some older businesses may have to be replaced; e.g., Kodak and Fuji films are less readily available, and physical checks may also be disappearing soon.

A. Investments by the entrepreneurial firms

The entrepreneurial firms as defined in Table 1 would not solely rely on the traditional $NPV > 0$ rule for investment decisions. Reliable inputs to the NPV calculations, in many cases, are simply not obtainable. Under uncertainty, it would not be possible to estimate the magnitude of cash flows, as well as the identity of the states of nature (i.e., list of possible outcomes in each time period required for discounted cash flow calculations), and thus their probabilities are not known or capable of being even imagined. The discount rate, which is a product of aggregating various state prices, is not available. The lack of tangible assets as collateral and residual assets at liquidation also reduce the ability to estimate current value.

To summarize, the investment decision of the entrepreneurial firms is defined by these two related notions:

1. For each entrepreneurial firm, and for all entrepreneurial firms in aggregate, the expected NPV of entrepreneurial venture is negative.
2. From the standpoint of the entire economy, after considering all the beneficial externalities that comes from the efforts of all entrepreneurial firms, the expected aggregate NPV is positive.

I consider the negative NPV, individually and for a portfolio of projects, as a distinguishing characteristics of a true entrepreneurial environment. If a portfolio of projects has positive NPV, investment and financing of these firms, albeit high risk, could be solved with more traditional approaches, such as via aggregation, diversification, and securitization (see Hull, Lo, & Stein, 2017).

Table 1: Differentiating the Entrepreneurial Firms

	Traditional Firm	Entrepreneurial Firm
Averaged NPV	NPV>0	NPV<0
Unknowns	Risks, probability distribution of payoffs can be specified, i.e., known states, probabilities, and payoffs.	Uncertainty in its purest form: unknown states and unknown payoffs.
Frequency	Payoffs are often; across most states	Long shot; payoffs are rare events
Spanning	All states are known	Could create new states, and spanning possibilities
Tangible assets	yes	Few to none
Residual Assets at Liquidation	yes	None

The will to commit one's life to negative expected return pursuits is entrepreneurial but not unique to business ventures. In fact, this spirit can be found among a significant number of individuals in a society. Witness the number of athletes in high schools and colleges who aspired to be professional players, as well as those who aspire to be actors, singers, performers, writers, Nobel Prize caliber scientists, world class musicians, as well as those pursuing pure honors with no monetary payoff, as in some Olympic events. These examples demonstrate that in order to understand entrepreneurship, we need not assume entrepreneurial persons are unique or irrational. It is just part of the human spirit that is vital for the society to advance.

In the tradition of Adam Smith's *Law of the Uncoordinated Market*, the Invisible Hand (or the '*First Law*'), as a result of individuals using their own information and meeting their own needs, produces the market price that aggregates all information and achieves the best allocation. I postulate the *Second Law of the Uncoordinated Market* as the Invisible Hand that, as a result of individual entrepreneurs pursuing long odds ventures with negative expected returns, produces positive benefits for the Economy as a whole. The size of the Economy's gain is a function of the number of entrepreneurs. Countries in which the entrepreneurial spirit is not discouraged, where qualities of risk taking, tolerance of failure, encouraging creativity, uniqueness, individual accomplishments, and non-conformity are found to have more innovations and economic growth.

Hence, when it comes to entrepreneurial finance, we neither need to be burdened with textbook investment criterion that insists each investment pass the positive NPV hurdle for an entrepreneur to undertake it, nor make the assumption that entrepreneurs are rare and irrational.

The real challenge here is the financing of the entrepreneurial ventures, in face of negative returns on the average. There are two easy answers. The first is through ‘self-financing.’ In terms of frequency, but not in the sum dollar amount, this is the largest category. Here, the entrepreneurs internalize the financing decision, albeit constrained by the amount available; one may say investment and financing are joint decisions. The second convenient solution is to refer all innovations with large externalities to the economy as the responsibility of the government. This notion is correct in theory, as government is the entity that can capture most of the externalities and distribute the burden of financing through taxes and fees. However, this solution idealizes what governments actually do. For example, if governments are capable of providing financing for society-enriching ventures, we should not observe such large differences in the rates of development among countries, or waste in the use of these funds. Furthermore, given its constrained resources, a government involving itself in venture financing would also require that the bureaucrats in charge are able to excel in picking winners. Since returns to these new ventures (representing new products, new industries, new uses, etc.) are highly uncertain (given unknown states and their probabilities), it is doubtful that government bureaucrats could make the best decisions to allocate limited funds to future winners. Instead, the selection and allocation decisions would most likely be influenced by political considerations and the intensity of the lobbying efforts. To explain why for-profit individuals and other non-founder and non-government entities provide financing is more challenging. Fortunately, entrepreneurial ventures do receive this outside funding and thus, the issue is not whether they are funded, but rather why they are funded. I shall defer the discussions of these finer points in financing entrepreneurial firms to a later section; at this point, let us continue with the comparison of financing theory for traditional finance versus entrepreneurial finance.

B. Taking stock of the extant capital structure theory

Capital structure theory has received one of the largest shares of attention in corporate finance research, and is presumably among the best developed¹. In the following, I discuss the applicability of the two principal capital structure theories (the tradeoff theory and the pecking order theory) to the entrepreneurial firms. Table 2 compares the traditional versus entrepreneurial firms under the

¹ For a partial list of review articles on capital structure Theory, see: [M. Baker](#) and [J. Wurgler](#) (2002), [M.Z. Frank](#) and [V.K. Goyal](#) (2003), [J.R. Graham](#) and [M.T. Leary](#) (2011), [M. Harris](#) and [A. Raviv](#) (1991), and [C. Parsons](#) and [S. Titman](#) (2009).

tradeoff theory of capital structure. The tradeoff theory is attractive because it inherits a desirable property of economic optimization – there is an interior optimum; i.e., it suggests optimal capital structures exist for different firms. There is a glaring deficit in this theory even in the general, non-entrepreneurial setting. The major benefit attributable to debt is the interest expense deductibility of debt. A weakness in this explanation (possibly the only rationale for debt in many applications) is that the use of debt by firms predates the incidence of corporate tax (at 1% in the United States, and much later in many other countries). The use of debt by businesses is as ancient as the earliest traders needing capital. In truth, though current capital structure is not capable of explaining debt use in most of the history, there is no mystery or missing explanation. We know businesses are like the individuals in Irving Fisher (1930)'s explanation that households use borrowing to smooth out intertemporal consumption; i.e., households needing to spend now borrow and repay with incomes in future periods, and thus achieve greater lifetime utility. Likewise, business borrow to expand (buy more assets), expecting to generate sufficient profits to pay back the debt in future periods. Debt is one of the first financial innovations to allow businesses to expand their scale of operations and, consequently, the size of the economy. For many purposes in the history of commerce, debt served more than adequately for business activities of the day (e.g., trading for needed inventory, farming in which land owners collect fixed rent from tenants). The basic contractual terms of debt – either pay back debt if the asset (or value of harvest) is worth more than debt owed (have net surplus from trading after paying off debt), or give up the asset to satisfy debt – elicit truth-telling and do not even require lenders to spend time and money on information collection and verification. However, these circumstances are no longer applicable to the type of business ventures among the modern entrepreneurial firms.

Table 2: Capital Structure Theory: Traditional vs. Entrepreneurial Firm

Factors for the tradeoff Capital Structure theory	Traditional Firm	Entrepreneurial Firm
<i>Reasons to limit debt</i>		
-Asymmetric Information	A key assumption, insiders/managers are assumed to know future outcomes better with greater precision.	Not assumed
- Agency	Another key assumption, implies there exists slacks in the firm to be appropriated.	Few slacks
- Distress or bankruptcy costs	Not insignificant for firms with real and intangible assets.	Reduced role for debt financing, and lack of residual assets make this item less relevant,
<i>Reasons to acquire debt</i>		
- Taxes	Key, firms are assumed to have taxable profits; crucial to explain debt financing. However, a weak link in the tradeoff theory (toe explained).	Not likely to have taxable profits prior to attend the status of the traditional firm.

Table 2 summarizes and contrast the differences in the underlying set of assumptions between the factors defining the capital structure of the traditional versus that of the entrepreneurial firms. To understand entrepreneurial firms, I shall use a broader definition of capital structure. Instead of the dichotomy between debt and equity, or that those represent current claimholders of the firm, I use an expanded definition that includes potential new features and security design, as well as current and future contributors of funds. This allows us to include arrangements for entrepreneurial firms such as sequential, contingent financing in the future, or contributions to capital with no claim on future cash flows or firm valuation; e.g., straight contributions for early Kickstarter projects prior to the JOBS Act, and grants from foundations and governmental agencies. Most importantly, I shall consider what we can do to design financial instruments to overcome individuals' resistance to become entrepreneurs.

These standard theories concentrate mainly on two financial securities: debt instruments with interest payments and repayment of principals as their main contractual features, and equity that receives residual payments after debt claims. Entrepreneurial ventures, by nature, are precluded from using traditional debt instruments as they are not capable of generating continuous periodic cash flows nor could fulfill the obligations to pay off debt at maturity, on the average. The same condition also precludes the entrepreneurial firm from

paying regular dividends to their equity investors. Thus, dividend is no longer relevant and not requiring a theory.

III. Reconciling the Entrepreneurial Investments and Financing Decisions

To say that extant finance theory is not useful for the entrepreneurial firms is not the same as saying no solution has evolved to solve these topics in the real world. Theories aim to be manageable and neat, and thus simplify the real world and tackle the most obvious issues; i.e., traditional firms. A real world approach is more akin to engineering. Engineers only aim to find a ‘good enough’ solution that represents the best one could do given the existing state of the art in technology. The fact that many but not all entrepreneurial firms do receive funding supports the notion that there exist ‘good enough’ solutions to the correlated entrepreneurial financing and investment problems. The readers know there exist those that provided funds to entrepreneurial firms including venture capital funds (VC), angel investors, small investors through Kickstarter, and some private equity and hedge funds.

As a way to summarize the big picture, we have:

1. For all ‘entrepreneurial’ projects, the aggregate NPV is negative by definition, but positive for the economy after considering all externalities to the rest of the economies. These are the benefits the entrepreneurs and innovators could not personally capture.
 $\sum \text{NPV}(\text{project } i) < 0$, adding up the NPV of all entrepreneurs; and
 $\sum \text{NPV}(\text{projects } i) + \sum (\text{externalities to the rest of the economy}) > 0$.
2. One solution is for the government to subsidize (i.e., spend tax payers’ money to fund entrepreneurs directly). There are two ways the government can subsidize innovation for the whole economy, though keep in mind that in both cases the sum of all subsidies is a net drain on the economy.
 - a. Government gives equal and proportional subsidies to all innovation activities; or
 - b. Government chooses which projects to subsidize.

In the real world, the government is not an entity that is impartial and omniscient. It is made up of self-interested politicians and bureaucrats, subject to the lobbying efforts by other interested parties. In the case of (a), proportional and equal subsidy of all projects making request after satisfied certain promulgated guidelines, there will be an incentive to create of too many additional and nonexistent projects just to receive the subsidy. Condition (a) will not be sustainable, as the number of initial projects to be designated as entrepreneurial will be far greater under subsidy than without subsidy.

The situation would not be much better under (b). It confers new power to politicians and bureaucrats to be handed out to friends, relatives, and whomever pays them bribes or kickbacks. Even in an ideal world of no corruption, were government bureaucrats and politicians asked to pick future winners, could monies be wisely allocated to the winning technologies in the uncertain future to those entrepreneurs who are more likely to succeed?

3. Finally, we deal with the real world. We do observe entrepreneurs receiving financing in addition to funds from their own resources and those of their friends and families. Our task here is simplified; we need not invent new solutions for funding entrepreneurs, but rather to provide rationale for the current practice and seek ways to further refine and improve it.
4. There are at least three explanations: sorting, matching, and hoping. One way to increase the overall profitability of entrepreneurial investments is to trim the clearly negative project proposals from the list. Sorting occurs when those with experience and technical expertise can perform this task. Since the size of the pool of those with these professional skills increases with experience gained over time and the number of potential entrepreneurial projects evaluated, the relative growth from the entrepreneurial sector of one economy versus another would also depend on the number and maturity of these professionals. The entrepreneurial activities of the most active economies would beget even more entrepreneurial activities – and the rich get richer.
5. Matching occurs when those with specific preferences and beliefs give funding to ventures with objectives that are consistent with theirs, even if some ventures may not yield a positive NPV in the conventional sense. Beliefs prompt investors to support green projects, religious projects, humanitarian projects, urban renewal, and education, for example. Preferences prompt investors to support ventures with long odds or lottery-like payoff characteristics, payoffs in some specific states, or to experience excitement in the resolution of a true sense of uncertainty; i.e., the discovery of hitherto nonexistent states.
6. Hoping, for a lack of better term, refers to those who provide financing in hopes of being able to sell to another at a higher price later. Hoping to sell to others at higher price later is a far more significant economic behavior than the credit it receives from the finance and economic literature would suggest. It accounts for most of the trading involving securities, future and option contracts on goods not expected for physical delivery at maturity, and the flipping of real estate. I use the neutral term ‘hoping,’ but an alternative could be ‘to expect a greater fool’ (“*Although the price I paid is high, there is a greater fool who will pay an even higher price for me to unload.*”) There are those who provide funding for new ventures, not expecting to wait till resolution of uncertainty or

revelation of a payoff, but instead exit at an earlier time. Early exit could result from refinancing in later rounds of venture financing, the sale of the entrepreneurial firm to another, or an IPO. The rise of so called over one billion dollars valuation ‘Unicorns’ is partly the result of those who acquiesce to the publicized high valuation in spite of knowing that it is inflated. They know the so called valuation is extrapolated from what a new investing group would pay for only a small fraction of the firm. Recall that demand curve is downward sloping, the price paid for the first 5% represents its highest valuation, and one should not expect the rest of the 95% to be worth as much.

7. For ease of discussion, we refer to all providers of financing to entrepreneurs as venture capital investors (VCs); they may alternatively be known as angel investors, venture capital funds, or Kickstarter investors.

To say that VCs are willing to fund the entrepreneurial firms, it must be the case that this new condition holds:

$$\sum \text{NPV}(\text{project } j) > 0, \quad \text{project } j < \text{project } i; \quad j < i,$$

where project j is the abridged list formed by the VC by selecting from the original set, project i , according to their screening process.

The remaining project set after screening is now:

$\sum \text{NPV}(\text{project } j, \theta) = \sum \text{NPV}(\text{all projects}, \theta) - \sum \text{NPV}(\text{project } i) < 0 > 0$,
where θ represents the development and specialization of the VC; hence this equation represents the contribution of the VC.

More specifically, the development and specialization (θ) of the VC allows them to cull the entrepreneurial projects, eliminating the non-fundable projects (e.g., the premature, poorly justified, and those lacking exclusivity) and entrepreneurs (e.g., the unqualified, overly optimistic, and overconfident).

In the following, I shall discuss how these practical solutions work, given the current state of finance ‘technology.’

As discussed above, given the nature of entrepreneurial ventures where returns (e.g., NPV) are on average negative, funding by individuals or governments alone will end up funding too many losers. Hence, we must recognize that what are needed as necessary prerequisites to funding entrepreneurial firms are: 1) the existence of those who specialize in filtering out extremely poor ideas and can hence raise the average NPV; and 2) the people these specialists can attract (or themselves) that are willing to supply the funds to support the remaining new ventures. For our purpose, I shall call them financial entrepreneurs. In a capsule, a healthy environment for new ventures to incubate and grow needs the twin necessary conditions: idea/investment/asset entrepreneurs, and financial entrepreneurs.

Financial entrepreneurs, as gate keepers, sort ventures and filter out poor projects through:

1. The experience of the VC, which accumulates through apprenticeship and trials, with the knowledge and experience to filter out most if not all potential entrepreneurs needing funds who have unrealistic expectations or are overly confident, overly optimistic, not prepared, or not able or willing to collect information on the market or competing technologies. Interestingly, although theory has a hard time dealing with these behavioral biases without losing rigor, practicing financial entrepreneurs regularly deal with these types and hence develop coping strategies.
2. Having a simple single objective to either make money for themselves or their investors. They are not distracted by entrepreneurs' behavioral bias (as in the case of self-financing), or burdened by political considerations, such as 'tit for tat' and bribery, as in the case of government funding.
3. Taking long term view. These financial entrepreneurs have long time horizon, as their ability to raise funds and thus create wealth for themselves depends on their previous performance record over several deals. That is, their utility from the return of a venture includes not only that of the present venture but also that of future ventures. Here, the financial entrepreneurs' horizon may span several generations of innovators and investment entrepreneurs.
4. Providing expertise that the investment entrepreneurs do not have, could not afford, or, even worse, do not know they need. The marginal costs (finding, selecting, and paying) incurred by the investment entrepreneurs to get expert opinion and knowledge may be high; however, the marginal costs to the financial entrepreneurs dispensing financial and market related advice are quite small due to repeated dealings and specialization in a certain product or market.
5. Serving as a watchdog and partner. Due to the nature of entrepreneurial investments; i.e., low payoff and long gestation period; finance entrepreneurs, who have the stronger bargaining position, demand timely access to information, control of the board, and have the power to replace managers. This arrangement eliminates most of insiders' information advantage and reduce the risk of opportunistic behavior. The two related concerns in the traditional finance theory, asymmetric information and agency, are much reduced and even eliminated in cases when the finance entrepreneurs have the deciding role.
6. Offering a more objective view of the firm. Even wealth maximizing founders funding 100% of the venture with their own money are still capable of possessing serious value-destroying behavioral biases. Founders are known to hold on to losers too long because so much time and personal wealth has been invested (the "sunk cost" fallacy), a "next time will be different and better"

mentality, and wishful thinking that valuation is not high enough to sell or to create an IPO. Finance entrepreneurs look at the venture with a more objective lens and come from a position of greater experience, knowing about more about similar companies and situations, and hence can provide sounder decisions (improving welfare economy wide, as well as for the founder) regarding when to expand or quit.

Researchers incorporating some or all of these features could generate a model of investments and financing for the entrepreneurial firm. The model would not be complete, however, without also incorporating its potential negative aspects. Because investment entrepreneurs and financial entrepreneurs are different individuals, there are inevitable conflicts of interest. The financial entrepreneur's priority is to look after his or her own interests first, followed by those of the individuals that invested with them and their standing in the investment community. Specific areas of conflict includes:

1. Exit. Financial entrepreneurs such as venture capital and private equity funds, dealing with startups, are inherently more patient than the average institutional investor. Nevertheless, there are several reasons why their expected holding periods are shorter than those of the founders and original investors. One, as professional managers, they need to report and harvest favorable investment results sooner in order to raise their profile and reputation. Two, they have other, perhaps more attractive, opportunities in which to invest. In other words, funded ventures also have to compete against other existing and potential ventures. Three, those working in venture capital and private equity funds are individuals, who in their desire to raise their profiles and personal reputations in order to move out or have funds of their own, have even shorter time horizons than those of the companies employing them.
2. Power. Financial entrepreneurs are often in more powerful bargaining position than the investment entrepreneurs in both pre and post funding. They often dictate the terms of the funding. After funding, they collectively control the company's board and with enough ownership control may even replace the founders.
3. Capture. Once the financial entrepreneur has funded an earlier round, they may also control the next funding rounds – including when, and who can participate.
4. Conflicts. Financial entrepreneurs may easily blur the line between monitoring, which is their province, and management, which is not. In an entrepreneurial firm with a longer funding history, there may be different classes of financial entrepreneurs with different priorities, claims on assets, current holdings, and options for shares, which could result in more frictions among them.

5. Expectations. Financial entrepreneurs investing in startups with extremely high valuation but no profit; i.e., the unicorns; will end up with unmet expectations. Sooner or later, they will face the prospect of large portfolio loss and will look after their own interests at the expense of the startup.

Taking inventory, the factors listed above may be regarded as the building blocks of an entrepreneurial firm's investment and financing model. The positive and negative factors may also lead to a tradeoff solution. What is notable is that the model for the entrepreneurial firms do not resemble, nor are they an extension of, the traditional investment and financing model of capital structure.

IV. Reformulating the Financing Problem of the Entrepreneurial Firm.

In this section, I shall shift the traditional focus of capital structure, based on the mix of debt and equity and choices at the margin given a firm's current leverage, to one that is entrepreneur centric. The discussion is developed in stages, from simple to more complex. The entrepreneur is assumed to be rational; i.e., his or her objective is to maximize lifetime personal wealth, with refinements to be included later.

- A. First model: Outside financing provides needed funds and risk sharing.

Here, as in many cases, the entrepreneur has the idea and energy but does not have adequate funds for current as well as future investments. Payoff, if it shall occur, will be large, albeit not immediate. In each future stage t (i.e., an intermediate period), more information ϕ_t about final payoff be revealed, $\phi_{t+1} > \phi_t > \phi_{t-1}$. At any intermediate period, the information set has two signals: the idea is worthless ($\phi_n = 0$) or there is a possibility of a potential payoff ($\phi_c > 0$). The size of potential payoff increases with each continuation stage. The value of the future payoff, ϕ_t , at each t may be regarded as an option. At the beginning at time 0, the entrepreneur faces the decision of whether to start the entrepreneurial venture (a low probability, high payoff project). The entrepreneur's objective function is to maximize his or her expected final wealth, or:

$$\text{Max } E_T (\alpha_f \phi_f)$$

where α_f is the entrepreneur's share of the final payoff, ϕ_f . E_T is the value function of the utility to the entrepreneur; it elements include: time value, risk aversion, control of own destiny, pride, and recognition as an innovator. The entrepreneur's payoff is subject to an opportunity cost constraint that the

expected final payoff, $E_T(\alpha_f \phi_f)$, not be less than lifetime alternative sources of income,

$$E_T(\alpha_f \phi_f) > \sum_t w_t,$$

where $\sum_t w_t$ is the summation of all future potential wages. The financing constraint, or the amount of outside funds needed, is:

$$I_0 - F_0(e, ff) < VC_0$$

where I_0 is the initial outlay (e.g., personnel, facilities, equipment, licensing, and rights) to start or “get one’s foot in the door” in the case of a race among other competing entrepreneurs. $F_0(e, ff)$ is the original seed money, from own resources, e , and friends and family, ff . VC_0 is the value of the funds to be financed by outsiders, such as, venture capital firms or angels. In this model, there is only one funding period. Thus, the ownership claims to the payoff between the entrepreneur and those providing outside financing are distributed as $\{\alpha = F_0/I_0$, and $(1-\alpha) = VC_0/I_0\}$.

The model as formulated is one of the entrepreneur needing outside financing to provide funds she may not have or want to risk; i.e., financing needs and risk sharing. Solving the problem involves specifying the entrepreneur’s measure of willingness to take risk (or risk aversion; this term is not incompatible with the requirements for entrepreneurship), size of investment, and range of funds from own and friends and family to solve (3) for the amount of outside funds needed, VC_0 (or, equivalently, solving for $\{\alpha = F_0/I_0$, and $(1-\alpha) = VC_0/I_0\}$), or, alternatively, to solve (3) for the amount $F_0(e, ff)$; and to solve for last but not least, the range of values for the final payoff, $E[\phi_f]_{(l,h)}$.

- B. Second model: Choose a larger slice of a smaller pie or a smaller slice of a larger pie.

The first extension is to allow the model to incorporate stage financing, i.e., new outside funds are to be needed and provided in future periods. This requires at least a three period model: an initial period, an intermediate period, and a final period. In the intermediate period, as in above, there are two states: termination ($\phi_{n,t} = 0$), and continuation ($\phi_{c,t} > 0$) with probabilities $(1-\rho)$ and ρ , where $\rho \ll \ll \ll (1-\rho)$; i.e., low success probability for the entrepreneurial firm. Here, the continuation state refers to the option to invest more funds, I_t , for payoff to be realized in the next or final period $\{\phi_{n,t+1} = 0, \phi_{c,t+1} > 0\}$. The entrepreneur has the choice of either: a) raising the entire amount, $(I_0 + I_1)$, in the initial period and giving up $\{(1-\alpha)_{1\text{-stage}} = (VC_0 + I_1)/(I_0 + I_1) = (VC_0 + VC_1)/(I_0 + I_1)\}$ of the firm’s equity, or b) raise the fund in two stages; VC_0 in the initial period, and I_1 in the second period; and give up $\{(1-\alpha)_{2\text{-stage}} = (VC_0/I_0) + (VC_1/I_1) = (VC_0 I_1 + VC_1 I_0)/(I_0 + I_1)\}$. Since the firm’s value after revelation

of a positive payoff continuation state $\phi_{c,t}$, if occurred, is greater than the firm's initial value, the entrepreneur gives up less equity in the two stage solution, $(I-\alpha)_{1\text{-stage}} > (I-\alpha)_{2\text{-stage}}$. However, if the termination state occurs in the one-stage financing case, the firm is liquidated and the entrepreneur receives $\{\alpha_{1\text{-stage}}(I_t)\}$ (or, equivalently, $\{\alpha_{1\text{-stage}}(VC_t)\}$) share of the unspent amount raised. Hence, there is a tradeoff.

An important special case in practice is when the probability of success, ρ , is function of the amount of initial investment $I_0, \rho(I_0, I_{t+1})$. This may occur when there exists a first mover advantage, such as in new drugs introduction, or in defense contracting competition. Having the final payoff a function of initial and subsequent investments, $\phi_f(I_0, I_{t+1})$, means the entrepreneur's problem is one of choosing between a larger slice of a smaller pie, versus a smaller slice of a bigger pie.

C. Third Model: Could there be a role for a debt type financing in an entrepreneurial firm?

Previously, I show that the usual type of debt, requiring periodic interest payment with fixed maturity, could not exist in an entrepreneurial firms with long periods of no or little cash inflow. However, there is a desirable property of debt, versus outside equity, that makes some modified version of debt financing worth considering. Debt type financing allows the entrepreneur to retain existing equity.

Here, I shall discuss the desirable properties of a debt like security such that it could exist in an entrepreneurial firm. First, it could not be a single payment debt with cumulative interest. Although the cumulative interest feature is desirable to the entrepreneurs as it postpone cash payments (interest) in all intermediate periods, the single payment of debt supersedes the single payment of equity for the VC. Recall the nature of payoff in the entrepreneurial firm where probability of payoff is small but the amount realized is very large; this means that both single payment debt and equity will receive nothing in the no-payoff state. However, even if the payoff is large enough for both debt and equity in positive payoff final state, this means only that the debt payment will be less than the start-up's final value; there is no guarantee that the remaining equity will cover the investments of the VC. Second, since debt like financing for the entrepreneurial firm could only occur when debt has a high positive probability of being repaid in the intermediate period, the condition for some modified form of debt is that there is a reason to support such belief.

Before I discuss these circumstances, I would like to emphasize a special role played by a debt like securities that mature in an intermediate period. To the entrepreneur, an intermediate period maturing debt may be regarded as a

vehicle to provide financing that would otherwise mean giving up more equity in an earlier round. That is, it enables the entrepreneur to raise equity in a much later stage, in which, hopefully, equity may fetch higher valuation. The role of this ‘bridge’ to equity is particularly important to entrepreneurs who want to minimize ownership concession to outside investors and retain control of the firm.

Consider three sources of value where holders of debt like securities in an entrepreneurial firm may expect to be repaid in a future intermediate period. First, as in any form of lending, having sufficient assets to pledge as collateral serves as a sufficient requirement. However, when applied to asset poor entrepreneurial firms, only a relatively small percentage of new venture firms with some type of assets may qualify. Alternatives to assets, which can be pledged, are milestones to be achieved in a multistage financing. Milestones signify tangible progress but may not be readily sold or pledged as security. Thus, we are left with few assets that could be used as collateral from entrepreneurial firms with no sales. Examples include important patents, a database of potential customers, or insurance policies of key scientists. The second instance is not based on a sufficient condition but rather on an expectational one. A lender’s willingness to lend is partially based on the expectation that the debt could be refinanced by another party (debt or equity investors). Implicit in this condition is the expectation that the entrepreneurial firm could sustain an increasing valuation at least at or beyond the maturity of the debt. The phenomenon is similar to why some investors paid a high valuation for the so-called unicorns, where the expectation is to be able to sell to another investor at even higher price. The third is a debt security (e.g., contingent convertible or CoCo bond) that would be converted into equity under certain conditions; in the case of entrepreneurial finance, the condition is the inability to redeem and refinance maturing debt, or securities that would automatically rollover, as in PIK (pay in kind), in which more debt securities are issued in lieu of interests that the borrower does not have. However, VCs would find this condition undesirable unless the firm value is only temporarily depressed.

To summarize, we can see that the financing problem of an entrepreneurial firm revolves around two related issues: minimize equity dilution and retain management control of the firm while maximizes the entrepreneur’s wealth.

V. Is there a role for behavioral finance in the financing of entrepreneurs?

It is inevitable that behavioral considerations are involved in the process of financing the entrepreneurial firms, since it is dealing with individuals making long term decisions under uncertainty. These have both positive and negative roles. The fact that the entrepreneur could easily commit mistakes such as being overconfident and overly optimistic, causing them to plunge ahead, may not be his or her own long term utility maximizing behavior, but the acts could still result in positive externalities for the economy as a whole. The unintended consequences of their pioneering actions show later entrepreneurs what paths are and are not to be taken and help speed up the development of the new ideas and products. Consequently, an economy lacking such individuals could lag behind. To a smaller extent, behavioral decision making may also hinder entrepreneurial ventures. One is the potential entrepreneur's inability to calculate. To illustrate, suppose the entrepreneur understands the odds of success in the same product category even among the venture funded projects is only one in four. In this case, the VC would expect returns that reflect the commonly agreed odds; i.e., having to lose three out of four investments. The VC would then demand, as term for funding, for each venture to return four times the normal return. The entrepreneur may either balk or grudgingly accept as if being asked to "give up a pound of flesh" to the VC. Their failure to calculate is the inability to see that if they end up among the three out of four that failed, they will enjoy a free ride at the expense of the VC and indirectly will be the sole winner. Their behavioral mistake is to expect they are most likely to be the one out of four winner, in spite of the objectively higher odds of failure. VCs also may exhibit behavioral mistakes that may both increase funding and reduce funding for the entrepreneurs. The VC managers may increase funding if they believe in "hot hands" after a successful venture, or to follow other VCs (herding) into a new industry or product category, and they may also supply more funds to a losing venture due to loss aversion and sunk costs. This behavior would even be more prevalent among the less sophisticated or experienced fund providers, such as angels and Kickstarter investors who may choose to finance ventures, not based on rational economic calculations, but rather for their own personal or even behavioral reasons, such as noise and fads. Furthermore, friends and family, the first outside funding sources, often provide funds out of an affinity bias. On the other hand, funding may be reduced when managers at a VC have limited or no experience with successful ventures and thus use a small observed sample to infer the next project's chance of success. Additionally, fear of making a mistake may lead them to apply an extra high hurdle to receiving funding. The same concerns may also cause some VCs to withdraw from a venture too soon. Finally, there are the serial entrepreneurs

who keep score in a different way. They see entrepreneurship analogous to a sporting game – it is how often you win, and the winning margin is not as important.

VI. Conclusions

In the larger scheme of things, investment entrepreneurs must precede financial entrepreneurs. Investment entrepreneurs originate the business idea, create innovations, and invent new things. No amount of investable funds could generate economic growth without the ideas and drives of the investment entrepreneurs. The financial entrepreneurs serve as gatekeepers to screen out poorly conceived projects, and to provide monitoring and management expertise.

The entrepreneur's financing problem is one of deciding to take a "larger slice of a smaller pie, or a smaller slice of a bigger pie." Failure to reconcile the desire to maximize lifetime wealth versus "control" of their creations may end up no funding at all.

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