

Entrepreneurial Finance and Innovation: An Introduction and Agenda for Future Research

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The increasingly large role played by financial intermediaries, such as venture capitalists and angels, in nurturing entrepreneurial firms and in promoting product market innovation has led to great research interest in the area of entrepreneurial finance and innovation. This paper introduces the special issue of the *Review of Financial Studies* dedicated to entrepreneurial finance and innovation and highlights some of the promising topics for future research in this area. The special issue combines papers presented at the June 2010 “Entrepreneurial Finance and Innovation (EFIC)” conference, which was jointly sponsored by the Kauffman Foundation and the *Review of Financial Studies*, with other related papers. (JEL G24, G21)

This special issue combines papers presented at the first Entrepreneurial Finance and Innovation (EFIC) Conference, held in June 2010 (co-organized by the two coauthors, along with Debarshi Nandy of Brandeis University, and sponsored by the Kauffman Foundation and the *Review of Financial Studies*), with other related papers. Our objective in this introductory article is to place in perspective the nine articles in this special issue and outline an agenda for future research.

One broad theme of the papers in this special issue is the role of financial intermediaries, such as venture capitalists and angels, and that of more traditional intermediaries, such as commercial banks, in nurturing entrepreneurial firms and the mechanism through which they do so. A related research question is the financial and ownership structure of entrepreneurial firms and how it affects their future performance. Over the last twenty years, the importance of venture capital and related forms of financing (e.g., angel financing) in fostering new firms has grown tremendously, not only in the United States but also in the international context (in both developed and emerging economies). At the same time, two important trends have affected the venture capital industry and entrepreneurial finance in general: these are globalization and technological innovation.

With regard to globalization, over the last decade or two, venture capital (VC) investments across national borders have started to trend upward. Foreign or cross-border investment in venture capital markets has increased from 10% of all venture capital investments in 1991 to 22.7% in 2008 (based on the number of venture capital investments). An important driver of this increase is the significant upward trend in international venture capital investments in emerging nations over this time period. The number of venture capital investments by international investors as a fraction of total venture capital investments in emerging nations increased from 8.7% in 1991 to 56% in 2008. There has also been an increase, although more modest, in the number of international venture capital investments as a fraction of all venture capital investments in developed nations over the same time period (10.1% in 1991 to 20% in 2008). While there has been a significant increase in cross-border venture capital investments over the last two decades, a number of non-U.S. economies have developed their own venture capital industries over this period, with a significant number of local venture capitalists investing in entrepreneurial firms in their own countries. One interesting avenue of research in this context is the interaction between international and local venture capitalists in nurturing entrepreneurial firms in various countries (especially emerging economies) and how policy makers can help accelerate the growth of venture capital activity, and therefore entrepreneurship, in these countries.¹

In parallel with the globalization of venture capital and entrepreneurship, a second major trend affecting entrepreneurial finance over the last decade or two has been technological innovation. The Internet and other technologies have made communication across large distances much easier and cheaper and have had a significant impact not only on entrepreneurial firms (through phenomena such as large-scale outsourcing, especially in knowledge-related industries) but also on financial markets and intermediaries, such as venture capitalists, private equity firms, and investment banks (as well as commercial banks). Globalization and technological innovation interact in their effect on entrepreneurial finance, because the reduction in communication costs due to technological innovation have made cross-border venture capital investments easier, for example, by reducing venture capitalists' costs of monitoring such investments over long distances. However, there has been relatively little research until recently on the effects of these two powerful forces, namely, globalization and technological innovation, on the role of venture capitalists and other intermediaries in fostering the growth of young firms. Hopefully, this gap in research will be gradually filled as new datasets, especially on entrepreneurial

¹ There is a small, but emerging, body of literature on international investments in venture capital. See, for example, Chemmanur, Hull, and Krishnan (2010), who study how international and local venture capitalist interact to invest in entrepreneurial firms and the effectiveness of such interactions in generating successful new ventures.

activity in emerging economics and the effect of financial intermediaries on such activity, become available.

A third important development affecting entrepreneurial finance has been the growing importance of alternatives to the traditional form of venture capital (e.g., corporate venture capital) in nurturing entrepreneurial firms. Traditional venture capital firms (referred to as “independent venture capital firms” from now on) are organized as limited partnerships with a fixed life, typically ten years. Corporate venture firms, on the other hand, are structured as subsidiaries of corporations, so that they usually have longer investment horizons than do traditional venture capital firms.² Although constituting about 7% of venture capital investments in prior years, recently, the share of investments by corporate venture capital firms has increased significantly, reaching 15% by the end of 2011 (according to the National Venture Capital Association). Another alternative to investments from traditional venture capital firms are investments from angels and angel networks, where the term angel refers to a high net worth individual who makes significant investments in start-up firms. One question that arises in this context is the choice between these alternative forms of private equity financing in fostering the success of entrepreneurial firms. Although there has been some theoretical research on the equilibrium choice of financing of entrepreneurial firms between angel and venture capital financing (see, e.g., Chemmanur and Chen 2011) and between corporate and independent venture capital (Hellmann 2002; Fulghieri and Sevilir 2009a), empirical research on these issues has been very limited, perhaps because of data limitations. As we discuss in more detail later, the paper in this special issue by Kerr, Lerner, and Schoar on how angel financing affects the success of entrepreneurial firms makes a good beginning in this direction. However, this paper only scratches the surface in studying the role and effectiveness of alternatives to traditional venture capital firms in nurturing entrepreneurial firms, and there is room for much more future research to be conducted in this direction.

The above alternatives to financing by independent venture capital firms have been recently joined by an even more unconventional source of financing start-ups, namely, “crowdfunding.” Crowdfunding involves raising private funds via the Internet in relatively small amounts from a relatively large number of investors who may be future customers of the product(s) of the entrepreneurial firm being financed or from those who are otherwise interested in the success of the entrepreneurial firm (without the help of financial intermediaries and

² Two other important differences between corporate and independent venture capital firms are the following. First, as corporate subsidiaries, corporate venture capital firms pursue both the strategic objectives of their parent companies and financial objectives, whereas the sole investment goal of independent venture capital firms is to achieve high financial returns. Second, the performance-based compensation structure (i.e., 2% of management fees and 20% of carried interest) enjoyed by independent venture capital fund managers is normally not found in corporate venture capital funds, where fund managers are compensated by a fixed salary and corporate bonuses that are tied to their parent company’s financial performance.

without the need to conduct an Initial Public Offering (IPO)).³ The passage of the Jumpstart our Business Startups (known as the JOBS) Act by the U.S. Congress and its signature into law by President Obama in April 2012 legalized equity crowdfunding and will potentially increase the availability of funds to finance entrepreneurial firms by enhancing the pool of investors who are allowed to provide funds through crowdfunding. Of course, while making new sources of financing available to entrepreneurial ventures that may not otherwise receive financing is beneficial, such new sources of private equity financing (such as crowdfunding) may have their own pitfalls. First, allowing relatively uninformed small investors to invest in entrepreneurial firms through crowdfunding may increase the chance that such investors will lose considerable sums of money by investing in highly risky entrepreneurial ventures. Second, crowdfunding may not ultimately prove very beneficial to the long-term success of entrepreneurial firms themselves, because such funds may not come with the advice and monitoring that one associates with various forms of venture capital or even angel financing. Thus, the effectiveness of crowdfunding in nurturing successful entrepreneurial firms will be an interesting topic for future research (as more data on the performance of these ventures become available).

A second broad theme of papers in this special issue is the role played by financial intermediaries and the financial and ownership structure of entrepreneurial firms themselves in fostering product market innovation. The optimal organizational form for nurturing innovation by U.S. corporations has been the subject of an important policy debate in recent years. For example, as Lerner (2012) points out, whereas researchers in corporate research laboratories account for two-thirds of all U.S. research, whether the current corporate setting is the best organizational form to nurture innovation (perhaps because large firms provide researchers with too little contingent compensation) is not obvious. On the other hand, Lerner (2012) suggests that, whereas independent venture capital (IVC) firms have done great things for innovation, they have done so only in a few targeted industries, are subject to booms and busts (where funds from limited partners are either in oversupply or very scarce), and are vulnerable to mercurial public markets.⁴ He therefore suggests that perhaps the best way to motivate innovation is a “hybrid” model, such as a corporate venture capital (CVC) program, that combines features of corporate research laboratories and venture-backed start-ups.

³ An exploratory study of crowdfunding is reported in Mollick (2013), who studies the universe of projects that raised funds on the largest crowdfunding site, Kickstarter, from its inception in 2009 until July 2012. He defines crowdfunding as “the efforts by entrepreneurial individuals and groups: cultural, social, and for-profit, to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the internet, without standard financial intermediaries.”

⁴ Notably, the traditional venture capital industry has been shrinking since the financial crisis, and it has underperformed over the previous decade (see, e.g., Harris, Jenkinson, and Kaplan 2013).

A number of interesting research questions arise in the above context. The first set of questions deal with the role of financial intermediaries in fostering product market innovation in the entrepreneurial firms in which they invest. Some of these questions include the following: First, do financial intermediaries, such as venture capitalists, play an important role in fostering innovation in entrepreneurial firms? Second, if they do play a significant role, which type of intermediaries is best suited for playing the above-mentioned role of fostering innovation? For example, among different types of venture capital firms, are independent venture capitalists better than corporate venture capitalists, and are both of these types of venture capitalists better than angels in this role? Third, if they do play a significant role in fostering innovation in entrepreneurial firms, what is the mechanism through which financial intermediaries accomplish this? In particular, what is the nature of the optimal contract between financial intermediaries, such as venture capitalists and entrepreneurs, that can motivate the latter to be more innovative? Fourth, how does the structure of the industry of the financial intermediary (say, the extent of competition among venture capitalists or in the banking industry) affect innovation in the entrepreneurial firms they finance?⁵

We know that there are two obvious channels through which financing can affect innovation. First, the source of financing (the nature of the intermediary and the financing contract) may affect the availability of financing at various points in the firm's life, and the cost of capital incurred by the firm, thus affecting the extent and nature of innovative projects undertaken by it. Second, the source of financing and the provisions of the firm's financing contract with the intermediary may affect product market innovation by affecting the incentives of scientists and other employees of the entrepreneurial firm engaged in innovative activity and the various firm managers supervising them. Nevertheless, finding answers to the questions we have raised is quite difficult because of the unique nature of innovative activity. For example, as Holmstrom (1989) has pointed out, innovative activities involve a high probability of failure and the innovation process is unpredictable and idiosyncratic, with many contingencies that are impossible to foresee, so that the standard pay-for-performance incentive contracts may be ineffective for motivating innovation. In a similar vein, Manso (2011) models the innovation process as involving a trade-off between the exploration of new (untested) actions and the exploitation of well-known actions.⁶ An additional problem with motivating innovation is the presence of asymmetric information in the relationship between the financial intermediary (say, an angel of venture capitalist) and the entrepreneur. Two of

⁵ In this context, a number of recent papers study how banking deregulation events in the United States over the past four decades affect innovation output by firms financed by banks (see, e.g., Cornaggia, Mao, Tian, and Wolfe Forthcoming and Amore, Schneider, and Zaldokas 2013).

⁶ Manso (2011) shows that, in such a setting, the optimal contract to motivate innovation involves a combination of tolerance for failure in the short run and rewards for success in the long run.

the articles in this special issue address some of the above research questions: one theoretically and the other empirically.

A second set of research questions deal with the effect of the financial and ownership structure of the entrepreneurial firm itself and the legal and institutional environment in which it operates on the extent of its product market innovation. Some of these questions are the following. First, how does the private versus public status of a firm affect product market innovation? Second, for a firm that has gone public, how does the governance provisions (e.g., antitakeover provisions) in its corporate charter affect innovation? Third, how does the presence of labor unions or the lack of such unions among workers in a firm affect product market innovation by that firm?⁷ Fourth, how do various labor laws and other legal and institutional features of the economic environment the firm operates in affect innovation? Although some theoretical research and some empirical evidence exist to address the above-mentioned questions, much remains to be done. Two of the papers in this special issue address some of the above-mentioned questions: one theoretically and the other empirically.

In the rest of this paper, we will briefly discuss each of the articles in this special issue, placing each in the context of the related literature and pointing out open research questions related to each.

1. The Effectiveness of Financial Intermediaries in Nurturing Entrepreneurial Firms

It has been long argued, both in the theoretical literature and by practitioners, that one of the most important ways in which intermediaries, such as venture capitalists and angels, nurture entrepreneurial firms (beyond the provision of financing) is through a combination of intensive monitoring, help in developing high-quality management teams, and contacts and credibility with suppliers and customers. These inputs are supposed to lead to stronger growth and performance in portfolio firms. However, whereas there is some evidence to support these claims for venture capitalists (e.g., Hellmann and Puri 2000; Chemmanur, Krishnan, and Nandy 2011), there is very little evidence that examines the same claims in the case of angel investors. Angel investors are usually funders of early-stage ventures, and this paucity of evidence is partially due to data limitations. In the first paper in this special issue, Kerr, Lerner, and Schoar attempt to fill this gap by studying how angel investors affect the success and growth of the entrepreneurial ventures in which they invest.

Angel investors are increasingly structured as semiformal networks of angels who meet at regular intervals to evaluate pitches of business plans by

⁷ In a recent paper, Bradley, Kim, and Tian (2013) make a first attempt to tackle this question by examining the effect of unionization on firm innovation. They show that firms' innovation output declines significantly after the passage of union elections and increases significantly after successful deunionization elections.

entrepreneurs, after which they may conduct further due diligence and may eventually invest in some of them. The authors make use of detailed deal-level data on start-ups that pitched to two prominent angel investment groups during the period of 2001–2006. The authors gained access to confidential records on companies approaching these angel networks, the level of angel interest in these companies, the financing decisions made, and the subsequent venture outcomes. Such a dataset allowed the authors to compare funded and unfunded ventures approaching the same angel investor. Further, they were able to use the interest levels expressed by angels to form specialized treatment and control groups with similar qualities.

One problem with entrepreneurial finance studies that attempt to establish the role of intermediaries, such as venture capitalists or angels, in nurturing entrepreneurial firms is the endogeneity of the intermediaries' decision to invest: that is, unobserved heterogeneity across entrepreneurial firms might drive the growth path of firms subsequent to investment as well as the intermediaries' decision to invest in the firm. This makes answering the question of whether seed-stage investors have a causal impact on the performance of entrepreneurial firms or whether their main role is to select firms with better inherent growth opportunities difficult. In their paper, Kerr, Lerner, and Schoar get around this problem by applying a regression discontinuity approach. They exploit the fact that, within the quality ranges they analyze, there exists a discrete jump in the probability of funding as interest accumulates around a deal, as critical mass develops within angel groups around prospective deals. From the data, the authors identify the threshold at which a critical mass of angels emerges around a deal and compare firms that fall just above the threshold with firms falling just below: the underlying identification relies on firms around the threshold level having very similar *ex ante* characteristics. To establish the causal effect of angel financing, the authors first show the *ex ante* comparability of entrepreneurial firms around the above threshold, after which they examine differences in their long-run performance.

The authors report results both from a comparison of long-run outcome of firms that obtained funding from the angel groups and those that did not, as well as from the regression discontinuity analysis discussed above. They find that angel investments enhance the outcomes and performance of the firms that are funded by the above angel groups. Further, they find evidence consistent with the notion that financing by these angel groups is associated with an improved likelihood of survival for four more years, higher levels of employment, and more traffic on the entrepreneurial firms' Web sites. They also find that angel group financing helps in achieving successful exits and reaching high employment levels, though these results are only qualitatively supported in the regression discontinuity analysis.

Overall, the results of Kerr, Lerner, and Schoar indicate that the interest levels of angels in entrepreneurial firms at the initial presentation and due diligence stages are predictive of the future success of these firms. Thus, in addition to

having a causal impact on the entrepreneurial firms they invest in, angels seem to engage in an efficient selection and screening process. Of course, as more data becomes available, future research needs to evaluate whether their results generalize to a broader group of angel investors. Further, an examination of the role of individual angels in nurturing entrepreneurial firms in greater detail would be interesting, for example, by studying how the expertise levels of the angels involved in the industry of the entrepreneurial firm affects the future prospects of the firms that they invest in.

In the second paper, Celikyurt, Sevilir, and Shivdasani address a question which is in some sense the polar opposite of that addressed by the first paper: what, if any, is the role of venture capitalists in adding value to mature public firms? In particular, they investigate the role of board members of public firms who had prior experience as a venture capitalist (VC) on the performance of these firms. Because the role played by venture capitalists on the boards of mature public firms is not well known, the authors first document this using a hand-collected dataset on the board membership of S&P 1500 companies. They show that a substantial fraction of these firms have board members with a background as a venture capitalist prior to their appointment on the board. Further, about 35% of the firms in their sample with VC directors were not VC-backed at the time they had their IPO. Finally, of those companies that were VC backed at the time of IPO, almost half had VC directors from VC firms different from those that backed these companies at IPO. In summary, the paper first establishes that VCs play a role in mature firms that is not a direct outcome of their pre-IPO involvement in these firms.

The authors then go on to study the effect of having VC directors on the investment policies and performance of these firms. Given the experience of VCs in evaluating new products, technologies, and other innovation intensive activities, the authors hypothesize that VC directors bring specific knowledge or expertise to the board that helps the firm pursue investments in knowledge-specific and intangible assets. They then provide a number of pieces of evidence consistent with the above hypothesis, showing that the presence of VC directors on the board is associated with greater innovation activity by mature firms, as measured by research and development (R&D) expenditures, the number of patents obtained, and the citation counts of these patents.

To understand causality, the authors examine the time-series variation in board composition of the firms in their sample. In particular, they study the appointments of new VC directors to firm's boards and examine changes in R&D intensity and innovation output around these appointments. They find that firms become more R&D intensive and more innovative following the arrival of new directors. A similar analysis around the departure of VC directors shows that firms become less innovative when VC directors leave their boards. These results seem to indicate that the association between VC directors and greater innovative activity by firms is not driven by VCs self-selecting onto the boards of R&D-intensive and innovative firms.

Celikyurt, Sevilir, and Shivdasani go on to present a number of additional pieces of evidence on the effect of VC directors on the performance of mature public firms. First, they find that, following a VC director's appointment to a firm's board, announcements of the acquisitions of VC-backed start-ups by that firm generates greater abnormal returns than similar announcements prior to VC director appointments. Second, the operating performance of firms improves following the appointments of VC directors. Third, the announcement of VC director appointments to a firm's board are associated with significantly positive abnormal returns to the firm's equity, unlike the abnormal stock returns associated with the announcement of non-VC director appointments (the latter are not significantly different from zero). Overall, the article by Celikyurt, Sevilir, and Shivdasani complements the findings of the existing literature on the value addition of VCs to small private start-ups by showing that VCs are also able to add value to mature public companies. In particular, they show that VCs are able to help improve the innovation outcomes and investment policies of mature public firms by serving on their boards, thereby providing them with their expertise.

The third paper, by Hochberg, Ljungqvist, and Vissing-Jorgensen, speaks to the more general question of the industrial organization of VC funds and specifically to the issue of performance persistence observed in VC funds (Kaplan and Schoar 2005; Phalippou and Gottschalg 2009) as opposed to the lack thereof in mutual funds (see, e.g., Jensen 1968; Malkiel 1995; Busse, Goyal, and Wahl 2010). This is important because it implies some form of rigidity in the flow of capital into these VC funds.

For the mutual fund industry, Berk and Green (2004) argue that, if fund management skills are a scarce resource, new capital will flow to mutual funds operated by managers endowed with superior fund-management skills until expected returns (net of fees) are equalized across mutual funds. This implies that mutual fund flows follow performance, eliminating performance persistence. In equilibrium, fund managers endowed with superior skills earn greater fees. In the VC industry, on the other hand, VC funds show performance persistence, which means that investors are able to consistently capture some of the rents created by these VC firms' general partners and that competition among investors is not able to eliminate such rent extraction.

The paper by Hochberg, Ljungqvist, and Vissing-Jorgensen provides an explanation for this performance persistence. As in Berk and Green (2004), fund performance depends on the fund manager's (the General Partner's, GP's) unobservable skills. The difference here from the Berk and Green (2004) setting is that, in the case of VC funds, the investors in the fund (the Limited Partners, LPs) observe soft information on the skill level of the GP of the fund they invest in before the rest of the outside investors, who can make inferences on the GP's skills only later on (when they observe the actual eventual performance of the fund). This means that, at the time a GP forms a new follow-on fund, the incumbent LPs have an informational advantage on the GP's skills,

generating a winner's curse in the GP's effort in raising capital for the new fund. Consequently, the existing LPs of a fund managed by a GP with good revealed skills can invest in the new fund on advantageous terms, that is, they are able to extract some of the GP's surplus in the form of a superior return on their investment. Observationally, this leads to persistence in the return on the LPs' investments between the initial and follow-on investments.

Rigidities in the VC market have been recognized in other papers. For example, Fulghieri and Sevilir (2009b) suggest that VC funds may optimally limit their size to protect the incentives of fund managers to exert effort in their portfolio companies, promoting in this way the effort of firms' insiders (i.e., the entrepreneurs) as well. Another model seeking to explain VC fund performance persistence and why VC fund managers will limit fund size in order to improve fund performance is provided by Marquez, Nanda, and Yavuz (2012). In their setting, VC funds face a two-sided matching problem in which their success is contingent on attracting high-quality entrepreneurial firms (whereas the firms are similarly seeking to pair with high-ability managers). Prospective entrepreneurs, on observing fund performance, have difficulty in distinguishing between a manager's ability to add value and the innate quality of firms in his portfolio. As a consequence, fund managers may devote unobservable, but costly, effort into selecting firms so as to manipulate entrepreneurs' beliefs about their ability. Further, managers choose to keep funds smaller to limit their cost of selecting firms, while using a fee structure that can leave abnormal returns to their investors.

2. The Capital Structure of Entrepreneurial Firms

A commonly held belief about the financing of small firms and start-ups is that this class of firms is primarily financed by equity, either through the entrepreneur's personal equity or through external equity, such as independent venture capital and/or angel financing. This perception is largely due to the fact that most study of the financial structure of this class of firms is substantially biased in that it is based on firms that either are close to their IPO or because they received some sort of venture capital financing (and therefore fall in a venture capital database).

Robb and Robinson re-examine this commonly held belief by studying a new and more comprehensive dataset, the Kauffman Firm Survey (KFS), which focuses on newly founded firms and therefore on a universe of firms that is traditionally not covered by the usual datasets. The dataset covers nearly 5,000 firms starting from their inception through the early years of their development and operations, including the evolution of their financial structure (the survey is currently limited to firms that started in 2004). Thus, the novelty of the empirical study in this paper is that it gives us a glimpse of the financial structure of small firms and start-ups at a much earlier stage of their development than that provided by the existing literature.

The results of the Robb and Robinson paper challenge the conventional wisdom and show that newly founded firms rely heavily on debt financing. Debt financing can come in three forms: personal debt backed by other assets in possession of the owner (typically, the owner's home), business bank loans, and business credit lines. In addition, the amount of funding that comes from debt is substantial in amount, and it dwarfs other forms of financing, such as the more familiar "family and friends" equity financing. Thus, the entrepreneur typically holds a highly levered equity position, either through firm leverage or personal leverage. In addition, leverage is taking place through formal credit channels, such as mortgages, rather than informal channels, such as credit card debt. Interestingly, trade credit represents only a relatively small fraction of the overall credit supply. This finding is important because it helps us better understand the role of trade credit as a source of financing in small companies, over and above that documented in the existing literature (see, e.g., Petersen and Rajan 1997; Frank and Maksimovic 2005; Burkart, Ellingsen, and Giannetti 2011). The findings of this paper are also important because they document the degree of exposure of small firms to credit availability and thus the critical role of the credit channel in affecting the level of business activity (and ultimately, economic growth).

3. Venture Capital Financing and Product Market Innovation

The role of experimentation and tolerance for failure is a critical feature of financial contracting in that it can promote or stifle innovation. These issues have attracted increasing amounts of interest in recent research. For example, Manso (2011) suggests that to motivate innovation, compensation contracts may require substantial tolerance for early failures, in addition to job security and feedback on performance. These ideas are further explored in the next two papers in this special issue.

Bouvard examines, in a real option framework, the problem of an entrepreneur who is deciding on the duration of the "experimentation" phase of his project before ultimate implementation of the project. The benefit of the experimentation phase is that it generates a public signal about the quality of the project, allowing the entrepreneur to make a more informed decision on whether or not to implement the project. In the spirit of real option problems, the optimal timing of the investment occurs when the benefit from further delaying the investment (arising from the additional information that can be obtained about its quality) is offset by the cost of delaying the investment (arising from the loss of profits due to the delay). The paper then examines the timing decision under asymmetric information and entrepreneurial private benefits and solves for the optimal external financing contract. Asymmetric information takes the form of private information about project quality held by the entrepreneur. In addition, the assumption is made that the entrepreneur derives a private benefit from operating the investment project. The presence of asymmetric information

has the effect of inducing entrepreneurs with poor projects to implement them sooner so as to limit the risk that bad public information is revealed, thereby leading to the cancellation of the project. Private benefits induce entrepreneurs to implement their projects early so as to accelerate the enjoyment of such benefits.

The paper then solves for the optimal contract with external financiers and finds that entrepreneurs with good projects finance them with performance-sensitive contracts and delay the implementation of their projects beyond the full-information optimum. The reasoning underlying the optimal contract is very intuitive: entrepreneurs with good projects are relatively more willing to accept performance-sensitive contracts and to delay their investments. In the spirit of Manso (2011), the paper also shows that projects that require longer experimentation and have higher failure rates are characterized by contracts with lower performance sensitivity. The paper also shows that projects financed with more internal equity by the entrepreneur leads to shorter experimentation periods and faster project implementation.

The paper by Bouvard enhances our understanding of VC contracting in a real option and asymmetric information framework. It can therefore serve as the basis of empirical analyses of venture capital contracting as new datasets on such contracts become available. The most prominent paper in the existing literature that provides evidence on venture capital contracting is Kaplan and Stromberg (2003). Their paper primarily makes use of incomplete contracting theories (Grossman and Hart 1986; Hart and Moore 1990, 1998) and control switching theories (e.g., Aghion and Bolton 1992) to develop the theoretical framework for their empirical analysis. Given this, the paper by Bouvard that explores venture capital contracting in an alternative theoretical setting can serve as the basis of new empirical tests that can enhance our understanding of venture capital contracting.

In the next paper, Tian and Wang empirically analyze how venture capitalists affect product market innovation in the entrepreneurial firms backed by them. Clearly, the venture capital industry is a high-risk-high-return industry in which the projects financed by venture investors are characterized by significant failure risk. Therefore, venture investors' attitude toward failure is a crucial determinant of the development and performance of their portfolio firms. However, capturing these investors' attitudes toward failure is a challenging task, because they are inherently difficult to observe from the existing data that are available to researchers. The paper by Tian and Wang gets around this problem by developing a novel measure that captures a venture investor's tolerance for failure (in the spirit of Manso 2011). They do this by examining a venture investor's tendency to continue investing in an entrepreneurial firm even when it does not meet previously agreed-upon milestones. Specifically, they construct a VC failure tolerance measure by calculating the average investment duration (from the first investment round to the termination of follow-on investments) of its past failed ventures. They then show that IPO

firms financed by more failure-tolerant venture investors are significantly more innovative. These firms not only generate a larger number of patents but produce patents with higher impact (as measured by the number of future citations these patents receive).

Whereas the above findings are consistent with the hypothesis that venture investors' failure tolerance leads to higher innovation output in VC-backed ventures, an alternative interpretation is that failure-tolerant VCs are in equilibrium matched with ventures that have high ex ante innovative potential. Tian and Wang therefore use a number of identification strategies to establish causality. First, they conduct a falsification test by constructing an alternative failure tolerance measure that is based on a VC firm's past successful projects. Second, they control for VC firm characteristics that are known to affect the firm's project selection ability or investment preferences. Third, they make use of the cross-sectional heterogeneity in VC failure tolerance to study the circumstances under which the marginal effect of VC failure tolerance on entrepreneurial firm innovation is stronger. These empirical tests suggest a positive causal effect of VC failure tolerance on entrepreneurial firm's innovation.

The methodology developed by Tian and Wang can be applied to other settings in which financial intermediaries invest in entrepreneurial firms. For example, a natural question that arises here is the type of venture capitalist (corporate versus independent venture capitalist) that is better able to nurture innovation in entrepreneurial firms. Chemmanur, Loutskina, and Tian (2010) previously address this issue and conclude that corporate venture capitalists are better than independent venture capitalists in nurturing innovation. Their paper also makes use of the failure tolerance measure developed by Tian and Wang to show that corporate venture capitalists are more failure tolerant than are independent venture capitalists, attributing corporate venture capitalists' greater ability to nurture innovation by their portfolio firms partly to their greater failure tolerance.

4. Corporate Ownership Structure and Product Market Innovation

In the next paper, Ferreira, Manso, and Silva develop a theoretical model of the relation between the ownership structure (specifically, the private versus public status) of a firm and its incentive to engage in product market innovation. Starting with Stein (1989), several authors have argued that firms with publicly traded equity have an incentive to act myopically when choosing their investment projects, because the presence of liquid equity markets exerts pressure on managers to show quick results and thereby to prefer short-term projects to long-term projects (even when investing in the latter may be ex ante more efficient). Ferreira, Manso, and Silva go beyond this insight and link the private versus public status of the firm to the failure tolerance (as in

Manso 2011) of firm insiders and through it, the firm's propensity to invest in innovative projects.

Ferreira, Manso, and Silva study a setting in which a risk-neutral firm insider chooses between a conventional project and an innovative project; both projects generate cash flows over two periods. The insider has an option to liquidate his stake early by selling shares in the first period. Under private ownership, the insider can time the market by choosing an early exit after receiving bad news, making him more tolerant of early failures and therefore more inclined to invest in the innovative project. In contrast, under public ownership the firm's cash flow is observable, so that an early exit after receiving bad news is not profitable for the insider, so that no tolerance for failure exists in public firms. Thus, the fact that the market prices of public securities react quickly to good news creates incentives for short-term oriented behavior. The greater tolerance for failure of private firms makes them more likely to undertake innovative projects; conversely, public firms are more likely to invest in the conventional project, investing in such projects with a positive probability even when investing in innovative projects is *ex ante* efficient.

Ferreira, Manso, and Silva argue that this incentive structure of private versus public firms has implications for the evolution of corporate ownership structures over a firm's life cycle. In its early stages (or in an emerging industry), when a firm has access to more innovative projects, it should be under private ownership. As the firm matures, when it is engaged more in the exploitation of existing ideas, a public ownership structure is optimal. Further, their model predicts that, when a firm needs to go through a risky restructuring involving radical changes in strategy (i.e., it wants to "reinvent itself"), it should do so under private ownership.⁸

There is some evidence that, as predicted by Ferreira, Manso, and Silva, public firms are less likely to engage in product market innovation than are private firms. Bernstein (2012), who makes use of patent data from the NBER patent database, provides such evidence. In particular, he finds that the quality of internal innovation in a firm declines following its IPO and that firms experience both an exodus of skilled inventors and a decline in the productivity of its remaining inventors post-IPO.

Further, the insight that firms that are more exposed to short-term pressures in the equity market will be less inclined to engage in innovative activities applies to a broader context than to the public versus private status of firms. One such context is the relation between antitakeover provisions in a public firm's corporate charter and the extent of innovation undertaken by it. Thus, a model by Chemmanur and Jiao (2012) analyzes the choice of firms going

⁸ A model that generates somewhat similar predictions on the tendencies of private versus public firms to engage in product market innovation (but driven by considerations of product market competition rather than by failure tolerance) is presented by Spiegel and Tookes (2009).

public between single-class and dual-class share structures and between short-term (less innovative) and long-term (more innovative) projects in a setting in which firm management has private information about their ability to create value by undertaking long-run projects. They demonstrate that firms that choose dual-class share structures when going are more likely to invest in long-run (more innovative) projects, whereas those with single-class share structures are likely to engage in short-term (less innovative) projects. More generally, the prediction here is that public firms with a larger number of antitakeover provisions in their corporate charter and therefore with management teams more insulated from the short-term pressures of the equity market (such as the pressure to show good short-run profitability results arising from a fear of losing control due to takeover by a rival management team) will be more innovative. Some evidence to support such a prediction is provided by Chemmanur and Tian (2012).

5. Legal Environment and Product Market Innovation

The institutional and legal environment facing firms may have a significant effect on the innovative activities undertaken by them. In the next paper, Acharya, Baghai, and Subramanian analyze, theoretically and empirically, how one important aspect of the legal environment facing firms, namely, wrongful discharge laws (which provide employees protection against unjust dismissal), affect the adoption of innovative activities by these firms.

The theoretical setting analyzed by Acharya, Baghai, and Subramanian is one of incomplete contracting. As Grossman and Hart (1986) and Hart and Moore (1990) have shown, in such a setting of incomplete contracting, bilateral relationships (in this case between employers and employees who exert effort on innovative activities) suffer from hold-up problems, that is, innovative firms (employers) have an incentive to arm-twist employees who have contributed significant effort toward the success of the innovation to extract a larger share of the ex post surplus. To begin with, the likelihood of such a holdup dampens innovative effort by the employee. The authors argue that wrongful discharge laws, particularly those that prohibit employers from acting in bad faith ex post (the “good-faith exception” to the employment at will doctrine), can help to limit the ability of employers to hold up innovating employees by imposing the burden of proof on the employer in the case of an alleged wrongful discharge. This, in turn, enhances the employees’ innovative effort and thereby the firm’s innovative output. Further, this effect is likely to be more pronounced in innovative industries when compared to “brick-and-mortar” ones.

Acharya, Baghai, and Subramanian test the implications of their model by exploiting the natural experiment created by the passage of wrongful discharge laws by several U.S. states starting in the 1970s. The staggered adoption of these laws across U.S. states allows the authors to identify their effect in a difference-in-differences setup. Thus, making use of data from the U.S. Patent

and Trademark Office on the number of patents issued to U.S. firms (as a proxy for the quantity of innovation) and the number of citations to these patents (as a proxy for their economic importance), the authors estimate difference-in-differences, comparing changes in innovation in states that passed wrongful discharge laws to the changes in innovation in states that did not. The authors find that the passage of wrongful discharge laws leads to more innovation, with the good-faith exception having the strongest positive effect. They also find that the effect of the good-faith exception on innovation is positive and significant only in high innovation-intensive industries, with the effect being insignificant in low innovation-intensive industries. Finally, using specifications similar to their study of innovation, the authors also examine the effect of the passage of wrongful discharge laws on the number of start-ups and find that states that adopt the good-faith exception experience a significant increase in new establishments due to start-up firms.

The findings of Acharya, Baghai, and Subramanian indicate that employment protection laws present policy makers with the following trade-off: although the passage of such laws may cause ex post inefficiencies in the labor market (as documented by the existing literature; see, e.g., Lazear 1990), they have positive ex ante effects by fostering innovation and entrepreneurship. Their paper is related to the broader literature that has studied the effect of other laws on innovation: see, e.g., Acharya and Subramanian (2009), who show that the ex post inefficient continuations engendered by debtor-friendly bankruptcy laws encourage ex ante risk taking, thereby promoting firm-level innovation. In a broader context, it is also related to the literature studying the relationship between patent laws and innovation (see, e.g., Lerner 2012 or Moser 2005; see Boldrin and Levine 2013 for a review).

6. Interbank Liquidity and Firm Credit

The last paper in this special issue, by Iyer, Pedro, and Schoar, returns to the question of the role of banks on small firm financing and the exposure and vulnerability of such firms to credit crunch events. Again, the question is important in assessing the exposure of firms to variations in the credit supply and ultimately on the importance of the credit channel in the transmission mechanism of monetary policy. The paper tackles this issue through a new angle, namely, by looking at the impact of the shocks to the credit supply experienced by many firms during the recent financial crisis and the role of the interbank market to channel liquidity in the credit market. Using Portuguese loan-level data, the paper studies the credit supply effects of the unexpected freeze of the European interbank market. The paper finds that banks that rely more on interbank borrowing before the crisis decrease their credit supply to their client base to a greater extent during the crisis. Interestingly, the credit supply reduction is stronger for client firms that are smaller and with weaker banking relationships. In addition, the paper shows that small client firms cannot

compensate for the credit crunch with other sources of debt, so that these firms are affected more adversely by the credit crunch. This means that small firms that do not have long-lasting banking relationships are more exposed to the adverse effects of a restrictive monetary policy and credit crunches. These findings imply that there is a value to maintaining banking relationships as a tool for securing a steady credit supply, demonstrating the value of long-term banking relationships. The paper concludes by showing that an increase in the supply of liquidity by a central bank does not have overall positive effects in credit crises but rather results in greater hoarding of liquidity with little or no effect on lending to small enterprises.

7. Conclusion

In conclusion, the articles collected in this special issue have considerably enhanced our understanding in two broad areas. First, they have enhanced our understanding in regard to the role of venture capitalists, angels, and other intermediaries (such as commercial banks) in financing new firms and fostering their future growth. Second, they have improved our understanding in regard to the effect of financing by various intermediaries, the ownership structure of entrepreneurial firms, and the legal environment in which these firms operate, on product market innovation by entrepreneurial firms. Yet, this research has also raised a number of new questions to be answered, some of which we have discussed above. Our hope is to encourage others to attempt to answer at least some of these questions through their future research.

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