Entrepreneurial Finance and Innovation
Doctoral Student Consortium Lecture

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Asian Finance Association Meetings
Seoul, July 2017
Introduction

• In this lecture to doctoral students at the Asian Finance Association Meetings at Seoul, I am first going to talk about research strategies I suggest to my doctoral students and to all of you if I were to be your dissertation research advisor

• I will then provide an introduction to the still very active research area of Entrepreneurial Finance and Innovation, to which I myself and many of my doctoral students (now professors at various universities in the US and abroad) have contributed and are actively contributing and published several papers in the very top finance journals.
A Few Words on Research Strategies for Doctoral Students (I)

• Some research strategies I suggest to my doctoral students: Choice of Research Topic
  – Choose innovative new research areas where there is very little research so far. Avoid the temptation to do “wrinkles” on established papers!
  – Co-author with established professor(s) who are already experienced in research, while searching for your own (solo job market paper) research topic: finding your own idea and writing a good paper is one of the hardest things to do for most starting researchers.
  – However, many schools require a “solo” paper to make doctoral students a job offer: so do be on the lookout for a good topic for your single-authored paper. This is also a good learning exercise, even if this is the only solo paper you ever write. Co-authoring with a professor before you write a solo paper may give you good training for writing your solo paper.
A Few Words on Research Strategies (II)

- Some research strategies I suggest to my doctoral students:
  
  **Choice of Research Topic**
  
  - Attending as many conference sessions, seminars, and research tutorials as possible in the time available
  
  - Also using the internet, and searching and finding the syllabi of advanced Ph. D. classes that address interesting research topics: that may reduce your search costs
  
  - Follow-up and reading the papers cited in the papers you read and mentioned as addressing interesting questions not addressed in the original paper you are reading is important.
  
  - Be ambitious: In choosing the topic for your dissertation research (solo paper), target to publish the very top journals: JF, JFE, RFS (top three in finance); top economics journals; or A-minus journals such as JFQA or Management Science.
A Few Words on Research Strategies (III)

- Some research strategies I suggest to my doctoral students: Research Methodologies and Publishing your Research
  - In corporate finance, sometimes the name of the game is coming up with very interesting new data (often hand-collected or proprietary data).
  - Sometimes, even very small but interesting and original data sets from not so important countries have become very well-cited papers.
  - This is going to be controversial advice: focus more on the economics (finding interesting things) than on the econometrics (identification and related topics). If you have good findings, then you can start searching for methodologies to establish causality.
  - It is my belief that too many doctoral students these days start by first looking for an IV even before they see whether there are some interesting economic relationships they can establish in their baseline analysis (using OLS regressions or correlations).
A Few Words on Research Strategies (IV)

- Some research strategies I suggest to my doctoral students: Research Methodologies and Publishing your Research
  - Target your submissions to the very top (A or A-minus) journals, at least to begin with
  - Be persistent in resubmitting papers that you first got rejected to other good journals: there is nobody who can “absolutely” judge the quality of your research but yourself
  - But even if you get some of your papers (including your first solo paper) rejected from all the very top journals, do not be disappointed: continue working hard, since you will be evaluated by your “portfolio” of papers, not by how a single paper does.
  - Many eventually very successful researchers had originally a very hard time publishing in the very top journals initially.
Introduction and Overview of Entrepreneurial Finance and Innovation

- In the rest of this tutorial lecture, I propose to give an overview of the relatively new research area of “Entrepreneurial Finance and Innovation,” emphasize some trends in this area, and raise many interesting research questions in this area. I will focus more on entrepreneurial finance but also a bit on innovation on the second half of this lecture.

- I will then briefly discuss a few papers that I or others have recently published or completed in this area, attempting to answer some of these research questions. However, this is very selective, and not meant to be a comprehensive survey of the research area as a whole.

- In 2014, a special issue of the *Review of Financial Studies (RFS)*, from a conference jointly organized myself, Prof. Paolo Fulghieri, and Debarshi Nandy in Boston became the first special issue of a top finance journal devoted to the area of Entrepreneurial Finance and Innovation.

- We have organized this “Entrepreneurial Finance and Innovation Conference (EFIC)” in Boston every year for the last six years.
Introduction and Overview of Entrepreneurial Finance and Innovation

- There was also a recent conference on “Entrepreneurial Finance and Innovation Around the World” that Prof. Xuan Tian and I recently (June 2015) organized at Tsinghua PBCSF along with a dual submission option in the Review of Financial Studies.

- Some of the ideas presented in this lecture along with an agenda for future research are discussed in my introductory article in the special issue of the Review of Financial Studies devoted to Entrepreneurial Finance and Innovation, namely, Chemmanur and Fulghieri (2014), which is available from the Review of Financial Studies or on my personal website maintained on the Boston College Server.
Introduction and Overview of Entrepreneurial Finance and Innovation

• Entrepreneurial Finance and Innovation are related, since some of the major sources of innovation are “entrepreneurial” or “start-up” firms that are new private firms, that eventually go public (are listed on stock exchanges).

• Of course, a lot of innovation also comes from large corporations that are already public.

• I am going to first talk about papers in entrepreneurial finance at some length; I will then talk more briefly talk about product market innovation, and its connections to entrepreneurial finance.
Recent Developments in Entrepreneurial Finance

• Over the last twenty years, the importance of venture capital and related forms of financing e.g. angel financing, in developing new firms has grown greatly.

• While venture capital started in the U.S., significant growth in venture capital has also now occurred in the international context: both in developed and emerging economies.

• At the same time, three important developments have affected the venture capital industry and entrepreneurial finance in general: globalization, technological innovation, and availability of alternatives to venture capital.
Globalization and Entrepreneurial Finance

- Over the last decade or two, venture capital (VC) investments across national borders have started to trend upward.
- Cross-border investments has increased from 10% of all VC investments in 1991 to 22.7% in 2008 (based on number of investments)
- An important driver of this increase is the upward trend in international VC investments in emerging or developing nations.
- Out of total VC investment, the fraction invested by international venture capitalists in emerging nations went up from 8.7% in 1991 to 56% in 2008.
The Evolution of VC Markets

VC investments - 1990

[Map showing VC investments worldwide in 1990, with different colors representing varying levels of investment.]
Globalization and Entrepreneurial Finance

• Another important phenomenon is that a number of non-U.S economies such as China, India, and Brazil have developed their own local VC industries: i.e., a number of local VCs invest in entrepreneurial firms in their own countries.
• Of particular interest here is that China has now surpassed the UK to become the second largest venture capital market in world, surpassing the UK and second only to the US.
• One interesting avenue for future research is the interaction between international and local venture capitalists in nurturing entrepreneurial firms in various countries.
• A related interesting research question is what policy-makers in each country can do to accelerate the growth of venture capital industry in their own country, and therefore entrepreneurship in that country.
Technological Innovation and Entrepreneurial Finance

• A second major development 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.

• This has affected entrepreneurial firms through such phenomena as large-scale outsourcing, especially in knowledge-related industries.

• Technological innovation has also led to the development of entirely new kinds of entrepreneurial ventures such as the “sharing economy:” e.g., Uber; Airbnb; and a number of other industries that did not exist even a few years ago.
Technological Innovation and Financial Intermediaries

• This has also affected financial intermediaries such as venture capitalists, private equity firms, and banks (investment banks and commercial banks), and led to the rise of new intermediaries.

• Firms doing “peer-to-peer lending” clearly would not exist without technological innovation, and has the potential to disrupt the commercial banking and traditional lenders in general.

• The reduction in communication costs due to technological innovation have made cross-border investments easier, by reducing venture capitalists’ costs of monitoring investments over long distances.
Technological Innovation and Financial Intermediaries

• There has been relatively little research until recently on the effects of technological innovation on the role of financial intermediaries in financing and nurturing the growth of young firms.
New Alternatives to Traditional VCs

- A third important development affecting entrepreneurial finance in the U.S. is the growing importance of alternatives to traditional or independent venture capital firms: examples are corporate venture capital, angel financing, and more recently, crowd funding.

- Corporate venture capital (CVC) refers to the venture capital subsidiaries of some corporations, e.g., Intel, that invest in entrepreneurial firms.

- Although constituting only 7% of VC investments in prior years, the share of corporate venture capital firm investments reached 13% by the end of 2015. Larger % by number of VC deals.

- Angel financing refers to significant investments in start-up firms by rich individuals: e.g., Paul Allen, co-founder of Microsoft along with Bill Gates. Recently many angel investors have formed “angel networks” to invest together in young firms.
Corporate VC Example: General Motors (GM) Ventures

GM ventures:
• Exploring equity investment in a number of auto related technologies
• Formed in June 2010, starting out with $100 million
• Sep 2010 – Sakti 3(battery) – Series B,$ 4.2 Million, Syndicated
• Dec 2010 – Tula (engine technology) – undisclosed $, syndicated
• ... by now about 20 CV deals

GM venture is one example of emerging CVC phenomenon
• 20% of the VC industry, fast growth, 37% in 2015 (NVCA, 2016)
New Alternatives to Traditional VCs

• A recent addition to the above alternatives is “crowd-funding”. Crowd-funding involves raising private funds using the internet in relative small amounts from a large number of investors, some of whom may be future customers or people who are otherwise interested in the entrepreneurial firm being successful.

• The JOBS Act passed in April 2012 by the U.S. Congress and signed by President Obama enlarged the pool of investors who are legally allowed to provide funds to new firms through crowd-funding, and the amounts they are allowed to provide. Equity crowd funding has also become popular in many other countries.

• Equity crowd funding differs from other crowd funding where contributors are given early access to a product, which has long been practiced by sites like “Kickstarter” and “Indigogo” in the US.
New Alternatives to Traditional VCs

- However, equity crowd funding was legalized in the US only at the beginning of 2016, since the SEC (the securities and exchange commission of the U.S.) was worried about retail investors losing money in risky ventures.

- However, it has been legal in other countries, notably the UK.

- The availability of these alternative forms of financing start-up firms also raises several interesting research questions, some of which have been the subject of recent research, and others provide an avenue for future research.
New Alternatives to Traditional VCs: Some Research Questions

• First, between the two forms of venture capital (IVC and CVC), which is better at nurturing the success of entrepreneurial firms?

• Second, how does angel financing compare with VC financing in nurturing the success of entrepreneurial firms? Are angel investors able to provide the advice and monitoring that one associates with various forms of venture capital?

• How does crowd-funding compare with venture capital and angel financing in helping new firms succeed? Are there dangers to crowd-funding in terms of losses to small investors arising from investing in risky young firms, and do the benefits of crowd-funding exceed the social costs?

• Some of these research questions have not been addressed due to lack of current data sources, and will be addressed as new data becomes available. Others have been addressed recently, and I will discuss them here.
Product Market Innovation
Product Market Innovation: Important but Extremely Difficult

• Important source of economic growth (Solow, 1957) and competitive advantage (Porter, 1992)
  – Rosenberg (2004): 85% of economic growth may be attributable to innovation

• Unlike routine tasks:
  – The process is long and requires investments in R&D
  – High probability of failure: an unpredictable and idiosyncratic process
  – Standard pay-performance contracts may not work
How Financing May Affect Product Market Innovation: Some Theory

• The source of financing can affect innovation in two ways:

• First, the source of financing and the structure of the financial contract may affect the availability of financing at various points in a firm’s life and a firm’s cost of capital.

• Second, the source of financing and the form of financial contract between two financial intermediaries and the entrepreneurial firm may affect product market innovation by influencing the incentives of scientists and other employees supervising them.

• Several theorists have argued that innovative activities are not like routine tasks.
How Financing May Affect Product Market Innovation: Some Theory

• Holmstrom (1989) has pointed out that innovative activities involve a high probability of failure and the innovation process is unpredictable and idiosyncratic. Therefore, the standard pay-for-performance contract may not be effective for motivating innovation.

• Manso (2011) models the innovation process as involving a trade-off between the exploration of new actions and the exploitation of well known actions. He argues that a “tolerance for failure” on the part of intermediaries such as venture capitalists is required to motivate innovation.

• An additional problem in motivating innovation is the asymmetric information that may exist between the financial intermediary (e.g. venture capitalist) and the entrepreneur.
Financial Intermediaries and Product Market Innovation

• An important research question is the effect of financial intermediaries such as venture capitalists in fostering product market innovation.

• Traditionally, scientists in corporate research laboratories accounted for two thirds of all U.S. innovation: it is not clear that the current corporate setting is the best organizational form to nurture innovation.

• On the other hand, while independent venture capitalists (IVC) have done great things to nurture innovation in entrepreneurial firms, they have done so only in a few targeted industries; are subject to boom and bust patterns in the availability of start-up funding; and are often vulnerable to fluctuations in the new equity (initial public offering or IPO) market for new technology firms.
Some have suggested (e.g., Lerner (2012)) that Corporate Venture Capital (rather than traditional independent venture capital firms) may be a better intermediary to nurture innovation, since they are a “hybrid model”, combining the best features of corporations and independent venture-backed start-ups.

What is the best type of financial intermediary and the best organizational setting to finance and nurture innovation?
Financial Intermediaries and Product Market Innovation

• A number of interesting research questions arise on the role of financial intermediaries in nurturing product market innovation.

• First, do financial intermediaries such as VCs play an important role in fostering innovation in entrepreneurial firms?

• Second, if they do play a significant role, what types of intermediaries: e.g., venture capitalists, angels, commercial banks; or crowd funding, is best suited to playing the above mentioned role of nurturing innovation in entrepreneurial firms?
Financial Intermediaries and Product Market Innovation

• Third, what is the nature of the optimal contract between financial intermediaries such as VCs and entrepreneurial firms that can motivate such firms to be more innovative?

• Fourth, how does the competitive structure of the industry of the intermediary (banks or venture capitalist) affect innovation in the entrepreneurial firms they finance?
Corporate Governance, Board Structure, and Product Market Innovation

• How does the corporate governance of a firm affect corporate innovation? While there is a vigorous recent debate on the role of ATPs (e.g., dual class share structures) on firm performance in general, some recent co-authored research by me indicates that the traditional answers may be wrong.

• The opposite of this question is also interesting: do more innovative firms pre-IPO adopt more management friendly corporate charters (more ATPs)?

• Another interesting question that has been the subject of recent research is regarding the effect of board independence on corporate innovation.
Firm Financial and Organizational Structure, Legal Environment, and Innovation

• Many other interesting research questions arise regarding the effect of the financial and organizational structure of the entrepreneurial firm itself, and the legal and institutional environment in which it operates, on the product market innovation undertaken by the firm.

• First, how does the private verses public status of a firm affect product market innovation?

• Second, does the organizational structure matter: conglomerate firm versus stand-alone division?

• Third, does the ownership structure of its equity matter: e.g., institutional ownership; equity fraction held by large blockholders; affect innovation?
Firm Financial and Organizational Structure, Legal Environment, and Innovation

• Fourth, how does the process of labor union or the lack of such unions among workers in a firm affect product market innovation by that firm?

• Fifth, how do various labor laws, and the other legal and institutional features of the economic environment a firm operate in, affect product market innovation by that firm?

• Some of the above questions have been answered in the recent literature; others provide opportunities for new research
Top Management Quality and Innovation

• Another set of interesting questions concern the effect of top management human capital ("management quality") on corporate innovation.

• Several interesting questions arise here. First, does the quality or human capital of a firm’s top management team affect product market innovation by the firm? Is this effect confined only to small private firms, or is there such an effect on large, established firms?

• Second, if there is indeed such an effect, what is the channel through which such an effect takes place?

• Third, if there is indeed such an effect, does the financial market reward such an “innovation effect:” for example, in private firms going public?

• Later, I will discuss two papers where I have used management quality measures developed by me to answer such questions.
Stock Market Conditions and Product Market Innovation

• First, does the liquidity of a firm’s stock and the extent of asymmetric information facing the firm affect corporate innovation?
• Second, does the extent of analyst coverage of the firm’s stock affect corporate innovation?
• Third, does the extent of short-selling in the firm’s stock affect corporate innovation?
• Fourth, does the fact that there are options listed on the firm’s stock affect corporate innovation?
Answers to Some of These Research Questions

- So far in this talk, I have tried to raise some interesting research questions in the area of entrepreneurial finance and venture capital; in the area of product market innovation; and on how financing affects product market innovation.

- Some of these questions were hard to answer empirically in earlier years because of the lack of suitable data; however, with the availability of new data on venture capital firms and on innovation (patents), not only in the U.S. but also in various countries across the world, it has now become possible to address at least some of these questions.

- Further, the availability of the NBER Patent Database and several related databases (e.g., HBS Inventor database and USPTO databases) in recent times has accelerated research in corporate innovation.

- Several international databases (e.g., patent data from China and other countries) and hand-collected data sets from various countries have recently been used for research.
Answers to Some of These Research Questions

• Later, I will discuss some research papers where I have used US Census Data, various venture capital datasets, the NBER and US Patent Office patent databases; and the HBS Inventor Mobility Database to answer some research questions.

• However, there is a tremendous amount of research yet to be done in answering these and related questions.
Crowdfunding: A Brief History

- 1700s – The Irish Loan Fund, started by Jonathan Swift
- 1976 – Grameen Bank, in Bangladesh
- 1997 - British Rock band Marillion raised $60,000 from fans to finance their US tour. Started ArtistShare.
- 2000s – P2P lending: Kiva, Prosper, Lending Club
- 2008 – Indiegogo, one of the first “Reward-based” crowdfunding sites.
- 2009 – Kickstarter
- 2010s – Equity-type sites, GrowVC, Crowdcube, Seedrs, etc.
Some Examples of Crowd-Funded Products

Name – Pebble Watch
Campaign – Kickstarter
Year – 2012
Funds sought – $100,000
Funds Raised - $10 million

Name – Form1 3D Printer
Campaign – Kickstarter
Year – 2012
Funds sought – $100,000
Funds Raised - $3 million
Investor Motivation: Why invest?

• While funding of activities, art, and business by an atomistic group of strangers is not new, “rewards-based” funding is only 7 years old.

• Various motivations are suggested for why individuals may invest in “rewards-based” crowdfunding campaigns.
  – Desire to be part of a community or movement.
  – Desire for certain reward/Presales-product access
  – Personal fulfillment from having donated to a cause/product/service that one may believe in.

  – Evidence on these mechanisms is nascent in the literature.
Crowdfunding: Some Concerns

- Concerns about the impact of potential equity crowdfunding campaigns on “unsophisticated” investors.

- JOBS act – unfulfilled promise of equity crowdfunding.

- Are crowd-funders systematically naïve?

- Evidence on this is also scarce.
What Drives Fundraising Success in Crowdfunding?

- Kuppuswamy and Bayus (2014) – Funder support is U-shaped with a lot of funds being raised during the first week and during the final week of a campaign.
- Joennsen, Michaelis, and Mullerleile (2014); Kuppuswamy and Bayus (2014); Mollick (2014) – Campaign interactions such as user updates are positively related to their success likelihood.
- Cumming, Leboeuf, and Schwienbacher (2014) - The funding type (fixed vs. flexible) of a campaign influences its success.
- Agrawal, Catalini, and Goldfarb (2011) - Contribution patterns are independent of the geographic distance between funders and entrepreneurs.
Crowdfunding and Entrepreneurship

• Mollick (2013): Signals of quality that are used to evaluate new ventures tend to be similar for venture capitalists and crowdfunders.

• Ahlers, et al. (2012) - Quality signals such as detailed financial roadmaps, high education level of board members, and a large number of board members are important for success in equity crowdfunding.

• Kuppuswamy and Mollick (2014) – Campaigns that achieve fundraising success with large goals or those that are oversubscribed are more likely to get outside professional financing.
Terminology: Fixed vs. Flexible Crowd Funding Campaigns

• Fixed funding type:
  – The campaign team gets all funds if amount committed by investors is at least equal to the campaign goal.
  – If less than campaign goal is committed, the team gets 0.

• Flexible funding type:
  – Campaign team receives any amount of money raised, regardless of campaign goal.
Main findings: Krishnan, Lohmer, and Wang (2016, WP)

- Crowdfunding campaigns that offer products as rewards (pre-order perks) are more likely to be successful in raising their campaign goal.
  - Pre-order perk campaigns are significantly more likely to raise more than 150 percent of their campaign goal.

- The positive relation between pre-order perks and campaign success is enhanced:
  - For campaigns with technologically innovative products: Greater positive and anticipatory sentiment for technologically innovative product campaigns.
  - Anticipation drives the relation between innovative products and campaign success.
Equity crowdfunding: Signori and Vismara (2016)

• Signori and Vismara (2016) use UK data to study equity crowdfunding, and to analyze the returns to firms that raised money using equity crowdfunding after the start given by crowdfunding: they use data from an internet platform called “Crowd-Cube”
• While in equity crowdfunding the proponent is a company, in other markets projects are mostly launched by individuals
• Size: the average target capital to be raised by campaigns in their sample is £240,000, while in Kickstarter is below $15,000
• Information asymmetries surrounding the start-up’s ability to generate future cash flows are different from those in the delivery of a reward
• Cholakova and Clarysse (2015) and Vismara (2016a) find that non-financial motives play no significant role in equity-based crowdfunding
One Problem in Equity Crowd Funding: Market Failure

• The absence of third-party certification mechanisms, such as underwriters or analysts, and the presence of collective action problems, limiting investors’ incentives to pursue ex-ante due diligence and ex-post monitoring, may generate reluctance to invest in crowdfunding, with potential investors being willing to do so only if compensated by a discount (e.g. Rock, 1986)

• This could eventually ingenerate an Akerlof-type of market failure, resulting in vanishing markets because the only equilibrium price would be zero
Another Problem in Crowd Funding: Possible Fraud

• As leading source of Internet fraud, Internet auctions have been characterized by the information system and criminology literature as highly criminogenic environments (Chua, Wareham, and Robey, 2007; Newman and Clarke 2003)
• Relative to platforms such as eBay and Airbnb, the lack of repeated interaction increases the potential for fraud
• The transparency and traceability granted by the web-based structure of crowdfunding can reduce the risk of fraud
• Regulation on equity crowdfunding incorporates existing anti-fraud measures and requires intermediaries to comply with specific, additional measures
• Crowdcube, for instance, reports to have already conducted 36,927 anti-money laundry checks
Mollick’s (2014) study of Kickstarter finds that less than 5% of the projects fail to deliver their products, and 75% deliver with a delay.

A few headline-grabbing frauds have been reported in equity crowdfunding (e.g., Rebus).

Broadly speaking, the delisting rate five years after the IPO ranges from 9% to 48%, with firm quality shaping the variance.

Espenlaub, Khurshed and Mohamed (2012) and Pour and Lasfer (2013) document that a significant fraction of delistings from the London’s AIM are voluntary.

In a survey of 158 projects in Kickstarter, Mollick and Kuppuswamy (2014) find that 18% raised VC or BA capital, while 8% through additional reward-based crowdfunding campaigns.

Examples of M&A deals are E-Car Club and Camden Town Brewery.
Some papers study the **determinants of success** of the offerings.

E.g. characteristics of the business and its top management team (Ahlers, Cumming, Günther, and Schweizer, 2015; Ralcheva and Roosenboom, 2016) as well as CG mechanisms (Cumming, Meoli, Vismara, 2016).
Signori and Vismara (2016): Post-campaign scenarios

Successful offering (212)

Seasoned offering (64)
- Public SEO (47)
- Private SEO (22)
- M&A (3)

Active (126)

Failed (22)
Crowdcube

- **Crowdcube** is, today, the **world’s largest platform**, with £m155 successfully raised from 275,000 investors in 105 countries.
- Beaushurst names Crowdcube as the leading equity investor in 2015 and the most prolific investor in the e-commerce sector.
- Crowdsurfer estimates Crowdcube’s share in the UK investment crowdfunding market in 2015 at 52% (see NESTA for 2014 data).

<table>
<thead>
<tr>
<th>Platform</th>
<th>Founded</th>
<th>Equity Volume Funded to end September 2015 (millions)</th>
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<tbody>
<tr>
<td>Crowdcube</td>
<td>2011</td>
<td>£93.3</td>
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<tr>
<td>Seedrs</td>
<td>2012</td>
<td>£36.0</td>
</tr>
<tr>
<td>SyndicateRoom</td>
<td>2013</td>
<td>£37.7</td>
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<tr>
<td>CrowdBnk*</td>
<td>2013</td>
<td>£8.2</td>
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<tr>
<td>VentureFounders</td>
<td>2014</td>
<td>£11.4</td>
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*Altfi Data estimate*
They construct an **augmented dataset** by relying on Crowdcube, Crunchbase, and the UK Companies House as data sources.

Starting from the population of 318 successfully funded offerings in 2011-2015, we exclude 12 mini-bond offerings and 94 “seasoned” equity offerings, i.e. follow-on campaigns.

The final sample is made of **212 initial equity offerings**.

They monitor these companies till the end of March 2016, using **Crunchbase** to identify capital infusions and the UK **Companies House** to identify failures.
Main Result from Signori and Vismara (2016): Rates of return from Equity Crowd Funding

- They compute the annualized IRR (see, e.g., Kaplan and Schoar, 2005) when a company undertakes a SEO, as this is when its valuation becomes observable (max: 371%)

- **Dilution effects** are considered in public and private SEOs, as made of newly issued shares; no dilution in case of an M&A
- They set the return on investing in a **failed** company to -1, and to zero for **active companies. Their main result**:

<table>
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<th></th>
<th>sample</th>
<th>SEOs</th>
<th>Active</th>
<th>Failed</th>
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<tbody>
<tr>
<td>(212 obs)</td>
<td>(64 obs)</td>
<td>(126 obs)</td>
<td>(22 obs)</td>
<td></td>
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<tr>
<td>Return (%)</td>
<td>8.8</td>
<td>63.5***</td>
<td>0.0**</td>
<td>-100.0***</td>
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What do Venture Capitalists do?

• A Venture Capitalist provides:
  – Financing; typically early on in the life-cycle of a firm
  – Monitoring; to improve the efficiency of firm management. Many VC’s spend several hours per week with management.
  – Business or industry expertise, as well as contacts, from similar businesses they were involved with before.
  – Assistance in securing capital from additional sources, including initial public offerings (IPOs).
What Venture Capitalists Do: An Example

Kapor started “Lotus” (the first spread sheet company) in 1981 with financing from Sevin-Rosen, a well known (reputable) venture capitalist at that time.

What role did each party play:

**Kapor (entrepreneur)**
- (i) recognized a market need
- (ii) technical abilities and team
- (iii) had a reasonable business plan

**Sevin-Rosen (V.C)**
- (i) capital
- (ii) experience
- (iii) industry credibility
Many (though not all) firms go through the following life-cycle:

- Start out as small private firms
- Expand through various stages of V.C or other forms of private equity financing
- Go public (have an Initial Public Offering: IPO).
- Further expand through additional rounds of public equity/debt financing.
Potential Problems with Venture Capital Financing

• Potential for excessive dilution of equity (obvious).
• Potential interference in the day-to-day running of the firm.
• May force pre-mature abandonment of project(s) if venture capitalist is sole capital supplier.
• Pressure firms to try to go public too early.
Sources of Venture Capital Financing

1. Private partnerships and corporations set up to provide funds. Organizer behind the partnership may obtain funding from institutions (insurance companies and pension funds).

*Average amount invested by these per firm was around $1 to $2 million in prior decades; currently much more

E.g.: Artur Rock & Company of San Francisco provided venture funds to Apple computers

*Only 2 to 3% of requests for V.C. funding receive financing.
2. Venture capital subsidiaries of large industrial or financial corporations (called Corporate Venture Capitalists or CVCs) E.g.: Intel CVC (CVCs are only a small portion but increasing fraction of the venture capital market: about 15% of venture capital market as of 2011)

3. High net-worth individuals and families (“angels”), with experience and knowledge in that industry. (Typical angel net worth over $1 million).

*Angels tend to invest only smaller amounts on average ($500,000) than venture capital firms.

*However, the aggregate investments from this source is much larger (at least twice as much) as from venture capital firms.
4. “Crowd-funding,” involving the use of the internet to raise money (with some limits) from even retail investors, may become more popular after the passage of the JOBS act in April 2012.

E.g., “Kickstarter,” largest crowd-funding site so far.
# Returns and Risk for Public Equity, Bonds and Private Equity

<table>
<thead>
<tr>
<th></th>
<th>Mean Return</th>
<th>Standard Deviation</th>
<th>Correlation with S&amp;P500</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P500</td>
<td>12.40%</td>
<td>15.33%</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NASDAQ</td>
<td>14.70%</td>
<td>28.59%</td>
<td>0.88</td>
<td>1.64</td>
</tr>
<tr>
<td>Bonds</td>
<td>8.08%</td>
<td>7.61%</td>
<td>-0.16</td>
<td>-0.08</td>
</tr>
<tr>
<td>PEQR</td>
<td>16.00%</td>
<td>12.99%</td>
<td>0.63</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Efficient Portfolios with Private Equity

Figure 1: Efficient Portfolios With and Without Private Equity as an Asset Class, Using Reported Returns
Returns are annualized based on quarterly data for 1989–2005

Private Equity is measured by PEQR with risk parameters estimated using historic data.
### Descriptive Statistics: Investors In VC Funds

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Total Funds under Management (MM$)</th>
<th>Total Private Equity Commitments (MM$)</th>
<th>Percentage Committed to VC Funds (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public pension funds</td>
<td>66</td>
<td>26,380</td>
<td>2,320</td>
<td>33%</td>
</tr>
<tr>
<td>Corporate pension funds</td>
<td>66</td>
<td>11,731</td>
<td>652</td>
<td>47%</td>
</tr>
<tr>
<td>Endowments</td>
<td>87</td>
<td>1,698</td>
<td>206</td>
<td>43%</td>
</tr>
<tr>
<td>Advisors</td>
<td>48</td>
<td>4,811</td>
<td>3,654</td>
<td>43%</td>
</tr>
<tr>
<td>Insurance companies</td>
<td>29</td>
<td>33,711</td>
<td>1,198</td>
<td>33%</td>
</tr>
<tr>
<td>Banks and finance companies</td>
<td>23</td>
<td>92,513</td>
<td>655</td>
<td>27%</td>
</tr>
<tr>
<td>Other investors</td>
<td>33</td>
<td>1,236</td>
<td>155</td>
<td>43%</td>
</tr>
<tr>
<td>Overall</td>
<td>352</td>
<td>19,167</td>
<td>1,253</td>
<td>39%</td>
</tr>
</tbody>
</table>

Source: Lerner, Schoar and Wongsunwai (2007)
# Descriptive Statistics: VC Returns by Investor

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Early Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Fund Size (MM$)</td>
</tr>
<tr>
<td>Public pension funds</td>
<td>1,483</td>
<td>814</td>
</tr>
<tr>
<td>Corporate pension funds</td>
<td>572</td>
<td>740</td>
</tr>
<tr>
<td>Endowments</td>
<td>923</td>
<td>465</td>
</tr>
<tr>
<td>Private endowments</td>
<td>597</td>
<td>494</td>
</tr>
<tr>
<td>Public endowments</td>
<td>129</td>
<td>478</td>
</tr>
<tr>
<td>Foundations</td>
<td>197</td>
<td>369</td>
</tr>
<tr>
<td>Advisors</td>
<td>732</td>
<td>716</td>
</tr>
<tr>
<td>Insurance companies</td>
<td>385</td>
<td>429</td>
</tr>
<tr>
<td>Banks and finance co.’s</td>
<td>363</td>
<td>699</td>
</tr>
<tr>
<td>Mainly retail banking</td>
<td>214</td>
<td>673</td>
</tr>
<tr>
<td>Substantial corporate</td>
<td>90</td>
<td>1,003</td>
</tr>
<tr>
<td>Indeterminate bank type</td>
<td>59</td>
<td>330</td>
</tr>
<tr>
<td>Other investors</td>
<td>160</td>
<td>315</td>
</tr>
<tr>
<td>Overall</td>
<td>4,618</td>
<td>661</td>
</tr>
</tbody>
</table>

Source: Lerner, Schoar and Wongsunwai (2007)
Typical Exit Strategies Adopted by Venture Capitalists

1. Going public typically the most desirable route - so the one the V.C. Aims at; most common
2. Sale to another company
3. Sale of ownership stake to another investor, often to a “working partner”.
4. Sale back to entrepreneur: this is rare, but used if entrepreneur can borrow from bank or has cash.
5. Reorganizing the company (under Chapter 11 of bankruptcy code in the U.S.)
6. Liquidation of assets.
Financial Contracting with Venture Capitalists

A venture capital “deal” or contract is any agreement between parties for the allocation of economic value.

*A deal allocates cash flows by amount and timing, as well as risk.

*The structure of a V.C. Deal can result in the success or failure of the firm/project.
What A Venture Capital Contract or Deal Sets out to Accomplish

(i) Allocate cash flows appropriately.
(ii) Allocate the risks involved in the firm
Between the entrepreneur and venture capitalist.

(iii) Give rise to the “right” incentive effects for both the entrepreneur and the venture capitalist
(e.g., it should motivate the entrepreneur to put forth optimal effect and put-forth realistic cash flow projections)
Difficulties and Opportunities in Designing Deals between VCs and Entrepreneurs

(1) Uncertainty about cash flows
(2) Discount rates difficult to determine.
(3) Parties may disagree about expected cash flows, their risks and the appropriate rates.
(4) Parties affected differently by transaction (tax effects, for example).
(5) Asymmetric information
(6) Conflicts of interests
(7) Incentive effects of deal itself.
How to Overcome the Above Difficulties At Least Partially

(A) **Stage financing**: Financing the project (investing in the firm) in stages; project may get additional funding only if satisfies certain “milestones” or “contingencies”

(B) **Including contingencies in financial contracts**: may also be used to provide incentives for entrepreneur and other officers of the company to work harder

(C) **Use of appropriate financial contracts:**
   (i) Debt with warrants
   (ii) Convertible debt
   (iii) Convertible preferred equity.
The VC 27.0
(the danger of one-sided first rounds)
### Contingent Contracting: Kaplan and Stromberg (RES, 2003)

**Contingencies and the contracting space**

#### A. Percentage of rounds with contingent contracts

<table>
<thead>
<tr>
<th>Contingency</th>
<th>Cash flow rights</th>
<th>Voting rights</th>
<th>Board rights</th>
<th>Right to force sale</th>
<th>Liquidation, or dividend amount</th>
<th>Redempt. rights</th>
<th>Release of committed funds</th>
<th>Any rights</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contingent on financial performance</td>
<td>8.0%</td>
<td>5.6%</td>
<td>0.5%</td>
<td>1.4%</td>
<td>3.3%</td>
<td>0.5%</td>
<td>4.2%</td>
<td>17.4%</td>
</tr>
<tr>
<td></td>
<td>[11.2]*</td>
<td>[7.1]</td>
<td>[1.0]</td>
<td>[2.0]</td>
<td>[2.0]</td>
<td>[1.0]</td>
<td>[7.1]*</td>
<td>[22.4]*</td>
</tr>
<tr>
<td>Contingent on non-financial performance</td>
<td>6.1</td>
<td>4.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.3</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>[6.1]</td>
<td>[3.1]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[5.1]</td>
<td>[11.2]</td>
</tr>
<tr>
<td>Contingent on actions</td>
<td>1.9</td>
<td>0.5</td>
<td>0.5</td>
<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
<td>8.9</td>
<td>11.3</td>
</tr>
<tr>
<td></td>
<td>[2.0]</td>
<td>[0.0]</td>
<td>[1.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[12.2]</td>
<td>[14.3]</td>
</tr>
<tr>
<td>Contingent on default on dividend or redemption payment</td>
<td>5.2</td>
<td>5.2</td>
<td>19.2</td>
<td>1.4</td>
<td>2.8</td>
<td>0.5</td>
<td>0.0</td>
<td>27.7</td>
</tr>
<tr>
<td></td>
<td>[6.1]</td>
<td>[6.1]</td>
<td>[21.4]</td>
<td>[2.0]</td>
<td>[1.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[29.6]</td>
</tr>
<tr>
<td>Contingent on future securities offerings or “fair market value”</td>
<td>8.9</td>
<td>7.5</td>
<td>0.0</td>
<td>3.8</td>
<td>11.7</td>
<td>0.9</td>
<td>0.9</td>
<td>21.1</td>
</tr>
<tr>
<td></td>
<td>[13.3]**</td>
<td>[9.2]</td>
<td>[0.0]</td>
<td>[5.1]</td>
<td>[16.3]*</td>
<td>[1.0]</td>
<td>[1.0]</td>
<td>[27.6]**</td>
</tr>
<tr>
<td>Any of the above</td>
<td>18.8</td>
<td>15.5</td>
<td>19.2</td>
<td>6.1</td>
<td>15.5</td>
<td>2.3</td>
<td>14.6</td>
<td>52.6</td>
</tr>
<tr>
<td></td>
<td>[23.5]*</td>
<td>[16.3]</td>
<td>[22.4]</td>
<td>[8.2]</td>
<td>[19.4]</td>
<td>[2.0]</td>
<td>[20.4]**</td>
<td>[60.2]**</td>
</tr>
<tr>
<td>Contingent on founder remaining with firm</td>
<td>44.6</td>
<td>40.4</td>
<td>—</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.9</td>
<td>40.8</td>
</tr>
<tr>
<td></td>
<td>[51.0]*</td>
<td>[48.0]**</td>
<td>—</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[0.0]</td>
<td>[1.0]</td>
<td>[51.0]*</td>
</tr>
<tr>
<td>Any contingent contracting</td>
<td>52.6</td>
<td>50.7</td>
<td>19.2</td>
<td>6.1</td>
<td>15.5</td>
<td>2.3</td>
<td>14.6</td>
<td>72.8</td>
</tr>
<tr>
<td></td>
<td>[61.2]**</td>
<td>[58.2]**</td>
<td>[22.4]</td>
<td>[8.2]</td>
<td>[19.4]</td>
<td>[2.0]</td>
<td>[20.4]**</td>
<td>[79.6]**</td>
</tr>
</tbody>
</table>
Examples of Contingencies

<table>
<thead>
<tr>
<th>Type of contingency</th>
<th>Examples</th>
</tr>
</thead>
</table>
| 1. Contract contingent on financial measures of performance | - VC dividend on preferred shares, payable in common stock, is suspended if revenue and operating profit goals attained (CF, VO)  
- Founder (VC) receives options if revenue/earnings goal (not) attained (CF)  
- VC can only vote for all owned shares if realized EBIT below threshold value, in which case VC gets voting control (VO)  
- If net worth below threshold, VC will get three more board seats (BD)  
- Founder has veto power against sale of company for 3 years, as long as company achieves at least 80% of revenues and profits before tax relative to business plan (FS)  
- VC liquidation value multiple of net operating cash flow or net earnings (LI)  
- If earnings are below threshold, VC is allowed to redeem shares (RD)  
- Committed funds paid out when achieves projected net revenue (ST) |
| 2. Contract contingent on non-financial measures of performance | - Employee shares vest when release of second major version of the product that incorporates significant new functionality, FDA approval of new drug, new corporate partnership found, or patents approved (CF, VO)  
- VC gets fewer shares if secures distribution agreement within 3 months (CF, VO)  
- Founder gets options when company secures threshold number of customers who have purchased the product and give positive feedback (CF)  
- Committed funding paid out when new clinical tests completed, new strategic partnership completed, or patent approved (ST) |
| 3. Contract contingent on meeting dividend or redemption payment | - If company cannot pay dividend in cash, it has to be paid in common stock (CF, VO)  
- If company fails to redeem preferred stock, VC elects majority of board (BD) |

Source: Kaplan and Stromberg (2003)
### Examples of Contingencies (cont’d)

<table>
<thead>
<tr>
<th>Type of contingency</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• If company fails to pay out certain fraction of revenue as a dividend, VC elects majority of board (BD)</td>
</tr>
<tr>
<td></td>
<td>• If company fails to redeem preferred stock, VC has the right to select an investment banker to assist in the sale of the business (FS)</td>
</tr>
<tr>
<td></td>
<td>• If company fails to redeem preferred stock, cumulative dividend will be increased (LI)</td>
</tr>
<tr>
<td>4. Contract contingent on certain actions being taken</td>
<td>• Founder gets equity when VP of sales and marketing hired, or acquires certain technology (CF, VO)</td>
</tr>
<tr>
<td></td>
<td>• VC gets board majority if company fails to recruit a CEO within 9 months (BD)</td>
</tr>
<tr>
<td></td>
<td>• VC has option to redeem preferred stock until new CEO hired acceptable to VC (RD)</td>
</tr>
<tr>
<td></td>
<td>• Committed funding paid out subject to new business plan for entering new markets completed and approved by board, new key executives or CEO hired, certain company acquired, or company starts to develop new facilities (ST)</td>
</tr>
<tr>
<td>5. Contract contingent on offering of securities</td>
<td>• Founder ownership increasing non-linear function of share price obtained in sale or IPO (CF)</td>
</tr>
<tr>
<td></td>
<td>• VC receives dividend in stock, cancelled upon IPO of minimum value, or if company manages to raise minimum amount of new funding above minimum price per share (CF, VO)</td>
</tr>
<tr>
<td></td>
<td>• VC warrants expire if company manages to raise alternative funds where proceeds and price of securities exceed threshold (CF)</td>
</tr>
<tr>
<td></td>
<td>• If no IPO has occurred within 5 years, VC has right to force a sale of company (FS)</td>
</tr>
<tr>
<td></td>
<td>• VC can redeem preferred shares after IPO at a value that increases the later the IPO date (LI)</td>
</tr>
<tr>
<td></td>
<td>• VC can redeem shares at fair market value (LI)</td>
</tr>
<tr>
<td>6. Contract contingent on founder staying with firm</td>
<td>• Founder loses unvested shares if employment terminated (CF, VO)</td>
</tr>
<tr>
<td></td>
<td>• Founder loses voting rights (but keeps cash flow rights) for shares if terminated for cause (VO)</td>
</tr>
<tr>
<td></td>
<td>• Committed funding paid out under the condition that founder still employed (ST)</td>
</tr>
</tbody>
</table>

Source: Kaplan and Stromberg (2003)
Venture Capitalists versus Angels
Chemmanur and Chen (RCFS, 2014)

• There has been little analysis of the important economic differences between the two, beyond some stylized facts:
  – Angels tend to be individuals investing smaller amounts than VCs in individual firms.
  – The annual amount of angel financing is much larger than VC financing: e.g., Prowse (1998), Fenn, Liang and Prowse (1997).

• One objective of this theoretical paper is to develop a theoretical analysis of the different roles played by venture capitalists and angels in funding private firms; and also analyze when firms will make use of each type of financing.

• In practice, different rounds of financing for firms may come from the same source or from different sources: for instance, a firm may do multiple rounds of VC financing; or start with angel financing and switch to VC financing; or vice versa.
Key Contributions

• Develop predictions about an entrepreneur’s equilibrium choice between angel financing versus VC financing and the structure of private equity financing contracts.

• Demonstrate why firms prefer venture capital financing to angel financing in many situations, even though venture capitalists require a greater return from their investments.

• Characterize the conditions under which firms switch sources across financing rounds (angel to VC or VC to angel).

• Characterize the equilibrium dynamics of financing contracts between venture capitalists and entrepreneurs on the one hand, and angels and entrepreneurs on the other. This allows us to make predictions regarding the differences between angel and VC contracts (see, e.g., Prowse (1998)), and between more and less productive VCs’ contracts (see, e.g., Schweinbacher (2002)).
Key Contributions

• Make predictions regarding how the structure of venture capital contracts will evolve over time (e.g., difference between early and late-round financing contracts).

• Develop implications for the composition of projects (early versus later stage) financed by venture capitalists and angels, and how this composition varies with changes in the scarcity of venture capital financing relative to angel financing.

• Develop predictions regarding the announcement effects (for private equity investors) of various forms of financing, and the relationship between the dynamic path of firm financing and the quality of the firms’ projects.

• Characterize some of the situations under which financing conflicts between the entrepreneur and the early-stage financier over the terms of future rounds of financing can arise in equilibrium, giving rise to inefficient project implementation.
Four Main Ingredients Driving the Analysis

- Four key ingredients driving our analysis:
  - We assume that venture capitalists are able to add significant value to some of the firms they finance. Further, this added value is significantly above what angels can provide (Prowse 1998)
  - The venture capitalist has to engage in costly effort to add value. Thus, he has to be given appropriate incentives to put forth optimal effort to add value to the firm.
  - The entrepreneur has private information about the productivity of his own firm (including about the likelihood of the VC being able to add value). The extent of this private information reduces over time; financiers who invest in prior rounds will know more about the firm than a new financier.
Main Ingredients Driving the Analysis

– The entrepreneur also has to engage in costly effort to ensure project success. Thus he also has to retain securities of the firm that provide him with the appropriate incentives.
VC’s Trade-off Between Financing Early Versus Late Stage Projects

- The benefit of early stage financing to the firm (and to the VC, since he can extract a share of the value he creates) is that he is able to add more value to the firm compared to later stage financing, for two reasons:
  - i) He is able to accumulate knowledge about the firm starting at an early stage, so that the VC’s effort can therefore be more productive.
  - ii) The contracting between the VC and the entrepreneur at a later stage (time 1) does not have to be under asymmetric information in this case, so the VC can be provided with stronger incentives to exert effort.
VC’s Trade-off Between Financing Early Versus Late Stage Projects

- In contrast, the benefit of starting to finance a firm only at a later stage in its life is that there is less uncertainty about whether the VC’s effort will be productive in that firm (compared to investing in an earlier stage firm). Thus, the VC will not be faced with a situation where he starts financing a firm at an early stage, but has to leave it later when he realizes that his effort will not be productive.

- When this benefit of later stage financing dominates those of early stage financing, the VC chooses to fund only later stage projects when VC financing is highly scarce.
Early-Stage Financing Contracts Under Moderate Scarcity of VC Financing

• Since the VC finances only higher quality projects in equilibrium, the financing contract has to ensure separation between the entrepreneur with higher quality versus lower quality projects. Such a contract can be implemented with convertible preferred equity or convertible debt, but not equity with warrants (no separation achieved in this case).

• The fixed income portion of convertibles in early stage contracting is larger than in later stage contracting, since the focus of contracting here is on resolving the asymmetric information between the entrepreneur and the VC; in later stage contracting, there is also the need to motivate optimal effort by the VC.
Announcement Effects of VC and Angel Financing

• Under conditions of moderate-scarcity of VC financing, the announcement of a VC financing at an early stage conveys favorable information to outsiders. If a firm receives early stage financing from the VC, outsiders infer that there is a greater probability of the VC adding value to that firm at a later stage, compared to the case of a firm which is angel financed at the early stage.

• If a firm receives a new round of financing at a later stage from a VC, it conveys further positive information to outsiders, regardless of its earlier stage financing.

• If a VC exits a firm funded by him earlier, it conveys negative information to outsiders.
Empirical Implications

•  i) **Entrepreneurs' choice between venture capital and angel financing:**
   – Venture capitalists will finance firms in industries where the potential for adding value is more: e.g., in technologically sophisticated and knowledge-intensive industries.
   – Entrepreneurs who are technologically sophisticated themselves will tend to have self-financing or angel financing.

•  ii) **Differences between venture capital and angel financing contracts:**
   – Angel financing contracts are less likely to have convertible features, and, when present, will have a smaller upside (recall that it is the upside of the convertible which motivates the venture capitalist to put forth optimal effort in our setting).
Empirical Implications

• iii) The dynamics of venture capital contracts:
  – In the earlier rounds (when the extent of asymmetric information is greater), the contract gives greater down-side protection (i.e., the fixed income component contract will be greater) to the venture capitalist.
  – In later stages, when the asymmetric information between the venture capitalist and the entrepreneur is lower, the fixed income component of the contract will be less, and the upside (warrant) component of the contract will be more, since the need to provide incentives to the venture capitalist dominates.

• iv) Relationship between the productivity of the VC and the nature of the financing contracts:
  – Our model predicts that when the VC is more productive, the contract will have more of an “upside” (warrant component).
Empirical Implications

– Thus, more experienced VC’s will use convertibles more often: Schweinbacher (2002) finds this using a survey of European VCs.

v) Cross-sectional differences in later-round VC financing contracts:

– Our model predicts significant differences in the contracts between the VC and firms which are previously angel-financed versus those which are previously financed by the same VC.

– The latter contract, being characterized by less asymmetric information compared to the former, will have a larger upside (warrant) component and a smaller fixed-income component.
Does Venture Capital Financing Increase Firm Value and Efficiency: Chemmanur, Krishnan, and Nandy (RFS, 2011)

• Several papers in the theoretical VC literature have argued that, in addition to providing financing, venture capitalists provide other “extra-financial” services to private firms which considerably enhance their probability of success. - Repullo and Suarez (1999) or Chemmanur and Chen (2003).

• Both practitioners and academics have argued that, in addition to providing funding, VCs contribute by helping firms in hiring competent management, providing better incentives to firm management and employees, as well as by allowing them access to their network of contacts among suppliers and potential customers in the product market.

- “From whom you raise capital is often more important than the terms”- Sahlman (1997)
How does Venture Capital Financing Increase Firm Efficiency?

• If VCs do help to increase firm value, several questions arise as to how VCs improve firm value or create "extra-financial" value for private firms.
  – Do VCs identify and invest in higher quality entrepreneurial firms “screening”?
  – Do VCs improve operating efficiency and performance of such firms subsequent to their investing in the firm “monitoring”?

• Two major difficulties in conducting research on VC financing and its effects on firms' performance are first, on obtaining firm specific data on private firms that do receive VC financing, and second, obtaining data on private firms that could potentially use VC but do not.

• Chemmanur, Krishnan, and Nandy (2011), published in the Review of Financial Studies, address this question by empirically analyzing the role of venture capital financing in creating value for entrepreneurial firms
Chemmanur, Krishnan, and Nandy (2011) conduct the first large sample study in the literature providing direct evidence on the role of VC backing in improving the operating efficiency and performance of VC backed private firms compared to non-VC backed private firms.

They also present the first analysis in the literature that compares the efficiency and productivity of VC and non-VC private firms, and analyzes *how* and *when* efficiency improvements arise due to venture backing.

They use the Longitudinal Research Database (LRD) of the U.S. Bureau of Census. This is a confidential database consisting of all manufacturing firms in the U.S., both private and public, with the special permission of the U.S. Census Bureau and the Internal Revenue Service, since it uses some corporate tax data.
They use Total Factor Productivity (TFP) as their measure of overall firm efficiency.

- TFP measures the actual output of a firm relative to what it should have produced given the level of inputs used.

They obtain measures of TFP at the plant level, by estimating a log-linear Cobb-Douglas production function for each 4-digit SIC industry and year.

\[
\ln(Y_{ijt}) = \alpha_{jt} + \beta_{jt} \ln(K_{ijt}) + \gamma_{jt} \ln(L_{ijt}) + \delta_{jt} \ln(M_{ijt}) + \varepsilon_{ijt}
\]

VC financing involves the injection of additional capital into the firm which may increase the scale of the firm. Therefore TFP is a particularly appropriate measure to analyze changes in firm productivity due to VC backing, since it captures efficiency changes independent of the scale of production.
They employ the following regression framework to analyze the effects of screening and monitoring on firm TFP:

\[ Y_{it} = \alpha_t + \beta_i + \gamma X_{it} + \lambda_s \sum_{s=1}^{3} Y_{it-s} + \delta_1 VCBefore_{-4,0} + \delta_2 VCAfter_{1,4} + \delta_3 VCAfter_{\geq 5} + \varepsilon_{it} \]

- \( Y_{it} \) is our variable of interest, i.e., firm TFP;
- \( X_{it} \) is a control for firm size and the industry herfindahl index which are time varying;
- \( VCAfter_{it} \) is a dummy variable, which equals 1 if the firm received VC financing and the observation is in year \( t \) after the first round of financing and 0 if it is a firm that either did not receive VC financing or is a VC backed firm, but with the observation belonging to a year different from \( t \).
- The coefficients of interest of the effect of VC screening and monitoring on a firm's TFP is captured by the \( \delta 's \).
They find that the overall efficiency of VC backed firms (as measured by TFP) is found higher than that of non-VC backed firms.
- Both a screening and a monitoring role for VCs in improving firm efficiency.

The above increase in TFP of VC-backed firms relative to non-VC-backed firms is long lived and continues till exit.

The growth in TFP subsequent to financing is significantly higher for firms backed by higher reputation VCs.
- Higher reputation VCs (“HVCs”) have greater monitoring ability compared to lower reputation VCs (“LVCs”).

Round by round analysis indicates that for high reputation VCs these TFP improvements primarily arise in the period between Round 2 and Round 3.
## Panel A: Regression Results for TFP Changes Over Time

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<th>(2)</th>
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**TFP Change Over Time**

**For High and Low Reputation VCs**

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<td>VCAfter(≥ 5)</td>
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<td>0.139***</td>
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<td>-0.064***</td>
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### Panel A: Regression Results for TFP Change Over Rounds

<table>
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<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
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<tbody>
<tr>
<td>VCBefore</td>
<td>0.057***</td>
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<tr>
<td>VCAfter(R1)</td>
<td>0.102***</td>
<td>[0.033]</td>
</tr>
<tr>
<td>VCAfter(R2)</td>
<td>0.192***</td>
<td>[0.048]</td>
</tr>
<tr>
<td>VCAfter(R3)</td>
<td>0.189***</td>
<td>[0.060]</td>
</tr>
<tr>
<td>VCAfter(&gt;=R4)</td>
<td>0.155***</td>
<td>[0.046]</td>
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<tr>
<td>Firm Size</td>
<td>-0.057***</td>
<td>[0.003]</td>
</tr>
<tr>
<td>Herfindahl Index</td>
<td>-0.016</td>
<td>[0.020]</td>
</tr>
<tr>
<td>Firm Fixed Effects</td>
<td>Y</td>
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<tr>
<td>Year Fixed Effects</td>
<td>Y</td>
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</tr>
<tr>
<td>Observations</td>
<td>523750</td>
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<tr>
<td>Adj. R - Squared</td>
<td>0.414</td>
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### Panel B: TFP Change Over Rounds

<table>
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<tr>
<th></th>
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<tr>
<td>VCAfter(R1) - VCBefore</td>
<td>0.045*</td>
<td>[0.026]</td>
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<tr>
<td>VCAfter(R2) - VCBefore</td>
<td>0.135***</td>
<td>[0.043]</td>
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<tr>
<td>VCAfter(R3) - VCBefore</td>
<td>0.131**</td>
<td>[0.056]</td>
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<tr>
<td>VCAfter(&gt;=R4) - VCBefore</td>
<td>0.098**</td>
<td>[0.043]</td>
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<tr>
<td>VCAfter(R2) - VCAfter(R1)</td>
<td>0.090**</td>
<td>[0.039]</td>
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<tr>
<td>VCAfter(R3) - VCAfter(R2)</td>
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<td>VCAfter(&gt;=R4) - VCAfter(R3)</td>
<td>-0.03</td>
<td>[0.056]</td>
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</table>
Screening versus Monitoring by VCs

- To disentangle the screening and monitoring effects of VC backing on firm efficiency, we employ two alternative methodologies.
  - Switching regressions with endogenous switching.
  - Propensity Score matching algorithm.

- VC-firm matching results in an equilibrium outcome: for both VC and non-VC backed firms TFP growth declines had the firms been in the other category, i.e., had VC backed firms not received VC financing and had non-VC backed firms received VC financing.

- TFP growth of VC-backed firms subsequent to receiving financing is significantly greater than that of matching firms with similar TFP prior to receiving financing.
  - Again, monitoring effect of VC backing is greater for higher reputation VCs compared to lower reputation VCs.
Effect of Monitoring on TFP: Propensity Score Matching

• We employ a propensity score matching algorithm, where we match firms on the following dimensions:
  – Same 3-digit SIC industry;
  – similar size;
  – similar level of average 5 year prior TFP in the year prior to receiving funding.

• The last criteria ensures that at the time of receiving VC financing, both our sample (VC-backed firms) and matched (non-VC-backed firms) portfolios have similar levels of productivity and efficiency.

• We also investigate the difference in TFP growth between high and low reputation VCs, generated due to the monitoring activities of VCs.
## Effect of Monitoring on TFP: Propensity Score Matching

### TFP Growth: Matched Sample Comparison

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<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Matched</th>
<th>Diff.</th>
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<tbody>
<tr>
<td>TFP Growth Mean</td>
<td>0.023***</td>
<td>-0.050</td>
<td>0.072***</td>
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<tr>
<td>p-value</td>
<td>(0.010)</td>
<td>(0.239)</td>
<td>(0.008)</td>
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<tr>
<td>Quasi-median</td>
<td>0.007***</td>
<td>-0.041</td>
<td>0.048***</td>
</tr>
<tr>
<td>p-value</td>
<td>(0.009)</td>
<td>(0.962)</td>
<td>(0.007)</td>
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<tr>
<td>Observations</td>
<td>442</td>
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### TFP Growth and VC Reputation: Matched Sample Comparison

<table>
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<th>High Reputation VC</th>
<th>Low Reputation VC</th>
<th>Diff.</th>
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<tbody>
<tr>
<td>Matched Firm Adjusted TFP Growth Mean</td>
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<td>0.028</td>
<td>0.090</td>
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<td>p-value</td>
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<td>(0.498)</td>
<td>(0.106)</td>
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<tr>
<td>Quasi-median</td>
<td>0.088**</td>
<td>-0.002</td>
<td>0.090*</td>
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<td>p-value</td>
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Effect of TFP Levels and Growth on Exit

• Both the level of TFP of VC backed firms prior to receiving financing and the growth in TFP subsequent to financing positively affects the probability of a successful exit (either through an IPO or an acquisition).

• For HVC backed firms, the probability of an exit through an IPO versus an acquisition is increasing in both the level of TFP prior to financing and the TFP growth subsequent to financing.

• In contrast, for LVC firms, it is the probability of an acquisition that is increasing in the above two variables.

• Thus, firms with higher levels of efficiency are more likely to exit through an IPO rather than an acquisition.
Channels through which Venture Capital Financing Improves Firm Efficiency

- They find that the primary channel through which VC backing improves efficiency is by improving product market performance (sales).
- They find that the level of sales prior to financing is *lower* for high reputation VC backed firms compared to those backed by low reputation VCs; however, the growth in sales subsequent to financing is *greater* for the former firms.
- Total production costs prior to financing is lower for high reputation VC backed firms compared to low reputation VC backed firms and the growth in total production costs subsequent to financing is also lower for the former firms.
- Total labor costs prior to receiving financing are *higher* for high reputation VC backed firms compared to low reputation VC backed firms; but the growth in total labor costs subsequent to financing is *lower* for high reputation VC backed firms.
- Thus, the additional improvements in efficiency generated by high reputation VC backing of firms arise through both improvements in product market performance (sales) and also due to lower increases in input costs.
Are International or Local Venture Capitalists Better at Nurturing Young Firms?
Chemmanur, Hull, and Krishnan (JBV, 2016)

• Little research on:
  • The relative effectiveness of international versus local VCs in adding value.
  • The interaction between the two types of VCs.
• What drives development of VC markets?
  • Opening up to international investors?
  • Promoting local investment?
• Other issues:
  • Role of infrastructure?
International versus Local Venture Capitalists: Basic tradeoff

- Local VCs have local market expertise and their proximity helps in more effective monitoring.
  - But they may lack in expertise in venture capital investing.

- International VCs have expertise and experience in venture capital investing.
  - Lack of proximity disadvantages international VCs in terms of monitoring ability and local market knowledge.
  - Greater distance between the VC’s country and the entrepreneurial firm’s country may make such a disadvantage even worse.
International versus Local Venture Capitalists
Res Questions: Chemmanur, Hull, and Krishnan

• Which is the most effective syndicate composition? Purely local VCs, purely international VCs, or a combination of both.
• What factors influence the choice of international VCs and local VCs to syndicate with each other?
• How are the answers to the previous questions different for emerging and developed nations?
• Chemmanur, Hull, and Krishnan (2016) address these questions using data from the VentureXpert database covering venture capital investments in both emerging and developed countries
• Their sample covers the period from 1989-2008
## Country Distribution of Entrepreneurial Firms

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<th>Percentage</th>
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<td>20</td>
<td>1.06</td>
</tr>
<tr>
<td>Poland</td>
<td>81</td>
<td>4.28</td>
</tr>
<tr>
<td>Romania</td>
<td>34</td>
<td>1.80</td>
</tr>
<tr>
<td>Russia</td>
<td>55</td>
<td>2.91</td>
</tr>
<tr>
<td>South Africa</td>
<td>39</td>
<td>2.06</td>
</tr>
<tr>
<td>Thailand</td>
<td>76</td>
<td>4.02</td>
</tr>
<tr>
<td>Vietnam</td>
<td>12</td>
<td>0.63</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,891</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Total             | **28,180** |            |
Industry Distribution of VC-backed Firms

Frequency of VC investments

- Biotechnology
- Communications and Media
- Computer Hardware
- Computer Software and Services
- Consumer Related
- Industrial/Energy
- Internet Specific
- Medical/Health
- Other Products
- Semiconductors/Other Elect.
Chemmanur, Hull, and Krishnan (2016): Variable Definitions

- Success measures: IPO and M&A exit rates.
  - They also use post-IPO operating performance as a robustness check.

- Local VC: The country of the VC fund’s office is the same as the country of the entrepreneurial firm.

- Local and International VC: At least one VC is international and at least one VC is local.

- Distance: Measured as the distance between the country of the venture capitalist to the country of the entrepreneurial firm.
### Dependent variable: Successful Exit
(Logit Regressions, Successful Exit=1)

<table>
<thead>
<tr>
<th></th>
<th>(1) Emerging Nations</th>
<th>(2) Developed Nations (excl. US)</th>
<th>(3) Developed Nations (incl. US)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local VC dummy</td>
<td>0.068</td>
<td>-0.156</td>
<td>0.084</td>
</tr>
<tr>
<td></td>
<td>[0.093]</td>
<td>[0.138]</td>
<td>[0.092]</td>
</tr>
<tr>
<td>Local and international VC dummy</td>
<td>0.549***</td>
<td>0.174</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td>[0.130]</td>
<td>[0.144]</td>
<td>[0.124]</td>
</tr>
<tr>
<td>Firm country GDP</td>
<td>-2.085***</td>
<td>-0.390</td>
<td>-0.522***</td>
</tr>
<tr>
<td></td>
<td>[0.388]</td>
<td>[0.692]</td>
<td>[0.166]</td>
</tr>
<tr>
<td>VC investment amount</td>
<td>0.293***</td>
<td>0.237***</td>
<td>0.308***</td>
</tr>
<tr>
<td></td>
<td>[0.040]</td>
<td>[0.029]</td>
<td>[0.030]</td>
</tr>
<tr>
<td>Number of VCs</td>
<td>0.024</td>
<td>0.057**</td>
<td>0.040***</td>
</tr>
<tr>
<td></td>
<td>[0.035]</td>
<td>[0.028]</td>
<td>[0.006]</td>
</tr>
<tr>
<td>VC age</td>
<td>0.000</td>
<td>-0.003</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>[0.032]</td>
<td>[0.017]</td>
<td>[0.006]</td>
</tr>
<tr>
<td>Number of rounds</td>
<td>0.001</td>
<td>-0.107***</td>
<td>-0.071***</td>
</tr>
<tr>
<td></td>
<td>[0.030]</td>
<td>[0.024]</td>
<td>[0.014]</td>
</tr>
<tr>
<td>Stock market development</td>
<td>0.097</td>
<td>0.034</td>
<td>0.077**</td>
</tr>
<tr>
<td></td>
<td>[0.352]</td>
<td>[0.127]</td>
<td>[0.035]</td>
</tr>
<tr>
<td>US VC dummy</td>
<td>-0.030</td>
<td>-0.064</td>
<td>0.136***</td>
</tr>
<tr>
<td></td>
<td>[0.211]</td>
<td>[0.119]</td>
<td>[0.041]</td>
</tr>
<tr>
<td>UK VC dummy</td>
<td>0.495**</td>
<td>0.320***</td>
<td>0.203***</td>
</tr>
<tr>
<td></td>
<td>[0.231]</td>
<td>[0.057]</td>
<td>[0.072]</td>
</tr>
<tr>
<td>Observations</td>
<td>1,872</td>
<td>9,065</td>
<td>28,157</td>
</tr>
<tr>
<td>Pseudo R-sq</td>
<td>0.127</td>
<td>0.160</td>
<td>0.168</td>
</tr>
</tbody>
</table>

**Note:** All coefficients are significant at the 1% level unless otherwise noted.
Chemmanur, Hull, and Krishnan (2016): Summary of Results

- Local and international VC combination is the most successful in increasing firm’s chance of successful exit
  - Effect is significant in emerging nations but not developed economies (e.g., European countries).
  - Dominates either international VC backing alone or local VC backing alone
  - Robust to corrections for endogeneity.
    - IV analysis – Regulations on ownership, control, and capital.
    - Natural experiment – Terror attacks

- International VCs have a proximity disadvantage. They are:
  - Are more likely to syndicate with local VCs when they are geographically distant.
  - Are more successful when syndicating with local VCs when they are geographically distant.
Chemmanur, Hull, and Krishnan (2016): Summary of Results

• Local VCs have expertise disadvantage.
  • Local VCs with a greater extent of prior interaction experience with international VCs:
    • Are more successful investing on their own.
    • Less likely to syndicate again with international VCs.
  • Suggests potential learning by local venture capitalists.
  • Local VCs are more successful in countries where local VCs have more experience with investing.

• Compared to local VCs, international VCs:
  • Are less likely to invest in early stage firms.
  • Stage their investment over more rounds.
• Existing empirical literature evaluates the quality of financial intermediaries by their reputation
• Financial intermediaries perform many functions
  – For example, a VC can advise, finance, screen, monitor, and certify
• To what extent does a specific role played by a financial intermediary contribute to its reputation?
• How does the market discipline financial intermediaries that fail to monitor?
  – Evaluate the economic consequences faced by a FI after being revealed as an ineffective monitor

- The challenge: A research design linking directly monitoring failure to the discipline imposed by the market as a consequence
  - An event that identifies a breakdown in monitoring
  - In a market that we can measure the consequences on multiple dimensions

- They look at evidence from the venture capital (VC) market

- Proxy for VC’s monitoring failure
  - Revelation of accounting fraud committed by an IPO firm during the period when VC is present

- Why discovery of accounting fraud as a triggering event?
  - Fraud is a strong form of misrepresentation
    - The incidence of fraud indicates monitoring failure by a financial intermediary
    - Not confounded by other factors unrelated to monitoring efficiency
- Why VC?
  - VC firms are delegated monitors
  - Start-ups are highly opaque and risky \(\rightarrow\) requires intensive monitoring from VCs
    - No significant presence of other intermediaries
  - Unlike banks, VC market is substantially unregulated, thus not affected by government regulation and guarantees
  - Can measure the effect in multiple dimensions
Timing of the Event

- They examine the economic consequence associated with VCs up to three years after the discovery of IPO fraud.
Main Findings

• The market “disciplines” a VC for failing to monitor
• Reputation-damaged VCs find it more difficult to harvest their portfolio via the most profitable exit pathway
  – Less likely to bring their portfolio firms to public
  – Substitution effect
    • Tend to substitute the IPO exit with a much less profitable exit pathway
• Your “friends” are no longer your “friends”
  – Limited partners: reputation-damaged VCs raise smaller capital and follow a more conservative investment strategy
  – VC community: reputation-damaged VCs join smaller VC syndicates and team up with poorer quality VCs
  – IPO underwriters: reputation-damaged VCs work with poorer quality underwriters in subsequent IPOs
Entrepreneurial Finance and Innovation
Doctoral Student Consortium Lecture: Vol. II

Thomas J. Chemmanur
Professor of Finance and Hillenbrand Distinguishedroll
School of Management, Boston College

Asian Finance Association
Seoul, July 2017
Does Venture Capital Financing Help Increase Product Market Innovation?

• So far in this lecture, I have focused on how venture capitalists can help firms improve performance, either in terms of productivity, or in terms of successful exit.

• I now turn to whether venture capitalists help to nurture product market innovation in young firms financed by them.

• If indeed, venture capitalists help to nurture product market innovation, what are the characteristics of VCs that help to nurture this innovation?

• While some earlier research (Kortum and Lerner (2000)) has shown that venture capital financing helps to increase product market innovation, some of the characteristics of VCs that help to nurture innovation has only recently been studied.
The Concept of Failure Tolerance


- May also be affected by “forgiving” laws: Fan and White (2003), Armour and Cumming (2008), Acharya and Subramanian (2009), Acharya et al. (2012, 2013)

- 3M’s failure tolerant culture -- “I try to give people a feeling that it’s ok to fail, that it is important to fail.”
How Failure Tolerance of Venture Capitalists may Affect Innovation: Tian and Wang, RFS 2014

- Why VC’s failure tolerance may matter for innovation?
  - VCs have the final decision power, and lack of failure tolerance may lead to premature liquidation of innovative projects
  - Implication: VCs’ tolerance for failure may allow startups’ innovation potentials to be realized

- VC investor’s attitude towards failure ⇒ innovation in VC-backed startup firms

- Sample used by Tian and Wang (2014):
  - Startup firms, since they have high innovation potential and high failure risk, which eventually went public
Measurement of Failure Tolerance: Tian and Wang, RFS 2014

- VC Firm-\(i\)’s failure tolerance in year \(t\)
  - Weighted average investment duration in its eventually failed projects up to year \(t\)
  - Duration: time interval (in years) from the first capital infusion to termination of funding
  - Weight: \((\text{project investment})/(\text{total investment up to year } t)\)
Measurement of Failure Tolerance: Tian and Wang, RFS 2014

- Investing VC’s failure tolerance measured at the time when it makes the 1st round investment in the firm j being studied.
VC Failure Tolerance and Firm Innovation: Tian and Wang, RFS 2014

• Innovation (NBER patent database 1976-2006)
  – Patents: the number of patent applications filed in a year that are eventually granted.
  – Citations/Patent: the number of citations each patent receives in subsequent years.

<table>
<thead>
<tr>
<th></th>
<th>Ln(Patents)</th>
<th>Ln(Citations/Patent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lead VC</td>
<td>VC Syndicate</td>
</tr>
<tr>
<td>Ln(Failure Tolerance)</td>
<td>0.567***</td>
<td>0.258**</td>
</tr>
<tr>
<td></td>
<td>(0.114)</td>
<td>(0.113)</td>
</tr>
<tr>
<td>IPO firm controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>12,102</td>
<td>11,994</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.323</td>
<td>0.315</td>
</tr>
</tbody>
</table>
VC Failure Tolerance and Firm Innovation: Results of Tian and Wang, RFS 2014

• VCs’ tolerance for failure positively and significantly impacts startup firms’ innovation productivity.

• Particularly for startups with high failure risk
  – Ventures born in recessions
  – Ventures in early development stages
  – Ventures in industries where innovation is difficult to achieve
Is It Really a Failure-Tolerance Effect?

• Controlling for matching, is the failure tolerance effect still present?
• Where in the cross section should we observe a stronger failure tolerance effect?
**Controlling for Project Selection**

- **Table 4 Panel A**

<table>
<thead>
<tr>
<th></th>
<th>Ln(Patents)</th>
<th>Ln(Citations/Patent)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Ln(Failure Tolerance)</td>
<td>0.748***</td>
<td>0.682***</td>
</tr>
<tr>
<td></td>
<td>(0.161)</td>
<td>(0.133)</td>
</tr>
<tr>
<td>Lead VC fixed effects</td>
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<td>Yes</td>
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<tr>
<td>Industry fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>12,102</td>
<td>12,102</td>
</tr>
<tr>
<td>R²</td>
<td>0.456</td>
<td>0.351</td>
</tr>
</tbody>
</table>
Are Independent or Corporate Venture Capitalists Better at Nurturing Innovation?

- CVCs are subsidiaries of corporations that specialize in investing in early-stage ventures.
- CVCs and IVCs share a few common features:
  - Invest in early-stage ventures with high potential but high risk; Use equity and convertibles; Exit paths: IPO, M&A, Liquidation (Write-off)
- CVCs’ unique features allow them to better nurture innovation
  - Longer investment horizons
  - Less emphasis on performance-based compensation
  - CVC parent firms have non-financial benefits from investment (e.g., exposures to new technology, early product market alliances) and provide unique technology or industry knowledge
- IVCs unique features allow them to better nurture innovation
  - IVCs are not subject to centralized resource allocation problem
  - IVCs are not exploiting their portfolio firms given their sole financial objectives
  - IVCs specialize to a greater extent and have industry expertise
Are Independent or Corporate Venture Capitalists Better at Nurturing Innovation?

- They also examine the mechanisms through which CVCs better promote innovation
Chemmanur, Loutskina, and Tian, RFS 2014

\[ \ln(\text{Innovation}) = \alpha + \beta \times \text{CVC} + \delta' Z + \text{Year} + \text{Ind} + u \]

\( Z \) is a vector of controls

### Pre-IPO Innovation Productivity of CVC- and IVC-Backed IPO Firms

<table>
<thead>
<tr>
<th></th>
<th>Panel A: Ln(Patents)</th>
<th>Panel B: Ln(Citations/Patent)</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<tr>
<td>CVC Backing Dummy</td>
<td>0.269***</td>
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<tr>
<td></td>
<td>(3.02)</td>
<td></td>
</tr>
<tr>
<td>Number of CVCs</td>
<td>0.159***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.91)</td>
<td></td>
</tr>
<tr>
<td>CVC Share</td>
<td></td>
<td>0.618**</td>
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<tr>
<td></td>
<td></td>
<td>(2.17)</td>
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<tr>
<td>Controls</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>1,834</td>
<td>1,834</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.26</td>
<td>0.26</td>
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</table>
Panel A: Ln(Patents)

<table>
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<th>(3)</th>
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<tbody>
<tr>
<td>CVC Backing Dummy</td>
<td>0.449***</td>
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<td></td>
<td>(4.01)</td>
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<tr>
<td>Number of CVCs</td>
<td>0.219***</td>
<td></td>
<td>0.057*</td>
</tr>
<tr>
<td></td>
<td>(3.66)</td>
<td></td>
<td>(1.64)</td>
</tr>
<tr>
<td>CVC Share</td>
<td>0.812**</td>
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<td>0.434**</td>
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<tr>
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<td>(2.19)</td>
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<td>(2.10)</td>
</tr>
<tr>
<td>Controls</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry fixed effects</td>
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<td>Yes</td>
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<tr>
<td>Observations</td>
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<td>1,834</td>
<td>1,834</td>
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<tr>
<td>R²</td>
<td>0.330</td>
<td>0.329</td>
<td>0.325</td>
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</table>

Panel B: Ln(Citations/Patent)

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<tbody>
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<td>CVC Backing Dummy</td>
<td>0.132*</td>
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<tr>
<td></td>
<td>(1.91)</td>
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<td></td>
</tr>
<tr>
<td>Number of CVCs</td>
<td>0.057*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVC Share</td>
<td>0.434**</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>(2.10)</td>
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<td>Controls</td>
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<td>Year fixed effects</td>
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<td></td>
</tr>
<tr>
<td>Industry fixed effects</td>
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<td></td>
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<tr>
<td>Observations</td>
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<td>1,834</td>
<td>1,834</td>
</tr>
<tr>
<td>R²</td>
<td>0.208</td>
<td>0.207</td>
<td>0.207</td>
</tr>
</tbody>
</table>
Chemmanur, Loutskina, and Tian, RFS 2014

Graph showing two lines: one for CVC-backed firms and another for IVC-backed firms. The x-axis represents years from -5 to 5, and the y-axis represents a scale from 0 to 20.
Independent versus Corporate VCs: Main Findings of Chemmanur, Loutskina, and Tian, RFS 2014

• CVC-backed firms are more innovative than IVC-backed firms, although they are younger, riskier, and less profitable

• CVC backed firms are more innovative in terms of quantity and quality of innovation

• The above baseline results are unlikely to be entirely driven by a selection effect, although we cannot rule out selection

• They show a treatment effect by employing a propensity score based matching analysis to control for any selection based on observables

• We also present a diff-in-diff analysis using the entire universe of VC backed firms, showing a greater increase in innovation after CVC investment
Independent versus Corporate VCs: Main Findings of Chemmanur, Loutskina, and Tian, RFS 2014

• They show that two important mechanisms drive the greater innovation productivity of CVC backed firms
  – Technological fit between CVCs’ parent firms and their portfolio firms
  – Greater tolerance for failure
Ma (2015): Why do Firms Establish CVC Programs?

• **Question**: Why do parent firms engage in CVC investment?

• **Empirical approach**: Establish the three stage CVC cycle
  - Three sets of empirical tests along the CVC cycle
  - Analyses on CVC initiation, operation and termination

• **Takeaway**: One primary CVC rationale is to acquire information
  - Information acquisition- search for ideas, seek deeper understanding
  - Implications for the innovation process in general
Ma (2015): The Life Cycle of Parent Firm Innovation and CVC Programs

<table>
<thead>
<tr>
<th>CVC Initiation</th>
<th>CVC Operation (~4 years)</th>
<th>CVC Termination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Declining Innovation Motivates CVC Initiation</strong></td>
<td><strong>Select, Acquire &amp; Integrate New Info and Knowledge</strong></td>
<td><strong>Terminate CVC After Innovation Rebounds</strong></td>
</tr>
<tr>
<td>- The relationship appears to be causal</td>
<td>- Invest in companies with similar technology but different knowledge</td>
<td>- Incremental investment in new projects terminates after 4 to 6 years</td>
</tr>
<tr>
<td>- Using an identification strategy based on the rate of exogenous knowledge obsolescence</td>
<td>- Integrate new information through internal innovation and external acquisitions</td>
<td>- CVC parents’ innovation has improved at exit</td>
</tr>
<tr>
<td></td>
<td>- Human capital renewal is crucial</td>
<td>- CVC is hibernated when innovation is productive</td>
</tr>
</tbody>
</table>
Ma (2015): Data

- Hand-collect
- Fuzzy-matching

Financial, Governance (Compustat, 13(f))

Organization (SDC M&A, Strategic Alliances)

CVC (VentureXpert)

Innovation (NBER, USPTO, Google Patent, HBS)

Entrepreneurial Ventures

Entrepreneurial Ventures

Parent Firm
Ma (2015): CVC initiation

- Trading of informational benefits with cost
  - Van Nieuwerburgh and Veldkamp (2010), Yang (2013)
- CVC becomes more appealing when innovation deteriorates

(a) \( \ln(\text{NewPatents})_{i,t} \)

(b) \( \ln(\text{Pat. Quality})_{i,t} \)

\[ I(CVC)_{i,t} = \alpha_{industry \times t} + \beta \times \Delta \text{innovation}_{i,t-1} + \gamma \times X_{i,t-1} + \varepsilon_{i,t}, \]

- \( I(CVC)_{i,t} \) indicates if firm \( i \) launches a CVC unit in year \( t \)
- \( \Delta \text{innovation}_{i,t-1} \) is the innovation change over the past 3 years
  - Innovation: \( \ln(\text{NewPatents})_{i,t} ; \ln(\text{Pat.Quality})_{i,t} \)
- \( \alpha_{industry \times t} \) net out industry-year trend in innovation and CVC activities
- \( X_{i,t-1} \) includes ROA, Size (Log of Assets), Leverage, and R&D/Assets
- \( \beta \) estimates the effect of innovation changes
  - \( \beta < 0 \) indicates that Prob(CVC)\(_{i,t} \) increases with declining innovation
Ma (2015): Innovation Deterioration and CVC initiation

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>Logit</th>
<th>OLS</th>
<th>Logit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Δln(NewPatents)</td>
<td>-0.007***</td>
<td>-0.004***</td>
<td>-0.004***</td>
<td>-0.003***</td>
</tr>
<tr>
<td></td>
<td>(-6.227)</td>
<td>(-3.057)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δln(Pat.Quality)</td>
<td></td>
<td></td>
<td>-0.004***</td>
<td>-0.003***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(-4.459)</td>
<td>(-2.263)</td>
</tr>
<tr>
<td>Observations</td>
<td>25,976</td>
<td>25,976</td>
<td>25,976</td>
<td>25,976</td>
</tr>
<tr>
<td>Pseudo R squared</td>
<td>0.12</td>
<td>0.26</td>
<td>0.12</td>
<td>0.26</td>
</tr>
<tr>
<td>Controls</td>
<td>ROA, Size, Leverage, and R&amp;D/Assets</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry X year FE</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic Significance – 2 σ change</td>
<td>51.54%</td>
<td>29.45%</td>
<td>67.09%</td>
<td>50.32%</td>
</tr>
</tbody>
</table>

Takeaway: CVC initiation follows innovation deterioration
Effect of Corporate Governance on Innovation

• Innovation is a key corporate strategy for the long-run competitive advantage of firms. However, motivating and nurturing innovation are usually difficult.
  – Unlike conventional tasks, innovation process is idiosyncratic, full of uncertainties, and with high probability of failure (Holmstrom (1989))
  – Motivating innovation needs tolerance for failure in the short run and reward for success in the long run (Manso (2011))
• The public stock market gives short-term misleading signals to firms regarding their investment decisions; and managers feel pressures to follow the market’s signal, leading to “corporate short-termism.”
• How to solve the above conflicts?
Effect of Corporate Governance on Innovation

• Chemmanur and Tian (2016, *JFQA forthcoming*) address this relation in a recent paper.

• They examine if corporate governance mechanisms such as anti-takeover provisions (ATPs) that insulate managers from threats of hostile takeovers may help to solve the conflicts between pressures from short-term public markets and innovation activities and therefore spur corporate innovation.

• They also identify a channel, namely innovation, through which ATPs affect firm value.

• They use the GIM Index (ATPs) as a measure of corporate governance, and the NBER patent database to obtain data on innovation.
Chemmanur and Tian, 2016: Hypotheses Tested

• Existing theories
  – Stein (1988) and Shleifer and Summers (1988): managers who are subject to greater exposure to hostile takeovers invest more in routine tasks.
  – Chemmanur and Jiao (2007): dual-class and other ATPs can solve the managerial myopia problem by insulating managers from pressures generated by the takeover market.
  – Manso (2011): Tolerance for failure is critical for motivating innovation.

• The long-term value creation hypothesis (tolerance for failure) predicts that ATPs spur corporate innovation.
Chemmanur and Tian, 2016: Hypothesis Tested

• Existing Theories
  – Grossman and Hart (1988), Harris and Raviv (1988, 1989): Managers have incentives to shirk and invest in routine tasks with quicker and more certain returns to enjoy their private benefits. The existence of hostile takeovers serves as an effective disciplining mechanism to mitigate moral hazard problem and helps push innovation back to the optimal level.

• The management entrenchment hypothesis predicts that ATPs impede innovation.
### Chemmanur and Tian, 2016:Baseline Regressions

\[
\text{\(Ln(\text{Innovation}_{i,t+n}) = \alpha + \beta \times GIMIndex_{i,t} + \delta Z_{i,t} + \text{Year}_t + \text{Firm}_i + u_{i,t}\)}
\]

<table>
<thead>
<tr>
<th></th>
<th>(\text{Ln(Patents}_{t+1}))</th>
<th>(\text{Ln(Patents}_{t+2}))</th>
<th>(\text{Ln(Patents}_{t+3}))</th>
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<tbody>
<tr>
<td>GIM-Index</td>
<td>0.090*** (0.025)</td>
<td>0.087*** (0.025)</td>
<td>0.090*** (0.028)</td>
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</tr>
<tr>
<td>Year FE</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>20,204</td>
<td>18,663</td>
<td>17,018</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.870</td>
<td>0.787</td>
<td>0.778</td>
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### Chemmanur and Tian, 2016: Baseline Regressions

<table>
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<tr>
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<th>Ln(Citations/Patent(_{t+1}))</th>
<th>Ln(Citations/Patent(_{t+2}))</th>
<th>Ln(Citations/Patent(_{t+3}))</th>
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<tbody>
<tr>
<td>GIM-Index</td>
<td>0.044*** (0.014)</td>
<td>0.038*** (0.015)</td>
<td>0.035** (0.016)</td>
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<td>Controls</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Year FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>20,204</td>
<td>18,663</td>
<td>17,018</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.671</td>
<td>0.657</td>
<td>0.645</td>
</tr>
</tbody>
</table>
Chemmanur and Tian, 2016: Summary of Findings

- Firms with a greater number of ATPs are significantly more innovative: more patents and patents with larger impact.
  - Individual ATPs such as staggered board, poison pill positively affect innovation, while other well-known provisions such as anti-greenmail, faire price, and golden parachutes do not.
  - The positive effect of ATPs on innovation is unlikely to be driven by endogeneity in ATPs.
  - The positive effect of ATPs on innovation is more pronounced for firms with a larger degree of information asymmetry, operating in more competitive product markets, and are in high-tech industries.

- ATPs positively contribute to firm value only if the firm is involved in innovation. ATPs reduce firm value if firms are not conducting innovation.
Top Management Human Capital and Innovation: Chemmanur, Kong, Krishnan, and Yu (2016, WP)

• The effectiveness of a firm's top management team in investing and managing innovative projects may determine the long-term product market success of a firm.
• Does the human capital or “quality” of the top management team of a firm affect corporate innovation?
• If it does, what are the channels or mechanisms through which this happens?
• Our focus is on top management quality, not CEO characteristics.
• There is relatively little analysis on how top management team quality affects corporate innovation.
Top Management Human Capital and Innovation: 
Chemmanur, Kong, Krishnan, and Yu (2016)

• Study the relation between top management quality and corporate innovation.
  – Innovation inputs: R&D expenditures
  – Innovation outputs:
    • Quantity of innovations: number of patents
    • Quality of innovations: total citations and citations per patent
  – Innovative efficiency: patents and citations per R&D capital
• Study the above relationship in industries where the relation between top management quality and innovation can be expected to be stronger: financially constrained and more competitive industries
• Also examine the underlying mechanisms through which management quality affects corporate innovative activities:
  – Firms with higher quality management teams may hire more inventors for a given R&D expenditure.
  – Such firms may also hire more higher quality inventors.
First Challenge

- How to measure the quality as well as the quantity of top management team human capital?
- We use **Common Factor Analysis** on these seven different individual management quality “proxies” to extract a single management quality factor (MQF).
Second Challenge

• Potential endogenous matching between management quality and firm quality
• Address this potential endogeneity using IV analysis
  – IV used: Number of management team members belonging to “Vietnam war draft risk cohort” or some transformation of that.
  – Students graduating from college during the Vietnam War era were more likely to increase their human capital by enrolling in graduate studies to avoid the Vietnam military draft (See, e.g., Card and Lemieux (2001)).
  – This likely increased not only their educational level, but their human capital in general, since higher education can provide a strong stepping stone for managers’ future careers (e.g., greater opportunities for higher quality starting jobs; better education and employment-based connections).
Second Challenge

• **Identifying Assumption**: Allocation of managers belonging to the Vietnam War era “draft risk” cohort across firms is random.

• Exclusion restriction for this IV is likely to be satisfied, since there is no reason why higher quality firms should hire a larger number of Vietnam war draft risk cohort managers.

• Good setting to use this instrument: Many top firm managers in our sample firms graduated from college during this “Vietnam war era draft risk” period.
Summary of Findings

- Our management quality factor MQF and most individual proxies are:
  - Positively related to R&D expenditures
    - A one inter-quartile increase in MQF leads to 0.74 percentage point increase in one year ahead R&D/Assets ratio (equivalent to 70% of the sample median).
  - Positively related to the quantity of innovation (measured by patent count)
    - A one inter-quartile range increase corresponds to a 12.3% increase in the number of patents for the next year.
  - Positively related to the quality of innovation (measured by total citations and citations per patent)
  - Positively related to innovative efficiency
  - Our IV analyses indicate that these relationships are causal.
Summary of Findings

- The mechanisms through which higher management quality firms generate more and higher quality innovation:
  - Higher management quality firms experience greater net inflows of inventors (controlling for R&D expenditures) and greater net inflows of higher quality inventors (as measured by inventors’ prior track record of citations per patent).
  - Average quality of incoming inventors hired by firms with higher quality management teams is higher than the average quality of outgoing inventors from such firms.
Management Quality and Innovation in Private Firms and IPO Market Rewards to Innovation: Chemmanur, Gupta, and Simonyan (2016, WP)

- The objective of this paper is to analyze the effect of the human capital of the top management team of a firm or “management quality” on innovation in venture-backed private firms and to also analyze how the IPO market rewards innovative activity.

- We make use of NBER Patent data, using the number of patents and citations per patent to measure the quality and quantity of firm innovation before their IPO in venture-backed private firms. We make use of management quality measures similar to those first developed by Chemmanur and Paeglis (2005) and later modified by Chemmanur, Paeglis, and Simonyan (2011).
Management Quality and Innovation in Venture Backed Private Firms: Chemmanur, Gupta, and Simonyan (2016)

- First, we analyze how the top management quality of venture capital (VC) backed entrepreneurial firms affects the quantity and quality of their product market innovation.

- Second, we analyze how the innovativeness of entrepreneurial firms prior to going public, together with management quality, affects various aspects of their initial public offering (IPO):
  - the number of anti-takeover provisions in their corporate charters;
  - IPO firm valuation;
  - firm age at IPO;
  - post-IPO operating performance.
Overview of Empirical Findings

1. Firms with higher management quality have greater pre-IPO (measured over the two years before IPO) and post-IPO (measured over the IPO year and the two years after IPO) innovation productivity both in terms of the quantity (number of patents) and the quality (citations per patent) of innovation.

   ▪ These results hold also after controlling for potential endogeneity of management quality using instrumental variable analysis.

2. Firms that are more innovative pre-IPO (measured by either the quantity or the quality of innovation) are likely to have a larger number of ATPs in their corporate charters at IPO.

2a. The joint effect of pre-IPO innovativeness and management quality on the number of ATPs is also positive.

   ▪ These findings provide support for the long-term value creation hypothesis and contradict the management entrenchment hypothesis.
Overview of Empirical Findings

3. Firms that are more innovative pre-IPO have higher IPO valuations (measured at the IPO offer price or at the first trading day closing price).

3a. The joint effect of pre-IPO innovation and management quality on firm valuation at IPO is also positive.

4. Firms that are more innovative pre-IPO go public at a younger age.

4a. The joint effect of pre-IPO innovation and management quality on a firm’s age at IPO is also negative.

5. Firms that are more innovative pre-IPO experience greater improvements/changes in operating performance in the years immediately after IPO (compared to the pre-IPO year).

5a. The joint effect of pre-IPO innovation and management quality on the changes in post-IPO operating performance is also positive.
Conclusion

• Entrepreneurship and therefore the financing of entrepreneurial firms has now been recognized as an important driver of economic growth all over the world.

• The availability of venture capital funding have been shown to play an important role in the success of new ventures, first in the U.S. and now, all over the world.

• Developing a successful venture capital industry has now been recognized as essential to promote successful entrepreneurship even in countries where venture capitalists were virtually absent before: e.g., in the Arab countries.
Conclusion

• The source of financing of new ventures, and the characteristics of intermediaries such as venture capitalists financing such firms, have also been shown to play an important role in nurturing product market innovation in young firms.

• The corporate governance of young firms, and the legal and institutional environment in which they operate, have also been shown to play an important role in nurturing product market innovation.