VENTURE'S ECONOMIC IMPACT IN AUSTRALIA*

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20 December 2012

* We are indebted to the Australian Private Equity and Venture Capital Association (AVCAL) and the Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE) for financial support. We owe thanks to Asish Naik, Vikrum Vijayarajan, and Warner Wu for research assistance. Also, we owe thanks to the seminar participants at the AVCAL Workshops in Sydney and Melbourne (September 2012), as well as Tricia Berman, David Brown, Jeremy Chrisp, Joshua Funder, Shanon Glenn, Tom Honeyman, Derek Kerr, Kathy Nielsen, Roger Price, Kar Mei Tang, Brigitte Smith, Stephen Thompson, Malcolm Thornton, Sam Waring, and Katherine Woodthorpe for helpful comments and suggestions.

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Executive Summary

This paper presents a comprehensive dataset of all known venture capital (VC), private equity (PE), and Innovation Investment Fund (IIF) investments since such funds first emerged in Australia. VC and PE funds established in Australia are similar to those established elsewhere in the world. IIFs are government subsidized funds in which the role of government is as a limited partner that invests alongside institutional and other investors; this type of government program has been adopted elsewhere in the world, including for example Ontario (Canada), the UK and Israel. We compare the economic contributions of VC, PE and IIF-backed firms to non-VC/PE/IIF-backed firms in terms of employment, R&D, patents, time to IPO, and market capitalization within Australia.

We analyze a large sample of both private and publicly listed Australian firms available in public data records. The data examined provide a number of insights into the impact of VC, IIF and PE investments:

- ***Before the IIF Program, Early Stage Capital was close to Nonexistent or Scant in Australia :*** Prior to round 1 of the IIF Program established in 1997, there were hardly any investments at all in early stage firms in Australia. Since that time IIF and VC investments have played an important role where other investors would not venture. VC and IIF investments are at an extremely early stage where firms typically do not develop or grow but for the presence of the VC or IIF investor. These firms are too young and have too little in terms of assets or collateral to qualify for other forms of finance. Said differently, but for the presence of the VC or IIF investor, many or most early stage firms would not flourish and might not even have existed. Hence, any economic output from IIF- or VC-backed firms is a positive contribution.

- ***On an Absolute Basis, IIF- and VC-Backed Firms Contribute Massively In Terms of Assets, Sales, Market Capitalization, R&D, Patents and Employment:*** As at 2011, the total amounts contributed by all 477 VC-backed firms include $4.1 billion in assets, $14.1 billion in market capitalization,[1] 2,165 patent filings, 18,160 patent citations, and 7,532 jobs, and in 2011 alone VC-backed firms had $2.8 billion in sales and $300 million in R&D. As at 2011, the total amounts contributed by all 90 IIF-backed firms include $1.0 billion in assets, $3.2 billion in market capitalization, 548 patent filings, and 465 jobs, and in the year 2011 alone IIF-backed firms had $357 million in sales and $58 million in R&D expenses.

- ***On a Relative Basis, IIF- and VC-Backed Firm Contribute Disproportionately to R&D and Patents:*** The data examined indicate that VC- and IIF-backed firms contribute disproportionately to R&D and patents. VC-backed firms account for 5.8% of the total number of comparable firms in the data sample and 0.04% in terms of company size as measured by total assets and 0.08% in terms of total sales, yet they contribute 9.9% to total amounts spent on R&D and account for 12.2% of patent filings and 26.2% of patent citations.[2] IIF-backed firms account for 1.1% of the total number of comparable firms and 0.01% in terms of company size as measured by total sales or assets, yet they contribute 1.9% to total amounts spent on R&D and account for 3.1% of patent filings and 4.7% of the patent citations. The massive differences in R&D and patents still hold in regression analyses controlling for other things being equal.

- ***On a Relative Basis, IIF- and VC-Backed Firms that Become Publicly Listed Generate Greater Market Capitalization:*** Controlling for other things being equal in regression analyses, after the passage of sufficient time, VC-backed firms have greater market capitalization relative to PE- and non-VC/PE/IIF-backed firms.

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[1] All figures in this report are in Australian dollars, except where explicitly indicated otherwise.

[2] For these figures we winsorized at the 99% level, effectively not biasing results from Australian subsidiaries of large multinationals with very large numbers of patents.

IIF investments show the highest proportion of subsequent public listings, and controlling for other things being equal, IIF investments result in greater market capitalization relative to both VC- and PE-backed firms.

- ***On a Relative Basis, PE-Backed Firms Generate Greater Employment:*** Controlling for other things being equal in regression analyses, PE-backed firms generate statistically significant higher levels of employment. While in sharp contrast to an oft repeated conventional wisdom, this finding holds true for numerous robustness checks including but not limited to accounting for different size quartiles.

Overall, the data highlight a central role for VC and IIF investment in facilitating R&D, innovation, and economic growth, and for PE investments facilitating jobs. The data indicate an expansion of VC and IIF investments would facilitate more innovation and economic growth in Australia relative to the expansion of other sources of capital, particularly in view of the comparative dearth of VC investments in Australia relative to other countries.

VENTURE'S ECONOMIC IMPACT IN AUSTRALIA

Abstract

We empirically compare the contributions of venture capital (VC) and private equity (PE) backed firms, including those backed by government subsidized Innovation Investment Funds (IIFs), to the Australian economy by analyzing employment, R&D, patents, time to IPO, and market capitalization from market inception to August 2012. VC-backed firms exhibit no material difference in employment, but do exhibit higher levels of R&D and patents and, after the passage of sufficient time, have greater market capitalization relative to PE- and non-VC/PE/IIF-backed firms. IIF-backed firms likewise exhibit no material difference in employment, but do result in a higher percentage of investments that are publicly listed and a greater market capitalization relative to both VC- and PE- and non-VC/PE/IIF-backed firms, controlling for other things being equal. PE-backed firms generate higher levels of employment, counter to anecdotal claims to the contrary. Overall, the data highlight a central role for VC and IIF investment in facilitating R&D, innovation, and economic growth. The data indicate an expansion of venture investments would facilitate more innovation and economic growth in Australia relative to the expansion of other sources of capital, particularly in view of the comparative dearth of venture investments in Australia relative to other countries.

Keywords: Venture Capital, Private Equity, Patents, R&D, Employment, IPOs, Market Capitalization, Government Policy

JEL Codes: G24, G28

1. Introduction

Since the collapse of the Internet bubble in 2000, venture capital (VC) has had a tough decade. Returns are widely reported to have been negative on average on a fund vintage-year basis as well as a rolling year-on-year basis, even in the United States (Cumming and Johan, 2012). Private equity (PE) has likewise faced tough times, particularly after the collapse of financial markets starting in August 2007 and the subsequent increase in the cost of debt financing. VC and PE markets in many countries around the world have nevertheless enjoyed subsidies in a variety of forms through tax policy and direct government investment programs. Policymakers, investors and taxpayers more generally are thereby starting to question the value proposition of VC and PE funds. "*Exactly how important are VC and PE funds to the economy?*" This question is precisely the issue that was raised by the Australian Private Equity and Venture Capital Association (AVCAL) together with the Australian Department of Industry, Innovation, Science, Research and Tertiary Education (DIISRTE), and thereby inspired this paper.

To be sure, quantifying the value of a type of source of capital to an entire economy is a daunting task. In order to quantify the value proposition of VC and PE funds to an entire national economy, we embarked on an extensive data collection effort to obtain a sample of all VC and PE-backed firms since the inception of the industry regardless of whether or not there were publicly listed, privately held, or bankrupt. We narrow our examination to the value proposition of VC and PE investments by focusing on Australia only, in view of the fact that data required is substantial but nevertheless tractable in Australia. Australia has the added advantages that the structure of the economy is comparable to other common law countries including the United States and Canada, and the fact that the country is relatively isolated such that there are less spillover effects into other countries (as might be the base vis-à-vis Canada and the United States, for example, or across European neighbor countries). In addition, we separately identified firms that were funded by an Innovation Investment Fund (IIF), the largest and most important government program that led to stimulating the VC market in Australia through a co-investment model with the role of government as a part-investor

into privately managed funds (Cumming, 2007). Through AVCAL's record keeping we have a complete sample, or at least the most comprehensive on record,[3] of all of the firms backed by VC and PE funds as well as by IIFs since the industry's inception.

Our central two propositions in this paper, as explained in detail in Section 2, are that the governance role played by VC funds enhance the economic contribution of VC-backed firms and thereby give rise to a relative increase in economic outputs in a country. Furthermore, to the extent that the government subsidized IIFs provide more intensive monitoring and governance to investees, the economic impact of such IIF-backed firms will be even more pronounced.

To test these propositions we compare the economic contributions of VC and PE-backed firms, including those backed by IIFs, to firms that had no such backing. The firms in our dataset include all firms available in publicly available datasets (Morningstar, Thomson Reuters SDC, AVCAL, Lexis-Nexis, Hoovers, Bloomberg, Patents IP Australia, The Australian Stock Exchange Webpage, Google Finance, Business Week, and numerous company webpages from Internet searches) regardless of whether or not they are privately held or publicly traded. We study a number of factors that proxy for economic contribution including employment, R&D, patents, patent citations, time to IPO, and market capitalization, while at the same time gathering other useful information about the firms such as sales and assets. We note that our sample includes bankrupt firms from both the VC, PE and IIF sample, as well as the non-VC/PE/IIF sample. While we understand from AVCAL that we have all known VC, PE and IIF investments in our sample, we understand information on non-VC/PE/IIF bankrupt firms possibly disappears from datasets over time; therefore, we acknowledge at the outset that if there is any bias in our sample it is that the sample overstates the economic contributions of non-VC/PE/IIF-backed firms relative to VC/PE/IIF-backed firms.

[3] The AVCAL sample comprises over 100% more transactions recorded than that available in Thomson SDC's database, and corrects for a large proportion of incorrect entries in SDC. AVCAL tries to include all the known investments and failed firms where possible, but of course they cannot be certain if they have captured 100% of failures.

Our findings from the data examined are summarized as follows. VC-backed firms exhibit no material difference in employment, but do exhibit higher levels of R&D, patents, patent citations, and, after the passage of sufficient time, have greater market capitalization relative to PE- and non-VC/PE/IIF-backed firms. IIF-backed firms likewise exhibit no material difference in employment, but do result in a higher percentage of investments that are publicly listed and a greater market capitalization of such investments relative to both VC- and PE-backed firms. The data highlight a central role for PE-backed firms generating higher levels of employment, counter to anecdotal claims to the contrary.

Overall, the data highlight a central role for VC and IIF investment in facilitating R&D, innovation, and economic growth. The data indicate an expansion of such VC and IIF investments would facilitate more innovation and economic growth in Australia relative to the expansion of other sources of capital, particularly in view of the comparative dearth of VC investments in Australia relative to other countries. Our findings are consistent with theoretical work (e.g., Keuschnigg and Nielsen, 2001, 2003, 2004a,b,c) and empirical evidence (e.g., such as from the SBIR and SBIC program in the U.S., see Audretsch, 2003, 2007; Audretsch et al., 2002), that shows an important public policy role that enables more VC investment through tax policy and properly designed direct incentive programs. In particular, the Australian IIF program where government investment is done at the institutional level as limited partners and in partnership with other private and institutional investors and the general partner is a professional private fund manager appears to be a successful model for engineering a successful VC market that generates substantial economic benefits in terms of innovation and economic growth. These effects are observed even after the worldwide financial crisis with data measurement up to 2012.

This article is organized as follows. Section 2 describes the institutional setting of VC, PE and IIF funds in Australia. The data are introduced in Section 3. Section 4 presents multivariate analyses of the relation between different types of investment and economic outcomes. Concluding remarks follow in the last section.

2. A Disproportionate Impact of VC on the Economy: How is it Possible?

Because of severe information asymmetries and agency problems associated with financing startups in high-tech industries with little or no tangible assets, such startups are typically not able to get other sources of capital; therefore, without the presence of VCs, such firms would not flourish and likely would not even exist (Amit et al., 1998). VC funds spend a massive amount of time screening potential investees. Fund managers typically see over a thousand business plans per year for requests for capital, seriously consider fewer than 50 investments, and eventually carry out 1-2 new deals per year until the fund is fully invested. It takes time and expertise to do such due diligence (Schwienbacher, 2007; Yung, 2009), and as such, generating VCs in an economy with sufficient capital from investors and skills to be successful is not easy. In other words, it is hard to "engineer" a VC market (Gilson, 2003).

The difficulty with engineering a VC market is exacerbated by the fact that VC fund managers have a difficult time raising a fund without a track record (Gompers and Lerner, 2004). VC funds are typically organized as limited partnerships, or structurally equivalent investment vehicles.[4] VCs source their capital from private investors and from institutional investors such as banks, life insurance companies, pension funds and endowments. Funds typically have a 10-13 year lifespan. For institutional investors an investment into a VC fund is at least tens of millions of dollars, and very illiquid.

Australia's experience with VC is graphically illustrated in Figures 1 and 2. Australia's share of worldwide investment activity has been low relative to the United States and Canada (Figure 1), and low relative to select countries from Europe and Asia (Figure 2). On a per GDP basis, as discussed further in the next section of this paper,
137-149.

[4] In 2002 Australia introduced legislation allowing venture capital limited partnerships to facilitate VC fundraising. Prior to that time funds were structured as trusts but essentially functionally equivalent to limited partnerships (Cumming et al., 2005).

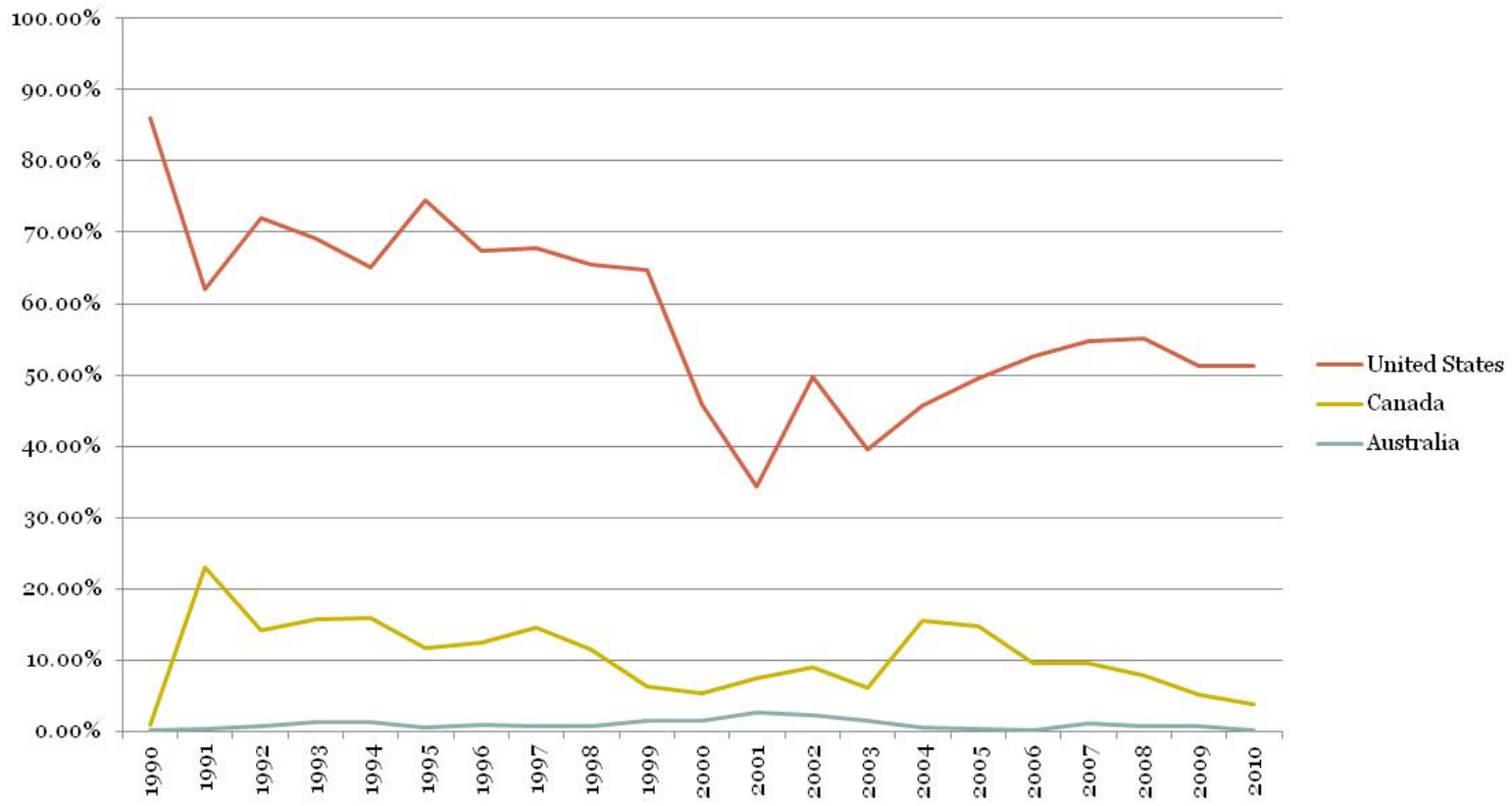

Figure 1. Worldwide Share of VC Investments in Australia Relative to Canada and the United States.
This figure presents the percentage of VC investments around the world carried out in Australia, Canada, and the United States Source: Authors' calculation based on data in Thomson SDC.

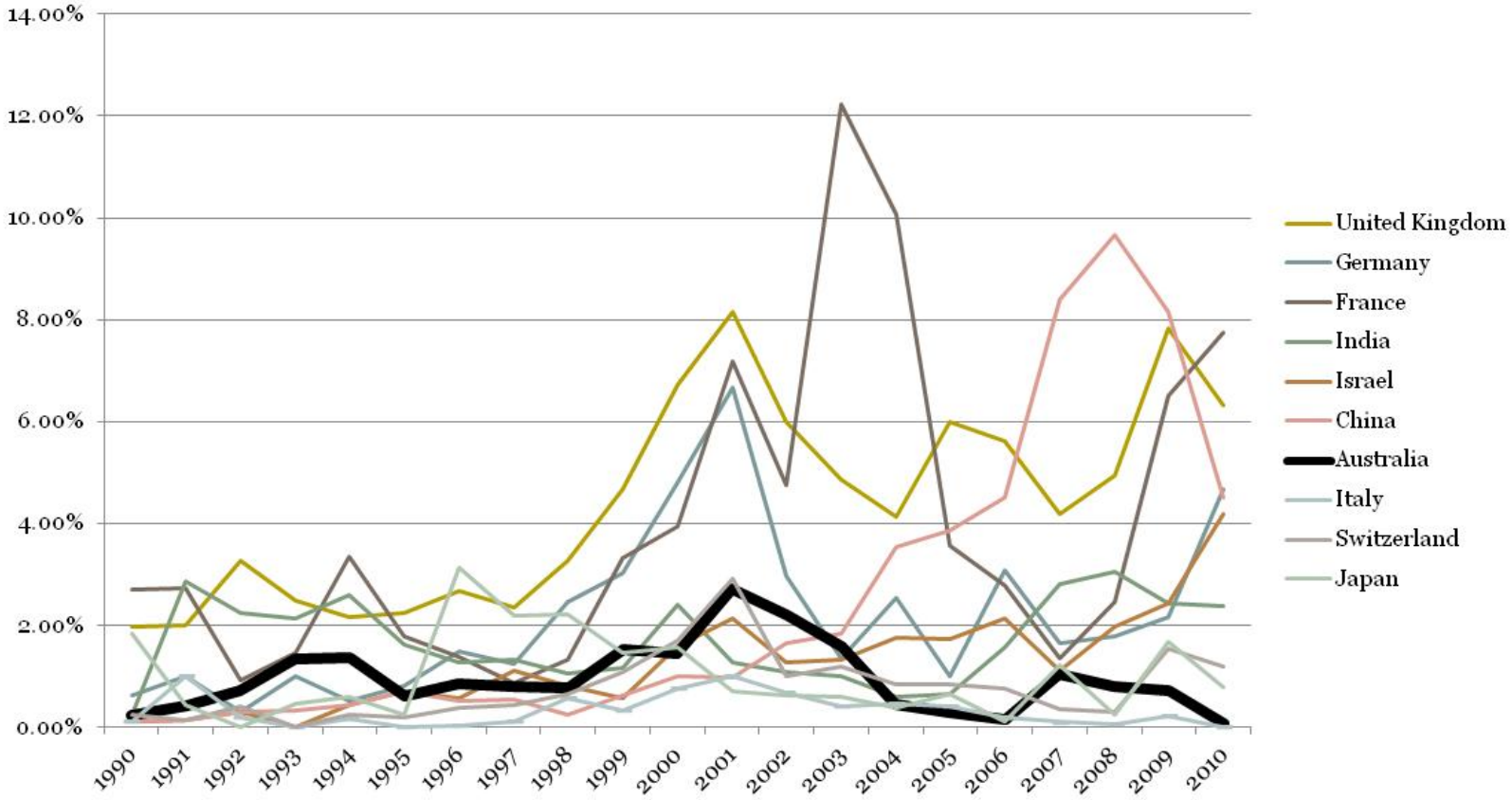

Figure 2. Worldwide Share of VC Investments in Australia Relative to Select Countries in Europe and Asia
This figure presents the percentage of VC investments around the world carried out in Australia, China, France, Germany, India, Italy, Israel, Japan, Switzerland, and the United Kingdom. Source: Authors' calculation based on data in Thomson SDC.

Australia ranks equally low. In 2011, VC/GDP in Australia is roughly 0.01% (rounded), while in the United States VC/GDP is roughly 0.2%.[5] The very low levels of VC investment in Australia are one explanation for the similarly low levels of innovation in Australia as reported by Gans and Hayes (2010).

VC and PE funds contribute both financial capital and human capital to their investee firms (e.g., Bertoni et al., 2012; Bonini et al., 2012; Croce et al., 2012; De Bettignies, 2008; De Clercq and Sapienza, 2005; Groh et al., 2010, 2011; Hazaruka et al., 2009; Jääskeläinen et al., 2006). VCs offer financial, administrative, human resource, marketing, and strategic advice to their investees. VCs normally sit on boards of directors. On average, VCs report that they spend over 15 hours per month with each of their investee firms (Cumming and Johan, 2009). For this reason, VC funds cannot be diversified in the way that mutual funds are diversified. VC funds make just a few investments per year. Portfolio size per manager is small: rarely is the number of investments in total over the life of the fund greater than 20 per fund manager (Cumming and Johan, 2009). Funds that make too many investments per fund manager typically perform very poorly. In fact, some of the more consistent determinants of the financial returns to a VC fund investment are portfolio size per manager (Cumming and Walz, 2010) and overall fund size (Cumming and Dai, 2012). There are enormous decreasing returns to scale among VC and PE funds.

Prior to 1998, in Australia there were extremely few investments of any kind that could be described as early stage venture investments. In response, the Government of Australia in 1997 established the IIF Program which was established in order to stimulate the financing of small high-tech firms in Australia. The objectives of the IIF are stated as follows:

- By addressing capital and management constraints, to encourage the development of new technology firms which are commercializing research and development;

[5] Source: http://www.nvca.org

- To develop a self-sustaining Australian early stage, technology[6]-based VC industry;
- To establish in the medium term a "revolving" or self funding program; and
- To develop fund managers with experience in the early stage VC industry.

The IIF Program works on the basis of partnerships with private VCs. The first round of the program was announced in the Government's Small Business Statement in March 1997 and provided $130 million, which has been matched on a ratio of approximately 2:1 by private capital raised by participating fund managers. . Government and private capital is pooled and invested.. Five licensed funds were established in round one and became operational during 1998.[7] The second round of the IIF Program enabled Government funding of $90.7 million, matched by private sector capital on the basis of a Government to private ratio of around 1.5:1. The Government to private capital ratio was a competitive element in the selection of the round two funds. Four funds were licensed under this round and became operational in 2001. In round three of the IIF program (implemented in 2006) fund managers are licensed in tranches, with seven new fund managers licensed since 2007, with the final tranche to be completed in 2013. When finalized, the government will have committed $240 million matched at least 1:1 with private capital (i.e. at least $480 million in total) to round 3 of the program.[8] At this stage it is not sure how many funds will be licensed in the final tranche of round 3.

Cumming (2007) shows that there were more investments from the IIF funds in 1998 (and continuing in subsequent years even after the collapse of the Internet bubble) than there were in all prior years before that date. Controlling for other things being equal such as economic and industry conditions among other things, Cumming (2007)

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[6] The word technology was included for the first two rounds of the IIF program (1997 and 2001) but removed for round 3 (2006) – see section 1.2 in http://www.ausindustry.gov.au/programs/venture-capital/iif/Documents/IIF-GuideForApplicants2012.pdf

[7] The government allocates capital to the IIF program. The government identifies appropriate fund managers through a competitive process and licenses them on the proviso that they can raise matching capital from private investors – it is then their job to go out and raise that capital.

[8] http://www.innovation.gov.au/Innovation/Policy/Pages/InnovationInvestmentFund.aspx. See also http://www.innovation.gov.au/Innovation/Policy/Pages/InnovationInvestmentFundProgressReport.aspx

statistically shows that IIFs increased the supply of early stage investments in Australia. That is, the IIFs demonstrated an increased propensity to take on risk by investing in early stage and high-tech investments. The IIFs also had greater propensity to screen, monitor and add value to investee firms through more intensive staging and syndication, and through smaller portfolio sizes per fund manager.

Most prior evidence from the United States and Europe suggests that we should expect the contribution of VC to be generally positive. For instance, Gompers and Lerner (2004), Caselli et al. (2009), Samila and Sorenson (2011), Croce et al. (2012) present evidence that suggests VCs stimulate innovation, economic growth, and lead to more successful publicly traded firms relative to those that are not VC backed. On the other hand, we acknowledge that not 100% of the evidence supports this view. There is nevertheless academic evidence that the contribution of VCs is sometimes less than what VCs like to claim. For example, Hirukawa and Ueda, (2008, 2011) present evidence consistent with the view that VC funds do not stimulate innovation but instead flock to innovation thereby providing less value-added than VCs appear to claim. Engel and Keilbach (2007) provide mixed evidence from Germany that innovative firms are more likely to obtain VC backing, and grow faster after obtaining VC backing, but are not more likely to generate innovations after obtaining VC backing.

PE funds make later stage investments than VC funds. Later stage investments require substantial monitoring and value added, albeit arguably less intensive than earlier stage VC investments (Cressy et al., 2007). The economic contribution of PE funds may nevertheless be derived from the reorganization of an investee firm in terms of its finances, leverage and operational structure through divisions and employment. Certainly there have been wide reference to the possibility that PE funds are “locusts” that kill jobs and destroy economic value, as characterized by Franz Müntefering, 2004, a German Social Democratic Party member, after observing some less than successful investments in his region.

Overall, however, we may infer from prior work and knowledge of VC and PE fund operations that if VCs are successfully providing governance to their investee firms through financial, administrative, human resource, marketing, and strategic advice, and sitting on boards of directors, then the economic contribution of VC funds should be positive. We would expect that VC funds would have greater investment in R&D, more patents, disproportionately more employment relative to the size of such investments, and subsequently more successful public listings in terms of their market capitalization.

Regarding the expected economic performance of firms backed by government subsidized VC funds, we need to consider first the impact of government VC programs in countries other than Australia, and then consider structure and governance of the IIF program itself. There is evidence from the US and Israel that government programs have been successful in stimulating venture capital markets (Audretsch, 2003, 2007; Audretsch et al., 2002; Lerner, 2009), while in Canada and Europe government programs have been much less successful (Armour and Cumming, 2006; Cumming and MacIntosh, 2006, 2007). These differences in success across countries can arguably be explained by program design. In the United States and Israel there is a fruitful public/private sector partnership where government funds do not operate in competition with private funds. By contrast, in Canada and Europe there is evidence that government funds compete in the same market for deals with private funds, thereby resulting in crowding out (Leleux and Surelmount, 2003; Bruton et al., 2005; Armour and Cumming, 2006; Cumming and MacIntosh, 2006). Moreover, the structural design and governance of government subsidized VC funds in Canada have been sufficiently weak whereby fund managers have massive amounts of capital and make well over twice as many investments per fund manager relative to private limited partnership funds (in some cases over five times the number); this leads to inefficient decision making, poor screening and limited due diligence, and weak governance and little value-added advice post investment (Cumming and MacIntosh, 2007). Some government subsidized investments may have been subject to political pressure and structural design differences that give rise to inefficient decision making and comparatively less value added.

The situation with the government subsidized funds in Australia, however, is different. In Australia there is evidence that the IIF program generated an increase in the number of VC investments while at the same time having smaller portfolios per manager and more intensive staging and syndication of investments relative to non-government subsidized private fund managers (Cumming, 2007). For this reason, we would expect that IIF-backed firms would be more R&D intensive, generate more patents, and be more successful in terms of generating economic value as proxied by the propensity to go public and market capitalization after being public.

In sum, prior literature suggests two main testable propositions: (1) that the governance provided by VC funds yields pronounced economic impacts among VC-backed firms, and (2) that the more intensive governance provided by government subsidized IIFs would yield an even more pronounced impact among IIF-backed firms. But to date, there is no evidence on the economic value added of VC, PE and IIF-backed investments to the Australian economy. Empirical scrutiny is clearly needed. We introduce a newly assembled dataset in the next section that enables such empirical testing.

3. The sample and summary statistics

3.1 The sample

We began with a task of identifying both public and private firms in Australia without discriminating against any particular region or industry. Data were sourced from Morningstar, Thomson Reuters SDC, the Australian Private Equity and Venture Capital Association (AVCAL), Lexis-Nexis, Hoovers, Bloomberg, Patents IP Australia, The Australian Stock Exchange Webpage, Google Finance, Business Week, and numerous company webpages from Internet searches. Information was gathered over June - October 2012.

At the outset we acknowledge a possible survivorship bias in the data. We know and include in the data all known successful and bankrupt VC/PE/IIF-backed firms.[9] Our sample of non-VC-PE/IIF-backed firms is not 100% of all firms in Australia; rather, we selected 40% of the comparable Australian firms with data records in Hoovers and Lexis-Nexis so as to not overweight any industry or region or public versus private status and bias the sample and obtain a statistically representative sample with less than a 1% sampling error.[10] Inclusion of 40% of the population of comparable non-VC/PE/IIF firms from Hoovers and Lexis-Nexis enables reliable statistical comparisons between the non-VC/PE/IIF sample and the VC/PE/IIF sample. We know some but suspect not all non-VC/PE/IIF-backed bankrupt firms because information on such failed firms tends to disappear over time from our data sources. Therefore, if there is any bias in our regression analyses carried out in the subsequent sections with our sample of firms, the data understates the economic importance of VC/PE/IIF-backed firms because not all bankrupt non-VC/PE/IIF-backed firms are in the data.

We gathered information on the firm location, public or private status, date of incorporation, whether or not there was a VC, PE and/or IIF investor, date of listing and market capitalization if public, financial statement information including sales, assets and R&D expenses for the most recent years ended in 2011 and 2010, and patent filings including relative to the timing of VC, PE and IIF financing. VC, PE and IIF information data were sourced from AVCAL due to the incomplete listings of such transactions and discrepancies in recording such information in the Thomson SDC database.[11] Amounts are expressed in 2011 Australian dollars (i.e., not inflation adjusted to a different date). If a firm in the data went bankrupt, then the information is still entered (as 0, for example in the case of assets if all are depleted) and not skipped or dropped from the data. The main variables used from the data are summarized in Table 1.

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[9] AVCAL acknowledges that they may not have captured 100% of failures, but have captured all known ones by the funds in the industry.

[10] With 40% of the population randomly selected in our data sample, our sampling error for non-VC/PE/IIF-backed firms is less than 0.5%; see, e.g., Gravetter and Wallnau (2011).

[11] We noted discrepancies in over 50% of cases in the Thomson SDC sample relative to the AVCAL sample. Inferences from the data herein are significantly different with the AVCAL sample. The AVCAL sample is much larger and a complete representation of all VC, PE and IIF transactions in Australia.

Table 1. Variable Definitions

This table defines the variables used in the subsequent tables. Data were sourced from Morningstar, Thomson Reuters SDC, the Australian and Venture Capital and Private Equity Association (AVCAL), Lexis-Nexis, Hoovers, Bloomberg, Patents IP Australia, The Australian Stock Exchange Webpage, Google Finance, Business Week, and numerous company webpages from Internet searches. Information was gathered over June - October 2012. Financial statement information was gathered for the most recent years ended in 2011 and 2010. Venture capital (VC), private equity (PE) and innovation investment fund (IIF) information data were sourced from AVCAL. Amounts expressed in 2011 Australian dollars.

Variable	Definition
Dependent Variables	
Number of Employees	The number of employees at the firm.
R&D Expenses	The firm's R&D expenses.
R&D / Assets	The firm's R&D expenses / assets.
R&D / Sales	The firm's R&D expenses / sales.
Patents	A dummy variable equal to 1 if the firm has filed for patents.
Number of Patents	A count variable for the number of patents the firm has filed.
Number of Patents After First Financing Date	A count variable for the number of patents the firm has filed after it obtained financing from a VC, PE, or IIF.
Time to IPO	The number of years from incorporation to IPO. If there has not been an IPO then the observation is not included.
Market Capitalization	The market capitalization of the firm as at August 2012. If the firm has never been publicly listed then the observation is not included. If the firm has been publicly listed and subsequently was delisted then the value 0 is assigned.
Type of Investor	
VC	A dummy variable equal to 1 if the firm was financed by a private venture capital (VC) fund.
PE	A dummy variable equal to 1 if the firm was financed by a private equity (PE) fund.
IIF	A dummy variable equal to 1 if the firm was financed by a government sponsored Innovation Investment Fund (IIF).
Year Effects	
Year of Incorporation	The year in which the firm incorporated.
Year of Listing	The year in which the firm obtained its listing on a stock exchange.
Publicly Listed	A dummy variable equal to 1 if the firm is publicly listed.
Regional Effects	
State Dummy Variables	Dummy variables equal to 1 for the different states in which the investee firm primarily operates: New South Wales, Victoria, South Australia, Queensland, , ACT, Tasmania, Western Australia, and the Northern Territory.
Industry Effects	
Industry Dummy Variables	Dummy variables equal to 1 for different primary industries in which the firm operates, including the following sectors: energy, information technology, consulting, biotech, medical, electronic, computer hardware, computer software, electronics, communications, services, mining, entertainment, advertising, industrial, construction, auto, supplies, transportation, retail, and farming.

Table 2 provides an aggregated overview of the Australian VC market. AVCAL reports[12] there was $120.6 million invested in the Australian VC industry in 2011, which is 0.01% (rounded) of Australian GDP that year. By comparison, VC/GDP in the United States in 2011 is 0.2%,[13] or 20 times that of Australia. In Australia PE transactions in 2011 were $3,517.83 million or 0.22% of Australian GDP that year, and IIF transactions totaled $24.5 million or 0.002% of GDP.

For the firms for which financial statement information is known (including all public listed firms in the sample and a subset of private firms in the sample), total assets of the 437 private and 38 public VC-backed firms amounted to $4.13 billion in 2011 (0.26% of GDP), total sales amounted to $2.78 billion (0.18% of GDP), and total market capitalization of publicly traded firms was $14.09 billion (0.89% of GDP). For the 613 private and 53 public PE-backed firms, total assets of amounted to $121.3 billion in 2011 (7.65% of GDP), total sales amounted to $111.1 billion (7.01% of GDP), and total market capitalization of publicly traded firms was $9.0 billion (0.57% of GDP). For the 81 private and 9 public IIF-backed firms, total assets amounted to $1.02 billion in 2011 (0.06% of GDP), total sales amounted to $365.5 million (0.02% of GDP), and total market capitalization of publicly traded firms was $3.2 billion (0.20% of GDP). For the remaining 1,861 private and 900 public non-VC/PE/IIF-backed firms, total assets amounted to $3.6 trillion in 2011 (230% of GDP), total sales amounted to $1.4 trillion (88.2% of GDP), and total market capitalization of publicly traded firms was $877.8 billion (55.4% of GDP).

VC- and IIF-backed firms carryout significantly more R&D and patenting activity on a relative basis, regardless of whether it is measured in reference to sales, assets or employment. VC-backed firms filed a total of 2,165 patents and employed 7,532 persons (or 0.29 patents filed / employee), and total 2011 R&D expenditure was $300.0 million (0.02% of GDP). PE-backed firms filed a total of 1,238 patents and employed 260,039 persons (0.005 patents filed / employee), and total 2011 R&D expenditure was $133.0

[12] http://www.avcal.com.au/stats-research/yearbookshttp://www.avcal.com.au/stats-research/yearbooks
[13] Source: http://www.nvca.org

Table 2. Comparisons Across VC / PE / IIF and Other Companies

This table presents total investment figures across venture capital (VC), private equity (PE), innovation investment fund (IIF) and other (non-VC/PE/IIF) backed firms in Australia. The non-VC/PE/IIF firms comprise a random sample of 40% of the public and private firms in Hoovers and Lexis-Nexis. The data are sourced from Morningstar, Thomson Reuters, Lexis-Nexis, Hoovers, Bloomberg, Patents IP Australia, Google Finance, and Business Week as at August 2012. Figures are in 2011 Australian dollars.

	Venture Capital (VC)		Private Equity (PE)		Innovation Investment Fund (IIF)		Other (non-VC/PE/IIF)	
	2011 Financial Statistics	Per GDP	2011 Financial Statistics	Per GDP	2011 Financial Statistics	Per GDP	2011 Financial Statistics	Per GDP
Total Investment in 2011	$120,600,000*	0.008%	$3,517,830,000	0.222%	24,500,000**	0.002%	Not applicable	
Total Assets as at 2011	$4,129,409,653	0.260%	$121,260,525,449	7.646%	$1,024,993,764	0.065%	$3,645,888,735,694	229.88%
Total Sales in 2011	$2,780,848,071	0.175%	$111,134,619,527	7.007%	$356,525,104	0.022%	$1,398,900,612,498	88.203%
Total Taxes Paid in 2011	$202,120,000	0.013%	$108,500,000	0.007%	$35,130,000	0.002%	$35,863,430,000	2.261%
Total Market Capitalization as at 2011	$14,091,755,000	0.889%	$9,009,853,000	0.568%	$3,232,490,000	0.204%	$877,810,561,136	55.347%
Total R&D Expenditures in 2011	$300,012,895	0.019%	$132,952,290	0.008%	$58,716,567	0.004%	$1,021,005,320	0.064%
Total Number of Patents Filed	2,165		1,238		548		5,516***	
Total Patent Citations	18,160		4,829		3,226		17,227	
Total Employment in 2011	7,532		260,039		465		3,129,829	
Total Number of Private Firms as at 2011	437		613		81		1,861	
Total Number of Public Firms as at 2011	38		53		9		900	

* VC figures include IIF investments (source: AVCAL); a comparison benchmark comes from the US where VC in 2011 was US$29.2 billion, or 0.2% of US GDP (source: NVCA).
**Estimate based on information available at http://www.innovation.gov.au/Innovation/ReportsandStudies/Documents/InnovationInvestmentFundProgramProgressReport.pdf.
*** Refers to winsorized figures at the 99th percentile, effectively not biasing results from Australian subsidiaries of large multinationals with very large numbers of patents.

million (0.01% of GDP). IIF-backed firms filed a total of 548 patents and employed 465 persons (1.18 patents filed / employee), and total 2011 R&D expenditure was $58.7 million (0.004% of GDP). Non-VC/PE/IIF-backed firms filed 5,516 patents[14] and employed 3,126,877 persons (0.002 patents filed / employee), and total 2011 R&D expenditure was $1.0 billion (0.06% of GDP).

Table 3 summarizes the VC, PE and IIF data by the percentage of investments (relative to the total number of investments by investor type) for each industry sector. Most VC investments are in medical/biotech (36.48%), followed by information technology (22.64%) and electronics / computer hardware / software (14.26%). Most PE investments are in industrial (28.34%) followed by supplies (10.79%) and retail (8.70%). Most IIF investments are in medical/biotech (38.89%), followed by electronics / computer hardware / software (21.11%) and information technology (20.00%). Non-VC/PE/IIF-backed firms are most commonly in the various services sectors (20.56%), followed by various supplies (12.20%), and mining (11.07%).

Table 4 summarizes the data by region. New South Wales has the highest percentage of firms regardless of whether or not they are VC, PE, IIF or non-VC/PE/IIF-backed firms. Among VC-backed firms, 37.11% are in New South Wales, followed by Victoria (28.5%), Queensland (11.74%), South Australia (10.27%) and Western Australia (7.13%). Among PE-backed firms, 37.7% are in New South Wales, followed by Victoria (24.32%), Queensland (11.86%) and Western Australia (8.11%). Among IIF-backed firms, 36.7% are in New South Wales, followed by Victoria (26.67%), Queensland (13.3%) and Western Australia (10.0%). Among non-VC/PE/IIF-backed firms, 34.2% are in New South Wales, followed by Victoria (22.3%), Western Australia (18.9%) and Queensland (14.7%). Overall, New South Wales, Victoria and the Australian Capital Territory enjoy more VC and IIF investment relative to the population of firms, while the other regions have comparatively less investment relative to the population of firms.

[14] As indicated in Table 2, for these non-VC/PE/IIF figures we winsorized at the 99% level, effectively not biasing results from Australian subsidiaries of large multinationals with very large numbers of patents.

Table 3. Data Summary by Sectors

This table summarizes the data by industry sector for venture capital (VC), private equity (PE), innovation investment fund (IIF) and non-VC/PE/IIF backed firms. Percentages are relative to other investments by the same investor type. Note that industry classifications in some cases can be ambiguous, such as in the case of computers which has many applications in automotive, entertainment, supplies, etc. Our main regression findings in the paper pertaining to VC, PE and IIF do not depend on the different industry classifications. Columns do not perfectly sum to 100% due to rounding.

	Medical / Biotech	Electronics / Computer Hardware / Software	Infor-mation Tech-nology	Mining	Energy	Finan-cial	Cons-ulting	Services	Enterta-inment	Adver-Tising	Indus-trial	Const-ruction	Auto-motive	Supp-lies	Trans-port	Retail	Farming	Commu-nication	Other
VC	36.48%	14.26%	22.64%	0.00%	3.77%	2.52%	0.84%	7.13%	0.63%	1.68%	2.94%	0.00%	0.00%	0.21%	0.42%	0.42%	0.00%	5.87%	0.19%
PE	6.45%	7.20%	0.75%	1.95%	2.55%	4.20%	0.00%	8.55%	5.85%	0.00%	28.34%	2.25%	0.00%	10.79%	4.20%	8.70%	1.05%	2.70%	4.50%
IIF	38.89%	21.11%	20.00%	1.11%	2.22%	1.11%	1.11%	5.56%	0.00%	1.11%	2.22%	1.11%	0.00%	0.00%	0.00%	0.00%	0.00%	4.44%	0.00%
Non-VC/PE/IIF	8.29%	2.24%	9.92%	11.07%	7.78%	6.91%	1.19%	20.56%	1.48%	0.25%	2.53%	2.39%	1.56%	12.20%	3.08%	2.10%	3.58%	2.71%	0.14%

Table 4. Data Summary by Regions

This table summarizes the data by state for venture capital (VC), private equity (PE), innovation investment fund (IIF) and non-VC/PE/IIF backed firms. Percentages are relative to other investments by the same investor type. Figures do not horizontally sum to 100% as the location in some cases could not be uniquely ascertained, and in some (rare) cases the investee firm is primarily based overseas.

	New South Wales	Victoria	Queensland	South Australia	Western Australia	ACT	Tasmania	Northern Territory
VC	37.11%	28.51%	11.74%	10.27%	7.13%	2.73%	0.63%	0.00%
PE	37.69%	24.32%	11.86%	5.11%	8.11%	0.75%	0.60%	0.45%
IIF	36.67%	26.67%	13.33%	7.78%	10.00%	3.33%	0.00%	0.00%
Non-VC/PE/IIF	34.17%	22.29%	14.73%	6.30%	18.93%	1.56%	1.59%	0.51%

Table 5 presents selected variables in the data by statistically comparing average and median values. The data indicate the average market capitalization is highest among non-VC/PE/IIF-backed firms at $1.1 billion relative to $380.9 million for VC, $191.6 million for PE, $359.2 million for IIF, and these differences are significant at (at least) the 10% level of significance. The median level of market capitalization is lowest for VC-backed firms ($24.5 million), and this median market capitalization is significantly lower than that for PE backed firms ($63.6 million) and IIF-backed firms ($101.1 million). The typical number of years the firms in the sample have been public is quite similar across the categories, ranging from 8 to 11 years. Non-VC/PE/IIF-backed firms and PE-backed firms are nevertheless significantly older on average (relative to their VC- and IIF-backed counterparts) from date of incorporation to IPO (roughly 17 years from incorporation to IPO date on average compared to roughly 7-8 years) and from incorporation to 2012 (roughly 26-27 years on average compared to 13-15 years).

Table 5 indicates VC- and IIF-backed firms have substantially fewer employees. VC-backed firms have a median of 36 employees and an average of 279, while IIF-backed firms have a median of 20 employees and an average of 46. By contrast PE-backed firms have a median of 106 employees and an average of 772 employees, while non-VC/PE/IIF-backed firms have a median of 40 employees and an average of 1,611 employees; this latter average is due to right skewness among the larger and older non-VC/PE/IIF firms in the sample.

VC- and IIF-backed firms are statistically more likely to have higher R&D expenses and patent filings. The median PE- and non-PE/VC/IIF-backed firm spends exactly $0 on R&D and generates 0 patents. The average PE-backed firm spends $3.4 million on R&D and has an average of 1.86 patent filings. The average non-VC/PE/IIF-backed firm spends $4.6 million on R&D and has 6.1 patent filings. By contrast, the average (median) VC-backed company spends $14.3 million ($2.0 million) on R&D and has an average (median) of 4.6 (1) patents. The average (median) IIF-backed company has 6.1 (1) patent filings. Similarly, note that VC- and IIF-backed firms are more likely to have patents both before and after obtaining financing relative to their PE-backed

Table 5. Comparison of Averages and Medians

This table presents average and median values for select variables in the data, along with comparison of averages and medians across venture capital (VC), private equity (PE), Innovation Investment Fund (IIF), and non-VC/PE/IIF backed firms. Patents pre- and post-financing in the right-hand-columns does not always add up for the total patent filings due to some missing observations for dates. Variables are as defined in Table 1. *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

		Market Capitalization (millions) for the subset of IPO firms	Years Since Being Public (to 2012) for subset of IPO firms	Time to IPO from Date of Incorporation for subset of IPO firms	Age from Incorpo-ration to 2012	Number of Empl-oyees 2011	2011 R&D Exp.	Sales 2011	Assets 2011	Patents	Number of Patents	Number of Patent Citations	Number of patents before first financing date	Number of patents after the first financing date
VC	Average	$380.86	8.50	8.95	16.54	278.96	$14,286,328	$95,891,313	$172,058,736	50.11%	4.56	112.80	3.71	2.05
	Median	$24.54	9.00	8.00	15.00	36.00	$1,969,574	$2,450,000	$10,974,232	100.00%	1.00	26.00	0.00	0.00
PE	Average	$191.62	8.79	16.92	26.95	771.63	$3,409,033	$1,736,478,403	$2,474,704,677	16.52%	1.86	69.99	0.93	1.03
	Median	$63.64	8.00	7.00	14.00	106.00	$0	$105,400,000	$148,374,000	0.00%	0.00	11.00	0.00	0.00
IIF	Average	$359.17	8.33	9.42	14.00	46.50	$8,388,081	$50,932,158	$146,427,681	51.11%	6.09	107.53	3.70	3.91
	Median	$101.10	9.00	6.00	13.00	20.00	$1,969,574	$910,000	$7,858,207	100.00%	1.00	36.00	1.00	0.00
Non-VC/PE/IIF	Average	$1,057.60	11.26	17.51	26.41	1610.82	$4,537,801	$745,682,629	$5,499,078,033	16.66%	6.11	82.03	N/A	N/A
	Median	$43.26	10.00	7.00	18.00	40.00	$0	$12,627,327	$70,860,000	0.00%	0.00	8.50	N/A	N/A
Differences in Averages (t-stats)	VC versus PE	0.34	0.35	-1.30	-1.83*	-2.67***	1.10	-1.63	-1.78*	12.26***	4.75***	2.48**	4.69***	1.94*
	VC versus IIF	-0.44	0.54	-0.10	1.11	1.58	0.20	0.21	-0.32	-0.25	-0.83	0.14	0.26	-1.11
	VC versus Non-VC/PE/IIF	-2.83***	-1.57	-4.30***	-4.99***	-4.07***	0.93	-7.16***	-2.87***	13.77***	-0.62	6.45***	N/A	N/A
	PE versus IIF	-0.64	0.28	1.29	2.33**	4.93***	-0.91	1.64	1.73*	-6.30	-2.52***	-0.96	-2.81***	-1.70*
	PE versus Non-VC/PE/IIF	-3.21'***	-2.50**	-0.14	0.11	-2.46**	-0.34	0.96	-1.31	-0.08	-1.85*	-0.43	N/A	N/A
	IIF versus Non-VC/PE/IIF	-1.89*	-2.08**	-1.82*	-5.00***	-5.08***	0.72	-6.73***	-2.84***	6.45***	0.00	3.13***	N/A	N/A
Differences in Medians (p-values)	VC versus PE	0.013**	0.179	0.625	0.351	0.314	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	VC versus IIF	0.851	0.825	0.830	0.793	0.731	0.145	0.539	0.119	0.168	0.108	0.000***	0.814	0.686
	VC versus Non-VC/PE/IIF	0.057*	0.293	0.553	0.142	0.32	0.007***	0.998	0.027**	0.000***	0.000***	0.000***	N/A	N/A
	PE versus IIF	0.224	0.344	0.480	0.883	0.258	0.003***	0.174	0.158	0.000***	0.000***	0.000***	0.000***	0.000***
	PE versus Non-VC/PE/IIF	0.097*	0.053*	0.941	0.000***	0.000***	0.288	0.000***	0.001***	0.935	0.911	0.000***	N/A	N/A
	IIF versus Non-VC/PE/IIF	0.313	0.364	0.782	0.003***	0.067*	0.008***	0.058*	0.059*	0.000***	0.000***	0.000***	N/A	N/A

counterparts in Table 5. The higher average levels of R&D for VC- and IIF-backed firms are not statistically significant in Table 5 due to large variances in R&D expenses in the sample, but the medians are statistically significant vis-à-vis PE- and non-VC/PE/IIF-backed firms. Table 5 does indicate there are statistically significant differences in terms of both averages and medians for the patent statistics for VC- and IIF-backed firms relative to the PE- and non-VC/PE/IIF-backed firms.

Similarly, VC and IIF firms likewise have greater median and average numbers of patent citations relative to PE-backed and non-VC/PE/IIF backed firms. The average (median) VC-backed firm has 112.8 (26) citations and IIF-backed firm has 107.5 (36) citations, compared to PE firms with 70.0 (11) citations and non-VC/PE/IIF-backed firm with 82.0 (8.5) citations.

Table 5 shows that on average VC- and IIF-backed firms are smaller in terms of sales and assets. The average (median) VC-backed firm has sales of $95.9 million ($2.5 million), and the average (median) IIF-backed firm has sales of $50.9 million ($0.9 million). The average (median) PE-backed firm has sales of $1.7 billion ($105.4 million), and the average (median) non-VC/PE/IIF-backed firm has sales of $745.2 million ($12.6 million). Similarly, Table 5 shows that on average VC- and IIF-backed firms are smaller in terms of assets. The average (median) VC-backed firm has assets of $172.1 million ($11.0 million), and the average (median) IIF-backed firm has assets of $146.4 million ($7.9 million). The average (median) PE-backed firm has assets of $2.5 billion ($148.4 million), and the average (median) non-VC/PE/IIF-backed firm has assets of $5.5 billion ($70.9 million). These differences are very large, albeit not all are statistically significant as indicated in Table 5 due to the large variances of the distribution in the sample.

The summary statistics and comparison tests in Tables 2-5 give an impression of general patterns in the data and differences between the VC-, PE-, and IIF-backed firms relative to their non-VC/PE/IIF-backed counterparts. The statistics suggest it is useful to control for other things being equal to make more precise inferences about the economic

contributions from the typical firm within each category. We provide such comparisons in the next section with the use of multivariate regression methods.

4. Multivariate analyses

4.1. Regression Results

The regression analyses in this section are presented in the following order. First, we examine factors that affect employment levels. Second, we present regressions pertinent to R&D expenditures. We consider R&D/Assets as well as R&D/Sales in order to illustrate robustness. Third, we report regression results for the determinant of patents and patent citations, as well as the number of patents in total and the number after obtaining finance from a VC or PE or IIF. Fourth, we report regressions for the time to IPO, and report different regressions depending on subsamples of the data in terms of whether the firm incorporated before or after year 2000. Finally, we report regressions for market capitalization, and again present results for different subsets of the data for incorporation before or after year 2000. After presenting these main regression results, in subsection 4.2 we discuss other robustness checks that were considered but not explicitly reported in the tables for reasons of conciseness.

The employment regressions are presented in Table 6. We use cross-sectional regressions across each firm for employment statistics as reported in 2011. We report quantile regressions to account for significant differences across firm sizes and the possibility that there are differential marginal impacts of investors for different size groupings. There are 2,044 firms in the sample for which employment data are available. Employment data were comparatively only scantly available for 2010 and hence are not considered. Control variables are included for firm age from time of incorporation and a dummy variable if the firm is publicly listed, as well as regional and industry dummy variables. The variables used to test for differences across different sources of capital are the VC, PE and IIF variables.

Table 6. Quantile Regressions of Employment

This table presents quantile regressions for the 75%, 50%, and 25% for the factors that affect employment in VC-, PE-, IIF- and non-PE/VC/IIF- backed firms. Variables are as defined in Table 1. The sample comprises all firms (IPO or otherwise); some missing observations are due to unknown dates for incorporation (excluding this variable and including those observations does not affect the main results). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

	(1) Employees (75% Quartile)		(2) Employees (50% Quartile)		(3) Employees (25% Quartile)	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Type of Investor						
VC	-37.519	-0.28	-24.750	-1.14	-4.778	-1.09
PE	215.342	5.67***	75.583	11.61***	9.556	7.19***
IIF	-113.025	-0.57	-36.000	-1.24	-1.500	-0.23
Year Effects						
Year of Incorporation	-14.658	-70.05***	-2.083	-46.81***	-0.389	-28.04***
Publicly Listed	235.658	7.24***	48.667	9.62***	8.667	8.91***
Regional Effects						
South Australia	-83.949	-1.58	-10.333	-1.14	-0.167	-0.09
Queensland	-29.316	-0.76	-2.250	-0.34	0.444	0.33
Victoria	-59.823	-1.78*	-5.167	-0.90	-1.500	-1.27
ACT	-87.797	-0.68	12.083	0.54	-2.167	-0.43
Tasmania	-118.367	-1.12	-24.750	-1.38	-3.944	-1.06
Western Australia	-78.633	-2.01**	-23.333	-3.56***	-4.833	-3.60***
Northern Territory	-163.671	-1.07	-15.667	-0.57	-4.722	-0.89
Industry Effects						
Energy	-112.544	-0.97	-30.583	-1.62	-5.389	-1.41
Information Technology	-12.709	-0.09	124.917	4.81***	101.222	19.44***
Consulting	-61.519	-0.54	52.083	2.67***	13.444	3.40***
Biotech	216.949	2.26**	-10.417	-0.63	-1.500	-0.45
Medical	-88.544	-1.16	-6.583	-0.49	1.500	0.56
Electronic	-134.051	-1.04	-15.083	-0.69	1.556	0.35
Computer Hardware	778.608	3.90***	99.750	3.09***	36.333	6.31***
Computer Software	-193.392	-1.96**	0.167	0.01	9.944	2.79***
Communications	-108.000	-1.08	6.417	0.39	3.944	1.12
Services	-9.228	-0.19	-0.750	-0.09	2.889	1.68*
Mining	-73.418	-1.31	-22.833	-2.46**	-4.000	-2.09**
Entertainment	-17.785	-0.17	-8.750	-0.51	2.278	0.66
Advertising	129.899	0.83	-31.250	-1.10	15.222	2.75***
Industrial	-118.392	-1.38	-12.000	-0.84	0.833	0.28
Construction	-40.418	-0.57	9.417	0.78	11.000	4.38***
Auto	-11.911	-0.14	34.083	2.39**	18.722	6.45***
Supplies	-89.076	-1.69*	-12.083	-1.35	1.278	0.70
Transportation	-44.911	-0.63	5.750	0.48	5.944	2.42**
Retail	-39.051	-0.47	20.500	1.45	-0.556	-0.19
Farming	-59.734	-0.89	-4.917	-0.43	-0.889	-0.38
Constant	29528.800	70.12***	4197.167	47.27***	785.278	28.47***
Number of Observations	2044		2044		2044	
Pseudo R2	0.033		0.010		0.024	

The regressions in Table 6 shows very consistent evidence that VC- and IIF-backed firms do not have materially significant differences in employment relative to non-VC/PE/IIF-backed firms. In other words, VC and IIF financing does not lead to a long term reduction (or an increase) in employment, regardless of which size quartile one examines. By contrast, PE-backed firms have a marked increase in long-term employment, and this effect is significant regardless of the size quartile. In terms of the economic significance, the data indicate that for the top quartile, PE-backed firms employ on average 215 more persons, while at the middle quartile they employ an additional 76 persons, and at the bottom size quartile than employ 10 more people than non-PE backed firms. These effects are significant at the 1% level of significance. This evidence clearly counters public sentiments such as those of Franz Munterfing referenced in Section 2 above that PE funds are locusts that kill jobs. On the contrary, PE funds make firms more efficient over the long term which enables them to employ more people.

The control variables in Table 6 show a number of significant effects that are consistent with expectations. Younger firms employ fewer people. The economic significance is such that an increase in firm age by one year gives rise to an additional 15 employees among the top quartile and 2 employees among the middle quartile. Among the bottom quartile an increase in age by three years gives rise to an additional 1 employee. These age effects are significant at the 1% level of significance. If a firm is publicly listed then there are an additional 235 employees among the top quartile, 49 employees among the middle quartile and 9 employees among the bottom quartile, and again these effects are significant at the 1% level. The regional effects show Western Australia has significantly lower employment levels (79 employees in the top quartile, 23 employees in the middle quartile and 5 employees in the bottom quartile), all else being equal. Other regional effects are not statistically significant. Finally, the industry effects show employment is higher in biotech among the top quartile only (due to some large outlier biotech firms). Employment is higher in all quartiles for computer hardware. Employment is higher in the consulting and auto related industries in the middle and bottom quartiles. Employment is lower in the bottom quartiles for mining.

Table 7 shows Poisson regressions for total R&D expenditures (model 4), R&D expenditures/assets (model 5), and R&D expenditures/sales (model 6). Poisson regressions are used since the distribution of the dependent variable is very consistent with the Poisson distribution: there are many firms with zero R&D expenditures (see Section 3), and there are fewer firms at each level of increasing levels of R&D expenses, regardless of whether or not one benchmarks by sales or assets. Control variables are identical to those reported in Table 6.

The data indicate in Table 7 (model 4) that VC-backed firms on average had larger total R&D expenditures by $1,146,432 in 2011 relative to non-VC/PE/IIF-backed firms, controlling for other things being equal, while PE-backed and IIF-backed firms had on average smaller total R&D expenditures by $478,396 and $232,889, respectively. When we benchmark R&D expenses against assets (model 5) and sales (model 6), however, we see more relevant comparisons of equals. IIF-backed firms had higher R&D/assets by 0.681 (where the average value of this variable is 0.336), and higher R&D/sales by 0.734 (where the average value of this variable is 1.271), and these effects are significant at the 1% level; this means that IIF-backed firms are much more R&D intensive on a per assets basis. PE-backed firms had lower R&D/assets by 0.014 and lower R&D/sales by 0.081, and these effects are both significant at the 5% level. VC-backed firms did not have significantly different R&D/assets, but did have higher R&D/sales by 0.130. In sum, therefore, VC-backed firms had the highest level of R&D expenses on average, and have higher R&D/sales than non-VC/PE/IIF-backed firms. But IIF firms had the highest level of R&D/assets and highest level of R&D/sales. The impact of IIF financing is such that R&D/assets is approximately 134 times larger than that for regular VC, and for R&D/sales the impact of IIF financing over 5.5 times larger than that for VC financing. The data thus indicate that the IIF program unambiguously facilitates R&D activity in Australia.

The control variables in Table 7 are highly significant for total R&D amounts, but these controls are largely insignificant when we scale for assets and sales in regression

Table 7. Poisson Regressions for R&D Expenditures

This table presents Poisson regressions for R&D expenditures, R&D Expenditures / Assets, and R&D Expenditures / Sales. Variables are as defined in Table 1. The sample comprises all firms (IPO or otherwise); some missing observations are due to unknown dates for incorporation (excluding this variable and including those observations does not affect the main results) *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

	(4) R&D Expenditures		(5) R&D Expenditures / Assets		(6) R&D Expenditures / Sales	
	Marginal Effect	t-statistic	Marginal Effect	t-statistic	Marginal Effect	t-statistic
Type of Investor						
VC	1146432	6596.64***	0.005	0.50	0.130	2.15**
PE	-478395.6	-5539.65***	-0.014	-2.11**	-0.081	-3.16***
IIF	-232889.1	-2353.72***	0.681	6.21***	0.734	2.61***
Year Effects						
Year of Incorporation	-22151.58	-12000.00***	0.000	-0.40	0.001	1.95*
Publicly Listed	-5.63E+07	-4746.07***	-0.467	-1.36	-2.113	-0.34
Regional Effects						
South Australia	-836297.6	-9841.89***	-0.004	-0.16	-0.049	-1.04
Queensland	-13316.44	-114.71***	-0.009	-1.79*	0.187	2.71***
Victoria	431000.4	4789.79***	0.004	0.53	0.050	1.89*
Western Australia	-757327.5	-8219.19***	-0.010	-0.71	-0.074	-2.49**
Industry Effects						
Energy	3.81E+07	1841.50***	0.089	0.53	55.093	0.68
Information Technology	6.02E+06	4077.69***	0.018	0.65	-0.020	-0.27
Consulting	3.17E+06	4523.10***	0.243	3.49***	0.763	2.10**
Biotech	4.25E+06	4727.62***	0.020	0.50	8.860	2.22**
Medical	1.83E+07	8937.23***	0.009	0.67	0.369	2.20**
Computer Hardware	1.59E+07	5493.71***	-0.006	-0.21	-0.046	-0.89
Computer Software	8.07E+06	5305.18***	0.016	0.69	-0.006	-0.09
Services	1.04E+05	406.93***	-0.018	-1.18	-0.042	-1.26
Mining	9.83E+06	3302.07***	-0.010	-0.31	-0.047	-0.4
Constant	71.684	36303.14***	6.855	0.40	-20.125	-2.21**
Number of Observations	231		219		230	
Pseudo R2	0.670		0.876		0.792	

models 5 and 6. Regardless of which industry and other controls included, the results pertaining to IIFs, VCs and PEs are not materially affected.

Table 8 presents logit regressions for the probability that a firm has filed for a patent (model 7), the number of patents filed (model 8) and the number of patents filed after financing (model 9, which excludes the subset of firms that do not have VC or PE or IIF financing). The data indicate that VC-backed firms are 37.1% more likely than non-VC/PE/IIF-backed firms to have a patent (model 7), and have 23.9% more patents on average, including patents before and after VC financing (Model 8); these effects are significant at the 1% and 10% levels, respectively. Relative to non-VC/PE/IIF-backed firms, PE-backed firms are 5.4% more likely to have a patent (model 7), and have 60.5% more patents (model 8), and these effects are significant at the 5% and 1% levels, respectively. Relative to PE-backed firms (model 9) VC-backed firms have 26.8% more patents after obtaining financing (this effect is significant at the 1% level). IIF-backed firms have 42.5% more patents than PE backed firms after obtaining financing (and this effect is significant at the 1% level).

Table 8 further indicates that VC-backed and IIF-backed companies have more patent citations than PE-backed companies and non-VC/PE/IIF-backed companies, and these differences are significant at the 1% and 5% levels for VC- and IIF-backing, respectively. In terms of the economic significance, VC-backed companies have 8.6 more citations and IIF-backed companies have on average 0.13 more citations.

The control variables in Table 8 show that older firms are more likely to have a patent and more patents (10 years older gives rise to a 1% increase in probability and on average a 0.03 greater number of patents). Publicly listed firms are 11.5% more likely to have a patent, on average have 2 more patents, and 0.55 more patents after obtaining financing. Firms that had a patent earlier in the life are less likely to have a patent citation, although this effect is very small (roughly decreasing at a rate of 0.01 citations per year) and significant at the 10% level only. A number of the regional and industry variables are likewise significant in ways that would be expected. Perhaps most notably,

Table 8. Logit and Poisson Regressions for Patents

This table presents logit regressions for the probability that the firm has filed for a patent, and Poisson regressions for the total number of patents and patent citations (winsorized at the 99% level), and the total number of patents obtained after first round of financing from a VC, PE or IIF investor (winsorized at the 99% level, and excluding observations from non-VC/PE/IIF backed firms). The variable for the year of first patent is treated as 2012 if the firm has no patents. Incorporation years are not known for all firms, and hence there are differences in observations in regressions (7), (8) and (10). Variables are as defined in Table 1. The sample comprises all firms (IPO or otherwise); some missing observations are due to unknown dates for incorporation (excluding this variable and including those observations does not affect the main results). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

	(7) Patents		(8) Number of Patents		(9) Number of Patents After Finance		(10) Number of Patent Citations	
	Marginal Effect	t-statistic	Marginal Effect	t-statistic	Marginal Effect	t-statistic	Marginal Effect	t-statistic
Type of Investor								
VC	0.371	2.91***	0.239	1.84*	0.268	2.67***	8.595	53.04***
PE	0.054	2.11**	0.605	8.79***			0.066	1.14
IIF	0.025	0.26	0.171	1.07	0.425	6.36***	0.133	1.99**
Year Effects								
Year of Incorporation	-0.001	-3.52***	-0.003	-18.21***	-0.001	-2.28**		
Publicly Listed	0.116	5.56***	1.964	27.91***	0.271	6.07***		
Date of First Patent							0.006	1.70*
Regional Effects								
South Australia	-0.009	-0.29	-0.042	-0.59	-0.338	-0.02	0.424	6.28***
Queensland	0.031	1.16	-0.130	-2.42**	0.425	6.70***	-1.483	-32.95***
Victoria	0.022	1.04	0.417	8.37***	0.210	5.04***	-1.057	-27.35***
ACT	0.242	1.86*	6.214	9.18***			-3.101	-56.80***
Tasmania	0.028	0.35	-0.280	-1.49			0.824	3.19***
Western Australia	-0.005	-0.23	-0.692	-15.39***	0.088	1.65*	-1.535	-29.55***
Northern Territory	-0.038	-0.39	-0.826	-4.97***			-3.290	-49.88***
Industry Effects								
Energy	0.165	1.43	2.433	3.75***			0.577	2.95***
Information Technology	0.190	1.39	-0.491	-1.88*			0.692	4.31***
Consulting	0.294	2.25**	9.570	6.68***	-0.121	-2.01**	2.023	4.85***
Biotech	0.415	3.92***	13.595	7.77***	0.259	2.49**	29.078	24.14***
Medical	0.396	4.26***	12.337	8.68***	-0.020	-0.35	20.413	26.23***
Electronic	0.413	2.99***	9.396	5.92***	3.037	7.71***	6.464	15.25***
Computer Hardware	0.293	1.49	0.166	0.32			-2.458	-10.71***
Computer Software	0.214	1.88*	5.569	6.20***	-0.150	-2.38**	-2.733	-30.31***
Communications	0.142	1.40	0.247	0.88	-0.232	-0.02	-3.219	-49.73***
Services	0.094	1.83*	2.554	8.05***	-0.096	-1.66*	0.653	4.12***
Mining	0.072	1.36	1.929	6.54***	-0.082	-1.56	-1.486	-11.84***
Entertainment	0.167	1.52	1.471	2.84***			-1.218	-5.42***
Advertising	0.009	0.07	-0.973	-5.08***			-3.094	-34.90***
Industrial	0.413	4.23***	11.383	7.77***	0.425	2.61***	-0.439	-2.20**
Construction	0.343	3.97***	8.257	8.32***	0.843	8.83***	17.601	20.86***
Auto	0.231	2.36**	1.131	2.77***			-1.565	-7.64***
Supplies	0.317	4.60***	9.980	10.47***	0.256	3.29***	6.180	17.74***
Transportation	0.192	2.27**	5.476	7.06***			10.526	18.32***
Retail	0.087	1.02	5.396	6.54***			-2.452	-19.59***
Farming	0.120	1.59	-0.037	-0.16			-3.049	-36.51***
Constant	10.982	2.72***	2.798	10.90***	8.124	1.89*	-2.378	-1.18
Number of Observations	2213		2213		208		3896	
Pseudo R2	0.106		0.205		0.399		0.274	

the high tech industries such as medical, biotech and electronics are associated with a higher probability and a greater number of patents.

Table 9 presents Poisson regressions for the time to IPO in years from the date of incorporation. Time to IPO provides an indication of the speed by which the firm is sufficiently professionalized whereby it can meet listing requirements and ongoing reporting requirements. Listing itself enables publicity benefits for the firm, as well as access to raising larger pools of external capital.

We present the full sample of firms (model 11), the subsample of firms that incorporated before 2000 (model 12), and the subsample of firms that incorporated after 2000 (model 13). The data indicate that VC-backed firms are more likely to go public quicker by an average of 0.8 years in the full sample (model 11), although this effect is statistically insignificant. For the firms that incorporated before 2000 this effect is more pronounced at 3.5 years quicker on average (model 12), and this effect is significant at the 1% level. However, for the subsample of firms incorporated after 2000, VC-backed firms are slower to go public by 2 years on average, and this effect is significant at the 10% level. By contrast, IIF firms are able to bring a firm to IPO quicker, if they were incorporated after 2000, by an average of 1.2 years, and this effect is significant at the 10% level. PE-backed firms take a longer time to go public in the full sample by 2.0 years on average (model 11) and by 3.9 years in the subsample of firms incorporated before 2000 (model 12). There is no material difference among PE-backed firms in the subsample after 2000.

The control variables in Table 10 show that younger firms end up going public quicker. In effect, this means that if the firm went public by 2012, it was a quick IPO. There is truncation in the regression insofar as we do not observe some IPOs that would take place at a later date. To account for this issue in other ways, we ran Cox proportional hazard models as well as two-step models where in the first step we predicted whether or not there was an IPO and then in the second step we considered the time to IPO. Our findings pertaining to VC, PE and IIFs are consistent regardless of

Table 9. Poisson Regressions for Time to IPO

This table presents Poisson regressions for the time to IPO in years from the date of incorporation. Variables are as defined in Table 1. The sample comprises IPO firms only; some missing observations are due to unknown dates for incorporation (excluding this variable and including those observations does not affect the main results). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

	(11) Time to IPO Full Sample		(12) Time to IPO Date of Incorporation <2000		(13) Time to IPO Date of Incorporate ≥2000	
	Marginal Effect	t-statistic	Marginal Effect	t-statistic	Marginal Effect	t-statistic
Type of Investor						
VC	-0.779	-0.78	-3.492	-2.33***	1.999	1.87*
PE	1.995	3.61***	3.892	4.23***	0.464	0.95
IIF	-0.274	-0.16	1.326	0.43	-1.222	-1.93*
Year Effects						
Year of Incorporation	-0.241	-86.74***	-0.329	-80.43***	-0.264	-5.97***
Regional Effects						
South Australia	1.488	3.02***	3.377	4.12***	-0.133	-0.27
Queensland	-0.981	-2.67***	-1.069	-1.78*	0.383	0.95
Victoria	1.621	4.83***	2.185	4.21***	-0.101	-0.27
ACT	-5.616	-2.31**	-9.705	-2.90***		
Tasmania	5.019	3.20***	8.040	3.19***	0.166	0.09
Western Australia	-1.268	-3.79***	-0.665	-1.23	-0.177	-0.61
Northern Territory	3.867	1.35	-0.108	-0.03		
Industry Effects						
Energy	3.346	3.04***	5.955	3.24***	-0.500	-0.91
Information Technology	1.494	1.29	-1.304	-0.86	-0.852	-1
Consulting	4.442	4.03***	5.237	3.19***	0.073	0.09
Biotech	2.069	2.19**	4.121	2.69***	-2.186	-6.16***
Medical	2.675	3.52***	2.336	2.07**	-0.097	-0.19
Electronic	0.598	0.65	1.434	0.98	-0.558	-0.4
Computer Hardware	-0.202	-0.14	-4.069	-2.31**		
Computer Software	-0.103	-0.1	-1.889	-1.22	-0.875	-1.37
Communications	1.139	1.27	-0.531	-0.43	-1.633	-3.13***
Services	2.668	4.85***	3.257	3.86***	-0.322	-0.8
Mining	2.623	5.10***	5.795	6.57***	-0.302	-0.72
Entertainment	-2.136	-1.56	-4.905	-2.45**	0.035	0.03
Advertising	5.625	2.15**	2.411	0.78		
Industrial	9.561	5.89***	8.624	4.19***	0.278	0.14
Construction	9.489	9.23***	11.031	7.75***	-0.517	-0.5
Auto	8.123	5.56***	8.086	4.07***	0.583	0.58
Supplies	2.303	4.78***	2.565	3.56***	-0.619	-1.18
Transportation	6.194	4.27***	6.324	3.12***	1.031	0.82
Retail	2.797	3.80***	3.993	3.53***	-1.593	-3.29***
Farming	-0.941	-1.63	-1.277	-1.37	0.091	0.13
Constant	43.834	114.02***	39.366	97.25***	217.068	5.86***
Number of Observations	667		439		228	
Pseudo R2	0.673		0.682		0.108	

which approach we take. Hence, we report regressions in a way that are consistent with the approach taken in our work on time to IPO, including Giot and Schwienbacher (2006), Nahata (2008), and Cumming and Johan (2009). A number of the other industry and regional variables are significant, as would be expected since time to fruition or IPO readiness can vary by industry or geographic proximity to institutional and retail investor bases.

Table 10 presents Poisson regressions for market capitalization. As in Table 9, we show the full sample (model 14) as well as the subsamples for pre- and post-2000 incorporations (models (15) and (16), respectively). The data indicate that, relative to non-VC/PE/IIF-backed firms, VC-backed firms have larger market capitalization in the full sample by $719.4 million and $1.0645 billion in the subsample of incorporations prior to 2000, but smaller market capitalization by $89.2 million on average in the subsample of incorporations after 2000. Relative to non-VC/PE/IIF-backed firms, PE-backed firms have smaller market capitalization in the full sample ($255.2 million lower), the subsample of incorporations prior to 2000 ($388.4 million lower), and the subsample of incorporations after 2000 ($58.1 million lower). By contrast, IIF-backed firms have on average lower market capitalization levels than the non-VC/PE/IIF subsample by $155.9 million for the full sample, $229.6 million in the subsample of incorporations prior to 2000, and higher market capitalization by $1.1 billion in the subsample after 2000. We note that, as expected, the IIF subsample result is based on a small subsample of 9 IIF-backed firms that went public; nevertheless, these findings are expected since outcomes of all VC-backed firms, government or otherwise, are driven by outliers that are commonly referred to as 'home-runs' (Cumming and Johan, 2009).

The control variables in Table 10 show that more recently incorporated firms have smaller market capitalization (by roughly $10 million for every extra year). More recently listed firms likewise have smaller market capitalization (by roughly $2 million for every additional year) in the full sample and the subsample of incorporations prior to 2000, while for the more recent incorporations after 2000 the more recently listed firms have greater market capitalization, effectively due to the market swings in the earlier part

Table 10. Poisson Regressions for Market Capitalization

This table presents Poisson regressions for market capitalization as at August 2012. Variables are as defined in Table 1. The sample comprises all firms (IPO or otherwise); some missing observations are due to unknown dates for incorporation (excluding this variable and including those observations does not affect the main results). *, **, *** Significant at the 10%, 5%, and 1% levels, respectively.

	(14) Market Capitalization Full Sample		(15) Market Capitalization Date of Incorporation <2000		(16) Market Capitalization Date of Incorporation ≥2000	
	Marginal Effect	t-statistic	Marginal Effect	t-statistic	Marginal Effect	t-statistic
Type of Investor						
VC	719.365	64.17***	1064.465	65.94***	-89.182	-33.64***
PE	-255.203	-198.04***	-388.385	-240.21***	-58.088	-37.61***
IIF	-155.918	-44.75***	-229.571	-54.29***	1113.970	7.69***
Year Effects						
Year of Incorporation	-9.423	-440.47***	-11.772	-358.24***	-13.344	-41.00***
Year of Listing	-2.893	-57.67***	-1.910	-27.37***	26.246	82.14***
Regional Effects						
South Australia	-94.341	-48.34***	-78.750	-26.57***	-103.316	-77.35***
Queensland	-15.131	-7.94***	-83.267	-34.04***	53.617	20.35***
Victoria	618.421	226.13***	680.670	201.09***	253.134	60.75***
ACT	16.805	0.78	19.559	0.69		
Tasmania	43.543	2.76***	-182.740	-13.09***	59.345	5.41***
Western Australia	-63.869	-49.31***	-36.085	-20.36***	-109.271	-59.24***
Northern Territory	-188.659	-39.50***	-288.980	-59.07***		
Industry Effects						
Energy	1786.728	94.72***	1986.396	85.51***	60.317	11.27***
Information Technology	14.697	2.02**	-103.260	-14.21	26.954	2.21**
Consulting	475.695	57.78***	450.828	48.18***	87.666	9.41***
Biotech	6.774	1.43	-147.657	-31.63***	297.366	23.10***
Medical	176.213	40.88***	219.334	38.99***	-115.618	-86.3***
Electronic	-331.579	-442.53***	-443.081	-400.13***	-98.123	-22.88***
Computer Hardware	-138.049	-26.79***	-226.416	-40.10***		
Computer Software	-139.142	-26.88***	-239.388	-40.55***	-89.204	-39.50***
Communications	134.497	29.06***	63.836	12.03***	265.326	22.41***
Services	584.990	126.59***	608.281	106.73***	33.558	11.51***
Mining	1710.510	223.05***	2755.475	187.34***	85.804	32.74***
Entertainment	610.029	38.37***	783.694	37.58***	-106.588	-53.09***
Advertising	356.108	12.41***	283.219	9.48***		
Industrial	-32.394	-4.47***	-100.190	-12.18***	-114.794	-92.65***
Construction	-61.898	-16.85***	-136.700	-32.45***	-65.153	-13.83***
Auto	-74.680	-15.30***	-141.065	-24.65***	-97.844	-35.83***
Supplies	-167.407	-130.44***	-238.067	-131.93***	-26.944	-9.10***
Transportation	844.626	54.04***	760.419	43.96***	204.887	16.60***
Retail	1615.302	147.80***	1727.643	134.51***	902.209	41.45***
Farming	-284.051	-239.90***	-372.959	-218.29***	-65.480	-13.36***
Constant	81.771	264.59***	70.074	212.22***	-214.990	-45.42***
Number of Observations	663		437		226	
Pseudo R2	0.582		0.587		0.394	

of the decade. A number of the industry and regional dummy variables are significant as would be expected where firm size and growth options depend on the industrial sector and geographic location.

4.2. Additional Robustness Checks

In the course of our analysis we considered a number of robustness checks, including but not limited to the following. First, we considered matched sample methods, including propensity score matching, based on industry, location, and age. Second, we considered other subsamples based on subsets of the data by year, industry, and region. Third, we considered other explanatory variables, including year dummy variables and proxies for market conditions. Fourth, we considered two-step methods to assess possible selection effects or endogeneity. In all cases the data yielded results that were similar to those reported in the regressions above, with the sole exception of some differences in findings where subsamples became too small. Fifth, and perhaps most interestingly, we considered, for the subset of data where the figures are available, the dollar amounts invested. Because IIF investments are smaller on average than non-IIF VC investments, which are likewise smaller on average than PE investments (Cumming, 2007), the economic impact of IIF and VC comes out even stronger on a dollar basis relative to PE and non-VC/PE/IIF-backed firms. However, since we do not have all of the dollar amounts (they are in Thomson SDC, but over half of the VC, PE and IIF investments are missing in Thomson SDC and/or misrecorded by stage and date), we simply focus on the dummy variables. If anything, our empirical measures therefore understate the economic impact of IIF and VC investments.

5. Conclusions

In this paper we introduced a new dataset to study the economic impact of VC, PE, and IIF investment in Australia from industry inception to 2012. We developed and empirically tested two main propositions: (1) that the governance provided by VC funds would yield pronounced economic impacts among VC-backed firms, and (2) that the

more intensive governance provided by government subsidized IIFs would yield an even more pronounced impact among IIF-backed firms.

The data indicate a number of important findings about the role of VC, PE, and IIF investment to the Australian economy which can be summarized as follows. First, it is important to keep in mind that before the IIF Program was introduced in 1997, early stage capital was close to nonexistent or scant in Australia. Since that time IIF and VC investments have played an important role making investments and supporting firms that would otherwise not exist.

Second, the data herein indicate that VC- and IIF-backed firms contribute disproportionately to R&D and patents. VC-backed firms account for 5.8% of the total number of comparable firms in the data sample and 0.04% in terms of company size as measured by total assets and 0.08% in terms of total sales, yet they contribute 9.9% to total amounts spent on R&D and account for 12.2% of patent filings and 26.2% of patent citations.[15] IIF-backed firms account for 1.1% of the total number of comparable firms and 0.01% in terms of company size as measured by total sales or assets, yet they contribute 1.9% to total amounts spent on R&D and account for 3.1% of patent filings and 4.7% of the patent citations. The massive differences in R&D and patents still hold in regression analyses controlling for other things being equal.

Third, controlling for other things being equal in regression analyses, after the passage of sufficient time, VC-backed firms have greater market capitalization relative to PE- and non-VC/PE/IIF-backed firms. IIF investments show the highest proportion of subsequent public listings, and controlling for other things being equal, IIF investments result in greater market capitalization relative to both VC- and PE-backed firms. Moreover, controlling for other things being equal, there is no evidence of lower levels of employment among VC- and IIF-backed firms, and PE backed firms have higher level of employment than non-VC/PE/IIF-backed firms.

[15] For these figures we winsorized at the 99% level, effectively not biasing results from Australian subsidiaries of large multinationals with very large numbers of patents. The numbers are calculated from Table 2 based on having sampled 40% of comparable firms; see *supra*, footnote 10 and accompanying text.

Overall, the data highlight a central role for VC and IIF investment in facilitating R&D, innovation, and economic growth, and for PE investments facilitating jobs. The data indicate an expansion of VC and IIF investments would facilitate more innovation and economic growth in Australia relative to the expansion of other sources of capital, particularly in view of the comparative dearth of VC investments in Australia relative to other countries.

References

Amit, R., J. Brander, and C. Zott, 1998. Why do venture capital firms exist? Theory and Canadian evidence, Journal of Business Venturing 13, 441-466.

Armour, J., and D.J. Cumming, 2006. The Legislative Road to Silicon Valley, Oxford Economic Papers 58, 596-635.

Audretsch, D.B., 2003. Standing on the Shoulders of Midgets: The U.S. Small Business Innovation Research Program (SBIR). Small Business Economics 20, 129–135.

Audretsch, D., 2007. The Entrepreneurial Society, Oxford: Oxford University Press.

Audretsch, D.B., Link, A.N., Scott, J.T., 2002. Public/private technology partnerships: evaluating SBIRsupported research. Research Policy 31, 145–158.

Bertoni, F., M.A. Ferrer, and J. Martí, 2012, The Different Role Played by Venture Capital and Private Equity Investors on the Investment Activity of Their Portfolio Firms, Small Business Economics, Forthcoming.

Bonini, S., Alkan S., Salvi, A., 2012. The effects of venture capitalists on the governance of firms. Corporate Governance: An International Review 20, 21–45.

Bruton, G.D., V.H. Fried, and S. Manigart, 2005. Institutional Influences on the Worldwide Expansion of Venture Capital, Entrepreneurship Theory and Practice, 29, 737–760.

Caselli S., S. Gatti and F. Perrini, 2009. Are venture capitalists a catalyst for innovation or do they simply exploit it?, European Financial Management Journal 15, 92-101.

Croce, A., J. Martí, and S. Murtinu, 2012., The Impact of Venture Capital on the Productivity Growth of European Entrepreneurial Firms: 'Screening' or 'Value added' Effect? Journal of Business Venturing, Forthcoming.

Cressy, R., F. Munari, and A. Malipiero, 2007. Playing to their strengths? Evidence that specialization in the private equity industry confers competitive advantage. Journal of Corporate Finance 13, 647–669.

Cumming, D.J., 2007. Government Policy towards Entrepreneurial Finance: Innovation Investment Funds Journal of Business Venturing 22, 193-235.

Cumming, D.J., G. Fleming and J.A. Suchard, 2005. Venture Capitalist Value Added Activities, Fundraising and Drawdowns, Journal of Banking and Finance 29, 295-331.

Cumming, D.J., and S.A. Johan, 2009. Venture Capital and Private Equity Contracting, Elsevier.

Cumming, D.J., and S.A. Johan, 2012. Is venture capital in crisis? World Economic Review (July-August), 69-72.

Cumming, D.J., and J. MacIntosh, 2006. Crowding Out Private Equity: Canadian Evidence, Journal of Business Venturing 21, 569-609.

Cumming, D.J., and J. MacIntosh, 2007. Mutual Funds that Invest in Private Equity? An Analysis of Labour Sponsored Investment Funds, Cambridge Journal of Economics 31, 445-487.

De Bettignies, J., 2008. Financing the entrepreneurial venture, Management Science 54, 151-166.

De Clercq, D. and H.J. Sapienza, 2005. When do venture capital firms learn from their investments? Entrepreneurship Theory & Practice 29, 4, 517-535.

Engel, D., and M. Keilbach, 2007. Firm-level implications of early stage venture capital investment – an empirical investigation, Journal of Empirical Finance 14, 150-167.

Gans, J., Hayes, R., 2010. Assessing Australia's Innovative Capacity: 2009 Update. IPRIA.

Gilson, R.J., 2003. Engineering a venture capital market: lessons from the American experience. Stanford Law Review 55, 1067– 1103.

Giot, P. and A. Schwienbacher, 2007. IPOs, Trade Sales and Liquidations: Modelling Venture Capital Exits Using Survival Analysis, Journal of Banking & Finance 31, 679-702

Gompers, P.A. and J. Lerner,2004. The Venture Capital Cycle. 2nd Ed. Cambridge: MIT Press.

Gravetter, F.J., and Wallnau, L.B., 2011. *Essentials of Statistics for the Behavioral Sciences, 7th Ed.,* Wadsworth: Belmont, CA.

Groh, A.P., von Liechtenstein, H., Lieser, K., 2010. The European Venture Capital and Private Equity country attractiveness indices. Journal of Corporate Finance 16, 205–224.

Groh, Alexander P., and Heinrich von Liechtenstein. 2011. The First Step of the Capital Flow from Institutions to Entrepreneurs: The Criteria for Sorting Venture Capital Funds, European Financial Management 17:3, 532-559.

Hazaruka, S., R. Nahata, and K. Tandon, 2009. Success in Global Venture Capital Investing: Do Institutional and Cultural Differences Matter? Working Paper, Baruch College.

Hirukawa, M. and M. Ueda, 2011. Venture Capital and Innovation: Which is First? Pacific Economic Review, Vol. 16, Issue 4, pp. 421-465, 2011.

Hirukawa, M. and M. Ueda, 2008. Venture Capital and Industrial 'Innovation', CEPR Discussion Paper No. DP7089.

Jääskeläinen, M., Maula, M., & Seppä, T. 2006. Allocation of attention to portfolio companies and the performance of venture capital firms. Entrepreneurship Theory & Practice, 30: 185-206.

Keuschnigg, C., and S.B. Nielsen, 2001. Public Policy for Venture Capital, International Tax and Public Finance 8, 557-572.

Keuschnigg, C., and S.B. Nielsen, 2003. Tax Policy, Venture Capital and Entrepreneurship, Journal of Public Economics, 87, 175-203.

Keuschnigg, C., and S.B. Nielsen, 2003b. Taxes and Venture Capital Support, Review of Finance 7, 515-539.

Keuschnigg, C., and S.B. Nielsen, 2004a. Progressive taxation, moral hazard, and entrepreneurship. Journal of Public Economic Theory 6, 471 – 490.

Keuschnigg, C., and S.B. Nielsen, 2004b. Start-ups, Venture Capitalists and the Capital Gains Tax, Journal of Public Economics, 88, 1011-1042.

Keuschnigg, C., and S.B. Nielsen, 2004c. Public Policy for Start-up Entrepreneurship with Venture Capital and Bank Finance. Working Paper, University of St. Gallen and Copenhagen Business School.

Leleux, B., and B. Surlemont, 2003. Public versus private venture capital: seeding or crowding out? A Pan-European analysis. Journal of Business Venturing 18, 81-104.

Lerner, J., 2009. Boulevard of Broken Dreams: Why Public Efforts to Boost Entrepreneurship and Venture Capital Have Failed – and What to Do about It, Princeton University Press.

Samila, S. and O. Sorenson, 2011. Venture capital, entrepreneurship, and regional economic growth, Review of Economics and Statistics 93,338-349.

Schwienbacher, A. 2007. A Theoretical Analysis of Optimal Financing Strategies for Different Types of Capital-Constrained Entrepreneurs, Journal of Business Venturing 22, 753-781.

Yung, C., 2009. Entrepreneurial Financing and Costly Due Diligence, The Financial Review 44, 137-149.