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Josh Lerner: recipient of the 2010 Global Award for Entrepreneurship Research

Pontus Braunerhjelm · Simon C. Parker

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Abstract This article describes the academic contributions of the 2010 recipient of the *Global Award for Entrepreneurship Research*, Professor Josh Lerner of the Harvard Business School. Lerner's empirical research on the inter-relationship between venture capital, innovation and entrepreneurship has greatly extended and improved our understanding of one of the major drivers of growth in modern economies. The first part of this article explains Lerner's contributions as regards the structure and organization of the venture capital industry. Later, his most important publications on entrepreneurship, innovation and intellectual property rights are surveyed. Several aspects of Lerner's policy-oriented work are then outlined, before the article closes with a brief conclusion.

Keywords Global Award · Venture capital · Patent · Entrepreneurship · Innovation

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P. Braunerhjelm (✉)
Swedish Entrepreneurship Forum, Kungsgatan 33, Stockholm, Sweden
e-mail: pontus.braunerhjelm@entreprenorskapsforum.se

P. Braunerhjelm
Department of Transport and Economics, Royal Institute of Technology, 100 44 Stockholm, Sweden

S. C. Parker
University of Western Ontario, London, ON, Canada

1 Introduction

The field of entrepreneurship draws from and integrates theory and empirics from several different subject disciplines, including business and management, economics, and finance. Entrepreneurship research regularly appears in top-tier journals in all of these disciplines, as well as management-based specialist entrepreneurship journals. One of the most prominent international scholars in this field of research is Josh Lerner, the Jacob H. Schiff Professor at Harvard Business School (HBS). He holds joint appointments in the Financial and Entrepreneurial Management units of Harvard University. Lerner's pioneering research focuses on the structure and organization of venture capital (VC), and explores how VC stimulates innovation and entrepreneurship. His numerous and varied contributions have been instrumental in turning entrepreneurship into one of the fastest growing and most relevant fields of research in the last decades. Josh Lerner's contributions are unusual in terms of their sheer number and impact, and make him a deserving winner of the 2010 *Global Award for Entrepreneurship Research*.[1]

[1] The Global Award is a direct continuation of the International Award for Entrepreneurship and Small Business

This article meditates on his impressive and influential corpus of work, which has changed the way scholars, practitioners and policymakers think about VC financing of new high-value enterprises, innovation and entrepreneurship.

It should be noted at the outset that Lerner's influence spans a broader domain than just his publications alone. Josh Lerner founded, secured funding for, and still organizes two groups at the National Bureau of Economic Research: the Entrepreneurship Working Group and the Innovation Policy and the Economy Group. These groups' activities play a vital role integrating current issues in entrepreneurship with mainstream economics and finance research at the highest level of scholarship.

Josh Lerner's teaching has also been highly influential. He created and continues to deliver one of HBS's most popular electives on VC and private equity. In addition, he teaches a popular doctoral course on entrepreneurship at HBS. The course materials for his HBS elective have been collected in a published casebook, *Venture Capital and Private Equity*, now in its fourth edition. Josh Lerner also recently led an international team of scholars in a study of the economic impact of private equity for the World Economic Forum.

Yet Josh Lerner is probably best known for his pioneering research on VC and VC-backed entrepreneurship. He is justly regarded as one of the world's leading authorities in this area. One of Lerner's hallmarks is his ability to bring analytical rigor to bear on rich data sets and address questions of first-order importance in entrepreneurial finance. He likes to explore competing explanations of the questions under study, before going onto determine which of them are most consistent with the evidence. This often gives rise to a nuanced and rich account of how the VC sector operates. Thanks to his efforts in this regard, we now know a great deal more about the structure, operation and performance of the formal venture capital industry. In a series of brilliant single- and jointly-authored articles (many with Paul Gompers), Josh Lerner has shaped our modern analysis of VC-backed entrepreneurship.

Even though many of Lerner's best-known contributions describe the structure of the VC industry, he contributes regularly to a host of other research areas as well. These include industry research alliances; patents and open-source innovation development; and the design of public policies aimed at promoting VC-backed entrepreneurship. A consistent thread linking VC, innovation and entrepreneurship is evident throughout his work.

The remainder of this article is organized in the following way. The next section briefly discusses why VC is important from a societal perspective. Thereafter Lerner's contributions with regard to the structure and organization of the VC industry are discussed, followed by a survey of Lerner's insights about the relationship between VC, entrepreneurship and innovation. This is followed by a brief overview of Lerner's important contributions to the intricate issue of designing effective public policies to promote VC-backed entrepreneurship. The article closes with a brief summary of the reasons why Josh Lerner's research makes him a worthy recipient of the *Global Award for Entrepreneurship Research* prize.

2 Why VC matters

It is now well known that formal venture capital plays a prominent role in the financing of high-growth and high-tech entrepreneurial ventures. In the recent past, these have included Apple, Google, Amazon, Federal Express, and eBay (among many others). VC finance is "narrow but deep"—few entrepreneurs use it, but those who do can access very large sums of funding. For example, although venture capitalists finance only 1 or 2% of all new businesses in the USA, the proportion of initial public offerings backed by VC increased from around 10% in 1980 to over 50% in 2000. VC investments tend to be concentrated in cutting-edge, innovative sectors of the economy, including ICT, biotechnology, and health care. Taken together, VC-backed enterprises are a major engine of growth in modern economies.

Despite the VC industry's size and importance, many misconceptions about the nature and role of

Footnote 1 continued
Research, first launched in 1996 by the Swedish Entrepreneurship Forum (then Foundation for Small Business Research, FSF) and the Swedish Agency for Economic and Regional Growth. Thanks to a generous donation by the Swedish industrialist Rune Andersson of Mellby Gård AB, the Research Institute of Industrial Economics (IFN) joined these two organizations in giving the prize in 2009. The prize consists of 100,000 Euros and the statuette "Hand of God," created by the internationally renowned sculptor Carl Milles.

venture capitalists have marked recent history. Josh Lerner's research has helped dispel many of these false impressions, shedding new light on this crucial source of entrepreneurial finance. His research has also been unusually fertile: four of his path-breaking articles on VC published between 1994 and 1996 (all but one of which was single-authored) have received a total of over 2,000 Google Scholar citations and 415 ISI citations as of January 2010. His research appears in the top peer-reviewed academic journals in economics and finance, subjects in which he is justly regarded as a leading figure. Arguably, though, these papers are not even his most influential contributions. The first two editions of his well-known book, *The Venture Capital Cycle* (Gompers and Lerner 2006), co-authored with Paul Gompers, has registered over 1,300 Google Scholar citations at the time of writing. It is justly regarded as the "bible" of VC-backed entrepreneurship, and has been established as the standard reference text in the area.

A good introduction to the impact and importance of the VC revolution up until the early 1990s is the survey article by Gompers and Lerner (2001). They commenced their review with a brief historical overview of the VC industry in the United States and how institutional changes have evolved and shaped the industry over time. They contrasted the VC industry as a vehicle to commercialize new ideas with the traditional organization of corporate R&D labs.

Gompers and Lerner (2001) argue that in order to understand the VC industry, the entire venture cycle and its different stages—raising funds, investment/monitoring/adding value, exits, and raising new funds—must be considered. Gompers and Lerner then explain how the emergence of the VC cycle was driven by macro-level policies and institutional changes, in particular reforms to the tax system and changes to the regulatory environment. These changes were accompanied by the development of novel contractual compensation structures by VC firms themselves, including convertible contracts and staged capital infusions. Finally, Gompers and Lerner describe the performance of the VC industry in terms of investments, exits, and the rate of return. All in all, the Gompers and Lerner (2001) article is an excellent introduction into the subject of the VC industry and its extensive impact on the economy.

3 The structure and organization of the venture capital industry

Until the 1990s, academic understanding of VC as a source of entrepreneurial finance was rather limited. In particular, several structural features of the VC industry lacked explanation and rationale. A rigorous research agenda addressing the following questions was still in its infancy: why do venture capitalists syndicate their investments? What is the role of covenants in VC funds? What lays behind the decision of venture capitalists to take their entrepreneurial ventures public? How exactly do venture capitalists use their positions on the boards of new ventures to add value? How are venture capitalists compensated, and how do the funds they raise from external investors affect the performance of the entrepreneurial ventures they finance?

Josh Lerner has addressed these and several other questions in several influential empirical articles. Much of this research exploits rich datasets of VC-backed ventures, especially VC-backed American private biotechnology firms.[2] Lerner's articles not only illuminate important aspects of the VC financing process, but also highlight the heterogeneity of venture capitalists' expertise (see, e.g., Gompers and Lerner 1996, 1999; Gompers et al. 2006). In an analysis of 140 partnership agreements establishing VC funds, Gompers and Lerner (1996) report striking diversity in venture capitalists' use of covenants, a finding which is consistent with two alternative hypotheses about covenant usage: a response to agency problems, or a response to variations in the supply of and demand for VC.

Josh Lerner's work has revealed several important findings about the contours of the VC landscape. For example, Lerner's (1994a) analysis of 271 private US biotechnology firms showed that syndication among different venture capitalist firms is very common, even in first-round investments; the pairings of venture capitalists with each other depend on the stage of the financing round. He also finds support for his "second opinion" hypothesis, namely that syndication takes

[2] Several articles utilize a unique biotech sample, spanning the years 1978–1992, compiled by the organization Venture Economics. According to Lerner, the biotech sector is particularly interesting due to its innovativeness and its less capital-intensive nature, among other aspects.

place in order to process the views of other VC firms on the future potential of conceivable portfolio firms. Recent evidence suggests that about nine out of every ten deals in the United States VC industry are syndicated.

Subsequent research has developed these ideas in several ways. This includes identifying optimal forms of syndicated VC contracts (Tykvová 2007), and digging deeper into the advantages that syndication offers venture capitalists (see, e.g., Casamatta and Haritchabalet 2007). In short, Lerner's research has stimulated a rich and diverse literature on this important aspect of entrepreneurial finance.

In another important contribution, Lerner (1994b) established that venture capitalists are more likely to take a venture public when equity valuations are high—and more likely to employ private financing when values are low. Experienced venture capitalists appear to be especially well-placed to command high prices at the time of IPO. Furthermore, VC funds obtain higher returns from investing in serial entrepreneurs than in novice entrepreneurs, yet the serial entrepreneurs themselves cannot command higher prices for the equity they sell (Kaplan and Stromberg 2003; Gompers et al. 2006). These findings are consistent with an imperfectly competitive VC market, or at least a VC market in which the "top dogs" command a premium. This comes back to the idea of diversity among venture capitalists and underlies the importance of certification, whereby backing by a prominent VC can signal quality and reputation, which can then attract additional investors (Amit et al. 1998). Much subsequent work has built on this insight, showing that entrepreneurs frequently accept financing offers with lower valuations in order to ally with more prominent venture capitalists, consistent with the certification hypothesis (see, e.g., Hsu 2004). These findings carry several far-reaching implications for venture capitalists and those entrepreneurs seeking finance from them.

Certification is one of three major ways that venture capitalists can add value to fledgling entrepreneurial ventures. A second is by monitoring, i.e. exercising oversight of the ventures in their portfolio of companies. Although it had been known for some time that venture capitalists are active monitors (Gorman and Sahlman 1989; Sahlman 1990), it was Josh Lerner who obtained decisive evidence linking monitoring to venture capitalists' oversight role. Lerner (1995a) reported that the representation of venture capitalists on boards of directors significantly increases (by 1.75 venture capitalists on average) when the need for monitoring is greatest (e.g. when CEOs are replaced), whereas no such statistically significant difference could be found for other board members. This is what might be expected, given that these firms have relatively few tangible assets, thus necessitating more monitoring. Lerner (1994b) also shows that geographical proximity matters when it comes time to recruit board members. They are about twice as likely to be recruited from organizations within a range of 5 miles than those within a 500 mile radius. In addition, more than 50% of the firms have a venture director with an office situated within 60 miles from the firm's headquarters.

Subsequent work has built on Lerner's analysis by showing that venture capitalists shape the top management teams of the companies in which they invest, and allocate decision and control rights in a manner that facilitates post-investment monitoring activities (Kaplan and Stromberg 2001, 2003).

Getting "behind the scenes" to examine the primary source of VC funding has long been, and continues to be, an important priority in entrepreneurship research on venture capital (Mason 2006). Much of what we know about compensation in VC partnerships, fundraising by venture capitalists and the impact of fund inflows on private equity valuations can be traced to several seminal articles by Josh Lerner in collaboration with Paul Gompers (see in particular Gompers and Lerner 1998, 1999, 2000; for overviews, see Gompers and Lerner 2001, 2006).

This body of research highlights the importance of reputational capital, and thereby explains the differential structure of venture capitalist compensation by age and size. This stands in contrast to long-standing concerns that there is too little debt finance to supply the demand for entrepreneurial finance (Parker 2002). Gompers and Lerner argue the opposite about equity markets, where "money chasing deals" can often be found. The idea that there is a limited supply of very attractive entrepreneurial prospects, and an abundance of capital that bids for them, is not a new one (see, e.g., Dixon 1991), but the rigorous econometric evidence Josh Lerner has brought to bear on this topic makes the claim much more convincing. At the same time, Lerner's evidence can help to resolve an important puzzle, namely why it is that capital inflows into VC funds boost the value of these funds'

new investments without increasing the ventures' ultimate likelihood of success.

To summarize so far, by the end of the 1990s Josh Lerner's research was already unearthing crucial but hitherto imperfectly understood aspects of the VC industry's structure. This research was based on large comprehensive datasets that were analyzed using robust statistical methods designed to overcome pitfalls associated with endogeneity and selection biases. Far from being content with merely *describing* the structure of the VC industry, Lerner has sought to *explain* it, drawing on his wide-ranging knowledge of cutting-edge theory in economics, finance and other disciplines in the social sciences.

4 Venture capital, entrepreneurship and innovation

Entrepreneurial innovation is intimately connected to venture capital. Lerner has made several important contributions to the topic of entrepreneurial innovation, alliances and patent strategies, and open-source project development.

4.1 Innovation, entrepreneurship and firm level growth

Venture capitalists add value to new entrepreneurial ventures by enhancing their innovative capacity. Although it had already been known for some time that venture capitalists offer expertise as well as funding as part of the VC package, Lerner's empirical work expressed their role in promoting innovation in precise numbers. In a groundbreaking paper, Kortum and Lerner (2000) present the first systematic analysis of the influence of VC on patented inventions in the United States across 20 industries and three decades. They use a theoretical model in which innovations are predicted to decrease following higher costs of venture funds but increase as the value of inventions—an extension of technological opportunities—goes up. Venture funding is also predicted to increase relative to corporate R&D in accordance with the radicalness of innovations. In their empirical analysis, which implements both industry- and firm-level data, Kortum and Lerner (2000) recognize that venture capitalists help enterprises become more innovative, but also acknowledge that there might also be self-selection whereby more innovative firms choose VC as a source of finance. They also detailed an endogeneity problem in which both VC and patenting could be driven by a third unobservable factor, such as an increase in technological opportunities due to increased R&D and/or technological breakthroughs. To overcome these potential selection and endogeneity biases, Kortum and Lerner first instrumented the explanatory variable of venture capital by an exogenous policy regime change, namely the introduction of the Retirement Income Security Act, which freed pensions funds to invest in VC funds. Kortum and Lerner also used R&D expenditures as a control for increased technological opportunities.

Kortum and Lerner (2000) find that a dollar of venture capital is three to four times more potent on average in terms of innovative performance than a dollar of traditional corporate R&D. They also estimated that VC may have accounted for as much as 8% of industrial innovations in the period under study, even though the ratio of VC to R&D averaged less than 3%. Their central results were robust to using quality-adjusted patent data and involvement in litigation processes as measures of valuable innovations.

Again, Lerner's pathbreaking work has opened up avenues for subsequent researchers to build on, including the impact of VC on venture size and growth, and employment creation (Belke et al. 2005; Colombo and Grilli 2005). Lerner's emphasis on the productive long-term effects of VC-backed entrepreneurship has stimulated another line of research too, namely the possibility that VC-backed enterprises can "spawn" new VC-backed high-value enterprises. Josh Lerner was one of the authors of a prominent recent article that analyzes exactly this issue (Gompers et al. 2005). There is plenty of evidence that points to the fact that "entrepreneurial spawning" does exist, and that it can cause value-creation by VC-backed entrepreneurship to cascade through generations of new start-ups. For example, the "Traitorous Eight" left Shockley Labs to create Fairchild Semiconductor, which later saw its own employees start National Semiconductor, Intel, AMD and LSI Logic, which in turn became parents to Cypress, Zilog, Sierra Semiconductor, and many other semiconductor companies (Hellmann 2007, p. 919). Gompers et al. (2005) show that parent companies of new American VC-backed start-ups tend to be VC-financed themselves and are

located in high-tech clusters such as Silicon Valley or Massachusetts Route 128. Entrepreneurial learning and networks appear to be the channel by which "offspring" of parent firms survive and prosper in the spawning process.

4.2 Alliance and patent strategies

Venture capital is clearly a potent source of funding for entrepreneurial innovation. But what if the business cycle is in a downturn, so the supply of VC is scarce? This happened after the dot.com crash in 2000, for example. It leads one to wonder what innovative new ventures can do in response to limited external VC, and what implications this may have for the development of their innovations.

These are questions of first-order practical significance. Using data on US R&D biotechnology companies, Josh Lerner tried to answer them in two jointly authored papers (Lerner and Merges 1998; Lerner et al. 2003). He argued that alliances with larger corporate partners can be an important source of finance, especially when equity financing is in a downturn. However, alliances come at a price. Entrepreneurs who sign alliance agreements when only limited external equity financing is available are more likely to assign the bulk of the control rights to the larger corporate partner. The fewer internal resources possessed by the entrepreneurial venture, the more control rights they tend to sign away to the corporate partner—which is in turn consistent with microeconomic theory (Aghion and Tirole 1994). Problematically, though, agreements in which entrepreneurs only have limited control rights often end up less successful, and are more likely to be renegotiated if and when financial market conditions improve (Lerner et al. 2003).

These findings proffer a significant implication for public policy: business cycles in the VC industry can have important effects on the real economy. This provides another channel linking financial and entrepreneurial activity to economic performance. Lerner's findings also inform entrepreneurs about appropriate innovation strategies. In particular, he highlights the possibility that some alliances might actually destroy value for all parties.

Another strategic issue for entrepreneurs is patenting. An obvious practical question to ask here is whether entrepreneurs should aim for a broad or narrow patent scope when they come to register their patents. A related question is whether the decision of patenting scope is affected by the existence of competitors who hold patents in a similar area, given the threat of litigation and the costs it entails. Clearly, the answers to these questions are of direct relevance for innovative entrepreneurs who take the patenting route to try to secure protection of their intellectual property rights.

Lerner's findings in this regard are interesting and important. Using a sample of 535 financing rounds at 173 privately held VC-backed biotechnology companies, Lerner (1994c) showed that the broader a company's patent protection, the higher its value, and significantly so. For example, a one standard deviation increase in average patent scope is associated with a 21% increase in the firm's value. Broad patents are more valuable when substitutes in the same product class are plentiful, a finding consistent with prior theoretical research. In a subsequent paper (Lerner 1995b) using the same dataset, Lerner shows how firms with high litigation costs are less likely to seek patents in areas in which many other patents have been awarded, particularly those of rivals who have low litigation costs. Simultaneously, firms with high potential litigation costs will take precautions to avoid harming others. As in all of Josh Lerner's other work, these findings satisfy various tests of robustness designed to allow for alternative interpretations.

Together with Samuel Kortum, Lerner set out to identify the reasons behind the marked increase in patenting since 1985 in the United States (Kortum and Lerner 1998a, b). As a starting point, they noted little change in the institutions governing patenting between 1836 and 1945, even though patent activity fluctuated considerably. In particular, the 1930s has been called the "golden age" of patenting. Yet the end of the 1970s and beginning of the 1980s witnessed the establishment of some substantial institutional changes associated with patenting, including changed procedures at patent offices, longer patent durations, the installment of a special court, and the introduction of the Bayh-Dole act. Based on these changes, Kortum and Lerner proposed the "friendly court" hypothesis, which links the increase in patents to the development of a more conducive institutional set-up. They contrast that hypothesis with two other hypotheses—the "fertile technology" hypothesis (i.e. previous technological

advances spur patenting) and the "regulatory-capture" hypothesis (i.e. interactions between regulators and a set of firms that can be expected to benefit from increased patenting).

In short, Kortum and Lerner (1998a, b) ask whether institutional changes or factors related to increased R&D-spending and intensified lobbying explain the observed surge in patenting activity. By comparing the distribution of patents across countries and industries they conclude that the evidence is most consistent with the "fertile-technology" hypothesis. Because the observed trends occurred on a global basis and cut across differing industries and firm sizes, the other two hypotheses just don't explain the facts. Still, Kortum and Lerner acknowledge that changes in the management of innovation (a reallocation towards more applied activities) may have also influenced patenting activity.

A similar theme was pursued in a joint publication by Jaffe and Lerner (2004). According to these authors, the patent system has historically been beneficial to innovation, growth and prosperity. More recently, though, the efficiency of the US system has been questioned, since, the authors write, it inflicts high costs and wastes resources, affecting some of the most important and creative US firms and hindering innovation. In particular, patents are claimed to be granted for trivial or already known findings, or are used as a strategic instrument to harass rather than protect inventors and innovators. To address these issues, the authors argue for reinforced intellectual property rights (IPRs), including more adequate information for patent offices so the "right" inventions receive patents; clear incentive structures that minimize the abuse of IPRs; and measures that limit currently excessive litigation practices and reduce the role of lawyers.

4.3 Open source

"Open source" offers a more cooperative type of new product development, especially of computer software, allowing numerous programmers located in different places and in different organizations to share code and refine programs. The literature on this topic is still in its early stages, but once again Josh Lerner has made his mark on it with two pioneering contributions (Lerner and Tirole 2002, 2005). Both of these papers have already stimulated interesting research questions and have furnished some intriguing findings. These articles are set to become classics in their own right as the literature explores their themes and advances our understanding of what is likely to be an increasingly important mode of commercialization.

Lerner and Tirole (2002) attribute the increase in open source software development to three causes: (a) rapid diffusion via the Internet, (b) significant capital investments in open source projects, and (c) the new organizational structure of economic activities. They seek to answer the question of how open source can be integrated with mainstream economic theories. Drawing on four firm level case studies elaborated in detail—Apache, Linux, Perl and Sendmail—they show that the development of open source can be realigned with much of economic theory, particularly labor economics ("career concerns") and industrial organization.

Lerner and Tirole divide the development of open source activities into three distinct periods. The first, stretching from the early 1960s to the early 1980s, is referred to as the corporate "open source" era. It was based on informal exchange of software between corporations rather than institutionalized dialogue. In the second period, lasting between the early 1980s through 1990, the Free Software Foundation was established to promote access to software and underlying codes (note the difference to shareware, in which source code is not free). Finally, the last period encompasses the Internet revolution of the early 1990s through the time of article's publication (2002), during which Linux—perhaps the first true open source software—was launched, together with the organization that distributes the operating system.[3]

Looking at the developments from the perspective of economic theory, several interesting issues emerge. The authors focus on four, the first being the factors that actually motivate programmers. In principle, they can be expected to participate if they enjoy discernible benefits from engaging in open source development. Tentative benefits could be associated with signaling incentives, namely the possibility to make their talent visible. The second question refers to how the differences between open and closed source programming can be described, and the implications of such differences. Together with the fact of lower

[3] The organization Debian provided not only the software but also more general guidelines about free software and how it should be defined (see www.debian.org).

programming costs, an "alumni effect" may materialize, since the software is freely available and consequently already known to many users. Customization and bug-fixing benefits may also be obtained at lower costs for open software. The third issue relates to the presence of any evidence of individual incentives. Lerner and Tirole (2002) claim that obvious user benefits occur when credit is given to the "authors" of software programs, and rewards exist in terms of reputational benefits. In addition, open source programmers may enjoy being their own bosses. It could also lead to a more fluid labor market where competencies are less idiosyncratic. Finally, Lerner and Tirole raise the issue of governance and organization. Open source solutions are characterized by modularity, implying that projects can be disaggregated into smaller units which are then tackled individually. The governance structure is loose, so programmers have to trust in the project leader and respect improvements in the open source software. Hence, open source is quite elitist and primarily engages sophisticated users.

A related issue concerns how commercial software companies react to open source. Employers might wish to discourage their top programmers from getting involved, since they might become more visible and subsequently be poached by rivals. But, according to Lerner and Tirole, open source can also create new business opportunities for incumbents. Firms can employ a symbiotic strategy by offering complementary products to open source software, thereby raising their own profits. Similarly, firms can also take a proactive role in the development of open source and provide complementary services. Such a strategy could be applied in the case of companies being too small to compete in the primary segment, or when they lag behind the market leader.

Hence, much of open source economics can be aligned with mainstream economics, although some puzzles remain to be solved. For instance, as open source development matures, typical commercial software problems are likely to emerge, such as synchronization of upgrades and the efficient level of backward compatibility. The influence of open source on the competitive environment is also still largely unknown, and how much success open source has had in battling dominant firms remains unknown. The life span of open source also needs to be examined more closely, as do issues related to free riding and hijacking, i.e. offering proprietary rights to commercial firms.

5 The political economy of venture capital

Josh Lerner discusses the policy implications of his research on VC on every occasion. Perhaps this is best illustrated in Lerner's paper (1999) drawing on experiences of the US Small Business Innovation Research (SBIR) program, and his recent (Lerner 2009a) book, *The Boulevard of Broken Dreams*. The SBIR program was established in 1982 to address concerns about the competitiveness of US industry. The program aims to increase the share of procurement contracts going to small firms from the largest federal R&D agencies and to increase the commercialization of federally-funded research. SBIR expenditure is confined to contracts for the development of new technology needed by government agencies. The program is effectively a seed fund which provides full funding for project awards, thereby significantly reducing the risk of additional finance provided by outside equity providers.

Lerner (1999) evaluated the SBIR program using a unique matched sample of firms over a 10 year period, some of which received public funds and some of which did not. Lerner showed that program awardees located in areas with substantial VC activity grew substantially faster than non-awardees, especially in high-technology industries. However, larger subsidies alone did not lead to better performance, a finding that seems to be consistent with the certification hypothesis alluded to above.

SBIR is widely admired both within and outside the United States as an effective vehicle of government intervention for promoting VC-backed innovative entrepreneurship. Its reputation outside the USA has been enhanced in no small part by Lerner's (1999) findings. The SBIR program certainly seems to be more effective than public-sector VC schemes, such as the "Labor Sponsored VC Corporations" introduced by the federal government of Canada in the late twentieth century. The program offers generous tax subsidies to investors, which have fuelled its rapid expansion despite resulting in lower-than-average performance. There is compelling evidence to suggest that these public corporations have crowded out private VC and reduced the average performance of Canadian equity finance (Cumming and MacIntosh 2006).

In the light of this, what advice should be given to governments seeking to design effective public venture

capital programs? Josh Lerner has contributed directly to this relevant policy question as well. In Lerner (2002, 2009a), he highlights a common fault of government efforts in this regard: the presumption that political considerations can be divorced from hard-nosed business considerations when evaluating venture investments. Gompers and Lerner (1999) warn governments against trying to emulate VC-like decision-making on individual projects, a practice known as "picking winners." Decision-making of this kind requires specialized expertise and profit-seeking motives that government agencies generally lack. In addition, Jaffe and Lerner (2004) and Lerner (2009a) chronicle the problem of "regulatory capture", whereby powerful entrepreneurs can gain disproportionate benefits from public VC schemes. But this does not mean that public policy lacks a constructive role, provided that government officials seek to understand the business environment in which young, high-tech firms operate. Lerner (2002) argues that officials can add value as long as they are willing to learn from the VC industry in the following ways: concentrate on unfashionable but promising ventures rather than on "hot" sectors where a lot of private funding already reigns; provide follow-up financing when private flows of capital begin drying up; appreciate the need for flexibility in decision-making; and evaluate high-performers and under-achievers.

Building on these arguments, Lerner (2009a) contends that much of public policy has a truncated time horizon, offering in turn direct state support in ways that result in a perverse incentive structure. In contrast, he stresses four general areas of particular importance that provide the basis of effective public policy. First, the quality of infra-structure—broadly defined as roads, airports, education, and legal systems, and so forth—provides the basis for sound framework conditions. Second, in most cases it is insufficient demand for venture capital (the deal-flow), rather than the supply, that hampers innovation and entrepreneurship. Hence, the incentives to engage in productive entrepreneurship must be properly set. Third, general measures to reinforce already competitive or spontaneously emerging industries should be preferred over more targeted policy initiatives. Fourth, heeding institutional best practice is an effective and a cost–efficient way to improve conditions for entrepreneurial and innovative activities. Given the increasingly global nature of high-tech entrepreneurship, policymakers should benchmark and evaluate measures introduced in other countries.

6 Conclusion

Josh Lerner is a superstar, a contemporary giant of entrepreneurship scholarship in the domain of VC-backed business venturing. His empirical research on the inter-relationships between venture capital, innovation, and entrepreneurship has greatly extended and improved our understanding of one of the engines of modern economic growth. Most new ventures are mundane, repetitive, and of marginal economic importance (Baumol et al. 2007), so it is noteworthy that Josh Lerner has consistently focused his attention on the small minority of start-ups that innovate, attempt to create spectacular economic value, and go on (in some cases) to become the world-beating "gazelles" of tomorrow. Venture capital is an integral part of this story. And Josh Lerner's scholarly contributions are an integral part of the modern venture capital literature.

In terms of the extent to which he has informed and changed our ideas about VC-backed entrepreneurship and innovation, reflected in the consistently high number of citations his many research papers receive in leading journals in economics and finance, Josh Lerner's contributions are without parallel. What's more, his prodigious rate of academic output does not seem to be letting up (see, e.g., Lerner 2009a, b; Gompers et al. 2009; Chen et al. 2010). If entrepreneurship does indeed end up become integrated into "mainstream" economics and finance, rectifying the long-standing disjunction of the two fields noted long ago by William Baumol (1968), Josh Lerner will undoubtedly enjoy a large part of the credit.

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