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# Government Incentives for Entrepreneurship

Josh Lerner

## 7.1 Introduction

In the dozen years since the global financial crisis, there has been a surge of interest on the part of governments in promoting entrepreneurial activity, largely by providing financing (Bai et al. 2020). This chapter explores these policies, focusing on financial incentives to entrepreneurs and the intermediaries who fund them. (Other chapters in this volume discuss related policies to create a general business environment conducive to entrepreneurship and innovation, such as through the tax code, cluster development, and labor force reforms.)

The motivation for these efforts is clear: the well-documented relationships between economic growth, innovation, entrepreneurship, and venture capital. Yet despite good intentions, many of these public initiatives have ended in disappointment. To cite several examples from the past decade:

- The US Department of Energy's (DOE) clean energy initiative was created in 2005 but remained unfunded until 2009, when it received financing as part of the American Recovery and Reinvestment (also known

Josh Lerner is the Jacob H. Schiff Professor of Investment Banking at Harvard Business School and a research associate and codirector of the Productivity, Innovation, and Entrepreneurship Program at the National Bureau of Economic Research.

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as the Stimulus) Act.[1] The program was to provide loan guarantees and direct grants to risky but potentially rewarding energy projects that may otherwise have been too risky to attract private investment. More than $34 billion was spent in less than four years, which was almost $2 billion more than the total private VC investment in the field. The proposed investments were controversial at the time. As one organization protesting the program noted, "DOE has minimal experience administering a loan guarantee program, and its one test case ended with taxpayers paying a heavy price. In the late 1970s and early 1980s, DOE offered billions in loan guarantees for the development of synthetic fuels. Due in large part to poor administration and market changes, the federal government was forced to pay billions to cover the losses" ("Oppose Wasteful $10 Billion Increase," 2010). These worries proved prescient. The enormous scale of the public investment appears to have crowded out and replaced most private spending in this area, as VCs waited on the sidelines to see where the public funds would go. Moreover, in the wake of extensive industry lobbying, the investment decisions of government administrators led to a number of bankruptcies (e.g., Solyndra, A123 Systems, Beacon Power).[2] Rather than being stimulated, cleantech has fallen from 14.9 percent of venture investments in 2009 to 1.5 percent of capital deployed in the first nine months of 2019.[3]

- The Saudi government has spent many tens of billions of dollars seeking to promote venture capital activity in the kingdom.[4] These have included a wide variety of regulatory reforms (creating, for instance, a second-tier market for entrepreneurial listings and facilitating the business registration process), the establishment of venture funds and regional hubs (often in conjunction with new universities), and global venture capital investments. In the last regard, the most notable was a

1. See, for instance, Gold (2009), Kao (2013), Kirsner (2009), Mullaney (2009), and Sposito (2009).

2. Evaluating the return from these start-up investments is very difficult. As far as I can tell, the numerous evaluations of these programs by government agencies and academics have not attempted to compute one. Much of the difficulty stems from the fact that payments were made under a variety of programs (e.g., the 1705 Loan Guarantee Program and the Advanced Technology Vehicle Manufacturing Loan Program), and payments to start-ups were mingled with those to established entities like Goldman Sachs and NRG Energy, where the bankruptcy risk was presumably much lower (though the rationale for public funding may have been so as well) (Lipton and Krauss 2011). But given that public funding went to some of the most spectacular start-up bankruptcies in the sector, and that even independent venture capital investments in this sector between the beginning of 2008 and the third quarter of 2019 have yielded (according to Sand Hill Econometrics) an annualized loss of –2.6 percent (before accounting for fees), it is hard to be optimistic about the performance of the investments in entrepreneurial firms as part of this initiative.

3. Based on the author's analysis of data from Sand Hill Econometrics.

4. This paragraph is based on Seoudi and Mahmoud (2016), Sindi (2015), and assorted press accounts.

commitment of $45 billion by the Saudi Public Investment Fund—a Saudi sovereign wealth fund whose stated mission is to be "the engine behind economic diversity in the KSA" (Kingdom of Saudi Arabia 2019)—to the SoftBank Vision Fund. Yet the level of venture capital in the kingdom has remained very modest. According to the consulting firm MAGNiTT (2020), only $50 million of venture capital was raised by Saudi firms in 2018, and $67 million in 2019. The 2018 value represented 0.006 percent of gross domestic product, a level one-sixtieth of that of Israel and akin to that of the lowest nations tracked on this measure by the Organisation for Economic Co-operation and Development (e.g., Italy, the Russian Federation, and Slovenia) (OECD 2019).

- The Chinese government, after a series of adept moves to promote venture capital over two decades, made a major commitment in the middle part of the 2010s to promoting venture capital.[5] Under the Government Guidance Fund program, over $231 billion was invested in government-sponsored venture funds in 2015 alone, largely by Chinese government bodies and state-owned enterprises. By way of context, this amount was more than five times the total amount committed to venture funds worldwide by all other investors in 2015. The government claimed it had raised $1.8 trillion for these funds by the end of 2018.[6] The result appears to have been a massive bubble, followed by a quick collapse and slowdown. Between the fourth quarter of 2016 and the fourth quarter of 2018, fundraising dropped by nearly 90 percent, a trend that has continued into 2019. As a result, Chinese companies have fallen from a peak of 45 percent of venture capital invested worldwide to 15 percent in the second quarter of 2019 (Rowley 2019). The prediction of Gary Rieschel of Qiming Venture Partners (Shen 2016) is looking increasingly prescient: "They have a fantasy that if they give everyone money they'll create entrepreneurs. What it will result in is catastrophic losses for the government."

In this chapter, I argue that these disappointing outcomes have not simply been a matter of bad luck—for instance, the choice by the Obama administration to target its subsidies to entrepreneurial firms to A123 Systems and Solyndra rather than to more viable cleantech firms that would have avoided bankruptcy. Instead, the unfortunate outcomes have reflected the fundamental structural issues that make it difficult for governments to launch successful efforts to promote entrepreneurship over sustained periods. I highlight several critical challenges, and outline two principles that might render these efforts more effective.

5. This paragraph is based in part on Feng (2018), Oster and Chen (2016), and Yang (2019).
6. Based on the author's compilation of Preqin data (https://www.preqin.com/).

## 7.2 The Motivation

Public bodies have been motivated to undertake these efforts by the perceived relationship between entrepreneurial activity on the one hand and employment opportunities, innovation, and economic growth on the other. The reader by this point in the volume should be convinced of the importance of innovation to economic growth. But the role that entrepreneurship in general and venture capital in particular play in promoting innovation has been much less thoroughly discussed so far.

Initially, economists generally overlooked the creative power of new firms: they suspected that the bulk of innovations would stem from large industrialized concerns. For instance, Joseph Schumpeter (1942), one of the pioneers of the serious study of entrepreneurship, posited that large firms had an inherent advantage in innovation relative to smaller enterprises.

These initial beliefs have not stood the test of time. Rather, today they look like the intellectual by-product of an era that saw large firms and their industrial laboratories (such as IBM and AT&T) replace the independent inventors who accounted for a substantial part of innovative activity in the late 19th and early 20th centuries.

In today's world, Schumpeter's hypothesis of large-firm superiority does not accord with casual observation. In numerous industries, such as medical devices, communication technologies, semiconductors, and software, leadership is in the hands of relatively young firms whose growth was largely financed by venture capitalists and public equity markets. (Think, for example, of Amazon, Boston Scientific, Facebook, and Google.) Even in industries where established firms have retained dominant positions, such as finance, small firms have developed an increasing share of the new ideas, and then licensed or sold them to larger concerns. Large firms are if anything cutting back their investments in basic science. (See the evidence in Arora, Belenzon, and Patacconi 2015.)

This pattern of new ventures playing a key role in stimulating innovation has been especially pronounced in the past two decades. The two arenas that have seen perhaps the most potentially revolutionary technological innovation—biotechnology and the internet—were driven by smaller entrants. Neither established drug companies nor computer software manufacturers were pioneers in developing these technologies. Small firms did not invent the key genetic-engineering techniques or internet protocols. Rather, the enabling technologies were developed with government funds at academic institutions and research laboratories. It was the small entrants, however, who first seized on the commercial opportunities. Even in areas where large firms have traditionally dominated, such as energy research, start-up firms appear to be playing an increasing role.

Not only do Schumpeter's arguments fail the test of experience, but systematic studies have generated little support for his belief in the innovative

advantage of large firms. Over the years, economists have tried repeatedly to measure the relationship between firm size and innovation. While this literature is substantial, it is remarkably inconclusive. I will not inflict on the reader a detailed review of the hundreds, if not thousands, of papers on this subject, but it is worth highlighting that they give very little support to the claim that large firms are more innovative.[7] Much of this work has related measures of innovative discoveries—for example, R&D expenditures, patents, or inventions—to firm size. Initial studies were undertaken using the largest manufacturing firms; more recent works have employed larger samples and detailed data (e.g., studies employing data on firms' specific lines of business). Despite the improved methodology of recent studies, the results have remained inconclusive: the studies seem as likely to find a negative as a positive relationship, and even when a positive relationship between firms' size and innovation has been found, it has had little economic significance. For instance, one study concluded that a doubling of firm size increased the ratio of R&D to sales by only 0.2 percent (Cohen, Levin, and Mowery 1987).

Whatever may be the relationship between a firm's size and its innovations, one of the relatively few things that researchers can agree on is the critical role played by new firms, or entrants, in many industries. The role of start-ups in emerging industries has been highlighted not just in many case studies, but also in systematic research. For instance, a study by Acs and Audretsch (1988) examined which firms developed some of the most important innovations of the 20th century.[8] The authors documented the relative contribution of large and small firms. Small firms contributed almost half the innovations they examined. But they found that the contribution of small firms was not central in all industries. It was greatest in immature industries in which market power was relatively unconcentrated. These findings suggest that entrepreneurs and small firms play a key role in observing where new technologies can meet customers' needs and respond rapidly to them. Whether owing to poor incentives, inefficient internal capital markets, or other causes, larger firms do not appear to fare well in this regard.

Recent studies have also pointed to the special advantage in innovation enjoyed by young entrepreneurs backed by venture capital firms. Considerable evidence shows that venture capitalists play an important role in encouraging innovation. The types of firms they finance—whether young start-ups hungry for capital or growing firms that need to restructure—pose numerous risks and uncertainties that discourage other investors.

Where, then, does this advantage come from? The financing of young firms is a risky business. A lack of information makes it difficult to assess the potential of these firms and permits opportunistic behavior by entrepreneurs after financing arrives. To address these information problems,

7. The interested reader can turn to surveys by Azoulay and Lerner (2012) and Cohen (2010).
8. Similar studies include Aron and Lazear (1990) and Prusa and Schmitz (1994).

venture investors employ a variety of mechanisms that seem to be critical in boosting innovation.

The first of these devices is the screening process that venture capitalists use to select investment opportunities. This process is typically far more efficient than that used by other funders of innovation, such as corporate research and development laboratories and government grant makers. In addition to conducting careful interviews and financial analysis, venture capitalists usually make investments with other investors. One venture firm will originate the deal and look to bring in other venture firms. Involving other firms provides a second opinion on the opportunity. There is usually no clear-cut evidence that an investment will yield attractive returns. Having other investors approve the deal limits the likelihood of funding bad deals. The result of this detailed analysis is, of course, many rejections: only about 0.5 to 1 percent of business plans are funded (Kaplan and Stromberg 2004). Inevitably, many good ideas are rejected as part of the assessment process.

When venture capitalists invest, they hold not common stock but rather preferred stock (Kaplan and Stromberg 2003). The significance of this distinction is that if the company is liquidated or otherwise returns money to the shareholders, preferred stock is paid before the common stock that entrepreneurs, as well as other, less privileged investors, hold. Moreover, venture capitalists add numerous restrictive covenants and provisions to the preferred stock. They may be able, for instance, to block future financings if they are dissatisfied with the valuation, to replace the entrepreneur, and to have a set number of representatives on (or even control of) the board of directors. In this way, if something unexpected happens (which is the rule rather than the exception with entrepreneurial firms), the venture investor can assert control. These terms vary with the financing round, with the most onerous terms reserved for the earliest rounds.

The staging of investments also improves the efficiency of venture capital funding (Gompers 1995; Neher 1999). In large corporations, research and development budgets are typically set at the beginning of a project, with few interim reviews planned. This pattern contrasts with the venture capital process: once they make a decision to invest, venture capitalists frequently disburse funds in stages. The refinancing of these firms, termed "rounds" of financing, is conditional on achieving certain technical or market milestones. Proceeding in this fashion allows the venture capitalist to gather more information before providing additional funding, thus helping investors separate investments that are likely to be successful from those that are likely to fail. Managers of venture-backed firms have to return repeatedly to their financiers for additional capital, which allows venture capitalists to ensure that their money is not being squandered on unprofitable projects. Thus, an innovative idea continues to be funded only if its promoters continue to execute well.

Finally, venture capitalists provide intensive oversight of the firms they

invest in. Survey evidence (Gompers et al. 2020) suggests that over 25 percent of venture capitalists interact with the entrepreneurs that they are funding multiple times per week, and an additional one-third interact once a week. These interactions can have profound impacts. One intriguing study by Bernstein, Giroud, and Townsend (2016) supports these claims, showing that when an airline adds a direct flight between the city of a venture capitalist and one of his or her existing portfolio firms (which presumably facilitates face-to-face interactions), the firm is likely to experience a boost in innovative and financial performance.

With support from venture capitalists, start-ups can better invest in the research, market development, marketing, and strategizing they require to attain the scale necessary to go public. The importance of this backing can be illustrated in stylized facts, such as that of the ten most valuable companies in the world as of mid-2020, fully seven (five based in the United States and two in China) were originally venture backed (based on an analysis of Compustat data and various venture capital databases and media reports).

The positive impact of venture capital is also corroborated in large-sample research. Especially relevant is the finding of Kortum and Lerner (2000) that even after addressing the concern that venture capital investments are highly targeted, venture funding does have a strong positive impact on innovation. The estimated coefficients vary according to the techniques employed, but on average a dollar of venture capital appears to be *three to four* times more potent in stimulating patenting than a dollar of traditional corporate R&D. While venture capital has historically been small relative to corporate research, it is responsible for a much greater share of US commercial innovations.

## 7.3 The Challenges

Given the apparently strong relationship between entrepreneurship, innovation, and growth, it is not surprising that governments worldwide have sought to promote new ventures. But as the examples in the introduction suggest, many public efforts have gone astray.

In particular, in this section, I highlight three aspects of the nature of entrepreneurial ventures that pose substantial challenges to government policy makers.

### 7.3.1 The Geographic Dilemma

The first challenge is the tight geographical focus of entrepreneurial businesses. Entrepreneurial businesses are often clustered geographically (Glaeser, Kerr, and Ponzetto 2010), venture-backed businesses even more so (Chen et al. 2010). These patterns characterize such businesses around the world.

The highly skewed distribution of venture capital investment can be illus-

trated by a tabulation of Pitchbook data between 2015 and 2017 by Florida and Hathaway (2018). The authors concluded that the top ten urban areas for venture financing (six in the United States and two in China, as well as in London and Bangalore) accounted for 62 percent of venture disbursements worldwide, while the top 25 urban areas accounted for 75 percent of all disbursements.

This disbursement is not accidental, but rather reflects the nature of investment performance. The Sand Hill Econometrics index of gross (pre-fee) returns from venture capital investments between 1980 and 2019 highlights a substantial discrepancy between Silicon Valley and other US regions. Northern California transactions reported an annualized return of 25.6 percent, substantially more than other regions such as New England (14.3 percent), mid-Atlantic (15.4 percent), and non-California Pacific states (13.5 percent).[9] While accurate regional return data are not available worldwide, undoubtedly this pattern would repeat itself elsewhere.

Yet many efforts to boost high-potential entrepreneurship end up directing far too much funding to unpromising areas in an effort to "share the wealth." Much of the impact is diluted as funds that could be very helpful in a core area end up where they are not useful.

The Small Business Innovation Research (SBIR) program, the largest public venture program in the United States, provides an illustration of this problem. The effect of a fairness policy was shown in my work (Lerner 1999) comparing the performance of program recipients with that of matching firms: awardees grew considerably faster than companies in the same locations and industries that did not receive awards. In the ten years after receipt of SBIR funding, the workforce of the average award recipient in a high-tech region grew by 47, a doubling in size. The workforces of other awardees—those located in regions *not* characterized by high-tech activity—grew by only 13 employees. Though the recipients of SBIR awards grew considerably faster than a sample of matched firms, the superior performance, as measured by growth in employment (as well as sales and other measures), was confined to awardees in areas that already had private venture activity. Many other examples can be offered from the Americas, Asia, and Europe, where the pressure for fairness has led to the diversion of substantial funds for entrepreneurial investments with little chance of success.

These issues are particularly relevant for science-based entrepreneurship. Economic activity linked to disruptive new technologies seems to evolve in a very concentrated pattern (Bloom et al. 2020). Potential explanations for these patterns include the dependence on close ties with academia (many of these initial hubs are near academic centers), agglomeration effects that encourage firms to bunch together, and labor market dynamics. Whatever

9. Based on the author's compilation of Sand Hill Econometrics data.

the causes, the effect has been to render government efforts to encourage science-based ventures in peripheral locations very difficult.

Thus, in the name of geographic "diversity," the SBIR program funded firms with inferior prospects. Underneath these patterns lie some intense political pressures and conflicting interests. For one thing, congressmen and their staffers have pressured program managers to award funding to companies in their states. As a result, in almost every recent fiscal year, firms in all 50 states (and indeed in every one of the 435 congressional districts) have received at least one SBIR award. These patterns are far from unique: pressures for "fair" distribution of subsidies (Weingast, Shepsle, and Johnsen 1981) often lower the social and private returns from these government initiatives.

### 7.3.2 The Timing Dynamic

Another issue stems from the boom-bust cycles that frequently characterize entrepreneurial markets. The venture market is extraordinarily uneven, moving from cycles of feast to famine and back again. In some periods, far too many firms can get access to financing, while in others, worthy companies languish unfunded.

Funds operating in periods with little competition often eventually experience very good returns, a pattern that may reflect the fact that the funds operating during these years can invest in the most promising firms at relatively modest valuations. Over time, however, these high returns attract the interest of institutional investors. What starts as a trickle of funds ends as a torrent. The competition for deals rises, as does the pricing of these transactions. Ultimately, the expansion proves to be unsustainable, and returns fall. Then the cycle repeats itself all over again.

These cycles have led to considerable drama in the venture industry. Each industry downturn produces melodramatic claims that the venture industry is fundamentally broken, with too many investors competing for a limited supply of deals. For instance, in the dark days after the NASDAQ crash of 2000–2002, Steve Dow of the venerable firm Sevin Rosen indicated that his group was unlikely to raise a new fund. "The traditional venture model seems to us to be broken," he noted. "Too much money had flooded the venture business and too many companies were being given financing in every conceivable sector" (Helft 2006). (More typically, the conclusion of the complaining venture capitalist is that everyone should exit the market except for the market observer and his best friends.)

This song has been repeated almost verbatim in every market downturn. "Dramatic inflows of cash weaken the 'fragile ecosystem' of the venture capital industry by forcing some to 'shovel' money into deals. . . . The answer is to discourage more money from coming in and to suppress what [gets invested]," preached the *Venture Capital Journal* in 1993 (Deger 1993). The same periodical bemoaned in 1980, "The rate of disbursements from venture

investors to developing businesses continues to be extraordinary. . . . [A] major limiting factor in expansion will be the availability of qualified venture investment managers. Direct experience is so critical to venture investment disciplines" ("Special Report," 1980). (With the benefit of hindsight, the *Journal* was exactly wrong in both cases. The typical funds raised in the years of these two articles had a return of 26.1 percent and 21.6 percent, respectively, which remain among the two best vintage years for venture funds ever.)

Despite all the hype and drama, these boom-and-bust patterns are important, and the interest that these cycles have attracted is justified. It is natural to wonder why pensions and others seem to put most of their money to work almost inevitably at exactly the wrong time. Why don't venture groups pull back from investing in market peaks, rather than continuing to dance the dance? While much remains uncertain about these cycles of boom and bust, several drivers of the patterns have been documented.

At least some of the deterioration of performance stems from the phenomenon of "money chasing deals." As more money flows into their funds from institutional and individual investors, venture capitalists' willingness to pay more for deals increases: a doubling of inflows into venture funds led to between a 7 percent and 21 percent increase in valuation levels for otherwise identical deals. These results do not reflect improvements in the venture investment environment; when we look at the ultimate success of venture-backed firms, the success rates do not differ significantly between investments made during periods of relatively low inflows and valuations, and those of the boom years. But the findings, while suggesting how these cycles work, do not explain why they come about.

Part of the decline in venture activity stems from new funds. During hot venture markets, many inexperienced groups raise capital. In many cases, these funds are raised from inexperienced investors, who are attracted by the excitement surrounding venture funds or by funds-of-funds, which target these investors. Often, they cannot get into top-tier funds and instead reach out to less experienced funds, not appreciating the differences across groups.

Part of the deterioration in performance around booms reflects the changes in the venture funds. Established groups often take advantage of these hot markets to increase their capital under management aggressively. (This decision is likely to be driven by the typical compensation that venture funds enjoy, which is largely driven by fees from capital under management.) As venture groups grow in size, they tend to increase the capital that each partner is responsible for and to broaden the range of industries in which they invest. These changes are often associated with deteriorating performance.

Whatever the precise mechanisms behind these cycles, their impact on innovation is most worrisome. Skeptical observers of the venture scene fre-

quently argue that these cycles can lead to the neglect of promising companies. For instance, during the deep venture trough of the 1970s—in 1975, no venture capital funds at all were raised in the United States—many companies seeking to develop pioneering personal-computing hardware and software languished unfunded. Ultimately, these technologies emerged with revolutionary impact in the 1980s, but their emergence may have been accelerated had the venture market not been in such a deep funk during the 1970s.

Townsend (2015), in an intriguing analysis of the technology-market collapse of 2000–2003, looks at the probability that firms failed to get refinanced through no fault of their own. He examines the probability that firms in sectors unrelated to IT during the collapse period got another financing round, and how this varied with their lead venture firm's exposure to the internet sector. He compares non-IT firms whose backers invested heavily in internet companies during the years leading up to the peak of the bubble with those whose backers invested little in the internet sector during that time. (Based on all observable characteristics, these firms are otherwise identical.) The unlucky ones with internet-exposed backers were far less likely to raise another financing round. The analysis suggests that these unlucky firms—even though their technologies had nothing to do with the internet, telecommunications, or software—experienced a 26 percent larger drop in the probability that they would raise additional funding than did those backed by funds without a heavy exposure to the internet. If a potential entrepreneur realizes that even if he does everything right, his business may fail because he was unlucky in choosing a financier, his enthusiasm for the new venture may fade. He might well conclude that if he is going to be gambling, a trip to Vegas is a less costly and painful alternative.

It might be thought that this termination of new ventures is not a big deal. After all, the personal-computing technology that may have languished unfunded during the 1970s ultimately saw the light of day in the next decade. But in addition to the delays inherent in this disruptive process, there is also the question of its impact on incentives.

Nor is the overfunding of firms during booms necessarily a good thing. While it can stimulate creativity (Ewens, Nanda, and Rhodes-Kropf 2018), it can also lead to wasteful duplication, as multiple companies pursue the same opportunity, with each follower often being ever more marginal. Often, the initial market leader's staff is poached by the me-too followers, disrupting the progress of the firm with the best chance of success. Moreover, once the overfunding subsides, the firms that still survive struggle to attract funding, as the sector often takes on a poisonous atmosphere that deters venture investors. Numerous examples of such crazed duplication can be offered: the recent plethora of social networking companies, the frenzy surrounding B2B and B2C internet companies in the late 1990s, and the surge in funding disk-drive companies in the early 1980s. In each case, a surge of activity was

followed by a reaction, when venture capitalists, suffering from poor returns, recoiled from the industry. As a result, these periods were incredibly disruptive to all firms within the affected industries.

In many cases, however, political leaders interpret these surges in activity as signals that it is appropriate to intervene with new subsidies, even as the marginal returns from public money decline. The public funds can have the effect of adding "fuel to the fire" of an overheated market. The decision of the Chinese government to "double down" on subsidizing venture activity after the boom in the first half of the 2010s is a dramatic example.

### 7.3.3 The Human Dimension

The final disengagement reflects the nature of people who often are associated with the greatest entrepreneurial success. Government officials may have many valuable talents and play incredibly important roles, but the skill sets associated with successfully identifying and funding entrepreneurial businesses are very different from those encountered in their typical daily work. The ambiguity, complexity, and specialization associated with such ventures make these tasks quite challenging.

In many instances, officials may be manifestly inadequate to the task of selecting and managing entrepreneurial or innovative firms. Many examples can be offered of government leaders who did not think carefully about realistic market opportunities, the nature of the entrepreneurs and intermediaries being financed, and how the subsidies they offered would affect behavior. Well-intentioned officials can make rules that prove to be very harmful to those they mean to help, whether they are rules that affect the ability of firms to accept outside financing, to offshore routine coding work, or to respond to shifts in customer demands.

But beyond public incompetence, much of economists' attention has been focused on a darker problem that affects these and similar programs: the theory of "regulatory capture." This hypothesis suggests that entities, whether part of government or industry, will organize to capture the direct and indirect subsidies that the public sector hands out.[10] Yet public subsidies are often prone to political capture problems, where well-connected individuals end up with the bulk of the benefits, and those geared toward entrepreneurial firms are no exception (Akcigit, Baslandze, and Lotti 2018). These issues are exacerbated by the fact that the most creative entrepreneurs are often outsiders; for instance, an extensive literature has documented the disproportionate representation of immigrants in US entrepreneurship, both in general and among high-potential enterprises (Kerr and Kerr 2017; see Fairlie and Lofstrom 2015 for a more general review).

These capture problems are often exacerbated by opaque and poorly

10. The articulation of this model in the economics literature is frequently attributed to Olson (1965); its formal modeling is attributed to Becker (1983) and Peltzman (1976).

defined processes. While selecting the most promising new ventures is unlikely to ever be easy, making the process opaque is unlikely to help. For instance, the Department of Energy had little transparency about the criteria used to select the awards to cleantech firms discussed in the introduction. Reflecting this lack of clarity, firms responded by hiring lobbyists to seek awards. More than half of the cleantech companies in the portfolio of New Enterprise Associates, a large US venture firm, hired lobbyists to attempt to influence the rewards. The emphasis on influence activities was exacerbated by the huge size of the individual awards: rather than scattering the funds over a variety of contenders, the Obama administration sought to pick winners. This is a classic situation where a public program targeted an area that was already interesting to private investors and actually ended up introducing counterproductive distortions.

## 7.4 The Search for Solutions

How can these seeming disconnects be addressed? In the final part of the chapter, I discuss two potential policy reforms—independence and reliance on matching funds—that could address them.

### 7.4.1 The Need for Independence

One way to address the incentive issues described above is for policy makers to emulate central bankers and seek to insulate entrepreneurial policy making from day-to-day political pressures. A long list of economists has extolled the need to separate monetary policy form political pressures, lest the temptation to "do the wrong thing" prior to an election be too strong. Establishing an organization to implement new venture policies in which the leadership has the independence from day-to-day political pressures can similarly lead to longer-term decisions that can address some of the challenges delineated above. Such a step may also make it easier to terminate a program when it is no longer needed.

Similar independent governance has been successfully implemented in other investment arenas. For instance, consider the experience of the Canadian Pension Plan (CPP).[11] The plan was established in 1966 as a layer of retirement savings sitting between the Old Age Security System (similar to Social Security in the United States) and individual savings. It collected mandated contributions from employers and workers, and offered benefits that were a set percentage of wages, paid by the contributions of previous years and the returns from the plan's investments.

For the first 30 years of CPP's existence, expenses rose as benefits like inflation indexing were added. Funds were invested in nonnegotiable Canadian-

11. This vignette is drawn from Canadian Pension Plan Investment Board (various years); Hardymon, Leamon, and Lerner (2009); and Lerner, Rhodes-Kropf, and Burbank (2013).

government fixed-income bonds and also loaned to the provinces at submarket interest rates for projects such as building schools and roads. These projects may have benefited Canadian society, but not surprisingly they did little for CPP's bottom line. Furthermore, an aging population was working against CPP. The government realized that rescuing CPP meant either drastic cuts in benefits or sharp increases in contribution rates.

Similar problems have been shown to beset many US pensions, especially those with heavy political representation on their board (Andonov, Hochberg, and Rauh 2018). But unlike in the United States, where governments have almost universally kicked pension problems "down the road," between 1995 and 1997, the federal and provincial Canadian governments managed to craft a solution.

The CPP Investment Board was established in 1997 in response to these challenges. One crucial part of the reforms adopted by the Canadian government was a dramatic restructuring of the plan's governance. It adopted a structure that former CEO Mark Wiseman referred to as "turducken," except instead of a series of stuffed poultry, it featured "a partnership model inside a Crown corporation inside a pension plan" (Lerner, Rhodes-Kropf, and Burbank 2013). In order to limit political influence, the CPPIB governance was set up as a 12-member board notionally appointed by the federal and provincial governments, with appointments based entirely on business acumen, not political connections. The board of directors in turn appointed the CEO, with no right of veto from any government. The organization's mandate was set as investing "solely for the benefit of CPP members" to achieve the best long-term, risk-weighted returns for the plan's beneficiaries, regardless of government policy objectives. To further insulate CPPIB from political influence, any changes to its charter required approval by an amending process more stringent than that of the Canadian constitution itself. Small experiments along these lines have been reasonably successful in the entrepreneurial promotion business, such as the New Zealand Venture Investment Funds program,[12] and it is my hope that these can be expanded.

Another advantage of independence is more flexibility in setting pay. Setting competitive compensation is even harder for public institutions in Western democracies, where the media may be overeager to engage in sensationalism. The architects of the modern CPPIB created a structure that allowed the public pension unique freedoms, including the ability to set salaries and bonuses completely outside the Canadian civil service scale. With multimillion-dollar bonuses—as well as the ability to live in Toronto, work in a congenial setting, and contribute to the betterment of the nation—CPPIB attracted a high-caliber investment team, many of them Canadians, eager to move home after a stint on Wall Street.

12. For a detailed history and analysis of the program, see Lerner, Moore, and Shepherd (2005).

But implementing this scheme has been challenging. The fund was bitterly criticized for proposing to pay bonuses totaling $7 million to four top executives for 2008–9, after the fund had lost almost 19 percent of its value during the financial crisis. CPPIB's rationale that the pay packages were based on long-term performance fell on deaf ears, whether due to its complexity or the political feeding frenzy. The board ultimately adjusted its compensation policy downward. Perhaps unsurprisingly, eventually much of CPPIB's leadership team left for jobs elsewhere.

A similar cautionary tale emerges from the experience of In-Q-Tel, a nonprofit VC firm that was established in 1999 to give the US Central Intelligence Agency greater access to cutting-edge technologies.[13] The agency's scientific leaders realized that the most sophisticated technologies were being developed not within government laboratories, but rather in Silicon Valley start-ups. In-Q-Tel was designed to address this problem by allowing the government to access some of the key innovations of these firms. Using a variety of venture-like tools, the organization invested modest stakes in emerging companies, often in conjunction with independent venture firms.

The CIA realized it needed a special kind of team to run In-Q-Tel: individuals who were at once conversant with the world of high-technology start-ups and with a ponderous, security-conscious government bureaucracy. To maximize the chance of getting the right people, the CIA set up In-Q-Tel as an independent, not-for-profit entity, which shielded it from civil service rules that might discourage many recruits. In order to attract these staff members—and to avoid a revolving door through which people left as soon as they had the requisite experience—the CIA designed a compensation scheme quite different from that of typical government jobs. The package included a flat salary, a bonus based on how well In-Q-Tel met government needs, and an employee investment program, which took a prespecified portion of each employee's salary and invested alongside In-Q-Tel in the young firms in its portfolio.

After In-Q-Tel had operated for a few years, the *New York Post* decided to turn its attention to the organization.[14] Describing the undertaking as "an astonishing tale of taxpayer-financed intrigue on capitalism's street of dreams," journalists homed in on the compensation scheme; one article charged that In-Q-Tel employees were "speculat[ing] with taxpayer money for their own personal benefit." Needless to say, there was no discussion of the challenges of recruiting investment staff conversant with Silicon Valley, or the likelihood that many In-Q-Tel professionals could make far more in the private sector. This arrangement, the *Post* intoned, was "almost identical to the so-called 'Raptor' partnerships through which top officials at Enron

13. This account is based on Book et al. (2005), Business Executives for National Security (2001), and numerous press accounts.

14. These quotes are drawn from one of several pieces on In-Q-Tel done by Byron (2005).

Corp were able to cash in personally on investment activities of the very company that employed them." Whether it was the criticism of the compensation levels—which while attractive by government standards, were far below those of independent venture capitalists—the distractions associated with frequent congressional investigations, or the media scrutiny, In-Q-Tel has struggled to hold on to its investment staff, despite a creative attempt to establish attractive incentives.

While independence does not necessarily guarantee effective policy making, it can increase the likelihood that decisions avoid political fads, relying instead on rules-based approaches and experimental evidence. All too often, in the rush to boost entrepreneurship, policy makers allow no provision for the evaluation of programs. In an ideal world, the future of initiatives should be determined by their success or failure in meeting their goals, rather than considerations such as the vehemence with which supporters argue for their continuation. Independent governance can facilitate better decisions.

Turning again to the SBIR program, there are many examples where analysis could be enormously helpful. A striking study by Howell (2017) suggests while the initial Phase I awards made up only 20 percent of the total of $2.8 billion in awards in fiscal year 2017 (US Small Business Administration 2018), essentially all of the program's positive benefits resulted from those initial grants. Similarly, both Howell's analysis and my own suggest the troublesome impact of the companies that have managed to capture a disproportionate number of awards. These "SBIR mills" commercialize far fewer projects than the firms that receive just one SBIR grant (or a handful of grants). They often have staffs in Washington that focus only on identifying opportunities for subsidy applications. These problems have proven difficult to eliminate, as "mill" staffers tend to be active, wily lobbyists.

An added benefit of such efforts has to do with time frames. Democracies worldwide are shaped by the ebb and flow of election cycles. This inevitably leads to a short-run orientation. And even leaders in office for life are often anxious to display progress and look for quick fixes. But building a venture capital industry is a long-run investment, which takes many years until tangible effects are realized. To cite one example, historians date the birth of the modern US venture capital industry to 1978, a full 20 years after the enactment of the SBIC program. This is not a process that can be accomplished overnight.

As a result, an entrepreneurship or venture capital initiative requires a long-run commitment on the part of public officials. The one certainty is that there will be few immediate returns. If programs are abandoned after a few months or years, they are highly unlikely to bring any benefits. There has to be a commitment to be undaunted by initial failures—for example, the low rate of return that early publicly subsidized investments or funds garner—and instead to fine-tune programs in the face of such discouragements. An independent governance structure can limit these distorting effects.

At the same time, there may be times when a program has lived its useful life and is no longer needed. One nomination might be the Small Business Investment Company (SBIC) program in the United States, which subsidized the formation of venture funds. The US industry is today many orders of magnitude bigger, and the need for the program much less compelling. And many of the firms receiving SBIC funding have been marginal ones that cannot attract private funds. Yet SBIC recipients have vehemently argued for expanding the program, not terminating it.

### 7.4.2 Matching Funds

Far too often, decisions about fund allocation are distorted by a lack of understanding of how the market works or by political rather than economic considerations. By requiring that matching funds be raised from the private sector, the dangers of uninformed decisions and political interference can be greatly reduced.

We have already alluded to examples of well-intentioned but uninformed leaders making boneheaded decisions, as well as political capture leading to unfortunate decisions, such as to allocate much of the funding to regions where there is little chance of success. Yet another distortion is when policy makers make decisions based on "buzz," or incomplete information. One study determined that 49 of the 50 US states started major programs to promote the biotechnology industry, in hopes of creating a cluster of activity (Feldman and Francis 2003). In fact, only a handful of these states had the base of scientific resources and the supporting infrastructure (e.g., lawyers versed in biotechnology patent law and financing practice) to support a successful cluster, so the bulk of the funds was wasted. When these programs did support a promising firm, in many cases it rapidly moved to a region more conducive to biotechnology entrepreneurship.[15]

The vast majority of efforts by the public sector to target particular industries seem to have been far from successful. If dozens of PhDs poring for years over econometrics models with mountains of historical data have been unable to show how to target industries, how can the typical government leader identify good prospects in a compressed time period and with limited information?

But there is a way to address this problem, at least partially. The most direct way is to insist on matching funds. If venture funds or entrepreneurial firms need to raise money from outside sources, organizations that will ultimately not be commercially viable will be kept off the playing field. In order to ensure that these matching funds send a powerful signal, the matching should involve a substantial amount of capital (ideally, one-half the funding or more should come from the private sector). These stipulations can

15. See, for instance, the saga of Cleveland's biotechnology initiative, as related in Fogarty and Sinha (1999).

limit the temptation to impose geographic diversity requirements that direct funds into nonviable areas.

The power of matching funds was clearly demonstrated in what has been considered the gold standard of public venture capital initiatives. In June 1992, the Israeli government established Yozma Venture Capital Ltd., a $100 million fund wholly owned by the public sector (for more details, see Avnimelech, Kenney, and Teubal 2004; OECD 2003; Senor and Singer 2009; and Trajtenberg 2002). At the time, a single venture fund, Athena Venture Partners, was active in the nation. While there were certainly well-trained engineers in Israel working on promising technologies, entrepreneurs (and would-be company founders) were suspicious of venture investors. This reluctance was based in part on their interactions with the pioneering venture capitalists, as well as on their general skepticism about selling equity to unaffiliated parties. Instead, they preferred to rely on bank debt for financing. The only problem, of course, was that such financing was rarely available for young, risky ventures.

The key goal of Yozma was to bring foreign venture capitalists' investment expertise and networks of contacts to Israel. The need for this assistance was highlighted by the failure of the nation's earlier efforts to promote high-technology entrepreneurship. One assessment concluded that fully 60 percent of the entrepreneurs in prior programs had been successful in meeting their technical goals but nonetheless failed because the entrepreneurs were unable to market their products or raise capital for further development. Foreign expertise was seen as key to overcoming this problem.

Accordingly, Yozma actively discouraged Israeli financiers from participating in its programs. Rather, the focus was on getting foreign venture investors to commit capital to Israeli entrepreneurs. The government provided matching funds to investors, typically $8 million of a $20 million fund. The venture fund was given the right to buy back the government stake within the first five years for the initial value plus a preset interest rate of roughly 5 to 7 percent. Thus, the design of Yozma meant that the government provided an added incentive to the venture fund if the investments proved successful. Moreover, learning from the nation's misadventures during earlier programs to stimulate the venture industry—when cumbersome application procedures and burdensome reporting requirements discouraged participation—the administration of the program was deliberately made simple.

The Yozma program delivered beyond the wildest dreams of the founders. Ten groups took advantage of the offer, mostly from the United States, Western Europe, and Japan. Many of the original Yozma funds, including Gemini and Walden Ventures, earned spectacular returns and served as precursors to larger, follow-on funds. Moreover, many of the local partners recruited by the overseas venture capitalists were able to spin off and establish their own firms, which global venture capitalists were eager to fund because of their impressive track records. (A Yozma "alumni club" allows

groups to learn from each other's experiences while making these transitions.) One decade after the program's inception, the ten original Yozma groups were managing Israeli funds totaling $2.9 billion, and the Israeli venture market had expanded to include 60 groups managing approximately $10 billion (Erlich 2007). The magnitude of this success is also suggested by the fact that the ratio of venture investment to GDP is consistently higher in Israel than in any other nation.

As powerful an idea as matching funds is, the devil is in the details. In the Government Guidance Fund initiative in China, the central government imposed matching fund requirements as well. In a number of the top cities, the government funds were matched with capital from legitimate investors. In many second- and third-tier cities (where many of the funds were set up), however, the requirements for matching funds were relaxed. Much of the capital came not from informed private-sector actors, but rather from provincial and state governments eager to boost the local economy, or else from state-owned enterprises under these officials' control. Thus, the informative quality of the matching funds was much reduced.

One concern about a requirement of matching funds is that there are sectors and regions where private funding is very scarce. In these cases, a requirement that firms raise matching venture funding may lead to very little public funding at all. It may be possible to resolve this "chicken or egg" problem by targeting earlier-stage, more informal investors such as individual angel investors. Some governments, for instance, have not only matched the funding provided by these investors, but subsidized the groups to hire an executive director to ensure that their activities run more smoothly. In other cases, however, it may make sense for government to back up even further and focus on "table-setting" activities that create a conducive environment for entrepreneurs and their potential investors, rather than directly financing companies or investors.

## 7.5 Final Thoughts

Many of the same policies that have driven governments to promote innovation in general have led to a public policy focus on entrepreneurship. The bulk of these efforts have been well intentioned. But the substantial challenges associated with the promotion of entrepreneurial businesses have meant that the success rate is not as great as many policy makers hoped or expected.

At the same time, the numerous efforts around the globe suggest some guiding principles for maximizing the success of these funds. In particular, I highlight here two ideas. Rather than distributing the public funds willy-nilly, a requirement for matching funds can ensure market validation for the ideas. And placing the body under the aegis of an independent body can help buffer these long-run initiatives from the ebbs and flows of political fashion.

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