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Ernesto Stein
Dany Bahar
Adrian Magendzo
Victor Zuluaga

Department of Research and Chief Economist

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Ernesto Stein*
Dany Bahar**
Adrian Magendzo*
Victor Zuluaga***

* Inter-American Development Bank
** Brookings Institution
*** University of Houston

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Abstract[1]

This paper reviews Israel's early experience with dynamic entrepreneurship programs. Rather than discussing current policies, it focuses on two programs that were at the core of these policies since the early 1990s: the technological incubator program, and YOZMA. It provides new evidence on the success of the technological incubator program and discusses what lessons from these experiences may be useful for the design of dynamic entrepreneurship policies in Latin America.

JEL classifications: G24, L26, M13, O30
Keywords: Entrepreneurship, Start-up, Incubator, Innovation, Venture capital

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1. Introduction

1.1 Background

Dynamic entrepreneurship policies are gaining traction in Latin America. Inspired by the experience of Israel, where policies in support of technological incubators and early stage venture capital had an extraordinary impact, governments in the region are pursuing entrepreneurship policies in support of incubators, accelerators and the venture capital (VC) industry, among other efforts to strengthen their entrepreneurship ecosystems. But entrepreneurship policies in the region are relatively young, and there is a lot to learn regarding what works and what doesn't. In this regard, the experience of Israel, probably the most successful case of entrepreneurship policies around the world, may offer important lessons. This paper reviews this experience, with particular emphasis on the technological incubator program, focusing not so much on current policies, but rather on the evolution of these policies over the last 25 years, including a discussion of the learning and adjustment process that took place over time.

When it comes to dynamic entrepreneurship policies, the focus on the evolution is particularly important. Entrepreneurship policies often have more than one objective. Consider, for example, the case of a program to support incubators. On the one hand, they can foster the emergence of dynamic start-up companies selected and nurtured by the incubator. On the other, they can contribute to strengthening the entrepreneurial ecosystem by supporting the development of capabilities of incubator managers to select and nurture promising start-ups, by allowing entrepreneurs to gain experience from success or failure without falling into personal debt, thus changing attitudes toward risk, and by contributing to create deal flow, i.e., a critical mass of projects that may then make a market more attractive to the VC industry.

The relative importance of these objectives may change over time. At the outset, creating capabilities and building up the ecosystem may be more important than the degree of success of the start-ups that benefit directly from the programs. A program in which initially most of the selected start-ups fail but where important capabilities for managing incubators are developed may be very worthwhile. As the ecosystem matures, the focus of the policy, and the metrics for measuring success, should change.

The importance of developing an ecosystem in entrepreneurship policies cannot be overstated. For this reason, rather than thinking about specific interventions in isolation, one should think in terms of bundles of interventions, as well as the sequencing of interventions, that

may become desirable or even necessary to foster dynamic entrepreneurship as the ecosystem develops. One implication of the above discussion is that different countries, with different starting points in terms of the strength of their ecosystems, may require different policies.

Studying the case of Israel is important for two reasons. First, Israel probably presents the most successful case of entrepreneurship policies in the world. While Israelis have a number of features that make them unique—the risk-taking culture, the challenge of authority, the fact that they are given important responsibilities at a young age in the army, the "thrown-out-the-door-come-back-in-through-the-window" mentality—there is no doubt that entrepreneurship policies played a crucial role in the transformation of the country from an economy based on agriculture and traditional manufacturing to one of the world leaders in technology and innovation that we observe today. Second, many policymakers in the region are looking closely at the case of Israel for inspiration. But getting to know current policies may not be enough; rather, looking at the evolution of these policies may be even more relevant for countries with weak innovation ecosystems.

1.2 Why Focus on Policies to Stimulate Dynamic Entrepreneurship?[2]

Latin American countries have a long tradition of policies supporting small and medium enterprises. The typical justification has been that these firms employ a substantial portion of the labor force. But evidence from the United States and Latin America suggests that it is *new* firms, not *small* firms, that have a disproportionate impact on net employment.[3] Moreover, new firms, rather than established firms that remain small, are a natural conduit for introducing innovative, high productivity ideas to the marketplace.

The process of converting good ideas into good new businesses, however, is rife with market failures. A new firm that introduces a novel idea could be imitated, generating spillovers. If so, the entrepreneur may not appropriate all the benefits of introducing her idea, thus discouraging entrepreneurship. New innovative firms face important information asymmetries, which make access to finance difficult. These asymmetries are particularly severe when firms are intensive in intangible assets such as knowledge, which is hard to collateralize.[4] In addition to

[2] The discussion in this section is partly based on Wagner and Stein (2014).
[3] See Haltiwanger, Jarmin and Miranda (2013) for the United States, and Eslava and Haltiwanger (2012) for Colombia.
[4] Developing intellectual property protection for the ideas in question may help address some of these market failures, but developing a good IP strategy for a technical idea is a complex undertaking, particularly in weak ecosystems where specialized talent is thin.

these market failures, an entrepreneur may have great ideas but not the complementary skills—such as managerial capacity or marketing knowledge—to start-up and grow a viable organization, or to involve those who do.[5]

Not all new firms, however, have the same potential impact on job creation or innovation. In fact, the majority of new business owners—such as contractors, auto mechanics, dentists or insurance brokers—do not plan for their firms to innovate or grow substantially. Unfortunately, the market failures discussed above tend to be more severe for innovative firms, which if successful are more likely to grow quickly. Compared to a technology start-up, an auto mechanic is less likely to introduce a novel idea or to require sophisticated and hard-to-get complementary skills, and the mechanic can typically use his shop as collateral. Moreover, firms of this type know their market and product, while innovative start-ups need to go through an experimentation and exploration process in order to understand their business model, their market and their product. This process is subject to high uncertainty and requires financing. For these reasons, efforts to encourage the creation of new firms should not consist of blanket policies favoring entrepreneurship. Rather, they should focus on dynamic entrepreneurship, that is, on encouraging the creation of innovative new firms with high growth potential.

But if policies need to target the most promising new firms, how can countries identify the "right" ones? There is no need to pick them ex ante. Rather, countries need to adopt policies that, by solving some of these market failures, tend to attract high-productivity firms, and leverage private sector capabilities to screen, identify and support the most promising ones. For example, programs supporting business incubators may have an impact on a relatively modest number of firms; with proper incentives in place they can target the right type of firms, which may potentially end up having a substantial impact. In addition to channeling government grants to promising innovative projects, incubators provide entrepreneurs with access to networks of mentors and financing, and thus may help these promising firms emerge and grow. But in order for incubators to select the right firms and provide valuable services that boost their chances of receiving investments, incentives have to be right. Incubators should be rewarded according to firm performance, not just based on the number of incubated firms, as often done in Latin America.

[5] In this regard, it is worth noting that the management skills needed to lead an innovative start-up are not the same as the management skills required in traditional industries, or in large corporations. We thank Oren Gershtein for making this point.

Encouraging the development of a venture capital (VC) industry is another complementary way to stimulate dynamic entrepreneurship. Unlike banks, VC funds can accept innovative ideas as "collateral" because they participate in the financial upside of firms, and thus have incentives to screen and back the most promising ventures, thereby contributing to those firms' success through their involvement in their management. Policies in support of incubators and the VC industry have been at the heart of Israel's start-up success. In order to draw lessons for countries in Latin America, it is important to understand the nature of these policies. We will start with the technology incubator program, the main focus of our analysis.

2. The Technology Incubator Program

Israel's incubator program was launched in 1991, under very special circumstances. In the late 1980s, Mikhail Gorbachev opened the borders of the Soviet Union, allowing Jews to legally migrate to Israel under the "Law of Return," which allows migrants of Jewish descent to receive Israeli citizenship immediately upon arrival. Soviet Jews migrated *en masse* and, by the year 2000, the population of Israel had increased by nearly one million people—a 20 percent increase. A large proportion of these newcomers were highly educated, with engineering degrees and Ph.Ds. This development presented great opportunities but also posed important challenges. Newspapers at the time were full of articles about professors washing dishes at restaurants. The issue of how best to absorb the newcomers in a way that avoided the loss of their accumulated knowledge and skills became one of the most important policy issues of the day, and different government departments were looking for ways to deal with this problem. The incubator program was an attempt by the Chief Scientist of the Ministry of Commerce and Industry (later, Ministry of Economy) to do precisely this.[6]

The Chief Scientist of the Ministry of Industry was a powerful, influential position that had been created in the early 1970s, focused on the promotion of industrial R&D. In 1990, the Chief Scientist was Yigal Erlich, and he, like others, was trying to come up with ways to address the problem of how to absorb the newcomers. To do so, he hired Rina Pridor, who was at the time living in the United States but had had prior experience at the Ministry. Together, influenced by the rise of incubators in the United States, they created the incubator program.

[6] This office is known today as the Israel Innovation Authority.

At the time, incubators in the United States were typically financed by local governments and tasked with helping new businesses develop professionally through mentoring. The start-ups did not typically receive funding, but rent in the incubators was subsidized. The mentoring aspect of incubators appealed to Pridor and Erlich, who understood that just handing money over to scientists and engineers without business experience and few local ties would not be a good way to build an effective, influential program.

While the program was focused on immigrants from the Soviet Union, the decision was made early on to allow locals to participate as well. The thought was that the only way for the immigrants to adapt was to have locals as neighbors in the incubators. Yet, since the main driver of the policy, at least at the outset, was the absorption of the immigrants, a quota was adopted: 70 percent of the start-up research teams had to consist of new immigrants. This rule, however, did not apply to the founders of the companies. In fact, Shefer and Frenkel (2002) report that, out of a sample of 176 founders from 109 incubated firms they interviewed in 2001, 49 percent were born in Israel, and only 33 percent in the former Soviet Union. This, plus the other 30 percent of the research team, provided ample opportunities for the immigrants to interact with the locals.

Most of the founders were highly educated. Out of the 176 founders interviewed by Shefer and Frenkel (2002), 63 percent had Ph.Ds, and 21 percent had a Master's degree. It is worth mentioning that the supply of scientists and engineers was not only associated with immigration from the Soviet Union. On top of relatively high number of scientists and engineers trained in Israeli universities, the closure of a large-scale military project (related to the design of the Lavi fighter airplane) a few years before the launch of the technology incubators program further increased the supply of skilled professionals available in the high-tech civilian sector.[7] This large supply of highly educated scientists and engineers may have been an important precondition for the success of the incubator program.

The idea of the technology incubator program was to provide non-recourse loans for people to start new businesses based on a technological idea within newly created incubators. Because the Office of the Chief Scientist (OCS) was tasked with promoting industrial R&D, the money had to be dedicated to business R&D associated with technological development.

Within a year, the program had already established 10 incubators, in some cases taking advantage of various different entities that had begun to emerge in different settings. Some were

[7] See Breznitz (2007) and Breznitz and Ornston (2013).

in universities, such as Tel Aviv University, the Hebrew University and the Weitzman Institute, but others were not. In the Golan Heights, for example, the program received three applications, one of them from the local administration that was already in the process of establishing an incubator. The three interested parties were asked to present a unified proposal, which was accepted. Geographic considerations certainly played a role in the selection process. Had geographical criteria not been included in the search, all incubators would have probably been established at the center, mostly in the Tel Aviv area. Yet, as Shefer and Frenkel (2002) show in a map that charts the geographical location of technological incubators as of 2001, incubators were spread across the whole country. Incubators had to have appropriate space available (owned or rented) to incubate 6-10 projects at once. At the beginning, they received 300,000 US dollars a year to cover operational expenses, although this funding was discontinued at a later stage once the incubators were privatized. (An exception was made for incubators in peripheral areas, which continued to receive subsidies for operational expenses).

Potential entrepreneurs (both Israeli and newcomers) had to apply to the incubator with a technologically innovative idea, with the hope of developing it into a business. The focus was on projects at the early stage. Incubators performed the screening of the applicants as well as the idea and submitted the projects they wanted to support to the OCS. The OCS established a committee headed by the Chief Scientist which, after consulting with outside peer reviewers, had final say in the approval of each project.[8] If approved, each project would receive 300,000 US dollars for a period of two years, and this public funding could be no more than 85 percent of the whole budget for the project. The remaining 15 percent had to come from private sources, and it could be raised either by the incubator or the entrepreneur. While the amount of funding per project has increased over time (the total funding for each project is now 500,000 US dollars), the 85 percent share of public funding has been a constant throughout.

Why 300,000 dollars? No rigorous method was applied to arrive at this number. Instead, this figure was what the implementing team thought was required to pay a reasonable salary to a founder and a small research team for two years while they developed their business. The underlying assumption was that a technologically based innovative product could not be brought

[8] Nowadays, about 80 percent of projects submitted to the OCS (now the Israel Innovation Authority) are approved, although the number was much smaller at the outset. In fact, Shefer and Frenkel (2002) report that, in the 21 incubators they examined focusing on the period 1998-2001, OCS approved about 55 percent of the projects submitted by the incubators.

to market for less. Larger projects that required more funding would need to raise more private money.

Likewise, why 85 percent? There was very little private money at the time searching for start-up opportunities, and the founders of the program knew that significant public money would be needed in order to get private money in at the outset, when the ecosystem was still weak. Again refraining from a rigorous decision-making process, they arrived at 85 percent, which has remained in place.[9]

Another key feature of the program was that the money did not have to be repaid if the project failed. If a firm's project did succeed, the start-up had to repay 3 percent royalties on sales until the principal and a small interest were covered. Thus, the government was taking a big part of the downside risk, but all the upside stayed with the entrepreneurs. All these features together—the large budget per project, the large share of government financing and the combination of public risk and private upside—resulted in a very generous program that attracted the attention of potential incubators and entrepreneurs alike. This was important in order to rapidly achieve a critical mass that would allow the ecosystem to develop. Within three years, there were 28 incubators and hundreds of technological start-up projects. Thus, an intervention primarily designed to facilitate the absorption of immigrants from the Soviet Union became a very significant building block of what Senor and Singer years later termed "Start-Up Nation."[10]

While some key aspects of the incubator program have remained the same for more than 25 years, other important features have changed. Changes over time in some cases reflect shortcomings of the program, while in others they reflect the need to shift gears as capabilities accumulated and the innovation ecosystem became stronger. In all cases, changes are a testament to the program administrators at the OCS, who rather than settling for "good enough," chose to embark in a process of learning and adaptation that ultimately strengthened the program. The following sections discuss some of the main changes that took place over time.

2.1 The Privatization of Incubators

Probably the most important change was what is known as the privatization of incubators, a process that began in 2002. Although nowadays incubators operate as for-profit businesses, at the outset

[9] Both numbers (300.000 dollars and 85 percent) had to be defended in front of the Finance Ministry, which wanted to provide less funding and a smaller percentage.

[10] See Senor and Singer (2009).

they were not-for-profit entities, managed by universities, research centers or local governments. Privatization involved the establishment of a franchise system in which incubators were licensed to private operators, some of them with prior experience in the venture capital industry.[11] Privatization was intended to bring in strong professional owners who would be able to finance the operation of the incubators, as well as the 15 percent of the cost of the projects not covered by the incubator program, and take companies through initial rounds of financing. In return for incubating new companies, incubators could take equity in the new ventures. Current rules specify that founders should get at least 50 percent equity and incubators at least 20 percent. The actual equity incubators get is the result of a negotiation within those bounds and is typically closer to 30 percent.

The privatization process was not without mishaps and has been subject to important changes along the way. The initial privatization model involved a change from a system of grants, during the public stage of the incubator program, to a model based on loans to the incubators, which had to be repaid within six years. To ensure repayment, the government took shares in each incubated company and had the option of selling them if the incubator did not repay the loan. A problem with this is that the incubator would repay if its portfolio was good but had no incentive to do so if the portfolio was not valuable, leaving the state with a weak portfolio of companies, a headache the government did not want to deal with. Additionally, the fact that the government had equity in incubated companies may have opened the door for the government to participate in management decisions, which would have been clearly undesirable.

This system, which had been designed in top-down fashion without much consultation with the industry, was just too complex, and it was reformed after a process of consultation with stakeholders. As a result, the program now allocates funds directly to the individual companies which, if successful, have to repay the funds received plus a small interest rate out of royalties on their revenues. In a way, this represented a shift back to the original model of grants repaid based on success. It shows the willingness of the OCS to experiment with new policy designs and go back to basics when changes do not work.

Another change involved the mechanism of selection and renewal of incubator licenses. Originally, incubators were licensed for three years and had to reapply for an additional three-year

[11] The involvement of VC talent in the management of incubators since the privatization is a clear example of the synergies between the technological incubator program and the Yozma program, which we will discuss below.

period. The program managers conducted a due diligence process, and if the incubator's performance was deemed to be good, they submitted a report to the Office of the Chief Scientist high-tech incubator committee recommending renewal.[12]

This licensing scheme, however, had two problems. On the one hand, given the two-year incubation period, three years was not enough time for the incubator to be able to have a decent rate of return, even if the projects were managed successfully. On the other hand, this method provided a big incumbency advantage to existing incubators. They just needed to show they were doing a reasonable job for their licenses to be extended, and they were not competing with outsiders. To deal with these problems, the licensing period was extended to eight years, and the renewal process was replaced by a tender process that enables new players (both domestic and foreign) to compete for the license. Each tender, which is specific to one geographic area, is released one year before the incubator's license expires. Incumbents can and do participate in the tenders, but they are examined with the same level of scrutiny as those that are competing for the first time. While incumbents may still have an advantage due to their additional experience, the new process creates additional competition, and new groups often beat incumbents, bringing new blood to the ecosystem.

Some of the new incubators more recently attracted by the privatization process are owned by multinational corporations (such as Johnson and Johnson, or Phillips in partnership with Teva), which also brings about stronger international connections. While these companies have huge R&D budgets, having an incubator allows them to exploit open innovation opportunities, as the flexible nature of the start-ups may allow them to solve some technological problems that are harder to tackle within a larger, more bureaucratic organization. In other cases, such as the Jerusalem Venture Partners (JVP) incubator, access to an incubator allows a venture capital firm like JVP privileged access to promising start-ups that they have nurtured and consider to be "investment-ready." At the same time, vertical integration between an incubator and a VC company provides incubated firms more opportunities to access initial rounds of VC financing.

The private scheme and the fact that incubators share in the upside of the companies has important advantages. Because incubators invest 75,000 US dollars of their own funds in each new company (the total amount per firm has now increased to 500,000 US dollars), they have "skin in the game" and thus the right incentives to choose the most promising projects and teams. Because

[12] See Catarina Wylie's (2011) interview of Yossi Smoler, former director of the Technological Incubator Program.

they get an important part of the upside in these companies, they have the right incentives to add value to them through mentoring, training and connections. These hard incentives were not necessarily present during the public phase of the program, when incubators were administered by universities or local governments.

So, if private ownership of incubators has these obvious advantages, why did Israel not adopt a private scheme at the outset? According to Rina Pridor, had they gone private from the start, the program would not have succeeded.[13] There was no tradition of investing in early-stage companies in Israel, and thus the capabilities to select and nurture companies were not developed enough for the private sector to invest its own money in the process. The "public" stage of the incubator program did much to stimulate the development of these capabilities, as incubator administrators learned on the job. Besides, the development of new important actors in the entrepreneurial ecosystem, such as a rapidly expanding venture capital industry—also stimulated by government policy through the Yozma program, which is discussed later in the paper—provided the platform needed for the start-ups to exit and grow, as well as a new cadre of potential incubator administrators with the required capabilities.

2.2 Transferring IP abroad

Another important change in the program relates to the issue of intellectual property (IP). At the outset, the intellectual property of projects incubated in the program had to stay within Israel, and selling the IP outside of Israel was simply not allowed. While this had the benefit of keeping know-how within Israel, it introduced selection bias against good entrepreneurs. If an entrepreneur believed his company had great potential to develop valuable IP that could be profitably transferred abroad, she would be more reluctant to apply to the OCS technological incubator program. To address this issue, the rules regarding transferring IP abroad changed in 2005. The transfer of IP was now allowed, but the entrepreneur had to compensate the state for taking the intellectual property abroad. While the regulation was complex, it basically boiled down to this: the company had to pay an amount equal to the money it received for the sale of the IP multiplied by the fraction of the project that had been financed by the OCS.[14] The new rule also specified a non-linear

[13] Interview with Rina Pridor, September 2016.
[14] See Levenfeld, Frisch and Green (2011).
(http://www.mondaq.com/x/151326/Corporate+Tax/Overview+Of+Israels+RD+Law+And+Funding+By+The+Office+Of+The+Chief+Scientist)

schedule of payments in case part of the manufacturing associated with a project was transferred abroad.[15]

While this new system introduced some flexibility and reduced the adverse selection bias, the rules were quite complex, and there was significant uncertainty at the outset regarding the size of the payments that would be needed to transfer the IP abroad. In response to this, in 2013 rules changed again in order to simplify them and make payments more predictable. Now, if there is an "exit" and transfer of IP abroad, a company must compensate the state as follows: If there is no manufacturing activity in Israel, compensation is capped at 6 times the original OCS funding. If the IP is transferred abroad but Israel retains some manufacturing, payments are capped at 3 times OCS funding.[16] This strikes a balance between providing incentives for companies to keep IP and manufacturing within Israel, and allowing the most promising companies, which expect to transfer IP abroad, to participate in the program, as they know that potential payments will be bounded.

Other important changes over time relate to the introduction of special parameters in the program rules for specific incubators. Biotechnology projects are different in nature from digital technology projects. They tend to be riskier and costlier, and they have longer gestation periods. For this reason, not enough biotechnology projects were being successfully incubated. In response to this, the OCS introduced special rules for biotech incubators. The incubation period is three years, rather than two, and start-ups get 800,000 dollars rather than 500,000. The 85/15 percent public/private funding rule remains the same. In the case of geographically peripheral incubators, the parameters have also changed. In addition to continued funding for the incubator's operational costs, start-ups incubated in these locations now receive 650,000 dollars. This may allow these incubators to attract better projects, and to compensate for the lack of access to a local pool of highly skilled workers and experts, despite the less attractive location.

2.3 Performance of the Technological Incubator Program

While our sense is that the program has been highly successful, and that it has been a key building block for the emergence of Israel's high-tech industry, establishing the impact of the technology

[15] If more than 50 percent of manufacturing was done within Israel, repayment would increase to 1.2 times OCS original funding; If manufacturing was done primarily in foreign countries (between 50 and 90 percent), payments increased to 1.5 times original OCS funding. If more than 90 percent of manufacturing was carried out abroad, payments increased significantly to 3 times the original OCS funding.

[16] The source for this discussion on IP rules is an interview with Itay Beck, manager of the technological incubator program at the OCS.

incubator program with precision is not an easy task. First, even if one had good data on the performance of the firms that went through the program, it would be challenging to come up with a good control group of firms to establish causal links between the program and firm performance. Even if that control group existed, however, other difficulties would remain. As discussed earlier, the program has a direct effect on the start-ups that go through it, but it may also have an impact on the development of the whole start-up ecosystem. If so, even firms that do not formally go through the program could potentially benefit from it. They would have access to more specialized services such as intellectual property lawyers, venture capital financing, etc. In the presence of these externalities, establishing the causal impact of the incubator program would be even more challenging. Perhaps due to these methodological difficulties, to the best of our knowledge, no rigorous impact evaluation of the technological incubator program exists to date.

There are, however, studies that provide some useful indicators of the performance of the program. One of the most detailed early studies is Shefer and Frenkel (2002). These authors looked at the rate of graduation of start-ups that went through the incubator program during a three-year period between 1998 and 2001, as well as the share of graduated firms that received further financing. While the paper examines how success indicators depend on a variety of features (whether the incubators are located in metropolitan areas or in the periphery, whether they are specialized or not, etc.), for our purposes it is enough to focus on the overall measures of success. They find that, out of 272 projects that went through the incubator program during this period, 235 of them (86.4 percent) graduated from the program. Only 37 projects dropped out. While graduating from the program does not provide a good sense of how successful these firms were after graduation, it still is an impressive rate of success. Moreover, out of the 235 graduating start-ups, 183 (that is, 78 percent) were able to secure some type of financial support following graduation. This means that two thirds of the firms that were selected to participate in the incubator program were able to secure additional financial resources after graduation.[17] In most cases, additional funding came from investment companies (90 projects), other OCS programs (46 projects) strategic partners (34 projects) or venture capital firms (32 projects). Regardless of the source of additional financing, again, this seems like a high rate of success.

Another more recent paper that analyzes success of incubated companies is Avnimelech, Schwartz and Bar-El (2007). These authors examine the IVC (Israel Venture Capital) online

[17] 0.864 * 0.78 = 0.67

database, which at the time included 3,747 Israeli R&D high-tech companies established between 1991 and 2004.[18] All firms in the dataset began as new Israeli start-ups. Out of these 3,747 firms, 618 graduated from the technological incubator program. These authors group firms into three groups: those that had initial public offerings (IPOs) or were targets of significant acquisition (this is the "exit" or high success group); those that were still active at the time of the writing ("survival" or moderate success group) and those that had closed (failure).[19]

Compared to the findings of Shefer and Frenkel, the success rates reported by Avnimelech, Schwartz and Bar-El (2007) appear to be more modest. In fact, these authors go as far as to characterize the success rates on incubator graduates as "very low." Out of the 618 companies that graduated from the technological incubator program through 2004, 46.4 percent had closed their operations at the time of the analysis, and only 3.9 percent had experienced high success (exits). The authors contrast this with the VC-backed firms in the sample, which experienced much lower failure rates (28.3 percent) and much higher exit rates (16.5 percent).

We think that these author's characterization of "very low" success rates is too harsh, however. First, the failure rate implies that more than 53 percent of incubated graduates were still alive at the time of the analysis. While "survival" may not be an indication of huge success, 53 percent is not a low survival rate by any means, especially considering that some of these firms had graduated from the program more than 10 years prior to the analysis.

Second, "exit" is a very demanding measure of success. Only companies that are hugely successful have IPOs or are targets of significant acquisition. Perhaps a better measure of success would add also the incubated graduates that received VC funding. For a firm that is invested by an incubator at a very early stage, receiving VC funding should already be considered a success. According to Avnimelech, Schwartz and Bar-El (2007), there were 83 of these graduates that were VC backed. Thus, according to this more realistic measure, the incubator rate of success would be just above 13.4 percent.[20]

Third, as the authors themselves recognize, the comparison with the success of VC-backed firms discussed above is somewhat unfair, as incubators invest during very early stages of

[18] An R&D high-tech company is defined as "a firm that develops its own highly advanced, innovative technology or device through investment in extensive R&D activity."
[19] It is worth noting that, within the culture of entrepreneurial ecosystems such as those in Israel and Silicon Valley, failures are often considered a rite of passage in the careers of successful serial entrepreneurs and are not generally stigmatized.
[20] This is in fact a lower bound, assuming that all the incubated graduates that experienced exits were also VC backed.

development (pre-seed and seed), when the risks involved are much higher, while VCs invest in early and mid-stages. Thus, it is not surprising that VC-backed firms are more successful.

Avnimelech, Schwartz and Bar-El (2007) also mention another very interesting fact: while there were 3,747 high technology start-ups between 1991 and 2004, the total number of high technology start-ups established in the 1980s only amounted to 300, approximately. That is, the number of high technology start-ups per year increased nearly 10-fold, from about 30 to 270! While this jump cannot be attributed to the technological incubator program or to Yozma, it would be hard to argue that they did not play an important role, whether directly (companies that were incubated within the program or VC backed) or indirectly (as a result of the positive impact of these programs on the Israel start-up ecosystem).

In order to complement the results in these papers, we examined all the high-tech firms (a total of 1,315) that have been part of the technological incubator program to date, as reported in the IVC database discussed above.[21] First, we extend the analysis in Avnimelech, Schwartz and Bar-El (2007), looking at their success measures, but using more than 10 extra years of data (including firms that were selected into the incubator program through 2015). Second, we produce a wider range of success indicators, from very lax ones (like graduation) to very demanding ones (like exit) but covering additional "intermediate" measures of success that may be a useful complement to the ones discussed above. For example, we track whether firms were still operating four years after inception into the program, and whether they received VC funding or exited within the same time frame, among others.[22,23] Third, we track these success indicators over time.

The top panel of Table 1 presents the success rates for the whole sample of incubated companies, which includes companies whose incubation period started between 1991 and 2015, with expected graduation between 1993 and 2017. More than 93 percent of companies selected for incubation graduated from the program. Of those that graduated, 38.7 percent are still operating today.[24] That means that the "failure rate" is 61.2 percent. In comparison, the failure rate reported by Avnimelech, Schwartz and Bar-El (2007) was 46 percent. Does this mean that the program has

[21] We thank Itay Beck for providing us the list of all the incubators that have been part of the program over the years.
[22] The VC funding and exit variables are conditional on graduation from the incubator program (that is, a firm that fails during incubation is not included in the calculation of success related to VC-backing and exit). Since 93 percent of companies graduated from the program, this should not affect the results significantly.
[23] We call inception the beginning of incubation.
[24] Firms that exit through IPOs or mergers and acquisitions drop out of the IVC database. For the purposes of computing this indicator, we assumed that firms that exited are still in operation today.

become less successful over time? Not necessarily! As time goes by, the average number of years since graduation for the whole sample increases, and the "survival test" becomes more stringent. The share of incubator graduates that obtained VC backing is just above 35 percent, while the share of exits is 9.5 percent. These are impressive numbers. Again, these figures are not strictly comparable to the 13.4 and 3.9 percent we reported from Avnimelech, Schwartz and Bar-El (2007), since in our sample companies have had more time, on average, to receive VC financing or exit.

Table 1. Success Rates

Variable	**%**
Graduated	93.31
Still Operating	38.71
VC-backed	35.62
Exit	9.54
VC or exit	38.63
Operating 4 years after inception into the program	63.47
Operating 6 years after inception into the program	48.73
VC within 2 years of inception	16.71
VC within 4 years of inception	30.03
Exit within 4 years of inception	2.93

Source: Authors' calculations based on IVC database.

To follow performance over time, a better way to measure success may be to track these performance measures during a certain set window after inception.[25] Thus, in the lower panel of Table 1 we include additional measures of success: whether the firm was still operating 4 and 6 years after inception, whether it obtained VC financing within 2 and 4 years of inception, and whether it achieved exit 4 years after starting incubation.

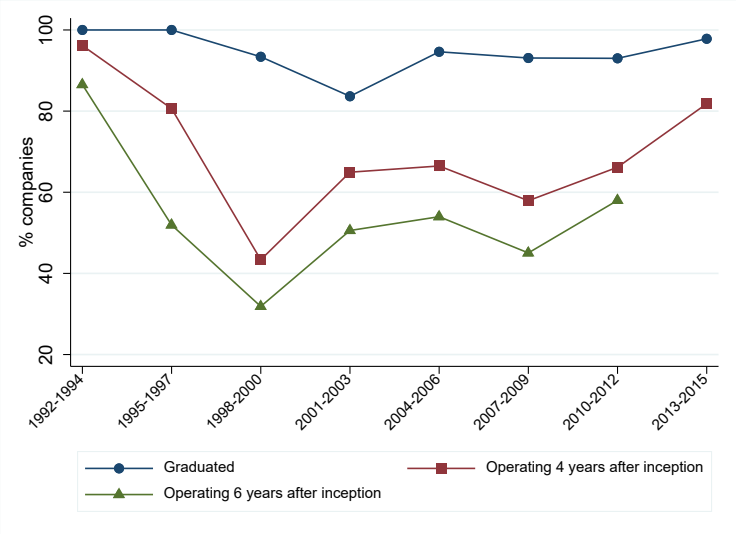
Using these measures, we track performance through time by grouping firms in cohorts of three years each, according to the year in which firms initiated their incubation. Figure 1 tracks three measures of "light" success: whether firms graduated, and whether graduating firms survived four and six years after inception. There is only slight variation in graduation rates over time. With the exception of the 2001-2003 cohort, where they fell below 84 percent, graduation rates have been consistently over 93 percent.[26]

[25] We chose to base these measures on the date of the start of incubation and not graduation, since the graduation dates are not available for all firms. For the graduation data above, in cases when information on graduation date is unavailable, we simply checked that the firm was still active two years after initial incubation.

[26] The dip for the 2001-2003 cohort may be related to potential dislocations associated with the shift from the public to the private incubator model which took place beginning in 2002.

There is a very noticeable dip in survival of graduated firms for the cohort 1998-2000. This is no doubt related to the burst of the dot-com bubble which began in 2000. There is another smaller dip associated with the 2008-09 global financial crisis. Overall, and perhaps surprisingly, the best overall cohort in terms of graduation and survival has been the first one. It is striking that this cohort also performs surprisingly well in terms of overall survival: 25 years after these firms were selected into the incubator program, more than 40 percent of them are still operating. Given that there were no incubators before the program, it is possible that there was a backlog of high-quality projects that were available when the program was established, so the newly minted incubators were able to get their pick of an excellent applicant pool.

Figure 1. Graduation and Survival Rates per Cohort



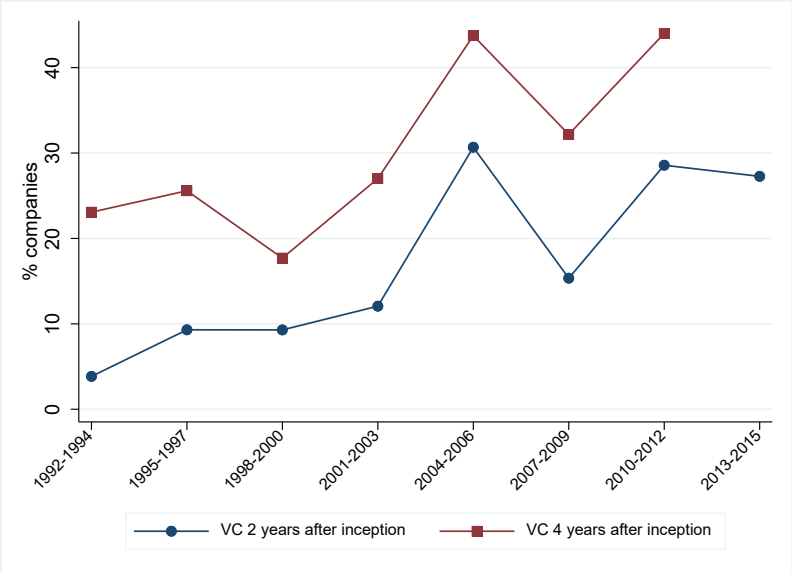
Figures 2 tracks a measure of deeper success: VC funding. Whether we look at the 2- or 4-year window, there is a clear upward trend in the share of incubated companies that receive VC funding.[27] Beyond the dips associated to the hi-tech bubble burst and the financial crisis, the increased success may be associated to a more developed ecosystem, including a closer link between VC funds and incubator managers following the privatization of the program. It is remarkable that, starting with the 2004-2006 cohort, the share of incubated graduates that obtained VC funding within a 4-year window is 39 percent. For the two cohorts between 2010 and 2015,

[27] Receiving VC backing within two years of inception implies that the firm received funding the year of graduation, or before that.

the share of graduates obtaining VC funding within a 2-year window is also a remarkable 28 percent.

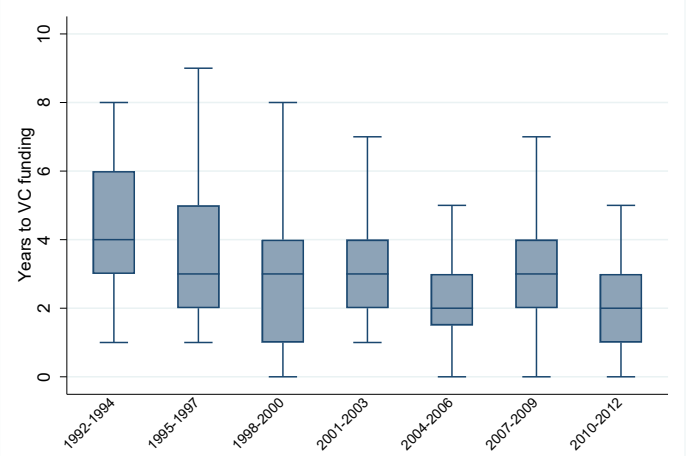
Part of the increase in the share of VC-backed incubated firms within set time windows can be linked to another important fact: the time elapsed between inception and VC funding became shorter as the ecosystem developed. This is important because it helps reduce what is typically called the "valley of death," the period of time in which firms still do not have enough revenues but cannot obtain adequate financing to develop and scale up. A first naïve way to look at this is to track the median time from inception to VC-backing for the different cohorts, as well as its distribution (Figure 3). The median time has been cut from 4 years, for the first cohort, to 2 years for the last one, with dispersion falling considerably as well. This means that most firms in the recent cohorts are obtaining financing just when they graduate from the incubators. This reduction in time to VC backing is misleading, however, since the maximum potential number of years to VC-backing declines for more recent cohorts.[28]

Figure 2. VC Backing Rates per Cohort



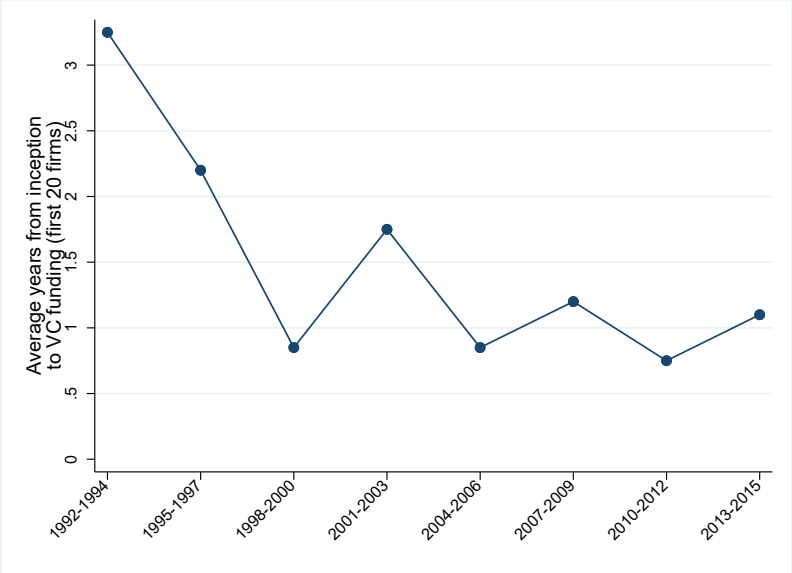
[28] For example, a firm incubated in 1992 may have received VC backing 20 years later. A firm incubated in 2012 may also receive VC backing 20 years later, but it does not yet appear in our sample as VC-backed.

Figure 3. Time Elapsed between Inception and VC Backing per Cohort



A better way to look at this, which avoids the problems discussed for Figure 3, is to track the average time it takes for the first 20 companies to receive VC-funding for each of the cohorts (Figure 4). The pattern is very similar. Time to VC backing following inception falls significantly over time, from more than three years for the first cohort to around one year for the last four cohorts. This is probably a sign of a more mature ecosystem and increasingly capable incubators. Note that, here again, there is a dip in time elapsed for the cohort 1998-2000, which is consistent with the easy VC money available for start-ups during the time of the dot-com bubble.

Figure 4. Time between Incubation and VC Backing of First 20 Firms per Cohort



Figures 5 and 6 show similar trends for exits. The share of exits within 4 years increases over time (Figure 5), as incubators become more experienced and the ecosystem around them develops, although there is an important peak for the 2001-03 cohort. The average time for the first 10 firms of each cohort to exit also declined significantly, from around 8 years in the first two cohorts to 2 and 3 years in the last two. Again, there is a noticeable dip for the 2001-2003 cohort.[29]

In Table 2, we present the results of a set of regressions in which we explore the impact that each additional year in the program has on the likelihood of success. We include six different measures of success: whether the incubated firm graduated from the program (column (1)); whether it was still in operation four and six years after inception (columns (2) and (3)); whether it received VC funding within a 2- or 4-year window (columns (4) and (5)); and whether it exited within a 4-year window (column (6)). We include dummy variables for the sector, as well for the years that were most affected by the burst of the dot-com bubble and the financial crisis. The coefficient of interest is the one corresponding to the year of selection into the incubator program.

The results differ whether we look at more shallow or deeper indicators of success. On the one hand, an extra year does not seem to correlate significantly with graduation rates, or with the probability of firm survival. One possible interpretation, broadly consistent with Figure 1, is that two different effects may be at play. On the one hand, at the outset there may have been a large number of high-quality projects competing to be incubated. Thus, graduation and survival were high, even when the ecosystem was not yet fully developed. Once the program was in a steady state, performance improved with time.

[29] These firms may have benefited from being at the right place at the right time. Since they were incubated right after the dot-com bubble burst, they faced less competition form firms in the earlier cohort, most of which had failed (see Figure 1). At the same time, many of them were ready to exit before the global financial crisis of 2008.

Figure 5. Exit Rates within 4 Years of Inception per Cohort

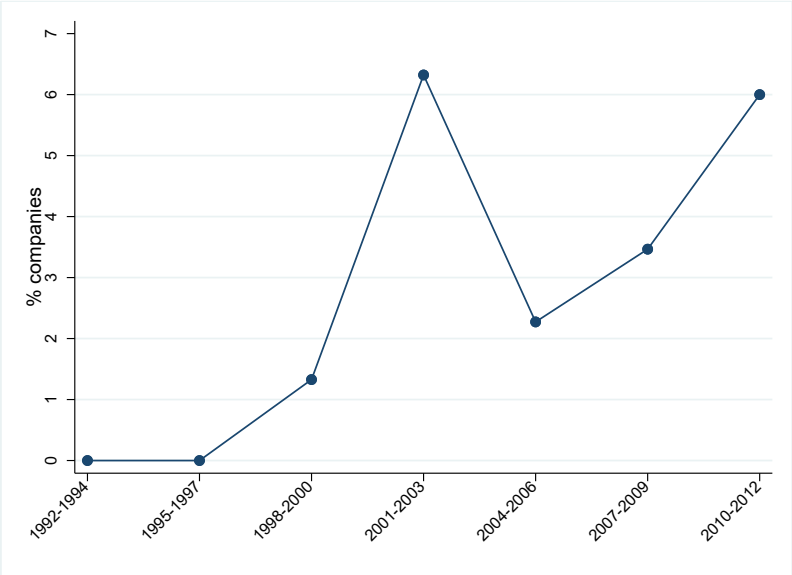


Figure 6. Time between Inception and Exit of First 10 Firms per Cohort

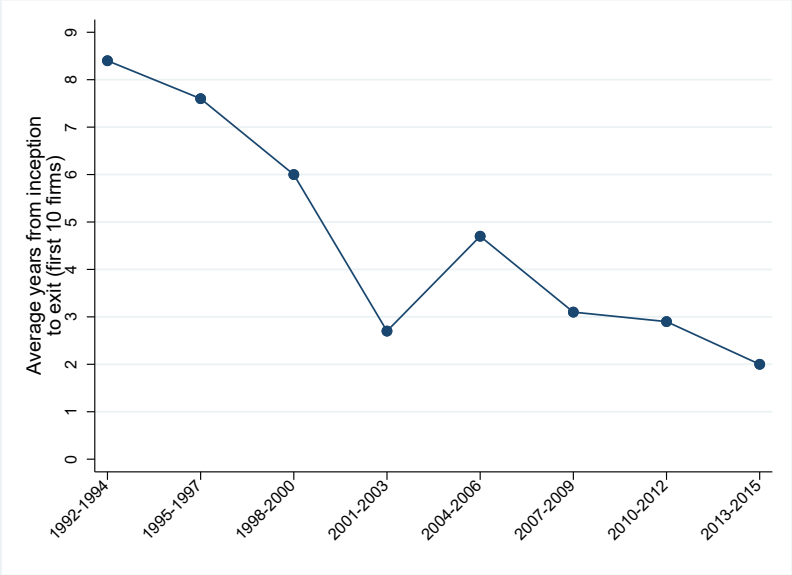


Table 2. The Impact of an Additional Year in the Program

VARIABLES	(1) Graduated	(2) Operating4	(3) Operating6	(4) VC2	(5) VC4	(6) Exit4
Year of Seed 1	-0.001	-0.005	-0.003	0.012***	0.012***	0.003**
	(0.001)	(0.003)	(0.004)	(0.002)	(0.004)	(0.001)
Sector: Communications	0.007	0.062	0.039	0.113**	0.114	0.033
	(0.034)	(0.067)	(0.076)	(0.048)	(0.072)	(0.024)
Sector: IT & Enterprise Software	0.035	0.060	0.084	0.105**	0.196***	0.010
	(0.023)	(0.054)	(0.069)	(0.043)	(0.060)	(0.025)
Sector: Internet	-0.022	-0.059	-0.058	0.159***	0.224**	-0.012
	(0.039)	(0.070)	(0.082)	(0.054)	(0.082)	(0.024)
Sector: Life Sciences	0.015	0.096**	0.071	0.044	0.115**	0.004
	(0.022)	(0.045)	(0.047)	(0.038)	(0.052)	(0.011)
Sector: Misc. Technologies	0.017	-0.046	-0.090**	0.003	0.017	0.003
	(0.020)	(0.043)	(0.038)	(0.035)	(0.041)	(0.015)
Sector: Semiconductors	-0.045	0.129*	0.107	0.160	0.227**	0.023
	(0.063)	(0.073)	(0.097)	(0.096)	(0.109)	(0.045)
1 if year==2000	-0.100*	-0.176**	-0.183***	-0.047	-0.14***	-0.02***
	(0.050)	(0.068)	(0.057)	(0.043)	(0.045)	(0.005)
1 if year==2001	-0.161**	-0.064	-0.120	-0.12***	-0.117**	-0.007
	(0.062)	(0.064)	(0.094)	(0.034)	(0.050)	(0.019)
1 if year==2008	0.002	-0.101	-0.074	-0.129**	-0.055	-0.019
	(0.036)	(0.076)	(0.089)	(0.050)	(0.085)	(0.019)
1 if year==2009	-0.020	-0.048	-0.093	-0.095*	-0.165**	-0.010
	(0.033)	(0.065)	(0.079)	(0.049)	(0.067)	(0.032)
Observations	1,315	1,125	1,059	1,125	1,059	1,059
R-squared	0.030	0.025	0.026	0.065	0.061	0.012
Incubator FE	NO	NO	NO	NO	NO	NO

Note: Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

On the other hand, there seems to be a significant correlation of an extra year with more demanding indicators of success. Perhaps having an initial backlog of good projects enhances survival but is not enough for VC-backing and exit when the ecosystem is not fully developed.[30] The coefficient associated to the VC variables suggests that the correlation is substantial. Every additional year of the program is associated with a 1.2 percentage point increase in the probability that a graduated firm will receive VC funding within the corresponding time window. This means

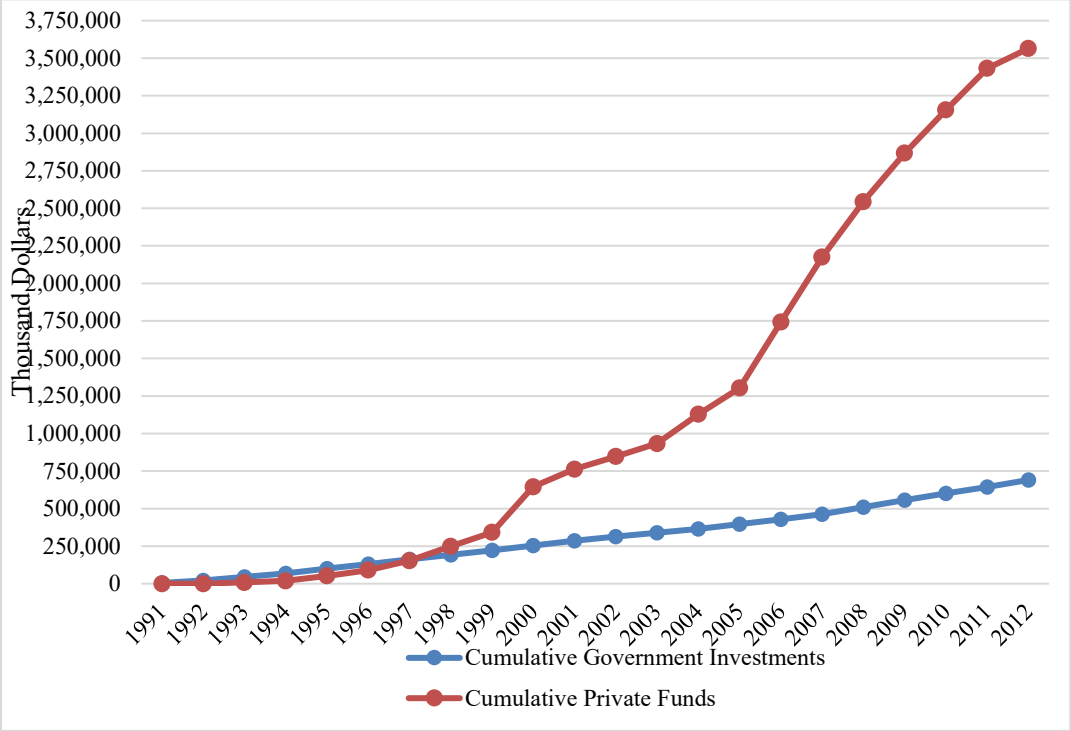
[30] Results are similar when including incubator fixed effects.

that, in the more than 20 years since the beginning of the program, the likelihood of receiving VC funding within these time frames for graduates increased by nearly 25 percentage points.

Likewise, the coefficient for exit within 4 years suggests that each additional year was associated to an increase in the probability of exit of 0.3 percentage points. Thus, over a 20-year period, the probability of exit if graduated from the technological incubator program increased by 6 percentage points. This is quite substantial if we take into account that, for the whole period, the average number of firms exiting within 4 years of graduation is 2.93 percent.

The success of the program in terms of bringing in private capital, for example through VC-backing and exit, has been highlighted by those responsible for the program. In fact, the OCS claims that, while at inception public money accounted for 85 percent of the funding as discussed above, over the life of the incubated companies, the amount of private money raised far exceeded the grants provided by the OCS. Figure 7, taken from a presentation by Yossi Smoler, former head of Technological Incubator Program at the OCS, shows this clearly: by 2012, cumulative private money outpaced public money by a factor of 5.

Figure 7. Government Investments and Total Private Funds Invested in Incubated Companies (1991-2012)



Note: Taken from Smoler (n.d.).

Taken together, these results suggest that the incubator program has been highly successful. Graduation and survival rates are high, and the probability of VC backing or exiting conditional on being incubated is close to 40 percent. The public money spent in the program was successful in leveraging vast amounts of private money for the incubated firms. Moreover, there is preliminary evidence that the program improved over time, as the ecosystem became stronger and incubator managers developed their capabilities. The results, however, should be taken with caution since, as discussed at the beginning of this section, a variety of issues of selection and spillovers associated to the program, and related issues of data availability, prevent us from undertaking a rigorous impact evaluation.

3. YOZMA and the Development of the VC Industry

The incubator program was an important piece of the start-up puzzle in Israel. But there was another crucial piece: Yozma (initiative, in Hebrew), a government program responsible for the establishment of a dynamic VC industry. In fact, many analysts argue that Yozma, rather than the technology incubator program, was the centerpiece of the government policy in support of the start-up ecosystem.[31]

As we have stressed from the beginning, the success of entrepreneurship policies in a country typically does not hinge on the success of individual programs, but rather depends on the presence of a bundle of policy instruments (as well as other country characteristics), which together strengthen the entrepreneurship ecosystem. In this regard, a business incubation program may be much more effective if there is a strong VC industry that provides "smart" financing to the best incubated projects. Without the early stage financing and guidance provided by VC funds, many good projects may not survive. Likewise, a strong VC industry requires a critical mass of deal flow, which a good incubation program helps provide. The technological incubation program contributed to this critical mass. But Yozma was instrumental in completing the virtuous circle.

As was the case with the technological incubator program, Yozma was established during Yigal Erlich's tenure as the head of the OCS.[32] Even before the creation of the technological incubator program, the OCS had programs to fund new companies. But in most cases, these new companies were failing. In many cases, companies were getting the technological aspects of the

[31] See, for example, Avnimelech and Teubal (2006).
[32] Part of this section is based on interviews with Erlich conducted by the authors in September 2016.

business right, but they did not know how to take their products to market. One crucial aspect of this problem, in the case of Israel, was that the size of the domestic market was simply too small. For these companies to succeed they would need to target global markets from the start. In order to do this, Erlich thought, the support of venture capital firms could prove to be invaluable. With this in mind, Erlich visited the United States to explore the possibility of developing a VC industry in Israel. While there was some VC activity in Israel prior to Yozma (the first Israeli VC fund, Athena, had been founded in 1985 and a few others had followed), the sector was very underdeveloped. There were very limited local VC capabilities, and the idea was to involve US actors in order to learn from them.[33]

The timing was right. At that time, the VC industry was not yet global in nature, and VC funds tended to invest in companies that were very proximate.[34] However, the industry was ripe for globalization. Advent, a spinoff of a fund called TA Associates, had recently separated from its mother company precisely in order to globalize. Erlich arranged for Advent to visit Israel, and during the visit Advent identified two important constraints. First, the market was not attractive enough for them to enter on their own. In order to participate, they would require support from the government. Second, they did not have the required knowledge of the local market. To overcome this, they would need local partners that would possess such knowledge.

In 1992, the OCS established Yozma, a government-owned fund with 100 million dollars of capital, with the aim of helping establish a strong VC industry in Israel. In line with the conclusions of Advent's visit, the idea was to create multiple VC funds consisting of three partners: Yozma, a US fund (which Yozma would help bring in) and a local partner who the US fund would look for. If the US fund and the local partners could raise 12 million dollars, Yozma would provide an additional 8 million. Part of the private money (around 60 percent) was typically raised in the United States, while the rest was raised within Israel. The Yozma VC funds would take the form of limited partnerships, the organizational form that had proved most successful in the United

[33] While there were no VC links at the time, there were other important links between Israel and the US regarding R&D. A number of US multinationals such as Motorola, IBM and Intel, had set up R&D labs in Israel in the 1960s and 70s. The BIRD Foundation (Israel-US binational industrial R&D) had been established in 1977 with the purpose of facilitating partnerships between US and Israeli firms. And a number of firms in Israel had become public through NASDAQ during the 1980s (see Avnimelech, Kenney and Teubal, 2004).

[34] In fact, market participants used to say that VC funds would only invest in companies they could visit by bike.

States.[35] The private partners, in addition, would have the option to buy Yozma out after a five-year period, under favorable conditions.

In 1993, Advent became the US partner for the first of the Yozma VC funds, Gemini. Within three years, Yozma had established nine funds with similar characteristics. Most of the funds exercised the option to buy Yozma out at the end of the five years. Within seven years, the remaining Yozma holdings were privatized, and a robust, privately owned VC industry had been established. The virtuous circle of deal flow and financing had been successfully closed. Today, there are about 70 active VC funds in Israel, with numerous success stories of exits through IPOs or M&As.

In short, Yozma was a huge success. The following figures, taken from Avnimelech and Teubal (2006), show the impact it had on the development of the VC industry (and corresponding development of the high-tech sector). In 1992, there were only 4 limited partnership VCs in Israel, which raised a total of US$ 27 million. In 1993, Yozma funds alone raised a total of US$ 149 million. By the year 2000, Israel had 61 limited partnership (LP) VC funds, and had become, by far, the number one country in the world regarding VC investments over GNP (0.7 percent vs. 0.48 percent in the United States). It also had more than 120 IPOs on Nasdaq, more than half of which represented VC-backed firms. At the time, Israel was the third country, following the United States and Canada, in number of IPOs in NASDAQ.[36]

While it would be very difficult to establish causality, Avnimelech and Teubal (2006) emphasize the co-development of the VC industry and the high-tech sector in Israel using the IVC database on high-tech companies discussed above. The numbers are striking: in the eight years before Yozma (1985-1992), total fundraising by limited partnership VCs amounted to 170 million US dollars. In the eight years after Yozma (1993-2000), LP VCs raised 7.480 billion US dollars. In the eight years before Yozma, the number of high-tech firms created was 297. In the eight years after the creation of Yozma the number of firms created jumped to 2,264. Of course, other developments, in addition to the already discussed technological incubator program, may be partially responsible for this jump in high tech-firms. The widespread adoption of the internet, for example, is an obvious one. However, we doubt that other countries experienced similar jumps in

[35] For a discussion of the nature and advantages of limited partnerships, see Gompers and Lerner (2001, 2004).
[36] Nowadays, Israel is still number three in IPOs in NASDAQ, after the United States and China.

the creation of high-tech firms. It seems obvious that Yozma, together with the high-tech incubator program, has to be an important part of the story.

But it is important to remember that shortly before there was Yozma, there was Inbal. Inbal, an earlier, failed attempt to develop the VC industry, displayed important differences from Yozma. While Yozma brought 100 million dollars of public money to the table in order to bring in private money at the outset, Inbal did not. While Yozma boosted the upside of VC by giving firms the option to buy out the public sector share at an attractive price, Inbal, a government owned insurance company, protected the downside risk by basically insuring 70 percent of losses of the VC funds. While Yozma funds adopted the limited partnership model, which had proven successful in the United States, Inbal funds were publicly traded in the Tel Aviv Stock Exchange. But perhaps the main difference is that, while Yozma established a network with experienced US VC funds, Inbal did no such thing. The fact that Yozma succeeded while Inbal failed suggests that the network aspect of Yozma, connecting Israeli actors with very experienced US partners with knowledge of how to target global markets and take companies to successful exits, was a key feature for success. Moreover, the fact that Yozma was launched shortly after Inbal speaks of the capacity of the OCS to learn quickly from experience, experiment and adapt policies as needed.[37]

4. Is the Incubator Program Still Needed in Israel?

The incubator program and Yozma were instrumental in getting Israel to where it is today. At the time, the ecosystem was much weaker, and there was little private money looking to support innovative start-ups. This situation has changed dramatically. It is obvious that Israel does not need to support further the VC industry. The industry has been completely private since the late 1990s, there are a large number of local and international funds that are very active in the market, and there is enough private money to fund the most promising projects. Deal flow is ample, and the profit motive is enough to lure VC funds to play the game.

How about the technological incubator program? That is a different story. While the technological incubators themselves are private, the system still relies to a great extent on public grants. With the dramatic development of the ecosystem, is this public support still necessary? While a definitive answer is beyond the scope of this paper, here we offer some thoughts. On the one hand, the technological incubators today coexist with a large number of other incubators and

[37] For a detailed account of the differences between Yozma and Inbal, see Avnimelech and Teubal (2006).

accelerators that do not receive government support. The existence of these other non-supported incubators suggests that, at the very least, the program is not as important as it once was.

On the other hand, our sense is that, to a great extent, these incubators and accelerators tend to focus on later stage projects, or on developing start-ups that suit the needs of the incubator's owners. Examples include Barclay's Tel Aviv accelerator, which supports start-ups that provide innovative fintech solutions, or Microsoft Ventures, whose start-ups become clients of Microsoft cloud services. To the extent that the incubator program continues to focus on high risk, early stage projects likely to introduce innovative products (and thus produce externalities) that would otherwise not come to fruition, then it would make sense to continue to support it.

The key, then, is to focus on worthwhile projects that would not emerge in the absence of the program. For example, the focus could be on peripheral incubators, with the purpose of developing the ecosystem in relatively backward locations, and on risky projects with longer gestation periods, such as those in biotechnology. By doing so, public money would be spent where there is additionality, and the private sector would take care of the rest.

To the extent that support continues for all technological start-ups, however, the program probably does not need to be as generous as it has been thus far. With the development of the ecosystem, it should be possible to entice good incubator managers to participate under less generous conditions. Certainly, incubators such as Johnson and Johnson should not require an 85 percent government grant to participate. Alternatively, the State could have a larger participation on the upside, at least in the case of very successful cases of exits through IPOs or significant acquisitions.[38]

5. Sequencing: Which Should Come First?

We argued at the beginning that, in building an ecosystem for entrepreneurship, rather than thinking about specific interventions in isolation, one should think in terms of bundles of interventions, as well as the sequencing of interventions. We have discussed in some detail two such interventions, the technological incubator program, and the YOZMA venture capital program, that were key in the development of the ecosystem in Israel. We also discussed how these programs may complement each other, and together they may become part of a virtuous circle that produces good outcomes. A strong VC industry can strengthen an incubation program, and a good

[38] This would be in line with the ideas of Mazzucato (2015).

incubation program can strengthen the development of a VC industry. But if you had neither and you had to start somewhere, which should come first? It seems clear that the answer should be incubation.

First, incubation happens at a very early stage of the development of a start-up. Venture capital comes later, as a potential exit for the most successful incubated firms. While the prospect of having venture capital financing at the end of the incubation period may increase the upside of projects and thus the attractiveness of the incubation process for both entrepreneurs (especially the better ones who think they may be targets of VC backing) and incubator managers, it is only at the end of the incubation period, that is, at graduation, that VC financing becomes key. In contrast, a critical mass of deal flow, which incubators help create, is absolutely essential for the development of VC. Absent sufficient deal flow at the outset, any program in support of the development of the VC industry is destined to fail. Thus, unless a large number of good projects that may be tapped into by the VC funds already exists, a good incubator/accelerator program should be a key component of an entrepreneurship policy at the outset.

The experience of these two programs in Israel supports this sequencing. The technological incubation program was deployed in 1991, and by 1992 there were already 10 incubators in place. The Yozma funds became operational in 1993, exactly when the first batch of start-ups were graduating from the incubator program. In discussing the issue of sequencing, Yigal Erlich, the creator of both programs, also supported this sequencing. He argued convincingly that the VC industry, whether in Israel or in other countries, should not be the place to start.[39]

6. The Incubator Program: Some Thoughts for Latin America

As we have argued above, the incubator program has been very successful in Israel. The question is, would a program such as this one, perhaps adapted to the realities of our region, be an important policy tool to foster entrepreneurship in Latin America? While it is important to acknowledge that Latin America is very heterogeneous, with countries that differ significantly in important dimensions, we think that, in general, a good incubation/acceleration program could be an important part of the entrepreneurship policy menu.

[39] Interview with Yigal Erlich, 2016.

In fact, more and more countries are deploying incubation and acceleration programs. However, they typically differ substantially from the technological incubator program in Israel. They tend to be substantially less ambitious in scope, and the benefits for incubators and incubated firms are less generous. They correspondingly tend to have much lower budgets.

So which of the features of the program are crucial for success, and which may be adapted to fit the Latin American reality?

1. *Incentives of incubators*. Income of incubators should be linked to the success of the incubated start-ups. Incubators should be rewarded not in proportion to the number of firms they incubate, but rather in relation to the performance of these firms. It is vital to structure the incubators' rewards so that they have incentives to select the most promising start-ups and provide and facilitate access to top-level incubation services. In the Technological Incubator program, the fact that incubators invest 70 thousand dollars of their own money in each of the start-ups implies that they have skin in the game, and thus have the right incentives to choose the best companies. The fact that they retain around 30 percent of incubated companies implies that they are rewarded on the basis of performance. In Latin America, most programs to support incubators lack this feature. Some programs, such as Chile's recently discontinued *Subsidio Semilla de Asignacion Flexible* (SSAF, or Flexible Allocation Seed Subsidy), allows accelerators to keep 7 percent of the equity. While the specifics of the rewards to incubators may be different in different cases, a system that aligns incentives of incubators with start-up performance should be an essential requirement of any incubation/acceleration program.
2. *Money to cover operational expenses.* At the outset, the Technological Incubator Program provided 300,000 US dollars a year for incubators to cover operational expenses. This support was eliminated once the program was privatized, except in the case of the geographically peripheral incubators. While it seems that these operational subsidies are not needed once the ecosystem is stronger, we think that they should be an important feature at the outset in programs in Latin America, particularly in conditions of relatively weak ecosystems. In order to deploy an incubator or accelerator program, the package

has to be sufficiently attractive in order to bring talented incubator managers into the program. At the time when the program is being launched, when success rates are expected to be low and the operation of an incubator is risky, money for operational expenses may initially be an important part of this package. The size of this subsidy should be large enough to bring talent in, but small enough that most of the income of a successful incubator should be tied to the performance of the incubated firms. As the ecosystem strengthens, money for operational expenses may no longer be required.

3. *Size of grants and co-financing share.* Israel's technological incubator program is very generous, with 500,000 dollars per start-up and 85 percent of public financing. The typical program in Latin America involves much smaller amounts (typically less than 50,000 dollars)[40] and smaller public financing shares (around 50 percent). While we think it is important to commit sufficient resources to each project in order to make it viable, we believe that much can be accomplished with grants that are significantly smaller than those in Israel. Nonetheless, some of the best programs in Latin America are increasing the size of their benefits. The recent Acceleration Fund in Argentina provided benefits of up to 100,000 dollars per firm, in the case of technology companies, with a 50 percent rate of public financing.[41] In the case of scientific accelerators, the fund's generosity approached that in Israel: companies received up to 450,000 dollars, 300,000 of which were provided by the program.[42] In Chile, CORFO has a sequence of programs to support innovative firms as they go from the initial stages to expansion to scale-up, which together total about 140,000 dollars, with nearly 70 percent provided by public grants.[43] In general, we think that 100 thousand dollars and 50 percent public support should be sufficient for

[40] The discussion in this section is partly based on Wagner and Stein (2014).
[41] https://www.argentina.gob.ar/acceder-al-programa-fondo-aceleracion
[42] One of the scientific accelerators, CITES, has retained the services of an Israeli consultant with vast experience in the sector. This consultant has also been influential in arguing for more generous funding in the case of scientific projects, which regularly require solving complex IP issues.
[43] See Semilla inicia: https://www.corfo.cl/sites/cpp/emp-semilla-inicia; Semilla Expande: https://www.corfo.cl/sites/cpp/emp-semilla-expande; and Escalamiento: https://www.corfo.cl/sites/cpp/emp-escalamiento

countries in Latin America, where fiscal revenues are scarce and it may be politically difficult to commit more resources to entrepreneurs.

4. *Selection of start-ups by incubator, not by government officials.* Even from the start, the selection of start-ups was made primarily by the incubators, not by bureaucrats. While the OCS established a committee which had final say in the approval of each project, the majority of projects were approved and, crucially, no project received funding if it was not selected by the incubators themselves. As the system became private and incubators put their own money into the start-ups, approval became almost automatic. We think that programs in Latin America would be well served by sticking to the rule that it should be incubator managers, and not public officials, who are primarily responsible for the selection of incubated companies.
5. *No repayment in case of failure.* We think this is a key feature of the Israeli program. By allowing entrepreneurs to gain experience from success or failure without falling into personal debt, this feature of the program may have contributed to changing attitudes toward risk, and thus to attracting a larger number of projects. In countries in Latin America, in which risk aversion and fear of failure are greater than in Israel, allowing for no repayment of failed start-ups appears to be the obvious choice. While under some conditions this feature may lead to overly risky projects, the fact that incubator managers have to put their own resources on the line when they select the start-ups should help mitigate this risk.
6. *No upside for the government*. In the Technological Incubator program, the start-up and the incubator retain all the upside. Firms only have to repay the grant, with a small amount of interest, if the project is successful. Only if the firm transfers the IP and/or manufacturing abroad does the program receive substantial additional payments, of up to 6 times its original contribution. We do not think that this is an essential feature of the program. In line with the thinking of Mazzucato (2015), in the case of firms that have substantial success (for example, firms that achieve exits in the form of IPOs or are the target of acquisitions) the government could be compensated more richly for its

contributions. The returns should be small enough in percentage terms so as to not significantly affect the incentives of founders, yet large enough to allow for the sustainability of the program beyond the scope of an administration.

7. *Learning and adjustment*. Rather than having a clear idea of the business model ex ante, innovative start-ups typically do not know their market and technology challenges at the outset. They start with a minimum viable product and pivot along the way in their search for the right business model. Similarly, the Technology Incubator program started quickly, and pivoted along the way on the basis of experience, as well as changing conditions in the ecosystem. This capacity to learn and adjust along way, as the case of privatization discussed above exemplifies, should be an essential ingredient of any incubator program in the region.

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