WHAT IS THE US COMPARATIVE ADVANTAGE IN ENTREPRENEURSHIP? EVIDENCE FROM ISRAELI MIGRATION TO THE UNITED STATES

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Abstract—We investigate underlying sources of the US entrepreneurial ecosystem's advantage compared to other innovative economies by assessing the benefits that Israeli startups derive from migrating to the United States. Addressing positive sorting into migration, we show that migrants raise larger funding amounts and are more likely to have a U.S. trademark and be acquired than nonmigrants. Migrants also achieve a higher acquisition value. However, their patent output is not larger. We conclude that the United States entrepreneurial ecosystem's advantage vis-à-vis other innovative economies arises from several sources producing sizeable gains for startups. These sources are investor availability as well as large consumer and acquisitions markets.

I. Introduction

ENTREPRENEURIAL ecosystems play a fundamental role in spurring a country's employment, innovation, and economic growth (Glaeser et al., 2015; Akcigit & Kerr, 2018). However, despite their acknowledged contribution, little is known regarding the factors that are responsible for their success (Moretti, 2012). The United States, for example, holds a similar ranking in education and innovation to that of other developed economies. Yet, its entrepreneurial ecosystem is considered to be relatively more successful.[1] Indeed, every year a substantial number of startups from highly innovative economies relocate their headquarters to the United States, raising the question of what advantages the United States entrepreneurial ecosystem offers relative to these economies.

One possibility is that the comparative advantage of the United States entrepreneurial ecosystem arises from sources that transcend the country's level of education and innovation. Possible sources include a large consumer market (Krugman, 1991)—especially when comparing the United States to other small innovative economies—the availability of specialized inputs (Marshall, 1920), the presence of investors (Chen et al., 2010), and a developed market for acquisitions (Gans & Stern, 2003). This paper takes a first step toward shedding light on the underlying sources of the United States entrepreneurial ecosystem's advantage relative to other innovative economies.

To do so, we use a novel dataset of 2,179 Israeli startups and evaluate the benefits they derive from establishing their headquarters in the United States (which we refer to as "migration"). Our empirical context is appealing for two reasons. First, Israel has historically built strong ties with the United States, and Israeli startups regard the United States as an attractive destination, thereby making migration to this country a frequent event (Senor & Singer, 2009). In our sample, for instance, 13% of the startups established their headquarters in the United States, while none of them opened headquarters in Europe. Second, Israel shares a specialization in similar industries to those of the United States, suggesting that the skills valued in the United States and in Israel are comparable. This is an important prerequisite for attributing any observed migration effect to differences in resources between Israel and the United States (Borjas, 1987).

We begin our empirical analysis by evaluating the startups' decision to establish their headquarters in the United States. We document positive sorting into migration, showing that, compared to nonmigrants, startups that establish their headquarters in the United States raise larger amounts of funds during their first financing round, and they are more likely to attract U.S. venture capitalists and be founded by successful serial entrepreneurs. Migrants are also more likely to have applied for U.S. granted patents and trademarks. A machine learning model predicting approximately 70% of the variation in the startup likelihood of migrating to the United States confirms positive sorting into migration. This model additionally shows that Israeli startups with a high predicted likelihood of migrating to the United States are successful even when they do not actually migrate. This result is reassuring, as it suggests that it is possible to find a valid counterfactual to migration among startups remaining in Israel.

We next delve into the core of our analysis and investigate the gains Israeli startups derive from migrating to the United States. We explore six startup performance outcomes that closely map onto some of the most relevant migration benefits we mentioned earlier. We first examine whether startups apply for a trademark with the U.S. Patent and Trademark Office (USPTO) to assess the benefits of penetrating a larger consumer market. We then analyze the number of U.S. patents startups apply for to evaluate the advantages of accessing innovation inputs localized in the United States. We also examine the amount of venture capital (VC) raised to gauge the gains migrants derive from a relatively large supply of U.S. investors. Finally, we evaluate the likelihood that a startup is acquired and that it experiences an initial public offering

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[1] See, for instance, http://paulgraham.com/america.html.

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(IPO), as well as its transaction value in the case of an acquisition. These last three measures allow us to assess whether migrants derive benefits from accessing a larger market for exits.

Our challenge is that failure to control for startup heterogeneity biases migration estimates upward. We adopt three approaches to address this concern. First, we implement a double-LASSO regression.[2] While LASSO is a widely used method for the regularization of high-dimensional data, the concern is that it may be suited for prediction but not for inference. To address this problem, we implement a double-LASSO algorithm, applying a first LASSO selection procedure to predict startup migration and a second LASSO to retain the largest predictors of the startup performance outcomes (Belloni et al., 2014a). The union of the observables obtained from these two procedures constitutes the set of controls in the performance equations. This double selection method has been shown to produce valid inference even when certain relevant variables are excluded (Belloni et al., 2014a, 2014b).

Second, we compare migrants' outcomes to those of startups that, for plausibly exogenous reasons, find it costly or impossible to migrate. The latter are startups operating in the defense sector and that conduct stem cell research. The defense sector is characterized by strict regulations that prevent Israeli startups operating in this sector from migrating to the U.S. market. Similarly, there are considerable restrictions on embryonic stem cell research in the United States as compared to Israel (Furman, 2012), reducing the profitability of migrating to the United States for startups developing technologies in this field. Conditional on our observables, we show that these startups represent an unbiased control group for movers. Our final approach consists of estimating a startup fixed-effects model and exploiting across migrant variation in migration age.

The results are consistent across models. We find that migrants are significantly more likely than nonmigrants to apply for a trademark in the United States. Migrants also raise more VC, particularly from U.S. venture captalists, and they experience a greater likelihood of being acquired, especially by US companies. Additionally, upon an acquisition, migrants' sales value is higher. The significance of these effects is confirmed after employing the Oster (2019) bounding method, which allows us to establish lower bounds for our migration effects: all these bounds are above zero. We do not find any significant migration effect on the likelihood that startups will experience an IPO, although Israeli migrants are more likely to go public on the U.S. stock exchanges and less likely to go public on the Tel Aviv Stock Exchange. Similarly, we find that migration produces no significant effect on the number of patents for which Israeli startups apply.

The significant effects we find are economically important. Our estimates indicate that startups that move by age 3 are 14–26 percentage points more likely to apply for a trademark with the USPTO and raise 36% to 111% more VC funds than nonmigrants. Additionally, migrants are 17 percentage points more likely to be acquired than nonmigrants, and their acquisition value is 100% higher. These effects are largest for startups that establish their headquarters in the United States instead of opening a subsidiary, and for those that migrate to California, Massachusetts, and the New York area.

Our findings provide important insights for policymakers investing resources to build entrepreneurial ecosystems and, in particular, for those policymakers from countries that try to emulate the U.S. model. Our results suggest that to build a successful entrepreneurial ecosystem, policymakers should broaden the scope of their investments beyond education and innovation.

This paper primarily builds on the economic geography and entrepreneurship literature. The first strand of the literature has highlighted the importance of factors such as market size (Krugman, 1991), access to specialized inputs (Marshall, 1920), and information spillovers (Audretsch & Feldman, 1996) in explaining the clustering of economic activities in certain regions of the world. We transpose these factors into the specific entrepreneurship context and identify those responsible for the relative success of the United States entrepreneurial ecosystem and the startups it hosts. In doing so, we rely on studies that have investigated the determinants of entrepreneurial clusters (Chinitz, 1961; Saxenian, 1994; Glaeser & Kerr, 2009; Glaeser, Kerr et al., 2010; Glaeser, Rosenthal et al., 2010) to specifically focus on underlying sources of the United States entrepreneurial ecosystem's comparative advantage.

II. Empirical Context: Israel, "The Startup Nation"

Israel is one of the world's most prolific innovative economies (OECD, 2018). An important share of Israeli innovations is produced by domestic startups (Bresnahan et al., 2001). In the past three decades, Israel has given rise to one of the most vibrant entrepreneurial clusters outside of the United States, hosting the largest number of technology startups per capita worldwide (The Economist, 2014). Many of these startups operate in information and communication technology (ICT) sectors, reflecting Israel's specialization in this area, although they have recently expanded to other sectors (Beyar et al., 2017). The country's successful efforts in building a startup ecosystem have earned Israel the title "Startup Nation." This success has been largely ascribed to a combination of factors, including Israel's military service, a large availability of scientists and engineers, and *ad hoc* government policies (Trajtenberg, 2000).

Israelis go through several years of compulsory military service, which provides them with training in military technologies that can lead to relevant commercial applications, especially in ICT sectors. The technical training Israelis receive is particularly intense in elite army units, such as Unit 8200. Individuals selected for these units have produced technologies at the forefront of the fields of wireless communications, IT networks, and data security, among others.

[2]LASSO stands for Least Absolute Shrinkage and Selection Operator.

These elite units are not only responsible for developing their members' technical skills, but also for providing them with important business-related experience. Admitted individuals manage projects that very much resemble those pursued in high-technology startups. Another determinant is the large availability of scientists and engineers, which is reflected in Israel's top ranking in the per capita number of individuals with a Science, Technology, Engineering, and Mathematics degree (Beyar et al., 2017). Renowned research institutions, such as Technion, and the large influx of Soviet Jews that followed the dissolution of the USSR, have greatly contributed to the creation of this human capital stock. Finally, it is important to mention the active role the Israeli government plays in sustaining private R&D projects, particularly those undertaken by startups (Conti, 2018).

Despite the fact that Israeli entrepreneurs benefit from domestic R&D spillovers, they operate in a small market. As a result, they have traditionally looked to the U.S. market as the preferred destination for their technologies, and many of them have established their headquarters there. Although Israeli entrepreneurs are attracted to the U.S. market, some of them run companies that are prevented from moving overseas. These include defense companies and those developing embryonic stem cell technologies. The international mobility of firms in the defense sector has traditionally been low. Israel is no exception. To prevent the leakage of information related to strategic technologies, Israeli legislation prohibits the overseas transfer of defense know-how unless individuals obtain an *ad hoc* license from the Ministry of Defense or the Head of the Defense Export Control Agency.[3] This regulation hinders the migration to the United States of Israeli defense startups, especially considering that relocation licenses are rarely granted. Regarding startups developing embryonic stem cell technologies, the Bush administration introduced restrictions on research conducted with embryonic stem cells in 2001, imposing severe limitations on federal funding (Furman, 2012). Relatedly, it is noteworthy that while the Christian religion considers that a person comes into existence at the time of conception, thus making it unacceptable to conduct research on an embryo, the Jewish Law gives priority to born human life over human life in development, and, moreover, it does not ascribe human dignity to an embryo outside of the uterus. Thus, Israel admits and subsidizes the creation of embryos for scientific purposes (Levine, 2008). Both the U.S. restrictions on funding for embryonic stem cell research and the differences in religious approaches with regard to the beginning of life increase the Israeli startups' costs of moving to the United States.

III. Data Set

We build our dataset from Conti (2018) and extend it by employing additional sources of information derived from the Israel Venture Capital Research Center (IVC).[4] Conti (2018) complemented the IVC data with information on both U.S. granted patents that Israeli startups applied for and grants awarded from the Israeli Office of the Chief Scientist. We enrich this original data set with information on startup migration as well as trademark applications with the USPTO. Descriptive statistics are reported in table 1.[5]

The startups in the data set were founded between 1990 and 2014. Israeli startups predominantly operate in ICT sectors, reflecting Israel's comparative advantage in these areas. Moreover, the majority of startups were initially established in the area around Tel Aviv, where most of the high-technology companies are concentrated.

Approximately 19% of the startups filed for a U.S. granted patent in the founding year or the year after. This figure increases to 34% when we examine a five-year window from inception. Twelve percent of the startups have a university connection, meaning that they were either established by a professor or received support from a university Technology Transfer Office (TTO). Altogether, these figures highlight that a considerable share of our startups are high-technology companies.

The average amount of funding startups raised during their first round is \$1.48 million.[6] The funding distribution is skewed and the median value is only \$0.4 million. Twenty-four percent of the startups received VC investment during their first round, and 7.2% obtained funds from US venture capitalists.[7] Regarding exits, 113 (5%) of the startups experienced an IPO as of 2014, and 494 (23%) experienced an acquisition. Of the acquired startups, 66% had a U.S. acquirer. The average sales upon an acquisition is \$78 million, and it increases to \$89 million when the acquirer is a U.S. company.[8] Taken together, these data provide an indication of the relevance of U.S. investors for Israeli startups. Following an established literature (Castaldi, 2019), we use data on trademark applications to the USPTO to measure the extent of Israeli startups' penetration in the U.S. product market. Of all the companies, 8.5% had applied for at least one trademark in the United States during the inception year or the year after. The percentage increases to 21 when considering a five-year window from inception.

A. Migration Data

We use business registration records from U.S. states to determine whether Israeli startups migrated to the United States. These public records are created when a firm is registered as

[3] http://www.shibolet.com/the-export-and-licensing-of-defense-technologies-part-i/.

[4] Conti, Thursby, and Thursby (2013) and Conti (2018) describe the details of the sample construction.

[5] Additional descriptives are reported in tables A1 and A2.

[6] Of the startups' initial rounds, 94% are "seed" rounds.

[7] IVC classifies institutional investors into venture capitalists, private equity firms, investment banks, insurance companies, pension funds, and advisory & management companies. While many non-VC investors manage venture capital funds, we conservatively exclude them from our VC category.

[8] Exit values are only available for 373 of the 494 acquired companies.

TABLE 1.—SUMMARY STATISTICS

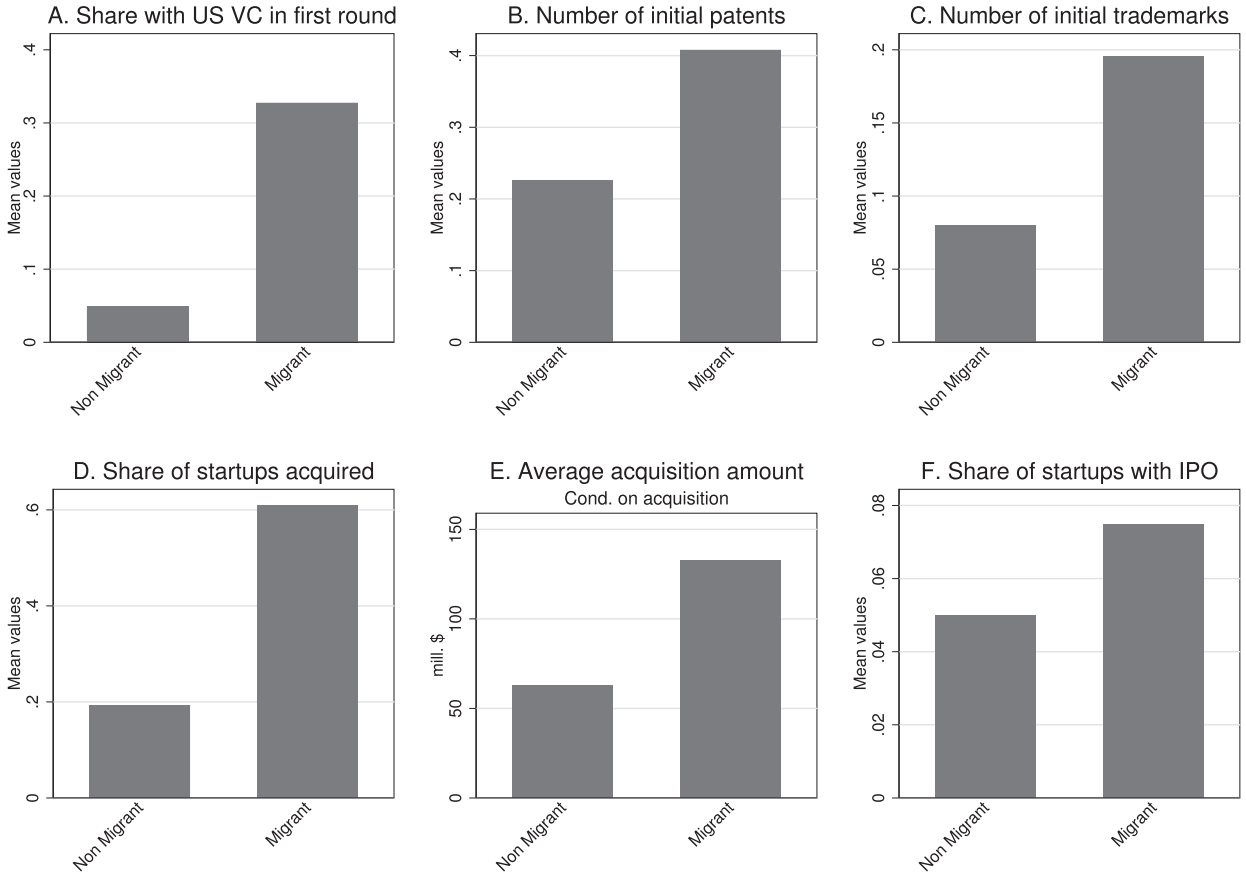
Variable	Mean	Std. Dev.	*N*
Human capital			
Num. Prior Successful Startups	0.277	0.803	2179
Num. Founders	2.009	1.073	2179
University T.T.O. Investment (0/1)	0.007	0.083	2179
University Spinoff (0/1)	0.118	0.323	2179
Has Funding from Israeli Chief Scientist (0/1)	0.145	0.353	2179
Initial intellectual property			
Initial Number of Patents	0.241	0.605	2179
Initial Number U.S. Inventors	0.187	1.31	2179
Initial Number Israeli Inventors	1.051	5.018	2179
Initial Trademarks	0.089	0.301	2179
Initial Number of Patents	0.241	0.605	2179
First round financing			
Financing in First Round ($ mill.)	1.484	3.664	2179
First Round Has U.S. VC	0.072	0.258	2179
First Round Num. of VC Investors	0.372	0.786	2179
First Round Num. of Corp. VC Investors	0.021	0.147	2179
First Round Num. of Angel Group Investors	0.025	0.163	2179
First Round Num. of Insurance Company Investors	0.001	0.037	2179
First Round Num. Private Equity Investors	0.019	0.139	2179
First Round Bank Num. Holding Investors	0.001	0.03	2179
First Round Num. U.S. Investors	0.171	0.493	2179
First Round Num. U.S. venture capitalists	0.091	0.366	2179
First Round Num. Non-Israeli Investors	0.265	0.638	2179
First Round Num. Israeli Investors	0.773	0.891	2179
First Round Num. Non-Israeli VC	0.114	0.412	2179
First Round Num. Israeli VC	0.257	0.604	2179
Migration			
Moves to United States (0/1)	0.08	0.271	2179
Age at Migration	1.052	1.022	174
Sector			
Clean Tech (0/1)	0.078	0.268	2179
Communication Technology (0/1)	0.163	0.37	2179
IT / Software (0/1)	0.214	0.41	2179
Internet (0/1)	0.158	0.365	2179
Life Sciences (0/1)	0.121	0.326	2179
Medical Devices (0/1)	0.127	0.333	2179
Hardware (0/1)	0.091	0.287	2179
Semiconductor (0/1)	0.048	0.213	2179
Performance outcomes			
Total Amount Raised (mill. $)	9.067	19.974	2179
Total Amount Raised Led by U.S. VC (mill $)	3.708	14.365	2179
Acquired (0/1)	0.227	0.419	2179
Acquired Outside United States (0/1)	0.076	0.265	2179
IPO (0/1)	0.052	0.222	2179
U.S. IPO	0.021	0.142	2179
Israel IPO (in Tel Aviv Exchange)	0.021	0.142	2179
Final Num. of Trademarks	0.024	0.427	2179
Final Num. of Patents	2.751	21.382	2179
Final Num. Investors	3.595	3.677	2179
Final Num. U.S. Investors	0.648	1.441	2179
Final Num. U.S. venture capitalists	0.339	0.933	2179
Final Num. Non-US Investors	2.948	2.905	2179

Descriptive statistics for the observables of our sample startups. The word "initial" refers to a startup's founding year (t) and the year after ($t + 1$). The word "final" refers to the years following $t + 1$ and up to 2016.

a corporation, partnership, or limited liability company with the Secretary of State (or Secretary of the Commonwealth) of any U.S. state (Guzman & Stern, 2017, 2020). We use the date of registration as the date of migration. According to the rules, companies must register at least two distinct addresses in each state: the address of the principal office and the address of the office within the state. This distinction allows us to differentiate between Israeli startups that establish their headquarters in the United States and those that open a U.S.-based subsidiary (such as a sales office) while maintaining their headquarters in Israel. To complement our data and verify existing information, we employ secondary sources of information, such as Crunchbase, LinkedIn, company websites, and newspaper records of startups' relevant events. In our main analysis, we define as migrants only those startups that established their headquarters in the United States and not those companies that opened a U.S.-based subsidiary.

A total of 290 startups relocated their headquarters in the United States, while 96 startups opened a subsidiary. More than half of the migrants (60%) established their headquarters within the first three calendar years of their inception, with the remaining scattered across subsequent years. We

FIGURE 1.—MEAN VALUES OF STARTUP CHARACTERISTICS DISTINGUISHING BETWEEN MIGRANTS AND NONMIGRANTS



This figure depicts the distribution of startup characteristics at around founding time (panels A–C) and performance outcomes (panels D–F) by migrant status. Both startup characteristics and performance outcomes vary substantially between migrants and nonmigrants.

restrict our definition of entrepreneurial migrants to consider only those that moved within three years of being founded. As a result, we remove 114 startups from the sample.[9] We additionally remove two startups that the data suggest moved at ages −2 and −3, but keep three startups that moved at age −1. The clustering of migrants in their early years is consistent with U.S. evidence provided in Guzman (2018). While the United States appears to be an attractive migration destination, our secondary sources show that none of the startups in our sample opened headquarters in Europe.

Migrants operate mostly in ICT sectors and are predominantly from the Tel Aviv district. A large share of them (53%) established their headquarters in California, a destination that matches well with Israel's comparative advantage in ICT.[10] Figure 1 depicts a series of startup characteristics, distinguishing by migrant status. This figure shows that migrants (i) are more likely to have a U.S. venture capitalist participate in their first round of financing than nonmigrants (panel A); (ii) filed relatively more patents (panel B) and trademarks (panel C) with the USPTO during the founding year or the year after; (iii) are more likely to be acquired (panel D) and, conditional on being acquired, sell at double the amount of nonmigrants (panel E); and (iv) experience IPOs more frequently than nonmigrants, although IPOs are relatively rare in general. Figure A3 depicts the distribution of first-round VC financing for startups that established their headquarters in the United States versus those that did not move. As shown, migrants raise on average larger financing rounds than nonmigrants.

IV. The Selection of Israeli Startups into Migration

We begin our empirical analysis by examining the differences across Israeli startups in their likelihood of migrating. This analysis will help guide the implementation of a machine learning algorithm for predicting the likelihood of moving to the United States and addressing selection concerns.

We initially estimate a logit model relating our observables to the likelihood of migrating to the United States. The results are presented in table 2, which reports incidence rate ratios (IRRs) and standard errors clustered at the founding-year

[9]We adopt this cutoff because we are interested in the location choices startups make during their earliest years.

[10]Figures A1 and A2 show the distribution of migrants by migration age, destination, sector, and founding location.

TABLE 2.—WHO MIGRATES? DETERMINANTS OF ISRAELI STARTUP MIGRATION TO THE UNITED STATES. LOGIT REGRESSIONS. D.V.: MOVES TO UNITED STATES

	(1)	(2)	(3)	(4)	(5)
Ln(First round amount mill. $ +1)	3.128***			2.809***	2.230***
	(0.402)			(0.396)	(0.345)
Num. Prior Successful Startups		1.437***		1.234**	1.193*
		(0.0815)		(0.0827)	(0.0890)
Has Initial Patents			1.613**	1.295	1.227
			(0.290)	(0.342)	(0.351)
Has Initial Trademarks			2.270***	1.070	1.092
			(0.532)	(0.282)	(0.236)
First Round Has U.S. VC					4.096***
					(1.197)
Clean Tech				0.0594**	0.0655**
				(0.0593)	(0.0649)
Communication Technology				0.370***	0.334***
				(0.0998)	(0.0882)
Semiconductor				0.406*	0.444*
				(0.144)	(0.172)
Internet				1.099	1.163
				(0.241)	(0.263)
Life Sciences				0.336**	0.374*
				(0.127)	(0.160)
Medical Devices				0.177***	0.220***
				(0.0638)	(0.0753)
Hardware				0.0364**	0.0442**
				(0.0402)	(0.0478)
Year F.E.	No	No	No	Yes	Yes
Observations	2179	2179	2179	2179	2179
Pseudo R^2	0.112	0.021	0.016	0.204	0.233
Log Likelihood	−538.6	−593.8	−596.8	−482.6	−465.5

We report the results from estimating logit models for the likelihood that an Israeli startup establishes its headquarters in the United States. The regressors of interest are measures for a startup's performance potential. To build the patent and trademark indicators, we only consider patents and trademarks that were applied for during the founding year or the year after. We report incidence-rate ratios (IRRs). Ratios greater than 1 imply that an increase in the value of a given regressor leads to a higher likelihood that an outcome occurs, with the opposite for ratios less than 1. Standard errors are clustered at the founding-year level to account for the possibility that the attractiveness of the U.S. market to Israeli startups might have changed over time. Significance denoted as $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

level. In column 1, we assess the relationship between the amount of financing a startup raised during its first round and the likelihood of migrating to the United States. The IRR is 3.13, implying that a one log-point increase in the amount of funds raised is associated with a 213% increment in the likelihood of migrating. The predictive power of this variable is remarkably high, producing a pseudo R^2 of 0.11. To the extent that a startup's initial financing is indicative of future performance, this result suggests strong positive sorting.

In column 2, we include a measure of the founders' human capital, that is, the number of successful startups they initiated in the past. The effect of an extra successful startup is 44%. The pseudo R^2, 0.02, is lower than the 0.11 figure at the bottom of column 1, suggesting that the predictive power of this variable is not as high as that of the size of a startup's first financing round. Column 3 examines (i) whether a company had applied for at least one U.S. granted patent during the start year or the year after, and (ii) whether a company had applied for at least one trademark with the USPTO during the same period. Startups with at least one successful patent application and those with at least one trademark application are, respectively, 61% and 127% more likely to migrate to the United States. However, the pseudo R^2 remains considerably lower than the one reported in column 1.

In column 4, we include all the controls and add sector as well as founding year fixed effects. The impact of the funding amount a startup received on migration remains large and highly significant relative to the effect reported in column 1. In contrast, the IRRs associated with the patent and trademark measures are no longer statistically significant. This last result should not be surprising, given that venture capitalists have been found to invest in startups possessing intellectual property rights (Conti, Thursby, & Rothaermel, 2013; Catalini et al., 2018). There is substantial sector variation in the likelihood of migrating. In particular, startups operating in IT and software are the most likely to migrate to the US. In column 5, we include an indicator identifying those startups that raised U.S. VC funding during their first round. As shown, the IRR is 4.1, indicating that startups supported by U.S. venture capitalists are 310% more likely to move to the United States. While this effect is large, the coefficients of the other variables change little from those reported in column 4, suggesting that the information embedded in the U.S. VC indicator only partially overlaps with that conveyed by the other variables.

Overall, these results highlight three relevant patterns. First, there is positive assortative matching, whereby migrants are startups with the greatest potential. Second, the examined measures of startup potential are correlated with one another and with other relevant startup aspects. Finally, the specific characteristics of venture capitalists participating in the startups' earliest financing round play a significant role in the companies' migration choice, and this role transcends the amounts venture capitalists invest.

A. *A Machine Learning Model for Predicting the Likelihood of Migrating*

Because the insights above suggest that there could be many factors predicting a startup's choice to move, we develop a machine learning model to select those observables with the largest predictive power. To implement this model, we compile a list of covariates including the startup selection characteristics controlled for in table 2 as well as additional variables reported in tables 1 and A1. Once this list is generated, we create two-way interactions among all the observables to account for the possibility that their relationship with the migration outcome is either nonlinear or contingent on certain startup characteristics. Finally, we construct fixed effects for each of the investors participating in a startup's first round of financing. In doing so, we address the possibility that differences in individual investors' characteristics or the strategies they envisage for their portfolio startups may drive the selection into migration. Expanding our initial data set in these directions generates 1,392 variables. As a next step, we prune the observables using LASSO (Tibshirani, 1996). This "regularization" algorithm addresses the problem of overfitting inherent to high-dimensional data. The coefficients are chosen to minimize the sum of squared residuals plus a penalty term that penalizes the size of the model through the sum of absolute values of the coefficients. The implementation of LASSO leads us to retain 110 out of the original 1,392 variables.

We employ this set of variables in a random subsample of our data, which maintains 60% of the initial observations ($N = 1,307$), to train a random forest model (Breiman, 2001) for predicting the likelihood of migrating to the United States. We then repeat this train/test procedure 49 times with newly extracted random samples of the same size as the original one.

Table A3 shows the top 50 variables by their average "feature importance," which reflects the variables' predictive power. Individual investor fixed effects are strong predictors of a startup's likelihood of migrating, suggesting that investors play an important role in either selecting startups with a high *ex ante* likelihood of migrating or inducing their investee startups to migrate. None of the sector fixed effects appears in the list, suggesting that the selected investor fixed effects disproportionately capture investor preferences for certain sectors.

We test the performance of our model by examining the Receiver-Operating-Characteristic (ROC) score, which is a measure of the model's ability to separate between true negatives and true positives. Larger values of this score are associated with higher chances that the model will correctly classify each startup as either migrant or nonmigrant. We compute the ROC score for the 40% ($N = 872$) observations we had initially excluded in the training of the random forest. The aim is to assess the out-of-sample predictive power of the model. The results are encouraging. As shown in figure A4, both the median and the mode ROC scores are equal to 0.84, a large value on a scale from 0.5 (completely uninformative model) to 1 (fully informative model). This value implies that our model accounts for approximately 70% of the variation in the data.[11]

Figure 2 reports the share of startups that experienced a liquidity event over the percentile distribution of the predicted probability of migration, obtained from the machine learning model. Panel A considers the entire sample of startups, while panel B only examines the subset of nonmigrants. As shown, startups with a high predicted probability of migrating are more likely to exit successfully, regardless of whether they actually migrate to the United States or not. The positive correlation between the startups' predicted probability of migrating and success that we observe in panel B suggests that it is possible to find a valid counterfactual to migration among nonmigrants.

V. The United States Entrepreneurial Ecosystem's Comparative Advantage

Having examined the factors determining sorting into migration, we move on to estimate the migration benefits Israeli startups derive from establishing their headquarters in the United States.

A. *Empirical Strategies*

We estimate the relationship between migrating and the performance of those startups that choose to migrate to the United States. Ideally, to identify migration effects on startup performance outcomes, we would estimate the treatment effect on treated companies, τ, which is defined as

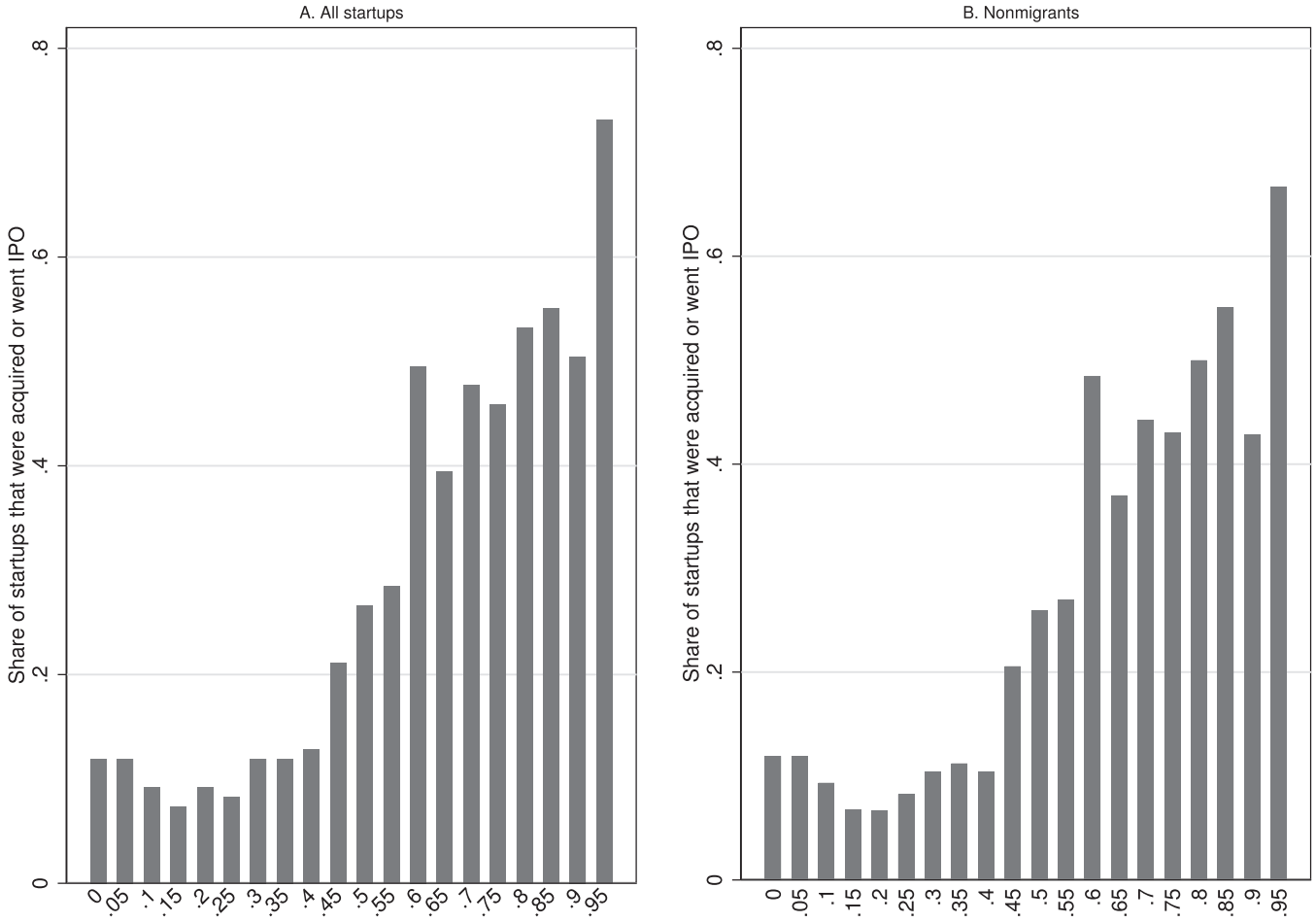
$$\tau = E[Y_i(1) - Y_i(0)|D_i = 1], \quad (1)$$

where $Y_i(1)$ indicates startup i's performance if it migrates the United States, $Y_i(0)$ denotes i's performance if it remains in Israel, and D_i is an indicator that is equal to 1 if startup i migrates and 0 otherwise. The fundamental empirical challenge we face is that $Y_i(0)$ is unobserved for the movers, which requires us to estimate $Y_i(0)$ from the information we have available. A naïve approach would regress the performance outcomes of startups on whether they migrate to the United States or not. Comparisons between migrants and nonmigrants based on this approach are likely to be upwardly biased given the positive sorting we documented in section IV. Thus, we adopt several alternative approaches that exploit both startup cross-sectional and panel data.

Double LASSO on high-dimensional data. Our first approach consists of implementing a double-LASSO model. As we mentioned earlier, LASSO is an appealing method for estimating the parameters of a sparse high-dimensional linear model (Belloni et al., 2014b). However, using this method to

[11] We obtain a similar distribution using subsector fixed effects (figure A5 and table A7).

FIGURE 2.—PERFORMANCE OF ISRAELI STARTUPS BY THEIR PREDICTED PROBABILITY OF MIGRATING TO THE UNITED STATES



This figure examines startup selection into migration. The *x*-axis reports the percentile distribution of the predicted probability of migration obtained from the machine learning model described in section IV. Startups that are more likely to migrate are also better performers (panel A). We show a similar pattern in panel B, where we specifically consider the subsample of nonmigrants.

select the best predictors of startup performance outcomes may prevent causal inference to the extent that LASSO drops controls that are highly correlated with the treatment on the ground that these controls do not add much predictive power for the outcome of interest. To address this problem, we estimate a double-LASSO algorithm wherein we apply a first LASSO to the selection equation that predicts startup migration to the United States and a second LASSO to retain the largest predictors of the startup performance outcomes. The union of the observables obtained from these two procedures represents the set of variables we control for in the performance equations. Belloni et al. (2014a) show that this double selection procedure can lead to valid inference even when selection mistakes occur and certain relevant variables are excluded. The first LASSO, which we described in section IV, led us to select 110 of the 1,392 high-dimensional covariates derived from expanding our initial set of observables. The high ROC scores obtained suggest that we are able to explain a large portion of Israeli startup selection into migration. Since we examine multiple startup performance outcomes, we repeat the second LASSO procedure as many times as the number of performance outcomes we consider.[12]

Quasiexperiment exploiting plausibly exogenous institutional constraints on a startup's ability to migrate. As we mentioned in section II, Israeli startups operating in the defense and embryonic stem cell domains are prevented from establishing their headquarters in the United States. Defense startups face moving restrictions imposed by the Israeli government. Similarly, startups developing embryonic stem cell technologies suffer from restrictions on U.S. federal funding, while no such restrictions are imposed in Israel. In our quasiexperiment, we employ the startups operating in these sectors as counterfactual to those companies that, instead, are not restricted by government regulations and migrate to the United States. After a careful analysis of the startup technology descriptions provided by IVC, we identified 32 defense startups and 14 startups developing embryonic stem cell technologies. Defining S_i as an indicator for whether a company

[12]The second step of the double-LASSO selects an average of 49 covariates.

belongs to the control group of startups that cannot migrate, we estimate the treatment effect on the treated as follows:

$$\hat{\tau} = \hat{E}[\hat{E}[Y_i|D_i = 1, p_i] - \hat{E}[Y_i|S_i = 1, p_i]], \quad (2)$$

where $\hat{\tau}$ is the estimated average treatment on the treated. To guarantee the comparability of treated and control startups, we restrict our sample to those treated and control startups ($N = 126$) that are in the region of common support as determined by p_i, that is, the predicted probability of migrating obtained from the random forest model described in section IV. The distribution of p_i for each group of treated and control startups is presented in figure A6.

The key assumption here is that the composition of the control group is orthogonal to a startup's performance, conditional on p_i. Under this assumption, the performance of the control group can be considered an accurate estimate of the migrants' performance had they kept their headquarters in Israel. One concern is that the government-regulated sectors we have identified would have been relatively secluded from the U.S. market even in the absence of government restrictions. For instance, Israeli startups in the defense sector may predominantly produce technologies for the domestic market, and these technologies could be incompatible with foreign standards. Similarly, Israeli startups developing embryonic stem cell technologies may be specialized in addressing domestic rather than U.S. market needs. Overall, these unobserved barriers could introduce a spurious positive correlation between founders' propensity to migrate and their startups' performance. However, Israeli defense companies are intensive exporters, and one of their largest destination markets is the United States (The Jerusalem Post, 2019). Likewise, Israeli embryonic stem cell companies have frequent collaborations with U.S. firms and research institutions (Luo & Matthews, 2013).

A related concern is that individuals with an intrinsically high propensity to migrate refrain from operating in sectors affected by government restrictions and, instead, self-select into sectors where migration to the United States is less costly. To the extent that the individuals' propensity to migrate to the United States is correlated with their entrepreneurial skills, the migration effects obtained from estimating equation (2) would be upwardly biased. However, here we note that Israeli founders' technologies are often the by-product of training imparted in specialized army units. As Perman (2004) points out, the selection process in these units very much resembles the process of "NBA scouts tracking kids in high school and college," leaving limited discretion to recruits. Moreover, within these specialized units, the technologies that conscripts develop are highly influenced by Israeli army needs, further reducing future founders' discretion. Similarly, founders commercializing technologies developed during their university studies, as is often the case for embryonic stem cell technologies, are unlikely to have enrolled in specific tertiary education programs in anticipation of institutional constraints on their ability to relocate overseas. Admission into these programs depends on a large number of factors, including individuals' secondary school performance and the score they obtained in the Psychometric Entrance Test, as well as the availability of advisors and their funding, in the specific case of graduate programs.

Another concern may be that venture capitalists, and especially foreign venture capitalists, avoid investing in certain sectors because startups in these sectors are prevented from accessing the U.S. consumer and exit markets. To evaluate this issue, table A5 reports relevant predetermined startup characteristics, distinguishing by migrant status and conditioning on the common support region. Reassuringly, these characteristics do not significantly differ between migrants and nonmigrants. Among them is whether startups received U.S. VC funding.

To further support our strategy, we compare several performance outcomes of "quasiexogenous" stayers with those of nonexogenous stayers, that is, those stayers belonging to "nonrestricted" subsectors. If our strategy were valid, then the former category of stayers should outperform the latter. Consistently, table A6 shows that stayers in the "restricted" subsectors outperform the other stayers across a large range of outcomes. Although this evidence is reassuring, we opt to control for p_i, which is the predicted probability of migrating obtained from our random forest model.

Panel regressions. Finally, we exploit within-migrant variation of performance outcomes over time by estimating the following regression for each startup i of age t moving at age m:

$$Y_{i,t,m} = \alpha_t + \gamma_m + \beta D_{i,t} + \lambda_i + \epsilon_{i,t,m}, \quad (3)$$

where α_t denotes age fixed effects, γ_m designates age of migration fixed effects, $D_{i,t}$ is an indicator equal to 1 if an Israeli startup had its headquarters in the United States at age t (and zero otherwise), λ_i are startup fixed effects, and $\epsilon_{i,t,m}$ is a random noise. The coefficient of interest is β, which captures the within-startup improvement in performance after a company moves to the United States. In this model, the age of migration fixed effects address the potential concern that there are systematic differences among startups migrating at different ages. This approach is useful for capturing startups' invariant characteristics, such as founders' "chutzpah" (i.e., audacity), which the literature has mentioned as one factor being positively correlated with Israeli startups' performance (Senor & Singer, 2009). To assess how the benefits from migrating vary over a startup's life cycle, we estimate a variant of equation (3) adding interactions between $D_{i,t}$ and startup age indicators:

$$Y_{i,t,m} = \alpha_t + \gamma_m + \delta_t \alpha_t D_{i,t} + \lambda_i + \epsilon_{i,t,m} \quad (4)$$

B. Results

We explore the effect of migrating to the United States on six startup performance measures. These measures closely

TABLE 3.—THE EFFECT OF MIGRATING TO THE UNITED STATES ON ISRAELI STARTUPS' INTERMEDIATE PERFORMANCE OUTCOMES: CROSS-SECTIONAL RESULTS

	(1) Applied for Trademark	(2) Ln(Patents + 1)	(3) Ln(VC + 1)	(4) Ln(VC + 1) (U.S. VC Led Only)
Model I: Naive ($N = 2179$)				
Moves to United States	0.357***	0.478***	1.686***	1.594***
	(0.0258)	(0.0284)	(0.0534)	(0.00910)
Model II: Double-LASSO ($N = 2179$)				
Moves to United States	0.256***	0.0597	1.112***	1.096***
	(0.0483)	(0.0675)	(0.0832)	(0.120)
Model III: Quasiexperiment ($N = 126$)				
Moves to United States	0.383***	0.263*	0.927***	1.280***
	(0.0699)	(0.140)	(0.349)	(0.254)
R2 Model I	0.0515	0.0213	0.115	0.167
R2 Model II	0.264	0.506	0.463	0.406
R2 Model III	0.418	0.213	0.398	0.334

This table reports the estimates for the impact of migrating on startup performance. We examine four intermediate outcomes. The first measure is an indicator for whether a startup applied for a trademark with the USPTO after $t + 1$, where t is the startup's founding year (column 1). The second measure is the number of U.S. granted patents a startup applied for, again after $t + 1$ (column 2). The third and fourth outcomes are the amount of VC raised after the first financing round (column 3) and the amount of US VC raised during the same period (column 4), respectively. Model I is the naive model described in the text. Model II is the double-LASSO. Model III is our quasiexperiment exploiting exogenous institutional constraints on the startup's ability to migrate. Model II controls for subsector and founding year fixed effects, while Model III only controls for founding year fixed effects. Standard errors (in parentheses) are double-clustered at founding year and sector levels for Models I and II, and bootstrapped for Model III. Significance denoted as $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

map onto the most relevant types of migration benefits startups could derive by establishing their headquarters in the United States. The first measure is an indicator for whether a startup applied for a trademark with the USPTO after $t + 1$, where t is the founding year. This indicator captures startup gains from penetrating a market larger than the domestic economy. The second measure is the number of U.S. granted patents startups applied for after $t + 1$, which captures the advantages of accessing innovation inputs localized in the United States. The amount of VC raised after the first funding round proxies the gains migrants may derive from accessing a comparatively large supply of investors. Finally, we consider the likelihood that a startup will be acquired and the likelihood that it will go public via an IPO, as well as the transaction value upon an acquisition. These are measures for the value startups could extract from their technologies after entering a relatively larger market for technology. In describing the results, we distinguish between startups' intermediate performance outcomes—that is, trademark, patent, and financing raised—and final exit outcomes.

Intermediate startup performance outcomes. The cross-sectional estimates of the migration effects on the startups' intermediate performance outcomes are displayed in table 3. We estimate ordinary least squares (OLS) regressions. We report the results obtained from the following three estimation models. *Model I* is a naive model that includes only an indicator identifying startup migrants, *Model II* refers to the double-LASSO model, while *Model III* is the quasiexperiment we mentioned in section VA. *Model I* and *Model II* control for founding year and subsector fixed effects (listed in table A4), while Model III controls for founding year fixed effects. In *Model I* and *Model II*, we double-cluster standard errors by founding year and sector. In *Model III*, we bootstrap standard errors given that the control p_i is derived from the entire sample and not just from the subset of the quasiexperiment.

Column 1 of table 3 reports the migration results for the likelihood that a startup applies for a trademark registration with the USPTO. According to the naive model, migrants are 36 percentage points more likely to apply for a U.S. trademark *ex post* than nonmigrants; the coefficient is significant at the 1% level. The double-LASSO model predicts that migrating to the United States translates into a 26 percentage point increased likelihood of applying for a U.S. trademark.[13] The relatively smaller coefficient is consistent with the positive sorting into migration we documented in section IV. The migration effect remains significant when we examine our quasiexperimental sample. This effect is larger than the one obtained from the double-LASSO. Indeed, it is derived from the subset of startups with a relatively low *ex-ante* probability of migrating.

Column 2 of table 3 displays migration effects on startup patent output. The naive model estimates a positive and significant effect of migrating on patents. However, the effect loses its significance and diminishes in magnitude with both the double-LASSO specification and our quasiexperimental sample. In moving from the naive to the double-LASSO specification, the magnitude of the effect declines by approximately 88%. This finding suggests that Israeli migrants do not derive significant benefits from accessing innovation inputs localized in the United States. As such, this finding confirms the fact that Israel hosts a large supply of highly skilled individuals, which diminishes the relative importance of achieving innovation productivity gains as a reason for moving to the United States. Indeed, several startups maintain their R&D centers in Israel when they migrate.

Column 3 presents the effects of migrating to the United States on the amount of VC funding that startups receive. As expected, the naive model considerably overestimates the

[13] We find similar results when the double-LASSO considers subsector fixed effects in the variable selection process of both the selection and treatment equations (table A7) and when we estimate a Coarsened Exact Matching model, which we report in table A8.

TABLE 4.—THE EFFECT OF MIGRATING ON ISRAELI STARTUPS' INTERMEDIATE PERFORMANCE OUTCOMES: WITHIN-MIGRANT VARIATION

	(1) Applied for Trademark	(2) Ln(Patents + 1)	(3) Ln(VC + 1)	(4) Ln(VC + 1) (U.S. VC Led Only)
Model I: Main difference				
Has Moved	0.0800**	0.00399	0.303***	0.448***
	(0.0329)	(0.0645)	(0.0957)	(0.0977)
Model III: Movers across age				
Age = 0 × Has Moved	−0.0540	0.0186	0.314***	0.193
	(0.0933)	(0.0837)	(0.117)	(0.245)
Age = 1 × Has Moved	0.0914*	−0.0294	0.384***	0.352***
	(0.0503)	(0.0645)	(0.0885)	(0.0944)
Age = 2 × Has Moved	0.102***	0.0215	0.511***	0.624***
	(0.0276)	(0.0531)	(0.0652)	(0.0782)
Age = 3 × Has Moved	0.135***	0.0528	0.357***	0.587***
	(0.0399)	(0.0758)	(0.127)	(0.0838)
Age = 4 × Has Moved	0.151***	0.0644	0.221*	0.593***
	(0.0394)	(0.101)	(0.126)	(0.0421)
Age = 5 × Has Moved	0.148***	0.0107	0.193*	0.630***
	(0.0435)	(0.129)	(0.105)	(0.0999)
Age = 6 × Has Moved	0.152***	−0.00892	0.0764	0.611***
	(0.0427)	(0.152)	(0.103)	(0.0920)
Observations	16768	16768	16768	16768
R2 Model I	0.804	0.795	0.840	0.823
R2 Model II	0.807	0.796	0.843	0.824

This table reports the estimates for the impact of migrating on startup intermediate performance outcomes, exploiting within-migrant variation. We examine the same outcome variables as in table 3. A startup's trademark (column 1) and patent output (column 2), as well as the amount of funding raised (columns 3 and 4) are cumulative from founding. All regressions include startup fixed effects, age fixed effects, and age at migration fixed effects. Model I uses an indicator (*Has Moved*) that takes on value 1 starting from the year in which a startup established its headquarters in the United States and zero in the premigration period. Model II introduces interaction terms between the indicator *Has Moved* and startup age dummies. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as $^{*}p < 0.1$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

effect of moving to the United States. However, after addressing selection concerns with both our double-LASSO and quasiexperimental approaches, we continue to find significant migration effects on the amount of VC financing. In particular, we show that migrants raise at least 93% more VC than nonmigrants. Finally, in column 4, we assess whether the gains startups derive in VC financing are led by U.S. venture capitalists. As shown, migrants raise 110% more U.S. VC than nonmigrants in the double-LASSO model, while the estimate from the quasiexperimental sample is 128%. The magnitudes of these effects are similar to those reported in column 3, supporting the conjecture that Israeli startups migrating to the United States derive positive gains from that country's comparatively large investor market.

Table 4 reports the panel results from estimating equations (3) and (4). Here, we exploit within-mover variation to assess changes in migrants' performance after they establish their headquarters in the United States. We limit the sample to the first seven years of a startup's life cycle to focus on the initial, entrepreneurial stages of a startup, rather than on those follow-on, more consolidated, stages. We examine the same outcome variables as in table 3. A startup's trademark and patent outputs, as well as the amount of funds raised, are cumulative from inception. *Model I*, in the upper part of table 4, uses an indicator (*Has Moved*) that takes on value 1 starting from the year a startup establishes its headquarters in the United States and zero in the premigration period. Therefore, the coefficient of this indicator represents the *average* variation in performance that migrants experience after they establish their headquarters in the United States. *Model II*, in the lower part of table 4, introduces interaction terms between the *Has Moved* indicator and startup age dummies. The coefficients of these interactions capture the effect of having moved by a given age on startup performance outcomes. In all models, we double-cluster standard errors by founding year and sector.

Column 1 of table 4 examines the trademark measure. Focusing on *Model I*, the coefficient of *Has Moved* is positive and significantly different from zero at conventional levels. The magnitude of the effect suggests that moving to the United States increases the likelihood that a startup will have applied for a trademark by 8 percentage points. *Model II* reveals an interesting pattern. By age 4, migrants are 15 percentage points more likely to have registered a trademark with the USPTO than nonmigrants, and the magnitude of the difference remains approximately the same for later years.

Column 2 of table 4 reports the results for over-time variation in a migrant's rate of patenting. Consistent with our cross-sectional results, we find that the coefficient of the *Has Moved* indicator is approximately zero in *Model I*. The results from *Model II* show that none of the coefficients for the interactions between *Has Moved* and the different startup ages are significant, and all their magnitudes are approximately zero. Collectively, these results confirm that Israeli startups establishing their headquarters in the United States do not derive significant innovation productivity gains.

Columns 3 and 4 examine the cumulative amount of VC financing Israeli startups raised over time. Column 3 considers the totality of a startup's cumulative VC amount, while in column 4 we analyze cumulative funding, taking into account only those rounds led by a U.S. venture capitalist. *Model I* shows that a startup raises significantly more financing after

TABLE 5.—THE EFFECT OF MIGRATING ON THE NUMBER OF UNIQUE TOTAL INVESTORS

	(1) Total Investors	(2) Total Investors	(3) Total U.S. Investors	(4) Total U.S. Investors (VC Only)	(5) Total U.S. Investors (Non-VC)	(6) Total Non-U.S. Investors
Model II:Double-LASSO ($N = 2179$)						
Moves to United States	1.656***	−0.413	0.520**	0.487***	0.0446	−0.967***
	(0.347)	(0.271)	(0.202)	(0.111)	(0.140)	(0.272)
Ln(VC + 1)		2.460***	0.696***	0.364***	0.335***	1.767***
		(0.168)	(0.0720)	(0.0636)	(0.0230)	(0.172)
Model III: Quasiexperiment ($N = 126$)						
Moves to United States	1.528	−0.172	0.808***	0.535*	0.273**	−0.980
	(1.086)	(0.557)	(0.263)	(0.294)	(0.131)	(0.607)
Ln(VC + 1)		2.234***	0.861***	0.439***	0.422***	1.374***
		(0.275)	(0.242)	(0.150)	(0.105)	(0.121)

This table reports the effects of migrating on the number of unique investors participating in the startups' financing rounds (starting from the second round), *having controlled for the total amount of funding raised*. In columns 1 and 2, we examine the total number of unique investors. In column 3, we consider the number of U.S. investors as an outcome, while in column 4 we focus on the number of U.S. venture capitalists. In column 5, the outcome is the total number of U.S. non-VC investors, while in column 6 we examine the total number of non-U.S. investors. In all regressions, we include fixed effects for the number of unique investors participating in the startups' first round of financing. Model II includes founding year and subsector fixed effects, and Model III only founding year fixed effects. Standard errors (in parentheses) are double-clustered at founding year and sector levels for Model II and bootstrapped for Model III. Significance denoted as $^{*}p < 0.1$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

migrating, regardless of whether we cumulate all the round amounts (column 3) or only those led by U.S. venture capitalists [column (4)]. The results from *Model I* indicate that, after migrating, startups receive, on average, 30% more financing and 45% more U.S. VC financing. The results from *Model II* reported in column 3 suggest that these migration effects are relatively smaller during a startup's inception, accelerate later on, and finally decline after age 2, although they generally remain statistically significant. The only exception is the effect for companies that have moved by age 6. These companies do not raise significantly more funds than companies that have moved by age 7. However, we note that most of the Israeli migrants' acquisitions occur before age 7. Regarding the cumulative funding raised from U.S. venture capitalists [column (4)], the magnitudes of the migration effects increase with a startup's age and remain large even during the company's later years. Starting from age 2, these magnitudes are substantially larger than those reported in column 3 for the total cumulative amount of funding raised.[14] Overall, our panel analyses confirm the cross-sectional findings. Israeli startups migrating to the United States derive significant gains from penetrating a comparatively large consumer market and accessing a wide availability of investors. At the same time, we continue to find that Israeli migrants do not significantly improve their innovation productivity.

While our three approaches to dealing with positive selection into migration deliver consistent results, one may still be worried that our findings are the result of selection rather than of the migration treatment. To further address this concern, we follow Oster (2019) and compute a lower bound for our migration effects to assess whether they can be convincingly bounded away from zero. The results are displayed in table A10. In each column, the baseline specification controls for founding year and sector fixed effects, while the expanded specification includes all the double-LASSO controls. Despite the fact that the expanded specification adds important startup aspects such as VC fixed effects, which make the *R*-squared increase by at least 73% once they are included, the migration effects decline by at most 31%. Consequently, the lower bounds of our estimates are all above zero. Moreover, the reported measure, δ, for the relative degree of selection on observed and unobserved variables suggests that the influence of unobservables relative to observables would need to be over 2.8 times larger to produce a null migration effect. This last scenario is unlikely given the predictive power of our machine learning model.

Exploring the mechanisms of our financing results. Tables 3 and 4 reported that Israeli startups raise more funding upon migrating. This result could be explained by Israeli startups attracting a larger number of investors after they migrate. Alternatively, it could be driven by the fact that investors located in the United States have greater financial means than other investors. We explore these conjectures in table 5, where we present estimates for the number of unique investors that have funded a startup after its first round of financing, *having controlled for the total funding amount the startup raises* during the same period. We present our cross-sectional models in table 5.[15]

While the number of unique investors is positively correlated with migration (column 1), the migration coefficient drops when we control for the amount of funding a startup raises and the point estimate becomes negative (column 2). However, when we consider the number of U.S. investors only (column 3), the coefficient of migration remains positive and significant, even after controlling for the amount of funding raised. Upon migrating, Israeli startups increase their portfolio of U.S. investors by at least 0.5. As shown in columns 4 and 5, this result is driven specifically by U.S. venture capitalists (column 4) rather than by other types of U.S. investors (column 5). Finally, the results reported in column 6 reveal that startup migrants attract fewer non-U.S. investors than nonmigrants, all else being equal. The magnitude of the

[14] We find similar results when we examine the yearly VC amount as an outcome (table A9).

[15] Unreported panel results are consistent with the cross-sectional findings in table 5.

TABLE 6.—THE EFFECT OF MIGRATING TO THE UNITED STATES ON ISRAELI STARTUPS' EQUITY OUTCOMES: CROSS-SECTIONAL RESULTS

	(1) Acquired	(2) Acquired by non-U.S. firm	(3) Ln(Exit $)	(4) IPO
Model I: Naive ($N = 2179$)				
Moves to United States	0.416***	−0.0328*	1.134***	0.0248
	(0.0393)	(0.0169)	(0.173)	(0.0180)
Model II: Double-LASSO ($N = 2179$)				
Moves to United States	0.174***	−0.0692**	0.996***	0.0357
	(0.0661)	(0.0325)	(0.234)	(0.0375)
Model III: Quasiexperiment ($N = 126$)				
Moves to United States	0.401***	0.000172	1.952	0.0111
	(0.0699)	(0.0642)	(1.214)	(0.0857)
R2 Model I	0.0724	0.00112	0.0710	0.000922
R2 Model II	0.303	0.141	0.368	0.213
R2 Model III	0.293	0.355	0.137	0.190

This table reports the estimates for the impact of migrating on four startup equity outcomes. The outcomes are: the likelihood that a startup is acquired (column 1), the likelihood it is acquired by a non-U.S. company (column 2), a startup's sales value (column 3), and the likelihood it exits through an IPO (column 4). Model I is the naive model described in the text. Model II is the double-LASSO. Model III is our quasiexperiment. Model II includes founding year and subsector fixed effects, and Model III founding year fixed effects. Model III in column 3 does not include founding year fixed effects given that the sample size is only 36 and the main effect cannot be identified. Standard errors (in parentheses) are double-clustered at founding year and sector levels for Models I and II, and bootstrapped for Model III. Significance denoted as $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

coefficients suggests that migrants attract one fewer non-U.S. investor than startups maintaining their headquarters in Israel. Collectively, the findings presented in tables 3–5 suggest that Israeli migrants substitute non-U.S. with U.S. venture capitalists after they move and raise larger amounts of funding as a consequence.

Startup exit outcomes. Here, we assess the impact of migrating to the United States on these companies' exit performance. Table 6 reports the cross-sectional results. *Model I* and *Model II* control for founding year and subsector fixed effects, while Model III controls for founding year fixed effects. *Model I* and *Model II* double-cluster standard errors by founding year and sector, while in *Model III* standard errors are bootstrapped. Column 1 reports the migration results for the likelihood of exiting via an acquisition. Relative to nonmigrants, companies moving to the United States are 17 percentage points more likely to be acquired under the double-LASSO approach. Given that 21% of the startups in our sample have been acquired, this effect is economically large.[16] In the quasiexperimental sample, we similarly find that migrants are 40 percentage points more likely to be acquired than the stayers.

We next explore whether these results are driven by the comparatively large U.S. supply of acquirers or by an increase in startup productivity following migration. To shed light on this point, column 2 reports migration results for the likelihood that a startup is acquired by a non-U.S. company. If the size of the U.S. market for acquisitions were a relevant determinant of the Israeli startups' decision to migrate, then Israeli migrants should be more likely to be acquired by U.S. companies than by foreign ones. Consistently, the results in column 2 show that either Israeli migrants are less likely than nonmigrants to be acquired by non-U.S. companies (*Model II*) or migration does not affect the likelihood that a startup is acquired by a non-U.S. firm (*Model III*).

Column 3 reports the effects of migrating to the United States on startups' sales values upon acquisition. The estimates are sizable. Relative to stayers, startups moving to the United States experience a 100% and a 195% increase in sales value, depending on whether we follow the double-LASSO or the quasiexperimental approach. These results suggest that acquirers respond to Israeli startups migrating to the United States along both the intensive (likelihood of acquiring) and extensive (sales price) margins.

Migrating to the United States does not significantly affect the likelihood that a startup will go public via an IPO (column 4). In table A12, we delve deeper into this finding by distinguishing between those IPOs that took place on the U.S. stock exchanges and those that occurred on the Tel Aviv Stock Exchange (TASE). Israeli migrants are more likely to go public on the U.S. stock exchanges than nonmigrants. However, migrants appear less likely than nonmigrants to go public on the TASE. These findings suggests that, while Israeli startups moving to the United States may show a preference for the U.S. stock exchanges, their overall probability of experiencing an IPO does not increase.[17]

We next discuss the panel regression results, which we present in table 7. As before, we include startup fixed effects and exploit within-mover variation to assess the change in migrants' performance after they establish their headquarters in the United States. We also include startup-age and age-of-migration fixed effects. We examine the same startup performance outcomes as in table 6, except for a startup's sales price, which cannot be analyzed in a panel format.

The panel results confirm our cross-sectional findings. Column 1 of table 7 examines the likelihood that a startup will have been acquired by a given year. Upon establishing their

[16] A Cox proportional hazards model reported in table A11 confirms this finding.

[17] Table A13 shows that migrants are, overall, less likely to go bankrupt than nonmigrants.

TABLE 7.—THE EFFECT OF MIGRATING TO THE UNITED STATES ON ISRAELI STARTUPS' EQUITY OUTCOMES: WITHIN-MIGRANT VARIATION

	(1) Acquired	(2) Acquired by Non-U.S. Firm	(3) IPO
Model I: Main difference			
Has Moved	0.0632	0.00300	−0.00974
	(0.0411)	(0.00790)	(0.0195)
Model III: Movers across age			
Age = 0 × Has Moved	−0.0425	0.0158*	−0.0131
	(0.0666)	(0.00888)	(0.0180)
Age = 1 × Has Moved	0.0172	0.0158	0.00664
	(0.0331)	(0.0112)	(0.0210)
Age = 2 × Has Moved	−0.000939	−0.000407	−0.0113*
	(0.0337)	(0.0138)	(0.00597)
Age = 3 × Has Moved	0.0626**	−0.00297	0.0129
	(0.0291)	(0.0143)	(0.0172)
Age = 4 × Has Moved	0.126***	−0.00994	−0.0118
	(0.0180)	(0.0136)	(0.0232)
Age = 5 × Has Moved	0.155***	−0.0223***	0.0151
	(0.0305)	(0.00834)	(0.0295)
Age = 6 × Has Moved	0.256***	−0.0115	−0.0289
	(0.0351)	(0.0114)	(0.0418)
Observations	16768	16768	16768
R2 Model I	0.539	0.451	0.432
R2 Model II	0.559	0.454	0.439

This table reports the estimates for the impact of migrating on three startup equity outcomes, exploiting within-migrant variation. Columns 1 and 2 examine a startup's acquisition events, while column 3 assesses the likelihood that the startup will have exited via an IPO as of a given year. All regressions include startup fixed effects, age fixed effects, and age at migration fixed effects. Model I uses an indicator (*Has Moved*) that takes on value 1 starting from the year in which a startup established its headquarters in the United States and zero in the premigration period. Model II introduces interaction terms between the indicator *Has Moved* and startup age dummies. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as $^{*}p < 0.1$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

headquarters in the United States, Israeli migrants become, on average, 6 percentage points more likely to have exited via an acquisition (*Model I*). Consistent with the fact that the gains from moving gradually accumulate over time, *Model II* reports a steady increase in the probability that a startup will have experienced an acquisition by a given year. A startup that moved by age 6 is 26 percentage points more likely to have exited through an acquisition. Column 2 reports the results for the likelihood that a startup will have been acquired by a non-U.S. company. The point estimate derived from *Model I* is small in magnitude (0.003), suggesting again that acquisition gains from moving to the United States are positively correlated with the availability of U.S. acquirers. The results from *Model II* support this conjecture. Except for startups at age 0, the coefficients of the interactions between the *Has Moved* indicator and a startup's age dummies are all approximately zero or negative and mostly insignificant. Finally, column 3 reports the results for the likelihood that a startup will have exited through an IPO. Migrants are less likely to have experienced an IPO after moving to the United States, and this difference, which is rather small, is consistent across the various startup ages.

To deal with the concern that our approaches may not completely address the nonrandom selection into migration, we again perform the Oster (2019) bounding method and report the results in table A14. As shown, the lower bounds of our migration effects are all greater than zero.

Exploring the mechanisms of our acquisition results. A concern with these findings is that the migrants' improved likelihood of exiting via an acquisition and increased sales value may not imply a U.S. comparative advantage in hosting a large market for acquisitions. In fact, the evidence we provide could be consistent with the United States hosting a relatively large market of VC investors who invest larger funding amounts than Israeli investors. As migrants receive relatively large funding amounts, they may become more attractive to potential acquirers and thus improve their likelihood of being acquired. Similarly, since a startup's sales value also reflects the startup's total capital, more funding would translate into a higher sales value. These examples illustrate that the size of the U.S. market for acquisitions may not be an independent source of the United States comparative advantage in entrepreneurship, but only a manifestation of a developed investor market.

We perform three complementary analyses to mitigate this concern. First, we estimate a modified version of the double-LASSO model presented in table 6 controlling, this time, for the total amount a startup raised from U.S. investors.[18] The results in table A15 continue to show that migrants are more likely to be acquired than nonmigrants, especially by U.S. acquirers. In particular, migrants are 14 percentage points more likely to be acquired and 22 percentage points more likely to be acquired by U.S. acquirers. These effects are similar in magnitude to those in tables 6 and A14, lending support to the interpretation that an important advantage of the U.S. entrepreneurial ecosystem relative to other innovative economies is the larger market for acquisitions.

Second, we estimate an instrumental variable (IV) model with panel data, which closely follows Freyaldenhoven et al. (2019). This approach consists of instrumenting a time-varying control with the leads of the treatment to remove the

[18] We also control for the number of U.S. patents and for whether a startup had a U.S. trademark.

effect of the confounding factor of interest. The approach requires a time-varying covariate that (i) is likely to be affected by the confounder—and therefore exhibits a pretrend—but that (ii) is not affected directly by the treatment. The covariate is employed in a two-stage least squares (2SLS) estimator. We use the cumulative number of startup investors as the time-varying covariate and instrument it with the first lead of the treatment. As we show in panel A of figure A8, this covariate exhibits an increasing pretrend, satisfying condition (i). As reported in table 5, this variable is positively correlated with the migration treatment in the uncontrolled regression, but it becomes uncorrelated with this treatment once we control for the amount of funds raised. Since this result suggests that migrants do not attract more investors than nonmigrants, but have different investors participating in their rounds, the cumulative number of investors satisfies condition (ii). Additionally, the finding confirms that our time-varying covariate is strongly correlated with the amount of funds raised, which is the confounding factor we worry about. The IV results are reported in table A16. The effect of migrating on the cumulative likelihood that a startup will have been acquired by t is positive and significant. This effect continues to be driven by the acquisition of Israeli startups by U.S. firms. Moreover, the pretrends reported in panel B of figure A8 are jointly insignificantly different from zero with a p-value of 0.61.[19]

Finally, we delve deeper into startups' sales prices. We condition the sample to startups that were acquired by U.S. companies and relate their sales value to whether they had migrated to the United States. We control for the amount of funding the startups raised through exit, an indicator for whether the startups raised U.S. VC funding, and the total number of unique U.S. VC investors participating in the financing of the startups. The rationale is to examine a homogeneous sample of acquired startups and assess whether, within this sample, migrants improve their transaction value once we control for the amount of funding they raised and investor characteristics. The results reported in table A17 show that migrants experience at least a 76% increase in sales value relative to nonmigrants. The significance of this effect does not vary with the set of controls we employ in the regressions (less stringent in column 1 and progressively more stringent in columns 2 and 3). This evidence provides an indication that the U.S. market for acquisitions represents an independent source of the U.S. comparative advantage in entrepreneurship.

C. Heterogeneity of Migration Responses

To bring our analysis full circle, we explore heterogeneity in startup performance response to migration. We present the results from the double-LASSO models that use the full sample.

[19] They were insignificant with a p-value of 0.38 in the within-migrant OLS model.

Establishing headquarters in the United States versus opening a branch office. We first explore heterogeneity in migration effects by contrasting the Israeli startups that choose to establish their headquarters in the United States with those that decide to open a branch, using the Israeli startups that do not migrate as a benchmark. While some of the benefits that startups opening a branch in the United States capture may be similar to those of startups establishing their headquarters in the United States, others may vary depending on the startups' chosen migration type.

Table A18 reports the results. When analyzing the likelihood that a startup files for a U.S. trademark, we find that the effect of establishing headquarters in the United States is larger than the effect of opening a branch. Examining the rate of patenting, instead, reveals that none of the coefficients associated with the different startup migration types is significantly different from zero. Moreover, the funding amount that Israeli startups opening headquarters in the United States raise is 47 percentage points larger than the amount raised by startups opening a branch. This difference increases to 59 percentage points when we only consider funding amounts raised from U.S. venture capitalists.

We next present the results for startups' equity outcomes. Israeli startups establishing their headquarters in the United States are 12 percentage points more likely to be acquired than startups opening a U.S. branch. This finding stems from acquisitions by U.S. companies. Among acquired startups, those with headquarters in the United States sell at a higher price than those opening a U.S. branch. The effect of migrating to the United States on a startup's sales price is circa 88 percentage points larger if the startup establishes its headquarters in the United States as opposed to opening a branch. Further, startups opening a U.S. branch are more likely to go public via an IPO than companies establishing their headquarters in the United States relative to the reference category of nonmovers. This last result, combined with the evidence presented in table A12, suggests that for startups that open a branch in the United States, the Israeli IPO market is a relevant source of financing. Collectively, these results confirm that the comparative advantage of the U.S. entrepreneurial ecosystem stems from multiple sources. However, startups' ability to access several of these sources depends on whether they establish their headquarters in the United States or open a branch.

Destination locations within the United States. We finally examine whether there is any heterogeneity in migration benefits depending on the U.S. location Israeli startups choose. We differentiate between the California (CA), Massachusetts (MA), and New York area (NY) destination locations, on the one hand, and the remaining U.S. locations on the other. We adopt this distinction to isolate the specific contribution to the United States entrepreneurial ecosystem's comparative advantage of these startup clusters versus other US regions. The results are reported in table A19. There is no considerable difference in effects between migrating to

CA/MA/NY and moving to another US destination, with respect to the following startup performance outcomes: whether or not startups applied for a trademark with the USPTO, the number of US patents a startup applied for, and the likelihood of exiting via an acquisition or an IPO. However, we observe a remarkable difference in effects when we examine the total (and U.S.) amount of funding startups raise, and the sales price at which they are sold. Startups located in CA/MA/NY raise at least 109% more funds than nonmigrants, while the increase for startups located in other states is only 59% and insignificantly different from zero. This gap becomes wider when we only consider startup rounds led by U.S. venture capitalists. Moreover, the price at which acquired startups located in CA/MA/NY are sold is at least 104% higher than the price at which acquired nonmigrants are sold. Conversely, the effect of migrating to U.S. states other than CA/MA/NY on sales price is negative. Overall, the sources of the U.S. comparative advantage are predominantly concentrated in those geographical areas that best characterize the U.S. entrepreneurial ecosystem.

VI. Concluding Remarks

This paper uncovers the underlying sources of the United States entrepreneurial ecosystem's advantage relative to other innovative economies. We do so using a rich data set of Israeli technology startups and estimating the benefits these companies derive from establishing their headquarters in the United States. We show that migrants are significantly more likely than nonmigrants to have a trademark registered in the United States. They are also more likely to raise VC funds and to be acquired. Moreover, conditional on experiencing an acquisition, migrant startups are sold at a higher price than nonmigrant startups. These effects are not only statistically significant but also economically relevant. We do not find significant migration effects on the number of patents startups produce, suggesting that Israeli startups do not move to the United States in order to improve their innovation output. The totality of these results lead us to conclude that, compared to other innovative economies, the United States entrepreneurial ecosystem offers a multiplicity of advantages that generate sizeable gains for startups. The advantages we highlight are a large consumer market, high investor availability, and a developed market for acquisitions. Our findings have implications for those countries creating or expanding their startup ecosystems. They suggest that to attract high-growth startups, policymakers should broaden the scope of their investments and not just focus on bolstering their workforce education and level of innovation.

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