What is the US Comparative Advantage in Entrepreneurship? Evidence from Israeli Migration to the United States

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Abstract

This paper investigates underlying sources of the US entrepreneurial ecosystem's comparative advantage by assessing the benefits Israeli technology startups derive from migrating to the US. To address positive sorting into migration we adopt three complementary approaches, which include examining exogenous institutional constraints on the startups' ability to migrate, estimating a double-LASSO regression, and exploiting within-mover variation in performance outcomes. We show that migrants raise larger funding amounts and are more likely both to apply for a trademark and to be acquired than non-migrants. Conditional on an acquisition, migrants also achieve a higher transaction value. However, they do not hold more patents than non-migrants. We conclude that the US entrepreneurial ecosystem's comparative advantage vis-à-vis other innovative economies, such as Israel, arises from a multitude of sources that produce sizeable gains for startups. These sources are high investor availability, a large consumer market, and a developed market for acquisitions.

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1 Introduction

Entrepreneurial ecosystems play a fundamental role in spurring a country's innovation and economic growth (Acs and Armington, 2006; Audretsch, 2007; Akcigit and Kerr, 2018). However, despite their acknowledged contribution, little is known regarding the factors that are responsible for their success (Bresnahan and Gambardella, 2004). The United States (US), for example, is reputed to be one of the most successful entrepreneurial ecosystems in the world. While this country hosts the largest number of high-performing startups worldwide,[1] its ranking in education and innovation is not as elevated.[2] Yet, domestic education and innovation are considered to be critical inputs to growth entrepreneurship. Therefore, what makes the US so successful? Addressing this question fills a fundamental gap. Many countries have invested considerable resources to try to replicate the US model (Lerner, 2009). Nonetheless, the foundations of this model are largely unknown.

One reason for the US' success could simply be that it hosts a large number of startups, regardless of the quality of its entrepreneurial ecosystem. Given the skewed distribution of firm success (Gompers and Lerner, 2004), the greater the number of startups, the higher the likelihood of observing positive performance outcomes. Another possibility is that the comparative advantage of the US entrepreneurial ecosystem arises from a multitude of sources that transcend the country's level of education and innovation. According to the literature, possible sources are a large consumer market (Krugman, 1991), the availability of specialized inputs (Marshall, 1920), the presence of investors (Chen *et al.*, 2010), and a developed market for acquisitions (Arora *et al.*, 2004; Gans and Stern, 2003). Which of these candidates matter in explaining the US' success?

This paper takes a first step towards shedding light on underlying sources of the US entrepreneurial ecosystem's comparative advantage.[3] For this purpose, we build on the Conti (2018) dataset and evaluate the decision of 2,179 Israeli startups to establish their headquarters in the US.

[1] See for instance: $https://www.forbes.com/sites/quora/2013/07/29/why-do-most-of-the-successful-startups-come-out-of-the-usa/\#1d50416d3166$ and $http://paulgraham.com/america.html$.

[2] Specifically, the US ranks 25th in the 2015 *Science, Reading and Mathematics score* compiled by the Programme for International Student Assessment (PISA), and 13th and 11th for the number of patent applications (per million population) and R&D expenditure (as a percentage of GDP), respectively, according to the 2018 Global Competitiveness Report produced by the World Economic Forum.

[3] We employ the "comparative advantage" terminology to refer to the advantages the US entrepreneurial ecosystem offers relative to other entrepreneurial ecosystems.

By estimating the different benefits these companies derive from moving to the US, we infer the sources of the US comparative advantage, especially relative to other innovative countries such as Israel. Our empirical context is appealing for a number of reasons. First, Israel has historically built strong ties with the US and Israeli startups regard the US as an attractive destination, thereby making migration to this country a frequent event rather than an outlier (Senor and Singer, 2009). In our sample, for instance, 13 percent of the startups established their headquarters in the US, while none of them opened headquarters in Europe. Second, Israel shares a similar specialization in Information and Communication Technology (ICT) with the US, suggesting that the skills valued in the US and in Israel are comparable. This is an important prerequisite for attributing any observed migration effect to differences in resources between Israel and the US (Borjas, 1987). Finally, the unique institutional features of the Israeli context provide us with a quasi-exogenous variation in the startup decision to migrate, allowing us to causally identify the effect of migrating on Israeli startups' various performance outcomes.

Having estimated a set of logit models for the likelihood of moving to the US, we document positive sorting into migration showing that, compared to non-migrants, startup migrants raise larger amounts of funds during their first financing round, are more likely to attract US venture capitalists (VCs), and are founded by successful serial entrepreneurs. Migrants are also more likely to apply for US granted patents and trademarks in their early years. Building on these results, we estimate a machine learning model that allows us to extract the most information from our set of observables. The results show that Israeli startups with a high predicted likelihood of migrating to the US tend to be successful even when they do not actually migrate. This finding demonstrates that the determinants of startup performance in Israel and in the US are comparable and provides further confirmation of a positive sorting into migration.

We next delve into the core of our analysis and investigate the gains Israeli startups may derive from migrating to the US. In particular, we explore six outcome measures for startups that closely map onto some of the most relevant benefits we mentioned earlier. We first examine whether or not startups apply for a trademark with the US Patent and Trademark Office (USPTO) in order to assess the benefits migrants derive from penetrating a larger consumer market than the domestic economy. We then analyze the number of US granted patents startups apply for to evaluate the advantages of accessing innovation inputs and R&D spillovers localized in the US. We also examine the amount

of venture capital (VC) raised to gauge the gains startup migrants derive from a relatively large supply of US investors. Finally, we evaluate the likelihood that a startup is acquired and the likelihood that it goes public via an initial public offering (IPO), as well as the transaction value in the case of an acquisition. These three measures allow us to determine whether migrants can extract a higher value from their technologies by accessing a comparatively large market for exits.

Given our earlier results on the positive sorting into migration, the challenge we face is that failure to control for startup heterogeneity biases migration estimates upward. We adopt three complementary approaches to address this concern. First, we implement a quasi-experiment that compares migrants' outcomes to those of startups that, for 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 high entry barriers (Adams and Adams, 1972) that make it very costly for Israeli startups operating in this sector to migrate to the US market. Similarly, there are considerable restrictions on embryonic stem cell research in the US as compared to Israel (Furman *et al*., 2012), reducing the profitability of migrating to the US for startups developing technologies in this field. Second, we implement a double-LASSO regression[4] (Belloni *et al*., 2014), which addresses selection bias through an efficient utilization of the observables. Finally, we exploit within-mover variation of performance outcomes and assess the effect of moving to the US in any given year.

We find that migrants are significantly more likely than non-migrants to apply for a trademark in the US. Migrants improve the amount of US VC they raise and the likelihood of being acquired by a US company. However, they receive smaller amounts of investment from non-US VCs and are less likely to attract non-US acquirers. The substitution of non-US with US investors and acquirers induces Israeli startups to raise larger VC rounds and makes them more likely to be acquired. The effects we find are economically important. For instance, the double-LASSO model predicts that migrants are 25 percentage points more likely to apply for a trademark with the USPTO and raise 114% more VC funds than non-migrants. Additionally, migrants are 18 percentage points more likely to exit via an acquisition than non-migrants, and their transaction value, upon acquisition, is 95% higher. Several of these effects are largest for startups that move their headquarters to the US instead of opening a subsidiary and for those that migrate to California, Massachusetts, and

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

the New York area, which are the Israeli migrants' most frequently chosen destination locations. We do not find any significant migration effect on the likelihood that startups will go public via an IPO, although Israeli migrants are more likely to go public on the US stock exchanges, while they are 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 Israeli startups apply for.

These results reveal that the US entrepreneurial ecosystem's comparative advantage arises from a multitude of sources that produce sizeable gains for startups. The sources we identify are a large consumer market, high investor availability, and a developed market for acquisitions. The insignificant migration effects we find on startup patents suggest that, while innovation inputs and R&D spillovers may be relevant for the *absolute* advantage of the US entrepreneurial ecosystem, they are less important for the *comparative* advantage of the US vis-à-vis other innovative economies.

This paper is situated at the intersection of the economic geography and entrepreneurship literatures. The first strand of the literature has highlighted the importance of factors such as market size (Krugman, 1991; Venables, 1996), access to specialized inputs (Marshall, 1920), and information spillovers (Audretsch and Feldman, 1996) to explain 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 US entrepreneurial ecosystem and the startups it hosts. In doing so, we build on studies that have investigated the determinants of entrepreneurial clusters (Chinitz, 1961; Saxenian, 1994; Glaeser and Kerr, 2009; Glaeser *et al*., 2010) to specifically focus on underlying sources of the US entrepreneurial ecosystem's comparative advantage relative to other innovative economies. Our analysis extends the work by Guzman (2018), who has examined the characteristics of startups that migrate within the US and the migration benefits these companies derive. In contrast with this study, we concentrate on the international migration phenomenon, using it to infer the specific characteristics of the US entrepreneurial ecosystem. Finally, our results speak to the literature that has analyzed the differences in productivity levels between the US and other countries (van Ark *et al*., 2008). In particular, our finding that migration produces no significant innovation productivity gains stands in contrast to the findings of Bloom *et al*. (2012), who have shown that Americans "do IT better". Israel hosts a large pool of highly skilled individuals, especially in ICT, which reduces the relative benefits of migrating to the US for the specific purpose of achieving productivity gains.

The remainder of the paper is structured as follows. Section 2 provides an overview of the features of the Israeli entrepreneurial context. Section 3 describes the dataset. Section 4 documents the selection of Israeli startups into migration. Section 5 outlines our identification strategies for estimating the benefits from migrating to the US and presents the results. Section 6 concludes.

2 Empirical Context: Israel, "The Startup Nation"

Israel is one of the most prolific innovative economies, ranked in top positions by several institutions, including the Organisation for Economic Co-operation and Development (OECD) and the World Economic Forum.[5] An important fraction of Israeli innovations is produced by domestic technology startups (Bresnahan *et al.*, 2001). In the past three decades, Israel has given rise to one of the most developed high-technology startup-intensive clusters outside of the US, hosting the largest number of technology startups per capita worldwide.[6] Many of these startups operate in ICT sectors, reflecting Israel's comparative advantage in these areas, although they have recently expanded to industries such as the life sciences (Beyar *et al.*, 2017). The country's successful efforts in building a startup ecosystem have earned Israel the title "Startup Nation" and the area around Tel Aviv, where most of the startups are concentrated, the name "Silicon Wadi" (Silicon Valley in English). This success has been largely ascribed to a combination of factors, including Israel's compulsory military service, a large availability of scientists and engineers, and *ad hoc* government policies (Trajtenberg, 2000 & 2005).

Israelis go through several years of 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, the internet, and data security, among others. 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 are required to take complete responsibility for their sub-unit organization and to manage projects that very much resemble those pursued in high-technology startups (Engel and del-Palacio, 2011).

[5] http://www.oecd.org/innovation/inno/researchanddevelopmentstatisticsrds.htm, accessed August 21, 2018 and https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018, accessed August 21, 2018.

[6] "All together now, what entrepreneurial ecosystems need to flourish," *The Economist*, January 18th, 2014.

While the Israeli Army has been crucial for the making of a "Startup Nation", it is not the only factor. Another determinant input 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 (STEM) degree (Beyar *et al.*, 2017). The education that renowned research institutions, such as Technion and the Weizmann Institute, provide has greatly contributed to the creation of this human capital stock, complementing the role of the Israeli Army. An additional contributing factor to the high proportion of scientists and engineers in Israel is the immigration of approximately 1 million Soviet Jews, which started in the late 1980s following the dissolution of the USSR.[7] A consistent share of these migrants hold STEM degrees, and their skills in STEM disciplines have been recognized as playing an important role in the ICT boom Israel experienced in the late 1990s (de Fontenay and Carmel, 2004).

It is also important to mention the active role the Israeli government plays in sustaining private R&D projects, particularly those undertaken by startups (Trajtenberg, 2000 & 2005). Among the government initiatives stands the creation of Yozma, a type of venture fund with the goal of stimulating other venture funds, and a conspicuous subsidy program for financing firm R&D projects. Additionally, the government established a number of high-technology incubators to absorb the large inflow of educated Russian Jews who typically lacked basic knowledge regarding commercialization practices.

While there is little doubt that Israeli entrepreneurs benefit from domestic R&D spillovers, they operate in a small market, which makes them very sensitive to location choices. These entrepreneurs have traditionally looked to the US market as their preferred destination for a multitude of reasons. The US offers not only a large consumer market, but also a greater availability of specialized inputs, investors, and potential acquirers. Many Israeli entrepreneurs have moved to the US over time, especially to the West Coast and, more recently, to New York. In doing so, they have progressively developed their own entrepreneurial network in the US, which has further stimulated Israeli startup migration to this country.

Although Israeli entrepreneurs are, in general, attracted to the US market, some of them run companies for which establishing headquarters in the US is intrinsically costly. These include companies operating in the defense sector and those developing stem cell, particularly embryonic

[7] $http://meyda.education.gov.il/files/AdultEducation/hed_haulpan/hed_105_marina_sheps.pdf$

stem cell, technologies. The defense sector has traditionally been characterized by high entry barriers (Adams and Adams, 1972), which typically take the form of restrictions imposed both by the source country producing defense technologies and by a potential destination economy. In particular, to prevent the leakage of information on strategic technologies, Israeli legislation prohibits the overseas transfer of defense know-how unless individuals obtain a defense export license – i.e., a license from the Director General of the Ministry of Defense or the Head of the Defense Export Control Agency.[8] Likewise, the US has enforced a number of import restrictions on defense goods,[9] to support the domestic development of this strategic sector. Altogether, these restrictions make it very costly for Israeli startups operating in the defense sector to penetrate the US. Regarding startups developing embryonic stem cell technologies, the Bush administration introduced restrictions on research conducted with embryonic stem cells in August of 2001, imposing severe limitations on federal funding (Holden and Vogel, 2002; Furman *et al.*, 2012). These restrictions have substantially increased the opportunity costs of migrating to the US for these startups, especially given that the Israeli government both permits and subsidizes the creation of embryos for scientific purposes (Levine, 2008).

3 Dataset

We build our dataset from Conti (2018) and extend it by employing additional sources of information.[10] The dataset comprises information on 2,179 Israeli startups[11] derived from the Israel Venture Capital Research Center (IVC). The IVC specializes in monitoring Israel's high-tech industry and assembles rich information on Israeli startups' founding location and date, industry sector, top management, financing rounds, participating investors, and exit outcomes. Conti (2018) complemented the IVC data with information on both US granted patents that Israeli startups applied for and grants awarded from the Israeli Office of the Chief Scientist. We enrich this original dataset with information on startup migration as well as trademark applications with the USPTO. Descriptive statistics are reported in Table 1.

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

[9] See, for instance, the 1941 Defense Appropriation Act and the Berry Amendment (http://trade.ec.europa.eu/doclib/docs/2009/july/tradoc_144160.pdf).

[10] An earlier version of this dataset was used in Conti *et al.* (2013a).

[11] From the original dataset in Conti (2018), we dropped 9 startups that were founded in earlier years and for which migration information is not available, 2 startups that our information sources suggest had moved at ages -2 and -3, and 114 startups that moved to the US after three years of their inception.

The startups in the dataset were founded between 1990 and 2014. As of 2018, the average age of a startup is 15 years. 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 percent of the startups filed for a US granted patent within one year of their founding. This figure increases to 34 percent 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 sample startups are high-technology companies.

The average amount of funding startups raised during their first round is $1.48 million. The funding distribution is very skewed and the median value is only $0.4 million. Twenty-five percent of the startups received VC investment during their first round and 7.2 percent obtained funds from US VCs.[12] Regarding exits, 113 (5 percent) of the startups experienced an IPO as of September 2014, and 494 (23 percent) an acquisition. Of the acquired startups, 66 percent had a US acquirer. Conditional on an acquisition, the average transaction value is $78 million and increases to $89 million when the acquirer is a US company.[13] Taken together, these data provide an indication of the relevance of US investors for Israeli startups.

Finally, following an established literature (Giarratana and Torrisi, 2010; Castaldi, 2018), we use data on trademark applications to the USPTO to measure the extent of Israeli startups' penetration in the US product market. Within one year of being founded, 8.9 percent of the companies had applied for at least one trademark in the US. The percentage increases to 21 percent when considering a five-year window from inception.

Migration data

Building on Guzman (2018), we use business registration records from the US states, complemented with secondary sources of information, to determine whether Israeli startups migrated to

[12] IVC classifies institutional investors into: VCs, private equity firms, investment banks, insurance companies, pension funds, and advisory & management companies. While many non-VC investors manage venture capital funds or funds of similar nature, we take a conservative position and exclude them from our category of VCs.

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

the US. As described in Guzman (2018), business registration records are public records created when a firm is registered as a corporation, partnership, or limited liability company with the Secretary of State (or Secretary of the Commonwealth) of any US state.[14] We count the date of registration as the date of migration. Business registration records in our data require that companies 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 migrate their headquarters (moving the principal office) and those opening of a US-based subsidiary (such as a sales office) while maintaining their headquarters in Israel. Using these records, we can assess the different types of startup migration choices. To complement our data and verify existing information we employ secondary sources of information, such as Crunchbase, LinkedIn, Bloomberg, company websites, and newspaper records of startups' relevant events. The totality of our searches reveals that 290 startups (13 percent) established their headquarters in the US, while 96 startups (4 percent) opened a subsidiary. In our main analyses, we define as migrants only those startups that established their headquarters in the US and not those companies that opened a US-based subsidiary. However, in Table 9 we assess both the effect of establishing headquarters in the US and the impact of opening a US-based subsidiary. While the US appears to be an attractive migration destination, our secondary sources show that none of the startups in our sample opened headquarters in Europe and only 59 companies opened a branch in this region.

Panel A of Figure 1 shows the distribution of migrants by the calendar year in which they moved to the US. More than half of the migrants (60 percent) established their headquarters within the first 3 calendar years of their inception, with the remaining being scattered across the following years. We further 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. Though this cutoff of three years is admittedly *ad hoc*, we adopt it because we are specifically interested in the location choices startups make during their earliest years. Our results are robust to adopting different cutoffs. We further 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 US evidence provided in Guzman (2018).

Panel B of Figure 1 reports the destination state of the movers. Not surprisingly, a large portion

[14] Other studies have used these data, including Guzman and Stern (2016) and Guzman and Stern (2017).

of migrants (53 percent) established their headquarters in California, a destination that matches well with Israel's comparative advantage in ICT industries.

Figure 2 depicts the distribution of first-round VC financing for startups that established their headquarters in the US versus those that did not move. Although migrants raise, on average, larger financing rounds than non-migrants, there is substantial overlap between the two groups, suggesting that other factors –besides migration– could be at play. Figure 3 depicts a series of additional startup characteristics, measured either within one year of inception or during a startup's first round of financing, and distinguishing between migrants and non-migrants. Panel A shows that migrants are considerably more likely to have a US VC participate in their first round of financing than non-migrants. Panels B and C show that migrants also hold relatively more USPTO-filed patents (Panel B) and trademarks (Panel C). On average, migrants hold 0.40 granted patent applications and 0.19 trademark registrations within one year of being founded, while the corresponding figures for non-migrants are 0.22 and 0.07, respectively. Panels D through F report the equity outcomes of migrants versus non-migrants. The differences in acquisition outcomes are striking. Migrants are more likely to be acquired (Panel D) and, conditional on being acquired, are evaluated at double the amount of non-migrants (Panel E). As shown in Panel F, IPOs are relatively rare in general, however the percentage is higher for migrants than for non-migrants. Finally, Figure 4 depicts the distribution of migrants across the different industries and the Israeli districts in which they were founded. Panel A shows that migrants are concentrated in ICT sectors, the highest concentration being in IT/Software. Panel B illustrates that migrants are mostly from the Tel Aviv district, Israel's Silicon Wadi.

4 The selection of Israeli startups into migration

We begin our empirical analysis by examining the differences across Israeli startups in their likelihood of migrating to the US. This investigation allows us to gain insight into the types of startups that self-select into migration and will help guide the implementation of a machine learning algorithm for predicting the likelihood of migrating to the US. Our ultimate goal is to address selection concerns in analyzing the causal effects of migration.

We initially estimate a logit model relating our observables to the likelihood of migrating to the US. Among the observables, those that are time-varying are measured either during a startup's

founding year or close to that date. The results are presented in Table 2, which reports incidence rate ratios (IRRs) and standard errors clustered at the founding-year level. This clustering criterion is justified on the basis that the attractiveness of the US for Israeli startups may have changed over time. 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 US. As shown, the IRR is 3.13, suggesting 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 introduce a measure related to the founders' human capital, that is, the number of successful startups they established in the past (Gompers *et al.*, 2010). The results show that having an additional successful startup is associated with a 44% increase in the likelihood of migrating to the US. The pseudo R^2, 0.02, is considerably lower than the 0.11 figure reported 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 the following two measures: i) an indicator for whether a company had applied for at least one US granted patent within one year of being founded, and ii) a dummy taking value one if a startup applied for at least one trademark with the USPTO during the same time frame and zero otherwise. As shown, startups with at least one successful patent application and those with at least one trademark application are 61% and 127% more likely to migrate to the US, respectively. Despite the significance of these effects, we again note that the predictive power of the two variables is limited in comparison with that of a startup's financing round size. The pseudo R^2 of 0.02 (column (3)) is a considerably smaller figure than the one reported at the bottom of column (1). [15]

In column (4), we include all the observables discussed above, also adding sector and 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

[15] A likelihood ratio test reveals that the variation explained in column (1) is significantly larger than that explained in columns (2) and (3).

should not be surprising, given that VCs have been found to invest in startups possessing intellectual property rights (Conti *et al.*, 2013b; Hsu and Ziedonis, 2013; Catalini *et al.*, 2018). It is also important to highlight that there is substantial variation in the likelihood of migrating depending on the sector to which a startup belongs. In particular, startups operating in IT and software are the most likely to migrate to the US. Using these companies as a reference outcome, we find that the likelihood of migrating is 96%, 94%, 82%, 63%, 66%, and 59% lower for startups operating in the following sectors, respectively: hardware, cleantech, medical devices, communications, the life sciences, and semiconductors. We do not find any significant difference in the likelihood of moving between startups operating in the internet sector and those in the IT and software sectors. Overall, these sector-specific results reflect the specialization of both Israel and the US in ICT sectors.

Finally, in column (5), we include an indicator variable identifying those startups that raised funding from a US VC during their first round. By introducing this variable, we assess whether investor origins play a role in a startup's decision of whether to migrate to the US. As shown, the IRR is 4.1, suggesting that startups supported by US VCs are 310% more likely to move to the US than the remaining companies. While this effect is large and highly-significant, the coefficients of the remaining variables change little from those reported in column (4), suggesting that the information embedded in the US VC indicator only partially overlaps with that conveyed by the other variables. In line with this conjecture, a likelihood ratio test rejects the null hypothesis that the explanatory power of the model in column (5) is the same as that of the model reported in column (4), with a p-value of 0.00.

Collectively, these results highlight three relevant patterns characterizing the selection of Israeli startups into migration. First, there is positive assortative matching, whereby startups with the greatest potential select to move to the US. Second, the observed measures of startup potential, that is, the amount of funding raised, the number of successful startups founders have created in the past, and having applied for patents or trademarks, are correlated with one another and with other relevant startup aspects. Finally, the specific characteristics of VCs participating in the startups' earliest financing round appear to play a significant role in the companies' migration choice, and this role transcends the specific amounts VCs invest as well as their ability to select high-performing companies.

A machine learning model for predicting the likelihood of migrating

Because the insights above suggest a complex interaction between our measures for startup quality and the other covariates, we develop a machine learning model to extract the most information from the available observables and to accurately predict the likelihood of migration. To implement this model, we initially compile a list of covariates including the startup selection characteristics discussed above as well as additional variables reported in Table 1. The additional variables include: an indicator identifying startups founded by university professors; the squared term of the funding amount startups raised in their first round; the number of VCs, corporate VCs, angel groups, private investors, insurance companies, investment banks, private equity firms, and pension funds investing in a startup's first round; and the number of Israeli, US, and other foreign investors as well as the number of Israeli, US, and other foreign VCs participating in a startup's first round. We also employ detailed information extracted from the startup patents, considering in particular the number of patents startups applied for within one year of their inception, the total number of inventors recorded in these patents, and the number of Israeli and foreign inventors.

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 non-linear 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.

Having expanded our initial dataset along these directions, we generate 1,882 variables. As a next step, we prune the observables using LASSO, an algorithm performing variable selection to improve the accuracy and interpretability of statistical models (Tibshirani, 1996). The implementation of LASSO leads us to retain 149 out of the original 1,882 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 for predicting the likelihood of migrating to the US. We implement a random forest instead of a logistic regression because this non-parametric model has been shown to perform relatively better when the data are non-linearly separable (Couronné *et al.*, 2018). Table A1 shows the top 50 variables by their "factor

importance", which reflects the variables' predictive power. Note that the factor importance does not provide any information on the direction of the relationship between a given covariate and the likelihood of migrating. It only informs us about the predictive power of each covariate.

The results in Table A1 provide some interesting insights. First, individual investor fixed effects are strong predictors of a startup's likelihood of migrating, as demonstrated by their high incidence in the list of variables. This result suggests 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. Second, the interaction terms between our observables appear to be more relevant predictors than the observables themselves. This finding confirms our conjecture above that the startups' choice to migrate is the result of an interaction of company, investor, and founder characteristics, thus lending strong support to our decision to model the startups' likelihood of migrating using a random forest. Finally, it is noteworthy that none of the founding-year fixed effects are listed in Table A1. While the attractiveness of the US for Israeli startups might have changed over time, this variation seems to be captured by our other observables.

We test the performance of our model by examining the Receiver-Operating-Characteristic (ROC) score, which is a measure of the degree of a model's separation 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 non-migrant. In particular, we compute the ROC score for the 40% (N=872) observations we had initially excluded from the training of the random forest. We then repeat this train/test procedure 49 times with newly extracted random samples (without replacement) of the same size as the original one. The aim is to assess the out-of-sample predictive power of the model. The results are encouraging. As shown in Figure 5, both the median and the mode ROC scores are equal to 0.85, a large value on a scale from 0.5 (completely uninformative model) to one (fully informative model). This value implies that our model accounts for 70% of the variation in the data.[16]

Figure 6 reports the share of startups that successfully exited via either an acquisition or an IPO over the percentile distribution of the predicted probability of migration, obtained from our

[16]Formally, a ROC score refers to the area under the ROC curve, which plots the true positive rate as a function of the false positive rate. The larger the area, the greater the predictive power of the model. As a measure of fit, we employ the percentage of the area lying below the ROC curve and above the 45 degree line, which corresponds to 70%.

machine learning model. In Panel A, we consider the entire sample of startups, while in Panel B we only examine the subsample of non-migrants. As shown, startups with a high predicted probability of migrating are more likely to exit successfully, regardless of whether they actually migrated to the US or not. By showing that the determinants of startup performance in Israel and in the US are comparable, we support our earlier evidence that there is positive sorting into migration.[17]

5 Analyzing the sources of the US entrepreneurial ecosystem's comparative advantage

Having examined the factors determining sorting into migration, we now move on to estimate the migration benefits Israeli startups derive from establishing their headquarters in the US. We begin by outlining our empirical strategies, which exploit both cross-sectional and panel data. We then present the baseline empirical estimates obtained from each model. Finally, we explore the mechanisms through which startups derive gains from migrating to the US.

5.1 Empirical strategies

We plan to estimate the effect of migrating on the performance of those startups that choose to move to the US. Ideally, to identify migration effects on startup performance outcomes, we would estimate the treatment effect on treated companies, τ, which is defined as:

$$\tau = E[Y_i(1) - Y_i(0)|D_i = 1] \tag{1}$$

where $Y_i(1)$ indicates startup i's performance if it establishes its headquarters in the US, $Y_i(0)$ 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 US or not. The problem with this approach is that comparisons between migrants and non-migrants are likely to be upwardly biased given the positive sorting we documented in Section 4. Rather than pursuing this naive approach, we adopt a number of alternatives that exploit both

[17] An Israeli startup would not want to migrate to the US if entrepreneurial outcomes valued in Israel were uncorrelated or negatively correlated with entrepreneurial outcomes valued in the US (Borjas, 1987).

startup cross-sectional information and panel data. In what follows, we describe each of these approaches in turn.

Quasi-experiment using a plausibly exogenous control group of non-migrants. This approach consists of exploiting plausibly exogenous institutional constraints on the startups' ability to migrate. As we mentioned in Section 2, startups operating in the defense and embryonic stem cell domains incur larger costs to establish their headquarters in the US relative to other companies. Specifically, startups in the defense sectors face moving restrictions imposed by both the Israeli and the US governments. Similarly, startups developing embryonic stem cell technologies suffer from the severe limitations on US federal funding that the Bush administration imposed starting in August 2001. These limitations stand in contrast to Israeli policies on human embryonic stem cell research, which, among others, admit the creation of embryos specifically for scientific purposes.

After a careful analysis of the startup technology descriptions provided by IVC, we identified 32 companies operating in the defense domain and 14 companies developing embryonic stem cell technologies. Considering that the majority of our sample startups migrate within two years of being founded, we include only those embryonic stem cell companies that were established after 1999. This criterion allows us to focus on those startups with the highest risk of being affected by the 2001 Bush administration restrictions. However, adopting different cutoffs does not meaningfully impact our results.

A possible concern with our empirical strategy is that Israeli founders may purposely avoid commercializing certain technologies in order to circumvent the institutional constraints mentioned in Section 2. However, the specific features of the Israeli context suggest that it is unlikely that founders choose their startups' technologies based on existing institutional constraints. In fact, Israeli founders' technologies are often the by-product of training imparted in specialized army units. As Perman (2004) points out, the selection process into 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 are unlikely to have enrolled in specific tertiary education programs in anticipation of institutional constraints on their ability to relocate overseas. In fact, 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. While individuals can influence some of these factors, they cannot completely control them.

Having built our control group, we employ a difference estimator in a sub-sample that only includes migrants and startups that cannot migrate for plausibly exogenous reasons. Defining S_i as an indicator for whether a company belongs to the control group of startups that cannot migrate, we estimate the treatment effect on the treated as follows:

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

where $\hat{\tau}$ is the propensity score-weighted estimator and p_i is the propensity score, that is, the predicted probability of migrating obtained from the random forest model described in Section 4. The distribution of p_i for each group of treated and control startups is presented in Figure A1. The key assumption of Equation (2) is that the exogenous composition of the control group is orthogonal to a startup's performance outcomes, conditional on p_i. Under this assumption, the performance of the control group represents an accurate estimate of the migrants' performance, had they kept their headquarters in Israel. In reporting our results, we restrict the sample to those treated and control startups (N=92) that are in the region of common support, which is displayed in Figure A1.

Double LASSO on high-dimensional data. Our second approach consists of implementing a machine learning algorithm to address selection bias through an efficient utilization of the observables. As highlighted by Belloni *et al.* (2014), estimators that simply control for measures predicting a given treatment may be biased if they systematically overlook characteristics explaining the outcomes of that treatment but not the treatment itself. To address this issue, Belloni *et al.* propose a double-LASSO procedure. This approach consists of two steps. In our empirical context, the first step involves the selection of covariates that predict the likelihood of migrating to the US, while the second step requires the identification of the covariates that predict startup performance outcomes. The union of the sets of explanatory variables selected from each step ultimately defines the set of controls employed in the outcome regression equations. The first step,

which we described in Section 4, led us to select 149 of the 1,882 high-dimensional covariates derived from expanding our initial set of observables. The high ROC scores obtained from the random forest model predicting the likelihood of migrating suggest that we are explaining a large portion of Israeli startup selection into migration. Since we examine multiple startup performance outcomes, we repeat the second step of the double-LASSO procedure as many times as the number of performance outcomes we consider.

Panel Regressions. As a final approach, 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:

$$Y_{i,t,m} = \alpha_t + \gamma_m + \beta_t D_{i,t} + \lambda_i + \varepsilon_{i,t,m} \tag{3}$$

where β_t is the coefficient of interest. Moreover, α_t denotes age fixed effects, γ_m designates age of migration fixed effects, $D_{i,t}$ is an indicator taking on value 1 if an Israeli startup had its headquarters in the US at age t (and zero otherwise), λ_i are startup fixed effects, and $\varepsilon_{i,t,m}$ is a random noise.

Contrary to our cross-sectional approaches, the inclusion of startup fixed effects implies that the relevant performance comparisons are carried *within* the startup rather than *across* startups. The additional fixed-effects listed in Equation (3) control for common factors that could influence startups with the same age (through α_t) and migrating at the same stage of their life cycle (through γ_m). Therefore, the remaining variation stems from the different ages at which these companies move to the US.

5.2 Results

In this section, we explore the effect of migrating to the US on six startup performance measures. These measures closely map onto the most relevant types of migration benefits startups could potentially derive by establishing their headquarters in the US. 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 US granted patents startups applied for after *t+1*. This indicator captures the advantages of accessing innovation inputs and R&D spillovers localized

in the US. Next, the amount of VC raised after the first funding round proxies the gains Israeli startup migrants may derive from accessing a comparatively large supply of investors with deeper pockets. 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 in the case of an acquisition. These three measures are proxies for the value startups could extract from their technologies after entering a relatively larger market for technology and ideas. We begin by describing the results for the effect of migrating to the US on Israeli startups' trademark, patent, and financing outcomes. These are the startups' intermediary performance outcomes, which we distinguish from their final exit outcomes. In reporting the results, we first discuss the cross-sectional models and then the panel regressions.

5.2.1 Intermediary startup performance outcomes

The cross-sectional migration effects on the startups' intermediary performance outcomes are displayed in Table 3. We estimate ordinary least squares (OLS) regressions for each outcome. Moreover, we report the results obtained from the following three estimation models. The first is a naïve model that includes only an indicator identifying startup migrants (*Model I*). The second model, *Model II*, compares the performance outcomes of migrants to those of a control group of startups that, as we mentioned in Section 5.1, were not able to move for plausibly exogenous reasons. We restrict the analysis to startups lying within the region of common support and control for the log-odds of the startups' predicted probability of moving to the US (p_i).[18] Finally, *Model III* refers to the double-LASSO model discussed in Section 5.1. To account for any correlation in the error terms within founding year and sector, we double-cluster standard errors by founding year and sector.

Column (1) of Table 3 reports the results for the effect of migrating on the likelihood that a startup will apply for a trademark registration with the USPTO. According to the naïve model, migrants are 36 percentage points more likely to apply for a trademark registration with the USPTO *ex post* than non-migrants; the coefficient is significant at the 1% level. The migration effect increases to 51 percentage points when we examine our quasi-experimental sample, although the large standard errors suggest that this effect is not precisely estimated. Finally, the double-LASSO

[18] In unreported analyses, we investigate whether the predicted probability of moving significantly impacts follow-on startup performance. Reassuringly, the effect is insignificantly different from zero, regardless of the startup performance outcome.

model predicts that migrating to the US translates into a 25 percentage point increased likelihood of applying for a trademark registration with the USPTO. These results suggest that Israeli startups migrating to the US derive sizeable gains from accessing a relatively large consumer market.

Column (2) of Table 3 displays migration effects on startup patent output. The naïve model predicts positive that migration positively affects the number of US patents that startups apply for. However, the effect loses its significance with our quasi-experimental sample and the double-LASSO specification. Moreover, in moving from the naïve to the double-LASSO specification, the magnitude of the effect declines by approximately 91%. This is a remarkable result, as it suggests that Israeli migrants do not derive significant benefits from accessing innovation inputs and R&D spillovers localized in the US. This finding should be interpreted in light of 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 US.

Column (3) presents the effects of migrating to the US on the amount of VC funding that startups receive. As expected, the naïve model considerably overestimates the effect of moving to the US. However, after addressing selection concerns with the double-LASSO approach, we continue to find significant migration effects on the amount of VC financing. In particular, migrants raise approximately 114% more VC than non-migrants. In the quasi-experimental sample, the effect of migrating is not significantly different from zero.

The potential benefits of relocating to the US in terms of the amount of funds raised could reflect differences in the availability of financing opportunities in Israel and in the US. Alternatively, these gains could result from an intrinsic increase in the Israeli startups' productivity after they migrate, which would make them more attractive to potential investors. To help disentangle these two explanations, we estimate the effect of migrating on the amount of VC funding obtained, having specifically considered only those rounds led by at least one US VC investor.[19] If Israeli startups move to the US to take advantage of investor availability, then they should especially attract funding from US VCs rather than from VCs based in another country. As shown in column (4), migrants raise 178% more US VC than non-migrants in the quasi-experimental sample, while

[19] As in other VC studies, we observe the total amount a startup raised in a given round and the investors participating in that round. However, we lack complete information on both a startup round's lead investor and the amount invested by each investor. Therefore, we make the assumption that, anytime a US VC is involved in a round, it participates as lead investor.

the double-LASSO estimate is 111%. The magnitudes of these effects are similar to, or even larger than, those reported in column (3), supporting the conjecture that Israeli startups migrating to the US derive positive gains from that country's comparatively large investor market.

We now move on to discuss the panel regression results, which we report in Table 4. We include startup fixed effects and exploit within-mover variation to assess change in migrants' performance after they establish their headquarters in the US. All our regressions also include age fixed effects to account for life cycle effects, and age-of-migration fixed effects to account for potential differences in dynamics between earlier and later movers. An advantage of this model is that it controls for all time-invariant aspects of a startup, including the characteristics of the original founders, initial venture idea, location at founding, and inception period. 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 US and zero in the pre-migration period. Therefore, the coefficient of this indicator represents the *average* variation in performance that migrants experience after they establish their headquarters in the US. *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 moving at 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 the *Has Moved* indicator is positive and significantly different from zero at conventional levels. The magnitude of the effect suggests that moving to the US increases the likelihood that a startup will have applied for a trademark by 8 percentage points. *Model II* reveals an interesting pattern. While migrating at the beginning of the life cycle does not significantly impact migrants' likelihood of applying for a US trademark, migration effects become significant from age 1. By age 4, migrants are 15 percentage points more likely to have registered a trademark with the USPTO than non-migrants, and the magnitude of the difference remains approximately the same for later years.

Column (2) of Table 4 reports the results for variation over time in a startup migrant's rate of patenting. Consistent with our cross-sectional results, we find that the coefficient of the *Has Moved* indicator is positive in *Model I*, although not significantly different from zero. Similarly, the results from *Model II* show that none of the coefficients for the interactions between the *Has Moved* indicator and the different startup ages are significant. Collectively, these results suggest that Israeli startups establishing their headquarters in the US do not derive significant innovation productivity gains, regardless of the age at which they move.

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 US VC. *Model I* shows that a startup raises significantly more financing after migrating, regardless of whether we cumulate all the round amounts (column (3)) or only those led by US VCs (column (4)). The results from *Model I* indicate that, after migrating, startups receive, on average, 30% more financing and 45% more US VC financing. Remarkably, 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. Regarding the cumulative funding raised from US VCs (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. Overall, our panel analyses confirm the cross-sectional findings. Israeli startups migrating to the US 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.

Tables 3 and 4 reported that Israeli startups raise larger funding amounts upon migrating to the US. 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 US exercise larger financial means than Israeli investors. We explore these conjectures in Table 5, where we present the estimates for the number of unique investors that have funded a given startup after its first round of financing, *having controlled for the total funding amount the startup raises* during the same period. For the sake of brevity, we only report the results from our LASSO models.

However, as we show in Table A2 of the Appendix, the results hold even when we estimate panel regression models with startup fixed effects.

The results reveal an interesting pattern. While the number of unique investors is positively correlated with migration (column (1)), the migration coefficient drops and becomes insignificantly different from zero when we control for the amount of funding a startup raises (column (2)). However, when we consider the number of US investors only (column (3)), the coefficient of migration remains positive and statistically significant, even after controlling for the amount of funding raised. Upon migrating, Israeli startups increase their portfolio of US investors by 0.5. As shown in columns (4) and (5), this result is driven specifically by US VCs (column (4)) rather than by other types of US investors (column (5)). Finally, the results reported in column (6) reveal that startup migrants attract fewer non-US investors than non-migrants, all else being equal. The magnitude of the coefficient suggests that migrants attract 1 fewer non-US investor than startups maintaining their headquarters in Israel. Collectively, the findings presented in Tables 3 to 5 suggest that Israeli migrants substitute non-US with US investors after they move and raise larger amounts of funding as a result.

5.2.2 Startup exit outcomes

Having examined migration effects on startups' intermediary outcomes, we move on to assess the impact of migrating to the US on these companies' exit performance. Table 6 reports the cross-sectional results having double-clustered standard errors by founding year and sector. Column (1) reports the effect of migrating on the likelihood of exiting via an acquisition. Relative to non-migrants, companies moving to the US are 52 and 18 percentage points more likely to be acquired, depending on whether we consider the quasi-experimental sample or estimate the double-LASSO model. Considering that 21% of the startups in our sample have been acquired, these effects are economically large.[20] We next explore whether the results we obtained are driven by the comparatively large US supply of acquirers or by an increase in startup productivity following migration. To shed light on this point, column (2) reports the effect of migrating to the US on the likelihood that a startup will be acquired by a non-US company. If the size of the US market for

[20]Results reported in Table A3 of the Appendix and obtained from estimating a Cox proportional hazards model confirm this finding.

acquisitions were a relevant determinant of the Israeli startups' decision to migrate, then Israeli migrants should be more likely to be acquired by US companies than by foreign ones. Consistent with this conjecture, the results in column (2) show that Israeli migrants are less likely than non-migrants to be acquired by non-US companies. Column (3) reports the effects of migrating to the US on startups' sales values upon acquisition. The estimates are sizable. Relative to non-migrants, Israeli startups moving to the US experience a 376% and a 95% increase in sales value, depending on whether we consider the quasi-experimental sample or follow the double-LASSO approach. Collectively, these results suggest that acquirers respond to Israeli startups migrating to the US along both the intensive (likelihood of acquiring) and extensive (sales price) margins. In parallel, these findings suggest that Israeli migrants substitute non-US with US acquirers and secure larger transaction values as a result.

Remarkably, we find that establishing headquarters in the US does not significantly affect the likelihood that a startup will go public via an IPO (column (4)). In Table A4 of the Appendix, we delve deeper into this finding by examining the effect of migrating on the likelihood that a startup will exit via an IPO, distinguishing between those IPOs that took place on the US stock exchanges and those that occurred on the Tel Aviv Stock Exchange (TASE). The results presented in columns (2) and (3) show that Israeli migrants are either more likely (quasi-experimental sample) or no more likely (double-LASSO model) to go public on the US stock exchanges than non-migrants. However, migrants are consistently less likely than non-migrants to go public on TASE (column (3)). Taken together, these results indicate that startup migrants extract greater value from their technologies by accessing the relatively large US market for acquisitions and IPOs than by going public on TASE.

We next discuss the panel regression results, which we display in Table 7. As before, we include startup fixed effects and exploit within-mover variation to assess the change in migrants' performance from establishing their headquarters in the US. 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 exit amount in the case of an acquisition, which cannot be analyzed in a panel format. *Model I*, in the upper part of Table 7, uses an indicator (*Has Moved*) that takes on value 1 starting from the year in which a given startup establishes its headquarters in the US and zero in the pre-migration period. *Model II*, in the lower part of Table 7, introduces interaction terms between

the *Has Moved* indicator and startup age dummies. In all models, we double-cluster standard errors by founding year and sector. Column (1) of Table 7 presents the results for the likelihood that a startup will have been acquired by a given year. Upon establishing their headquarters in the US, 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 as of a given year. By age 6, a startup migrant 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-US company. The point estimate derived from *Model I* is small in magnitude (0.003), suggesting again that acquisition gains from moving to the US are positively correlated with the availability of US 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 by a given year. As shown, migrants are less likely to have experienced an IPO after moving to the US, and this difference, which is rather small, is mostly consistent through the various startup ages. Overall, our panel analyses confirm the cross-sectional findings. Israeli startups migrating to the US derive significant gains in terms of accessing a large availability of potential acquirers. However, they do not significantly improve their likelihood of exiting via an IPO.

A concern with these findings is that the migrants' improved likelihood of exiting via an acquisition and increased sales value may not imply a US comparative advantage in hosting a large market for acquisitions. In fact, the evidence we provide could be consistent with the US hosting a relatively large market of VC investors that have particularly strong connections with potential acquirers. In that case, the size of the US market for acquisitions would not be an independent source of the US comparative advantage in entrepreneurship, but only a manifestation of a developed investor market. To investigate this concern, we condition the sample to startups that were acquired by US investors and relate their sales value to whether they had migrated to the US at some point in their lifecycle. In this estimation, we control for the amount of funding the startups raised through exit, a squared term of this variable, an indicator for whether the startups raised US VC funding

during their first round, the total number of unique US VC investors participating in the financing of the startups, and the squared term of the latter measure. The rationale is to examine an homogenous 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 the characteristics of their investors. To mitigate possible selection concerns, we further control for whether startups had applied for a US granted patent or a trademark at founding, for whether startups are university spinoffs, for whether they have spent time in a government-sponsored incubator, and for the number of founders. We also include founding year, sector, and founding location fixed effects. The results are reported in Table 8. We double-cluster standard errors by founding year and sector. The results in Table 8 reveal that, among startups acquired by US companies, migrants experience at least a 60% increase in sales value relative to non-migrants, all else equal. Reassuringly, 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)). While this evidence is suggestive, it provides an indication that the US market for acquisitions represents an independent source of the US comparative advantage in entrepreneurship. In fact, the significance of this source persists even after controlling for the startups' funding characteristics.

The totality of our findings in Subsections 5.2.1 and 5.2.2 suggest that the US entrepreneurial ecosystem's comparative advantage arises from a multitude of sources that produce sizeable gains for startups. The sources we identify are a large consumer market, a high availability of investors, and a developed market for acquisitions. The insignificant migration effects we obtain on startup patent output do not imply that the availability of innovation inputs and R&D spillovers are irrelevant for the *absolute* advantage of the US entrepreneurial ecosystem. Rather, this finding suggests that such factors are not as important as others when specifically comparing the US to other innovative economies. A possible criticism to this interpretation of our findings is that, rather than revealing the US entrepreneurial ecosystem's comparative advantage, they simply highlight the benefits Israeli startups derive from migrating, regardless of the destination location. However, as we mentioned in Section 3, none of the startups in our sample established their headquarters in Europe. We take this evidence as suggestive of the superior advantages the US entrepreneurial ecosystem offers relative to other ecosystems.

5.3 Exploring the mechanisms through which startups derive gains from migrating to the US

Having provided evidence of different sources underlying the US ecosystem's comparative advantage, we move on to explore the mechanisms through which Israeli startups migrating to the US improve their performance. We begin by relating the startups' type of migration to their performance. Successively, we examine whether migration benefits depend on the US location Israeli startups choose. We only present the results from the double-LASSO models. In fact, the quasi-experimental approach delivers noisy results especially when estimating heterogeneous treatment effects due to the small sample size.

5.3.1 Establishing headquarters in the US versus opening a branch office

In this section, we explore heterogeneity in migration effects by contrasting the Israeli startups that choose to establish their headquarters in the US with those that decide to open a branch and using the Israeli startups that do not migrate as a benchmark. Startups opening a branch office in the US should have a similar interest in the location benefits of the US as startups establishing their headquarters.[21] However, the level of effort they commit to migrating should be lower given that opening a branch overseas is not as costly as transferring headquarters. If the degree to which startups can appropriate location benefits is directly proportional to their migration effort, then we should expect startups' mode of migration to differentially affect their performance outcomes relative to non-migrants.

The results from our investigation are reported in Table 6. We examine the same startup performance outcomes as those investigated in Table 3, double-clustering standard errors by founding year and sector. Column (1) reports the results for whether a startup has filed for a trademark with the USPTO after one year of being founded. As shown, the effect of establishing headquarters in the US is larger than the effect of opening a branch. Indeed, startups establishing their headquarters in the US are 27 percentage points more likely to file for a trademark with the USPTO than non-migrants. This effect declines to 20 percentage points for startups opening a US branch and is no longer statistically significant.

[21] These startups were originally excluded from our set of Israeli migrants.

Column (2) displays the results for the rate of patenting. None of the coefficients associated with the different startup migration modes is significantly different from zero. This suggests that, regardless of whether Israeli startups establish their headquarters in the US or open a branch, they do not achieve significant innovation productivity gains relative to non-migrants.

Columns (3) and (4) show the findings for the funding amount startups receive after their first financing round (column (3)) and the funding amount they raise from US VCs specifically (column (4)). The founding amount that Israeli startups opening headquarters in the US raise is 44 percentage points larger than the amount raised by startups opening a branch, relative to the reference category of non-movers. As reported in column (4), the difference in magnitudes increases to 58 percentage points when we only consider funding amounts raised from US VCs.

Columns (5) through (8) present the results for startups' equity outcomes. As shown, Israeli startups establishing their headquarters in the US are 10 percentage points more likely to be acquired than startups opening a US branch (column (5)), relative to the reference category of non-migrants. As column (6) shows, this finding stems from acquisitions by US companies. In column (7), we assess the effect of each migration mode on a startup's acquisition value. We do so by restricting the analysis to those acquired startups for which we have data on their sales price. The magnitude of the effects indicates that, among acquired startups, those with headquarters in the US sell at a higher price than those opening a US branch. Specifically, startups establishing their headquarters in the US have 82% higher sales value than non-migrants, while the effect for startups opening a US branch is 4% and insignificantly different from zero. The results for the likelihood of exiting through an IPO are reported in column (8). Here, we observe that startups opening a US branch are more likely to go public via an IPO than companies establishing their headquarters in the US relative to the reference category of non-movers. This last result suggests that for startups that open a branch in the US, the Israeli IPO market is a relevant source of financing.

Collectively, these results suggest that a startup's level of commitment to migrating matters. While opening a US branch affords positive gains, these gains are generally not as large as those recorded for startups that establish their headquarters in the US.

5.3.2 Migration benefits and destination locations within the US

We finally extend our heterogeneity analysis to examine whether there is any heterogeneity in migration benefits depending on the US location Israeli startups choose. In particular, we differentiate between the California (CA), Massachusetts (MA), and New York area (NY) destination locations, on the one hand, and the remaining US locations, on the other. We adopt this distinction because from the descriptive statistics provided in Figure 1 it appears that California, Massachusetts, and the New York area (which include New York and New Jersey) are Israeli startups' preferred locations. This geographical distribution should be related to the ICT specialization of the Israeli economy and the more recent investments it has made in the biotechnology sector. Indeed, California hosts the Silicon Valley ICT cluster, the Boston area and New Jersey specialize in biotechnology, and New York hosts a vibrant e-commerce business environment. The goal of our analysis is to evaluate whether, by migrating to these geographical locations, Israeli startups indeed obtain greater gains than by moving elsewhere in the US.

The results are reported in Table 7. We observe that 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: the number of US granted patents applied for (column (2)), and the likelihood of exiting via an acquisition or an IPO (columns (5), (6), and (8)). However, we observe a remarkable difference in effects when we specifically examine the likelihood that startups register a trademark with the USPTO, the amount of funding startups raise, the amount they obtain from US VCs, and the sales price at which they are sold. For instance, Israeli startups moving to the New York area are 30 percentage points more likely to apply for a trademark than non-migrants, while startups moving to geographical areas other than CA/MA/NY are only 22 percentage points more likely. Furthermore, startups located in CA/MA/NY raise at least 112% more funds than non-migrants, while startups located in other states raise only 67% (column (3)). This gap becomes wider when we only consider startup rounds led by US VCs (column (4)). Moreover, the price at which acquired startups located in CA/MA/NY are sold is at least 97% higher than the price at which acquired non-migrants are sold (column (7)). Conversely, the effect of migrating to US states other than CA/MA/NY is negative. Overall, these results suggest that while migrating to the US yields positive gains in general, several of these gains are

specifically associated with Israeli startups' most frequently chosen locations.

6 Concluding remarks

This paper uncovers underlying sources of the US entrepreneurial ecosystem's comparative advantage using a rich dataset of Israeli startups and estimating the benefits these companies derive from moving to the US. Israel is an attractive empirical context given that the country has historically built strong ties with the US and its entrepreneurs consider the US market to be the preferred destination for their technologies. We begin by documenting that Israeli startups exhibiting a high predicted likelihood of migrating to the US are relatively more successful, regardless of whether they actually move or not. This result shows that the determinants of startup performance in Israel and in the US are comparable, leading to a positive sorting into migration.

We adopt a number of complementary approaches to address the endogeneity of Israeli startups' migration choices, which all deliver consistent results. We initially compare the outcomes of migrants to those of startups that, for plausibly exogenous reasons, find it costly or cannot migrate. We augment this approach with a machine learning algorithm to better address the non randomness of selection into migration. We next estimate a double-LASSO regression. Finally, we exploit within-mover variation in performance outcomes and assess the effect of moving to the US in any given year. Throughout these approaches, we show that migrants are significantly more likely than non-migrants to have a trademark registered in the US. They are also more likely to raise VC funds and to be acquired. Moreover, conditional on experiencing an acquisition, migrant startups achieve a higher transaction value than non migrant startups. These effects are not only statistically significant but also economically important. Remarkably, we do not find any significant migration effect on the number of patents startups produce, suggesting that improving innovation productivity is not the Israeli startups' main reason for moving to the US.

We delve deeper into these findings by showing that migrants improve the amount they receive from US VCs and their likelihood of being acquired by a US company. However, migrant startups receive smaller amounts of investment from non-US VCs and are less likely to attract non-US acquirers. The substitution of non-US with US investors and acquirers that we observe supports our identification strategies, suggesting that the size of the US investor and acquirer markets is indeed a relevant reason for migrating to this country. We further show that, among startups acquired by US

companies, migrants achieve a higher transaction value even after controlling for the total amount of investment raised and the total number of participating US VC investors. This last result shows that the market for acquisitions is an independent source of the US entrepreneurial ecosystem's comparative advantage. In fact, this source remains significant even after we hold the role of US investors constant.

Finally, we uncover heterogeneity in startups' responses to migration. We show that the effects of migrating to the US on the likelihood of registering a trademark with the USPTO, the amount of VC financing Israeli companies receive, the probability of being acquired, and the value at which these companies are sold, are especially high when Israeli startups establish their headquarters, rather than open a subsidiary, in the US. Further, we find that California, Massachusetts, and the New York area, which are the Israeli startups' most frequently chosen locations, indeed offer superior performance gains deriving from a large market size, a high availability of investors, and a developed market for acquisitions. Collectively, these findings suggest heterogeneity in the benefits Israeli startups derive from moving to the US depending on their commitment migration and their location choice within the US.

The results presented in this paper lead us to conclude that, compared to other economies, the US entrepreneurial ecosystem offers a multiplicity of advantages which generate sizeable gains for startups. The advantages we identify are a large consumer market, high investor availability, and a developed market for acquisitions. In contrast, innovation inputs and R&D spillovers are not as important when specifically comparing the US to other innovative economies, such as Israel.

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Tables and Figures

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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 Num. US Inventors	0.187	1.31	2179
Initial Num. Israeli Inventors	1.051	5.018	2179
Initial Patents	0.19	0.391	2179
Initial Trademarks	0.089	0.301	2179
First Round Financing			
Financing in First Round (mill. $)	1.484	3.664	2179
First Round Has US 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. US Investors	0.171	0.493	2179
First Round Num. US VCs	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
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
Founding Location			
Haifa (0/1)	0.089	0.286	2179
North (0/1)	0.093	0.29	2179
Center (0/1)	0.33	0.47	2179
West Bank (0/1)	0.006	0.08	2179
Jerusalem (0/1)	0.066	0.248	2179
Tel Aviv (0/1)	0.371	0.483	2179
Other Startup Characteristics			
Individual Investor Fixed-Effects			
Second Order Polynomials			
Two-Way Interactions			
Founding Year			
Migration			
Moves to US (0/1)	0.08	0.271	2179
Age at Migration	1.052	1.022	174
Performance Outcomes			
Total Amount Raised (mill. $)	9.067	19.974	2179
Total Amount Raised Led by US VC (mill $)	3.708	14.365	2179
Acquired (0/1)	0.227	0.419	2179
Acquired Outside US (0/1)	0.076	0.265	2179
Acquisition Value ($ mill.)	77.98	128.89	373
IPO (0/1)	0.052	0.222	2179
Final Number of Trademarks	0.336	0.498	2179
Final Number of Patents	2.993	21.505	2179
Final Num. Investors	3.595	3.677	2179
Final Num. US Investors	0.648	1.441	2179
Final Num. US VCs	0.336	0.933	2179
Final Num. Non-US Investors	2.948	2.905	2179

Notes: Descriptive statistics for the observables of our sample startups. The word "initial" refers to a startups founding year (t) and the year after ($t+1$). The word "final" refers to the years following $t+1$ and up to 2016.

Figure 1: Number of migrants by age and US state destination

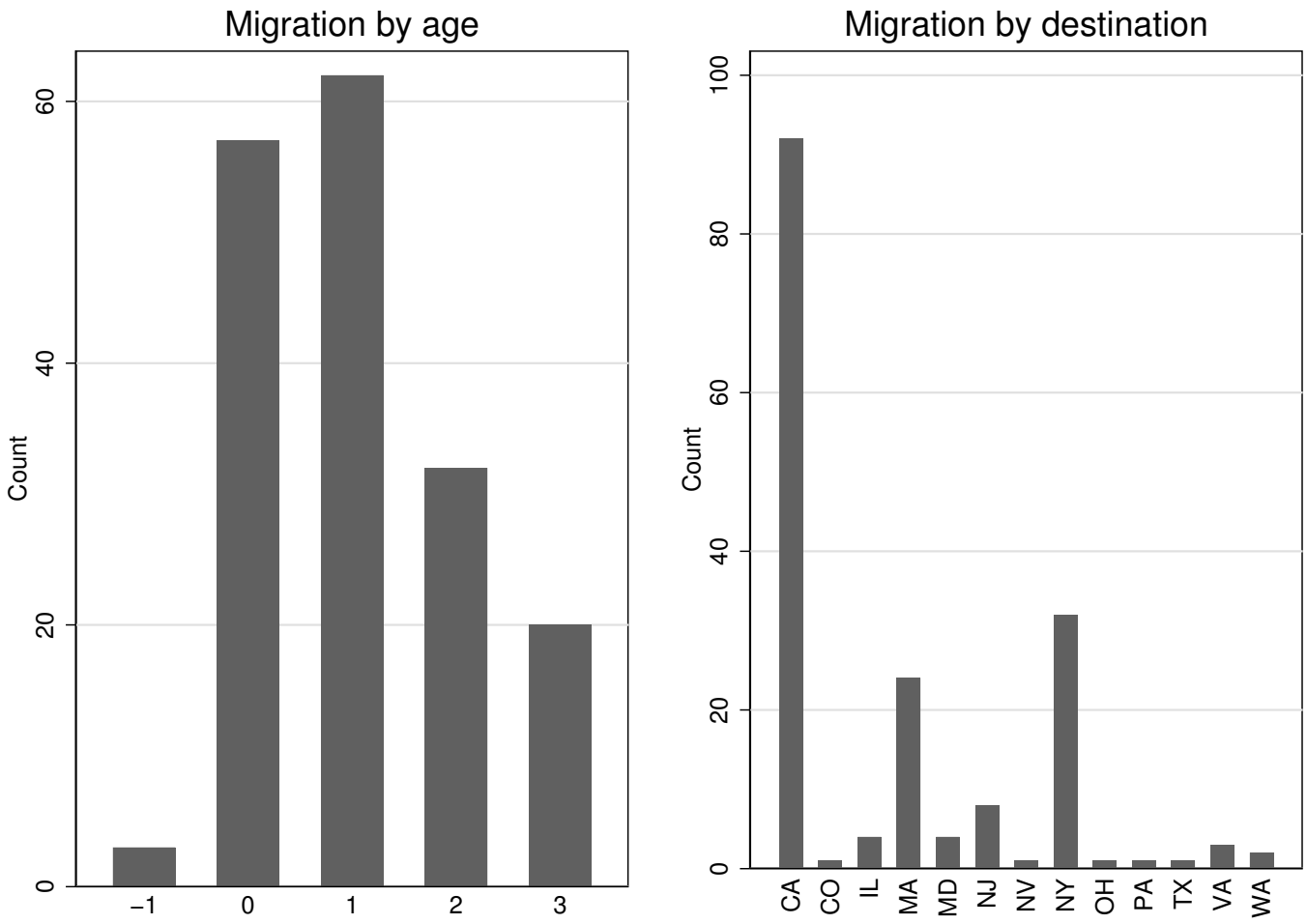


Figure 2: First-round VC financing distinguishing between migrants and non-migrants

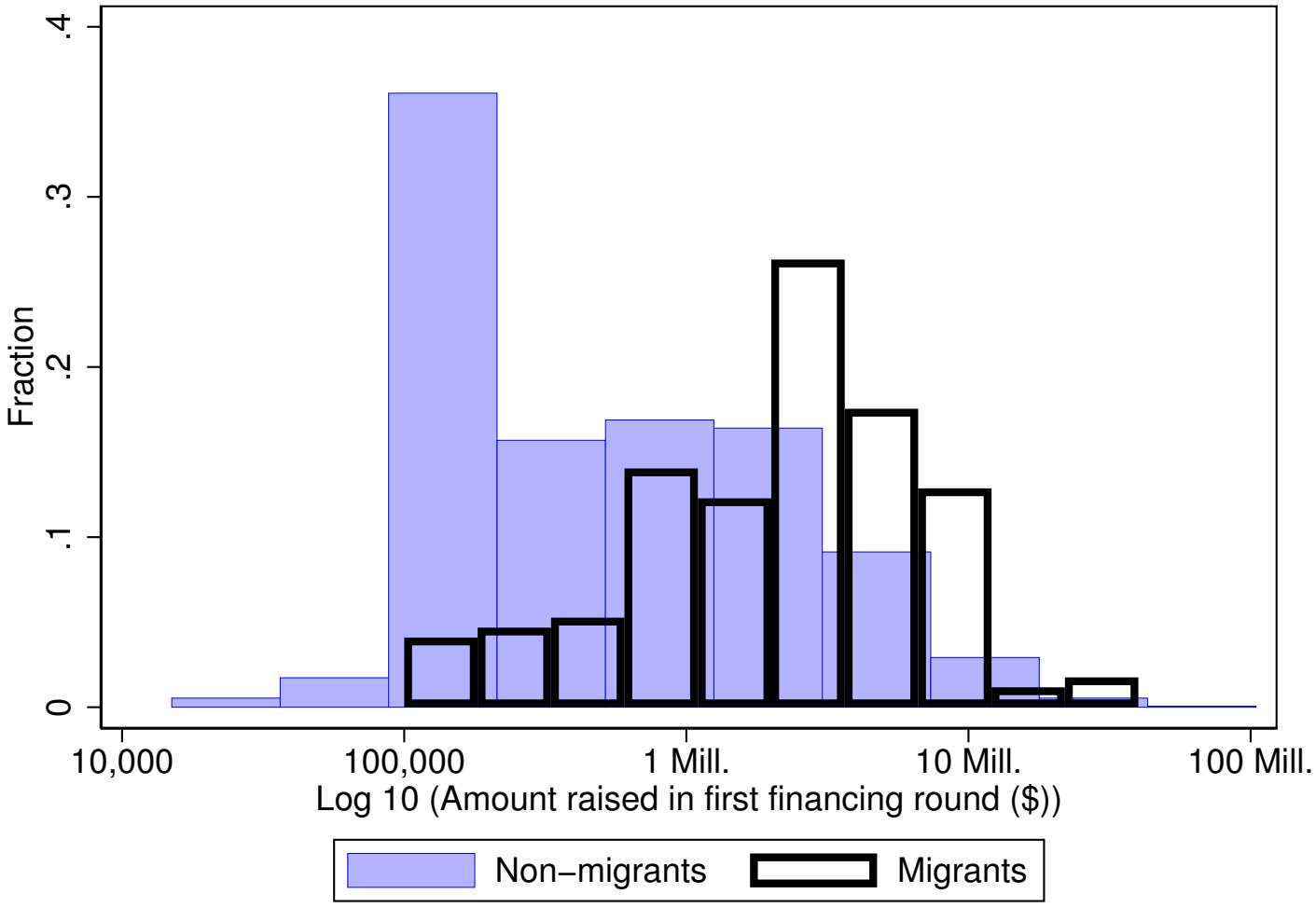
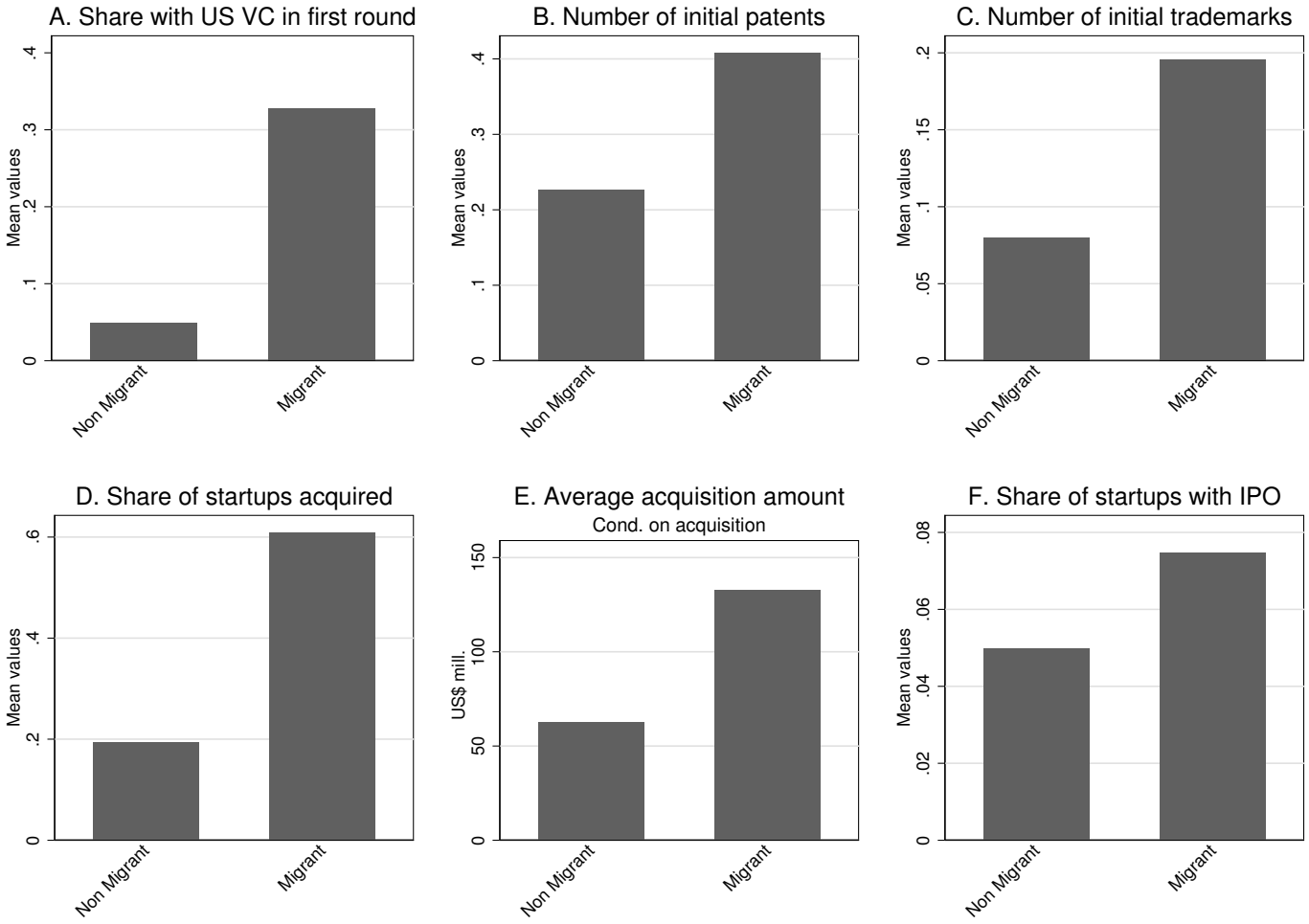


Figure 3: Mean values of startup outcomes distinguishing between migrants and non-migrants



Notes: Panel A depicts the mean share of startups that raised their first round of funding from US VCs. Panel B displays the average number of US granted patents startups applied for within one year of their inception. Panel C displays the average number of trademarks startups registered with the USPTO within one year of their inception. Panel D reports the mean share of startups that were acquired. Panel E displays the mean acquisition value ($ mill.). The acquisition value is available for 373 of the 494 acquired companies. Panel F depicts the mean share of startups that went public via an IPO. In all panels, we distinguish between migrants and non-migrants.

Figure 4: Sector and founding location of startup migrants

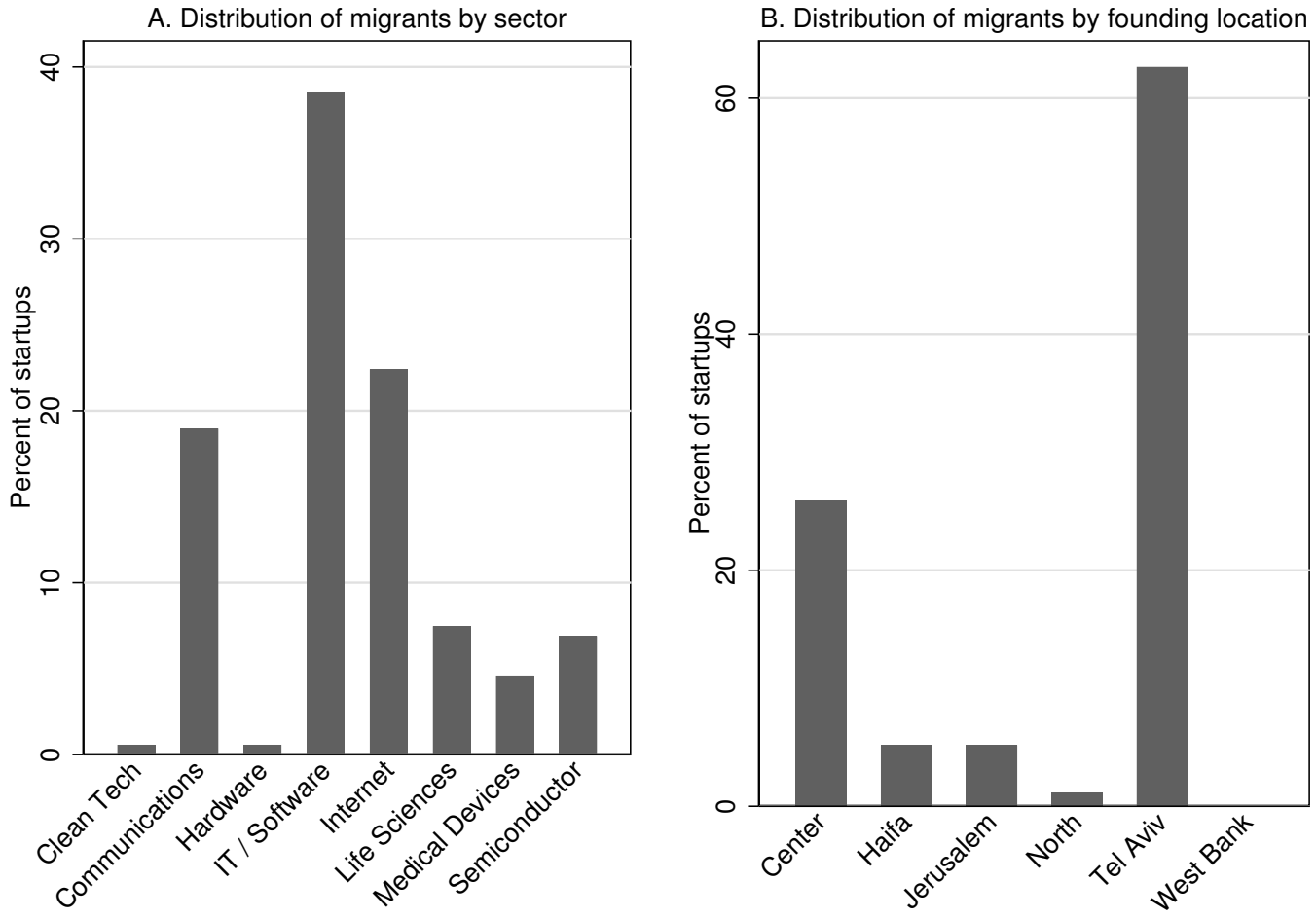
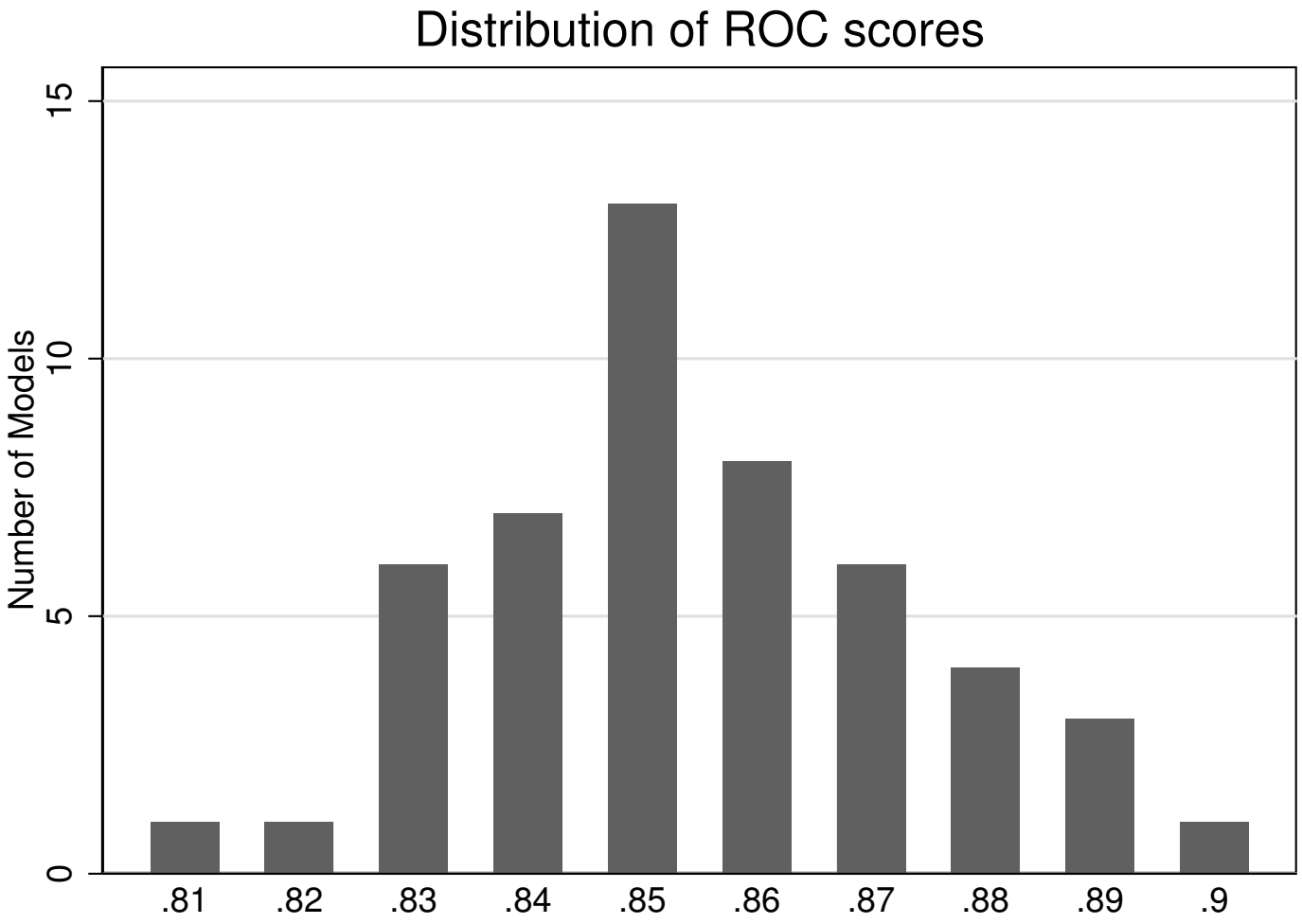


Table 2: Who migrates? Determinants of Israeli startup migration to the US
Logit regressions. D.V.: Moves to US

	(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 Patent			1.613**	1.295	1.227
			(0.290)	(0.342)	(0.351)
Has Trademark			2.270***	1.070	1.092
			(0.532)	(0.282)	(0.236)
First Round Has US 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

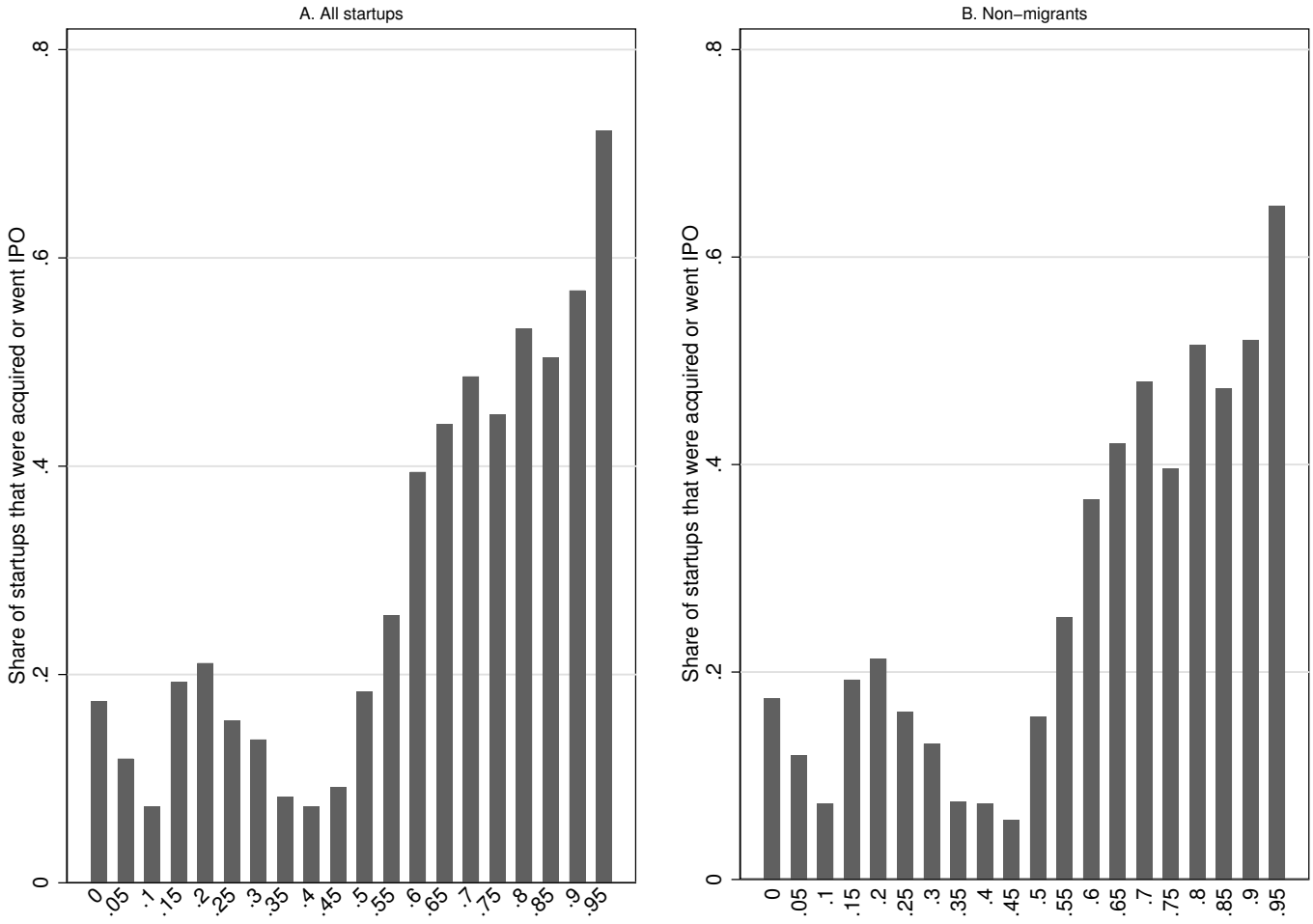
Notes: We report the results from estimating logit models for the likelihood that an Israeli startup establishes its headquarters in the US. The regressors of interest are measures for the performance potential of a startup. We report incidence-rate ratios (IRRs). Ratios greater than one imply that an increase in the value of a given regressor leads to a higher likelihood that an outcome occurs, with the opposite for ratios less than one. Standard errors are clustered at the founding-year level to account for the possibility that the attractiveness of the US market to Israeli startups might have changed over time. Significance denoted as: * p <0.10, ** p <0.05, *** p <0.01.

Figure 5: Out-of-sample performance of our machine learning model for predicting selection into migration



Notes: This figure assesses the performance of our machine learning model described in Section 4. We plot the distribution of the ROC scores derived from 50 random forest models, each trained with a random sample of 60% of the data (1,315 observations). Both the median and the mode ROC scores are equal to 0.85; this is a large value on a scale from 0.5 (completely uninformative model) to one (fully informative model).

Figure 6: Performance of Israeli startups by their predicted probability of migrating to the US



Notes: This figure examines the phenomenon of 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 4. As shown in Panel A, startups that are more likely to migrate are also better performers, in terms of their likelihood of exiting through an acquisition or an IPO. We find the same pattern in Panel B, which specifically considers the sub-sample of non-migrants, indicating that there is positive sorting into migration.

Table 3: The effect of moving to the US on Israeli startups' intermediate performance outcomes: Cross-sectional results

	(1) Applies for Trademark	(2) Ln(Patents+1)	(3) Ln(VC +1)	(4) Ln(VC +1) (US VC Led Only)
Model I: Naive (N=2179)				
Moves to US	0.357***	0.478***	1.686***	1.594***
	(0.0258)	(0.0284)	(0.0511)	(0.00908)
Model II: Quasi-Experiment (N=92)				
Moves to US	0.511**	0.505	0.101	1.775**
	(0.205)	(0.423)	(0.620)	(0.705)
Model III: Double-LASSO (N=2179)				
Moves to US	0.247***	0.0436	1.135***	1.108***
	(0.0472)	(0.0825)	(0.100)	(0.0920)

Notes: 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 US 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 our quasi-experiment that uses a plausibly exogenous control group of non-migrants. Model III is the double-LASSO (Belloni *et al.*, 2014) model. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <0.10, ** p <0.05, *** p <0.01.

Table 4: The effect of moving to the US on Israeli startups' intermediate performance outcomes: Within-migrant variation

	(1) Applies for Trademark	(2) Ln(Patents+1)	(3) Ln(VC+1)	(4) Ln(VC+1) (US 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 II: Movers Across Age				
Age = 0 X Has Moved	-0.0540	0.0186	0.314***	0.193
	(0.0931)	(0.0836)	(0.110)	(0.245)
Age = 1 X Has Moved	0.0914*	-0.0294	0.384***	0.352***
	(0.0501)	(0.0644)	(0.0886)	(0.0914)
Age = 2 X Has Moved	0.102***	0.0215	0.511***	0.624***
	(0.0279)	(0.0531)	(0.0659)	(0.0780)
Age = 3 X Has Moved	0.135***	0.0528	0.357***	0.587***
	(0.0399)	(0.0760)	(0.127)	(0.0835)
Age = 4 X Has Moved	0.151***	0.0644	0.221*	0.593***
	(0.0394)	(0.101)	(0.126)	(0.0445)
Age = 5 X Has Moved	0.148***	0.0107	0.193*	0.630***
	(0.0436)	(0.129)	(0.105)	(0.101)
Age = 6 X Has Moved	0.152***	-0.00892	0.0764	0.611***
	(0.0428)	(0.152)	(0.103)	(0.0924)
Observations	16768	16768	16768	16768

Notes: This table reports the estimates for the impact of migrating on startup intermediary 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 US and zero in the pre-migration 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, *** p <0.01.

Table 5: The effect of migrating on the number of unique total investors

	(1) Total Investors	(2) Total Investors	(3) Total US Investors	(4) Total US Investors (VC Only)	(5) Total US Investors (Non-VC)	(6) Total Non-US Investors
Moves to US	1.663***	-0.422	0.544**	0.522***	0.0384	-0.998***
	(0.313)	(0.268)	(0.202)	(0.126)	(0.130)	(0.270)
Ln(VC+1)		2.456***	0.702***	0.364***	0.343***	1.757***
		(0.188)	(0.0699)	(0.0620)	(0.0291)	(0.186)
Observations	2179	2179	2179	2179	2179	2179
R^2	0.517	0.802	0.653	0.665	0.504	0.749

Notes: 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*. We present the results from the double-LASSO models. In columns (1) and (2), we examine the total number of unique investors. In column (3), we consider the number of US investors as an outcome, while in column (4) we focus on the number of US VCs. In column (5), the outcome is the total number of US non-VC investors. In all regressions, we include fixed effects for the number of unique investors participating in the startups' first round of financing. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <0.1, ** p <0.05, *** p <0.01.

Table 6: The effect of moving to the US on Israeli startups' equity outcomes: Cross sectional results

	(1) Acquired	(2) Acquired by non-US firm	(3) Ln(Exit $)	(4) IPO
Model I: Naive (N=2179)				
Moves to US	0.416***	-0.0328*	1.134***	0.0248
	(0.0393)	(0.0169)	(0.170)	(0.0180)
Model II: Quasi-Experiment (N=92)				
Moves to US	0.522**	0.0408	3.759***	-0.0953
	(0.221)	(0.102)	(0.0585)	(0.158)
Model III: Double-LASSO (N=2179)				
Moves to US	0.175**	-0.0807**	0.954***	0.0287
	(0.0679)	(0.0321)	(0.292)	(0.0376)

Notes: 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-US company (column (2)), a startups' 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 our quasi-experiment that uses a plausibly exogenous control group of non-migrants. Model III is the double-LASSO (Belloni *et al.*, 2014) model. Standard errors (in parentheses) are double-clustered at founding year and sector levels. To derive the estimations in column (3), we restricted the sample to those acquired startups for which we had sales price information. Model II 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 as a result. Significance denoted as: * p <0.10, ** p <0.05, *** p <0.01.

Table 7: The effect of moving to the US on Israeli startups' equity outcomes: Within-migrant variation

	(1) Acquired	(2) Acquired by non-US Firm	(3) IPO
Model I: Main Difference			
Has Moved	0.0632	0.00300	-0.00974
	(0.0411)	(0.00790)	(0.0195)
Model II: Movers Across Age			
Age = 0 X Has Moved	-0.0425	0.0158*	-0.0131
	(0.0663)	(0.00839)	(0.0180)
Age = 1 X Has Moved	0.0172	0.0158	0.00664
	(0.0331)	(0.0109)	(0.0210)
Age = 2 X Has Moved	-0.000939	-0.000407	-0.0113*
	(0.0339)	(0.0137)	(0.00599)
Age = 3 X Has Moved	0.0626**	-0.00297	0.0129
	(0.0292)	(0.0142)	(0.0172)
Age = 4 X Has Moved	0.126***	-0.00994	-0.0118
	(0.0181)	(0.0136)	(0.0232)
Age = 5 X Has Moved	0.155***	-0.0223**	0.0151
	(0.0306)	(0.00865)	(0.0295)
Age = 6 X Has Moved	0.256***	-0.0115	-0.0289
	(0.0352)	(0.0116)	(0.0418)
Observations	16768	16768	16768

Notes: This table reports the estimates for the impact of migrating on three startup equity outcomes, exploiting within-migrant variation. Columns (1) and (2) report the effects of migrating to the US on the likelihood that a startup will have experienced an acquisition, while Column (3) reports the migration effects on the likelihood that the startup will have exited via an IPO, as of a given year. We do not examine a startup's exit amount in the case of an acquisition given that it cannot be analyzed in a panel format. Columns (1) and (2) examine the likelihood that a startup will have experienced an acquisition, while Column (3) is 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 US and zero in the pre-migration 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, *** p <0.01.

Table 8: The role of the market for acquisitions as a source of the US entrepreneurial ecosystem's comparative advantage - Controlling for venture capital financing in startups acquired by US companies

	(1) Ln(Exit $)	(2) Ln(Exit $)	(3) Ln(Exit $)
Moves to US	0.990**	0.604**	0.619**
	(0.275)	(0.193)	(0.216)
Ln(Total VC Raised +1)		0.378**	0.253
		(0.125)	(0.187)
Ln(Total VC Raised +1)^2			0.0371
			(0.0394)
Has US VC in First Round			-0.250
			(0.265)
Ln(Total Unique US VC Investors +1)			0.0879
			(0.268)
Ln(Total Unique US Non VC Investors +1)			-0.268
			(0.232)
Observations	253	253	253
R^2	0.213	0.258	0.286

Notes: This table reports regressions results for the impact of migrating to the US on the startups' acquisition price. We restrict the sample to startups acquired by US companies and control for multiple VC characteristics. All regressions include indicators for whether startups had applied for a US a granted patent or a trademark at founding, for whether startups are university spinoffs, and for whether they spent time in a government-sponsored incubator. We also control for the number of founders and include founding year, sector, and founding location fixed effects. The coefficient of *Moves to US* in column (3) can be suggestively interpreted the effect of the US market for acquisitions as a source of the US comparative advantage in entrepreneurship, having controlled for the role of VC financing. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <0.1, ** p <0.05, *** p <0.01.

Table 9: Full versus partial commitment migration strategies

	(1) Applies for Trademark	(2) Ln(Patents+1)	(3) Ln(VC +1)	(4) Ln(VC+1) (US VC-Led Only)	(5) Acquired	(6) Acquired by non-US Firms	(7) Ln(Exit $ mill.)	(8) IPO
Full Commitment Strategy								
Moves to US	0.270***	0.0772	1.226***	1.178***	0.185**	-0.0786*	0.823**	0.0326
	(0.0571)	(0.147)	(0.102)	(0.0953)	(0.0640)	(0.0335)	(0.326)	(0.0368)
Partial Commitment Strategy								
Opens Subsidiary in US	0.198	0.211	0.789***	0.594***	0.0824	0.00560	0.0399	0.0971*
	(0.110)	(0.163)	(0.189)	(0.152)	(0.0551)	(0.0485)	(0.441)	(0.0416)
Observations	2179	2179	2179	2179	2179	2179	373	2179

Notes: This table compares the performance of each migrant type, namely the startup establishing its headquarters in the US and the one opening a branch, to that of non-migrants. We present the results from the double-LASSO models. We examine the same startup performance outcomes as those investigated in Table 3 and Table 6. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <.01, ** p <.05, *** p <.01.

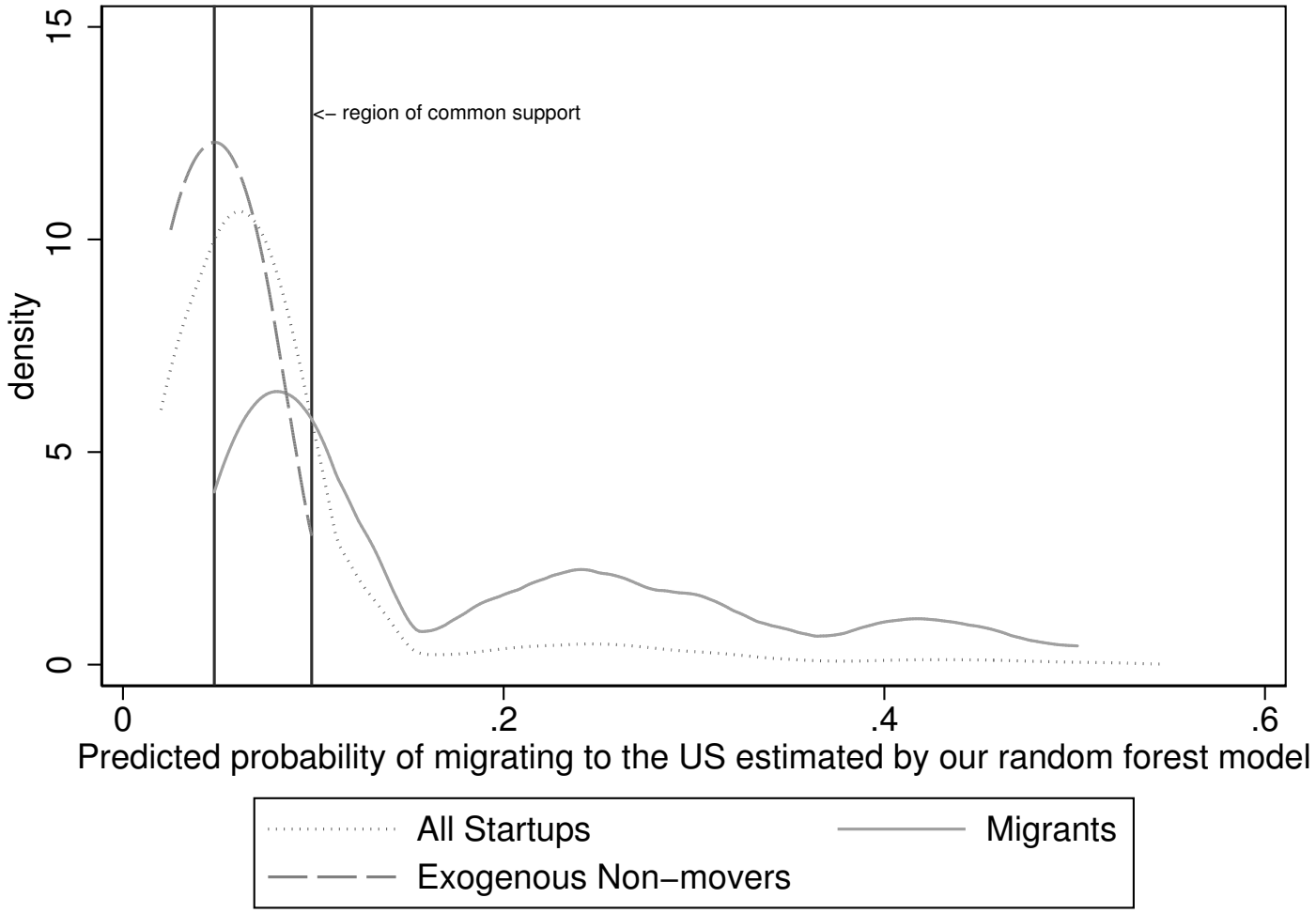
Table 10: The effect of migrating, by US state destination

	(1) Applies for Trademark	(2) Ln(Patents+1)	(3) Ln(VC +1)	(4) Ln(VC +1) (US VC Led Only)	(5) Acquired	(6) Acquired by non-US firm	(7) Ln(Exit $)	(8) IPO
Moved to California	0.228**	0.0252	1.217***	1.467***	0.188	-0.0681	0.968*	-0.00812
	(0.0752)	(0.135)	(0.194)	(0.229)	(0.120)	(0.0371)	(0.454)	(0.0349)
Moved to Massachusetts	0.233	0.288	1.202***	0.840**	0.140*	-0.128**	1.409**	0.0416
	(0.128)	(0.237)	(0.326)	(0.300)	(0.0722)	(0.0422)	(0.519)	(0.0579)
Moved to New York area	0.303***	0.0578	1.121***	0.935**	0.136	-0.0800	1.064	0.103
	(0.0335)	(0.127)	(0.281)	(0.385)	(0.104)	(0.0473)	(0.649)	(0.0912)
Moved to other US state	0.223*	-0.250	0.673	0.170	0.255	-0.0762	-0.546	0.00534
	(0.105)	(0.136)	(0.395)	(0.262)	(0.154)	(0.0768)	(0.425)	(0.0947)
Observations	2179	2179	2179	2179	2179	2179	373	2179

Notes: This table examines whether there are any differences in migration benefits depending on the US location Israeli startups choose. We differentiate between the California, Massachusetts, and New York area destination locations, on the one hand, and the remaining US locations, on the other. We adopt this distinction because from the descriptive statistics provided in Figure 1 it appears that California, Massachusetts, and New York area (i.e. New York and New Jersey) are Israeli startups' preferred locations. This geographical distribution should be related to the ICT specialization of the Israeli economy and the more recent investments it has made in the biotechnology sector. Indeed, California hosts the Silicon Valley ICT cluster, the Boston area specializes in biotechnology, and New York area hosts a vibrant e-commerce business environment. The goal of our analysis is to evaluate whether, by migrating to these geographical locations, Israeli startups indeed obtain greater gains than by moving elsewhere in the US. We examine the same startup performance outcomes as those investigated in Table 3 and Table 6. Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <.1, ** p <.05, *** p <.01.

Appendix

Figure A1: Distribution of the predicted probability of migrating



Notes: We plot the kernel distribution of the predicted probability of migrating to the US (estimated by the random forest model described in Section 4) for: i) all startups, ii) migrants, and iii) the set of exogenous non-migrants that constitute our quasi-experiment.

Table A1: Top 50 most relevant startup features in our random forest model

Rank	Feature Name	Importance	Std. Dev.
1	Invested by: Western Technology Investments (WTI)	.02	.059
2	Invested by: Flanders Language Valley (FLV) Fund C	.019	.058
3	Invested by: Mediseed Fund	.017	.052
4	Invested by: Vesbridge Partners LLC	.016	.05
5	Life Sciences X First Round Num. Israel Inv.	.014	.047
6	Invested by: Advanced Metal Technologies	.014	.047
7	Invested by: Goldman Hirsh Partners	.013	.048
8	Invested by: ES Cell International Pte	.013	.044
9	Miscelaneous X Has Funding from OCS	.013	.037
10	Invested by: WRF Capital	.013	.044
11	Invested by: Lombard Medical	.012	.046
12	Invested by: BG Negev	.012	.047
13	Invested by: Hummer Winblad Venture Partners	.012	.042
14	Invested by: International Group Inc.	.011	.048
15	Invested by: Levensohn Venture Partners	.011	.045
16	Invested by: Imclone	.011	.041
17	Internet X South	.011	.043
18	Invested by: Consensus Business Group (CBG)	.011	.038
19	Invested by: IdeaPlus Ltd.	.011	.042
20	Invested by: Heidia Ltd	.01	.04
21	Invested by: Avnan Investments LP	.01	.04
22	Invested by: Medmax Ventures	.01	.043
23	Invested by: Marathon (Now YBOX Real Estate)	.0099	.043
24	Invested by: Storm Ventures LLC	.0096	.043
25	Life Sciences X West Bank	.0096	.037
26	Invested by: Court Square Ventures	.0094	.037
27	Invested by: Check Point	.0094	.032
28	Invested by: MRV Ventures	.0093	.034
29	Invested by: Sega Enterprises	.0091	.036
30	Invested by: Portview Communications Fund	.009	.035
31	Miscellaneous X Tel Aviv	.009	.042
32	Invested by: OZOptics	.0089	.037
33	Num. Bank Investors	.0089	.031
34	First Round Invested by: Hashmira Hi-Tech Investments	.0089	.034
35	Invested by: London Merchant Securities	.0086	.032
36	Invested by: Gintec Active Safety Ltd.	.0085	.036
37	Invested by: Stata Venture Partners	.0081	.025
38	Invested by: Bernardo Cohen Investments Ltd.	.0079	.023
39	Financing in First Round (mill. $) X Num. Insurance Co. Inv.	.0079	.034
40	Semiconductors X North	.0079	.03
41	Invested by: DeA Capital SpA (formerly CDB Web Te	.0078	.033
42	Invested by: DOR Ventures Fund	.0077	.024
43	Invested by: Athena Venture Partners LP	.0076	.044
44	Invested by: PharmaBio Development	.0076	.032
45	Clean Tech X North	.0076	.03
46	Invested by: Digital Media	.0075	.03
47	Invested by: Synergy Venture Partners LP	.0075	.036
48	Invested by: Dotan Technologies	.0074	.029
49	Invested by: Agis	.0074	.016
50	Invested by: Integral Capital Partners	.0074	.025

Notes: In this table, we report the results from 50 bootstrap random forest models. The dependent variable in these models is an indicator for whether an Israeli startup migrates to the US. A feature's *importance* is measured as the change in the total predictive power of the random forest model after the given feature is controlled for. *Std. Dev.* is the standard deviation of the 50 estimates of a given feature's importance. Note that the *importance* coefficient does not provide any information on the direction of the relationship between a given feature and the likelihood of migrating.

Table A2: The effect of moving to the US on Israeli startups' equity outcomes: Within-migrant variation

	(1) Total Investors	(2) Total US Investors	(3) Total US Investors (VC Only)	(4) Total US Investors (Non-VC)	(5) Total Non-US Investors
Model I: Main Difference					
Has Moved	-0.717***	0.106	0.0950	0.0111	-0.823***
	(0.249)	(0.0977)	(0.0683)	(0.0675)	(0.209)
Model II: Movers Across Age					
Age = 0 X Has Moved	-0.637***	-0.144	-0.190	0.0464	-0.493*
	(0.234)	(0.178)	(0.154)	(0.130)	(0.286)
Age = 1 X Has Moved	-0.410**	-0.108	-0.0521	-0.0558	-0.302***
	(0.190)	(0.124)	(0.0327)	(0.119)	(0.0986)
Age = 2 X Has Moved	-0.665**	0.00668	0.0597	-0.0530	-0.672***
	(0.273)	(0.174)	(0.0697)	(0.133)	(0.0846)
Age = 3 X Has Moved	-0.785***	0.194	0.183***	0.0103	-0.978***
	(0.237)	(0.131)	(0.0508)	(0.114)	(0.104)
Age = 4 X Has Moved	-0.871***	0.388**	0.314***	0.0741	-1.258***
	(0.326)	(0.156)	(0.0639)	(0.120)	(0.217)
Age = 5 X Has Moved	-1.159***	0.365*	0.338***	0.0277	-1.524***
	(0.346)	(0.197)	(0.0969)	(0.116)	(0.246)
Age = 6 X Has Moved	-1.022***	0.500***	0.439***	0.0608	-1.522***
	(0.380)	(0.177)	(0.101)	(0.0954)	(0.243)
Observations	16768	16768	16768	16768	16768

Notes: 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 column (1), we examine the total number of unique investors. In column (2), we consider the number of US investors as an outcome, while in column (3) we focus on the number of US VCs. In column (4), the outcome is the total number of US non-VC investors. 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 US and zero in the pre-migration 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, *** p <0.01.

Table A3: Hazard models for the likelihood of exiting successfully

	(1) Exit	(2) Acquired	(3) IPO	(4) US IPO
Moves to US	1.428	3.723	0.362	0.372
	(0.647)	(2.593)	(0.205)	(0.249)
N	95	95	95	95
Log-Likelihood	-247.1	-177.4	-55.21	-34.45

Notes: We estimate Cox proportional hazard models on cross-sectional data using the quasi-experimental sample described in Section 4 (Model II). Standard errors (in parenthesis) are clustered at the founding-year level. We do not estimate the double-LASSO model given that our maximum likelihood estimator would not converge with the inclusion of the several covariates we selected. Significance denoted as: * p <0.1, ** p <0.05, *** p <0.01.

Table A4: The effect of migrating to the US on the Israeli startups' likelihood of exiting via an IPO, differentiating by stock exchange

	(1) IPO	(2) US IPO	(3) Israel (TASE) IPO
Model II: Quasi-Experiment (N=92)			
Moves to US	-0.0953	0.107*	-0.219
	(0.0899)	(0.0603)	(0.134)
Model III: Double-LASSO (N=2179)			
Moves to US	0.0216	0.0152	-0.0107
	(0.0360)	(0.0128)	(0.0129)

Notes: This table reports the estimates of the effect of migrating to the US on the likelihood of exiting via an IPO. We distinguish between those IPOs that took place on the US Stock Exchanges (NASDAQ and NYSE) and those that occurred on the Tel Aviv Stock Exchange (TASE). Standard errors (in parentheses) are double-clustered at founding year and sector levels. Significance denoted as: * p <0.1, ** p <0.05, *** p <0.01.