Are Immigrants More Innovative? Evidence from Entrepreneurs *

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Abstract

We evaluate the contribution of immigrant-entrepreneurs to innovation in the U.S. using linked survey-administrative data on 199,000 firms. We find that immigrants are more likely than natives to own businesses, and on average their firms display stronger innovation activities and outcomes. Immigrant-owned firms are particularly more likely to create completely new products, improve previous products, use new processes, and engage in both basic and applied R&D. The efforts of immigrants in innovation are reflected in substantially higher patents and productivity of their firms. Immigrant owners are slightly less likely than natives to imitate products of others, to obtain copyrights and trademarks, and to hire more employees. Delving into potential explanations of the immigrant-native differences, we study other characteristics of entrepreneurs, access to finance, choice of industry, immigrant self-selection, and effects of cultural diversity. We find that the immigrant innovation advantage holds in both high-tech and non-high-tech industries and that it tends to be even stronger in firms owned by diverse immigrant-native teams and by diverse immigrants from different countries. We conclude that nearly all measures show that immigrant-owned firms tend to operate more innovative and productive firms, which, together with the higher share of business ownership by immigrants, implies large contributions to U.S. innovation and growth.

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1 Introduction

Do immigrant entrepreneurs create and operate businesses that are more innovative than those owned by native-born Americans? The presumption that immigrant owners contribute disproportionately to U.S. economic growth is implicit in such policies as the EB-5 visa program, which provides a special pathway to U.S. residence for immigrant entrepreneurs founding large businesses. Yet immigrants face disadvantages in language, social networks, and other local knowledge that may be important complements to innovation. Such factors could especially hinder their ability to innovate in more radical ways, making immigrants more likely to simply imitate local practices and resulting in lower rates of innovation outcomes such as patents and productivity.

On the other hand, immigrant-owned firms might be more innovative for two broad sets of reasons, or types of mechanism. The first involves selection: the choice to move across countries may involve self-selection on personal characteristics such as risk preferences, aspirations, entrepreneurialism, and imaginativeness. Both immigration and innovation involve considerable uncertainty and would seem more likely for individuals who are more adventurous, who aspire to improve and advance, and who are better able to imagine alternatives to the current situation. The second possible mechanism involves the diversity of multiple societies, cultures, languages, and institutions. Perhaps the very fact of having experienced such diversity may create broader choice sets for immigrants. Either working alone or in combination with natives or with immigrants from other countries, immigrants may be more likely to learn from the confrontation of different practices to produce recombinations of diverse ideas that underlie innovation. Unlike self-selection, the diversity mechanism implies that immigration has a causal effect that raises innovation. Thus, while the two mechanisms are distinct but not mutually exclusive, they have different welfare implications: the selection channel implies that immigration may simply redistribute innovation across countries, as the receiving country skims innovative individuals from sending countries, but the diversity mechanism raises the intriguing possibility that immigration can raise innovation overall, and potentially economic growth in all countries.

Despite the policy relevance and popular interest in immigrants, as yet there has been relatively little systematic evidence on their role as potentially innovative entrepreneurs. A number of studies have examined immigrants as individual inventors, as employees of high-tech firms, and as scientists, engineers, and self-employed, but few have studied immigrant-owned firms. The few firm-level studies mostly examine size and growth, and most focus on small samples in the high-tech sector.[1] Hart and Acs (2011) examine innovation measures

[1] As far as we can determine, there are only two published studies on immigrant-owned firms using broad,

– research and development and patenting – at the firm-level, using a survey of 1300 "high impact" high tech companies. They report little difference between firms with and without immigrant founders. A few other studies focus on particular occupations, industries, regions, or immigrant ethnicities.

This paper aims to contribute to understanding of the innovation impact of immigrant entrepreneurship on the U.S. economy using a much larger, broader, and richer data set than those heretofore available. Much of our analysis exploits the Annual Survey of Entrepreneurs (ASE), a new database from the U.S. Census Bureau covering about 199,000 employer businesses based on a random sample of all nonfarm businesses. The ASE questionnaire contains detailed information on the four largest owners and some characteristics of the business, which provide us with control variables for measuring immigrant-native differences conditional on other characteristics including demographics, human capital, and ownership team. Unlike previous data sets containing owner information, however, and crucially for this paper, the ASE also includes many innovation measures that we study as outcome variables, including reported innovation activities in both products and processes, research and development, trademarks, and patents. We link these data to other data sources on patents, and on revenue and employment, which we use to construct measures of productivity. And we study Decennial Census, American Community Survey, and Current Population Survey data to examines shares of immigrants by employment and self-employment status and by the numbers of employees that immigrant entrepreneurs hire.

To provide some basic background over a longer perspective on the contribution of immigrants to entrepreneurship, we compile immigrant shares in population, employment, and self-employment using Decennial Census data from 1910 (the earliest year for which self-employment can be distinguished) to 2000, and American Community Survey (ACS) data for recent years in Figure A.1.[2]

The immigrant shares in the population and adult population show pronounced U-shapes with the trough in 1970. The overall shape is similar for the immigrant share in self-employment, but prior to 1940 this share was lower than the immigrant shares in the adult and the employed populations. These three shares track closely through 2000, rising substantially from about 6 percent in 1970 to 13 percent in 2000, but from that year they begin to diverge with the adult population share rising to about 16 percent, the employment share to 18 percent, and the self-employment share to more than 22 percent. The self-employment propensity in recent years is thus much higher than for immigrants, with the precise difference depending on the comparison: relative to total population, the immi-

representative samples: Fairlie and Lofstrom (2015) and Kerr and Kerr (2020)

[2]See Section 2 for data sources and definitions.

grant self-employment rate is 50 percent higher, relative to adult population it is 35 percent higher, and relative to employed it is 25 percent higher. By these measures, immigrants are responsible for a disproportionate share of businesses in the 21st century U.S.

In the broad literature on entrepreneurship, the self-employment measure is subject to criticism (e.g., Parker (2004)), as it may reflect outside contracting, casual work, or subsistence or "necessity" activities, and it does not take into account the degree to which the venture is genuinely entrepreneurial in the colloquial sense, creating jobs and innovating with new products or production processes. One approach in previous research (e.g., Levine and Rubinstein (2017)) to come closer to this notion of new business creation is to distinguish incorporated from unincorporated self-employed businesses. Kerr (2017) report a high and increasing share of incorporated businesses among immigrants. Adopting this perspective, we use information on incorporation, which is available in the Decennial Census since 1970 and in the ACS for all years, to show the immigrant shares for 1970-2021 in Figure A.2.

The immigrant shares in employment and self-employment are reproduced from A.1, while the shares in unincorporated, incorporated, and full-time self-employment are added. Before 2000, the immigrant share in incorporated self-employment is higher than for unincorporated, the two series diverged since then, with a larger rise in unincorporated than incorporated self-employment, reaching 23.1 and 20.8 percent, respectively. Both the incorporated and unincorporated shares of immigrants exceed their employment share throughout this period, but it appears that immigrants are less likely to incorporate their businesses. These calculations include all workers regardless of their hours, but working longer hours might also be taken as a proxy of more committed entrepreneurship. As a step in this direction, Figure A.2 contains the share of immigrants in full-time self-employed. This variable is also similar to the immigrant share in employment and self-employment until about 2000 after which it rises rapidly, diverging from the rise in employment. By 2021, it reaches 23 percent. By this measure, immigrants appear to be more committed entrepreneurs.

Our analysis explores these household data further below, but most of the paper focuses on firm-level data for which we have direct measures of innovation activities and outcomes. Unlike the broader research on characteristics of entrepreneurs, at least within economics, studies of immigrant entrepreneurs more commonly use data on businesses. Many of these studies rely on small sample surveys of businesses in particular industries, regions, or ethnicities of owners. The high-tech sector has been a particular focus, for instance in Saxenian (2002), Wadhwa et al. (2007), and Hart and Acs (2011). These studies are typically based on small sample surveys of firms, frequently collected by the authors themselves. Brown et al. (2020) also focuses on high-tech firms, but uses a national sample and studies innovation outcomes, as discussed below.

Less common is firm-level research on immigrant entrepreneurs using large, nationally representative samples. Kerr (2017) use data from the Longitudinal Employer-Household Dynamics (LEHD) to identify immigrant-owned firms and examine various measures of firm performance in the Primary Metropolitan Statistical Areas of eleven U.S. states. Focusing on new start-ups, they define immigrant-ownership for firms with at least one immigrant among the top three earners for the first three years after entry (first employee hired). Under this definition, they find rates of immigrant ownership increasing to 27 percent of employers in 2008, the last year in their data. They also report that the firms defined as immigrant-owned have higher rates of employment growth and probability of being large, but the results are not robust to adding fixed effects for cohort-PMSA-industry. Their regressions control for start-up size, and they exclude initial employment from the calculation of growth.

Kerr and Kerr (2020) uses a different data source to identify immigrant owners: the Survey of Business Owners (SBO) for 2007 and 2012. The SBO has the large advantage over the LEHD in containing direct questions on the characteristics, including immigrant status, of the top four owners in the firm (for owners with at least 10 percent ownership). Restricting attention to employer firms, Kerr and Kerr (2020) report 16 percent of firms have at least one immigrant owner in 2007, and 18 percent in 2012. The share of firms less than five years old with an immigrant owner is reported as 24 and 26 percent for the two years, respectively. Using the same 2007 SBO data but a different method based on the ownership shares of immigrants within firms and focusing on new entrants, Brown et al. (2019) report that 15 percent of firms are wholly owned by immigrants and another 4.3 percent are owned by mixed immigrant-native teams.

Kerr and Kerr (2020) use SBO data to examine differences in immigrant versus native-owned firms. For the raw data, they report that immigrant-owned firms have fewer employees, pay lower wages, and provide fewer fringe benefits. These results are largely robust to a large battery of controls used in regressions. With log employment as the dependent variable, for instance, Kerr and Kerr (2020) report eight different specifications for all firms and for firms younger than five years old, separately, and report negative coefficients in all 16 cases, ranging from -0.1 to -0.3 in magnitude. They also report higher productivity (receipts per employee) among immigrant-owned firms, with coefficients ranging from 0 to 0.1.

Using U.S. patents as a measure of innovation and federal censuses data between 1880 and 1940, Akcigit, Grigsby and Nicholas (2017) examine the impact of immigrants on innovation and labor market outcomes in the US. While it provides evidence of immigrants' higher productivity and lower labor income compared to natives, it is conducted at state and county-level data for historical periods. More recently, Bernstein et al. (2022) link the patent data from the US Patent Office (USPTO) to individual social security numbers and year of birth

using data from Infutor to identify immigrant status from 1990 to 2016. They find that immigrants represent 16 percent of all inventors in the U.S., producing 23 percent of total innovation output, measured by number of patents, patent citations, and the economic value of these patents. Also, looking at the co-patenting trend among immigrants and natives, they find that immigrants are more likely to work with other immigrants compared to natives especially in their early careers (17% vs. 7%), with a gradual decline of this trend over time.

Besides these studies, our paper is also related to several other areas of research. To start with, there is a voluminous literature on the consequences of immigration for native worker wages (e.g., Borjas (2003), Card (2001), and Ottaviano and Peri (2012)). Other immigration research focuses on the disadvantage faced by immigrants in U.S. labor markets and the extent and pace of immigrant-native convergence in wages, or "assimilation" (e.g., Borjas (1985), Chiswick, Lee and Miller (2005)). Some studies of immigrants consider the possibility that immigrants have certain advantages, and document higher rates of STEM workforce participation, patents, publication citations, and Nobel Prize winners among immigrants (Kerr and Lincoln (2010), Stephan and Levin (2001), Hunt and Gauthier-Loiselle (2010).)

Yet much innovation takes place within firms, and our study relates to research on firm-level Research and Development (R&D), patenting, and other aspects of innovation. As widely recognized, however, R&D and patents both have limitations as measures of innovation, much of which takes place without formal R&D or patenting. Some surveys, including the Community Innovation Surveys (CIS) in Europe and the Business Research and Development and Innovation Survey (BRDIS) in the US, attempt to fill this gap with qualitative questions on product and process innovations (Mairesse and Mohnen (2010)). These surveys have documented the incidence of such activities and demonstrated their correlation with productivity (e.g., Griffith et al. (2006) Parisi, Schiantarelli and Sembenelli (2006), Hall (2011). But the data in these studies is usually based on small samples (for example, only 5000 receive the full questionnaire for the BRDIS) that are non-randomly selected to focus on firms with known R&D activity. And crucially, for our purposes, they contain no information on the firm's founders or owners.

The next section contains a description of our data, including the sources and definitions of the measures of innovation activities and outcomes. The third section describes our empirical methods, and the fourth contains results, divided into subsections for unconditional differences in innovation, regression results controlling for alternative sets of covariates, innovation in high-tech vs. loch-tech firms, and an analysis of co-ownership diversity and innovation. A brief section concludes the paper.

2 Data

2.1 Data Sources and Samples

Our analysis of the role of immigrant entrepreneurs in innovation combines data from several sources, some of which have never before been studied for this purpose. The database provides a much broader set of innovation measures and and enables us to examine some alternative hypotheses for differences between immigrant- and native-owned firms.

The principal source for most variables is the 2014 Annual Survey of Entrepreneurs (ASE) from the U.S. Census Bureau. The ASE collected information on businesses in the nonfarm sector with at least one paid employee and annual receipts of $1,000 or more. The ASE sample is stratified by the 50 most populous Metropolitan Statistical Areas (MSAs), state, and the firm's number of years in business, and it is randomly selected based on volume of sales, payroll, or number of paid employees, except large firms selected with certainty in each stratum. The initial 2014 ASE sample size is about 290,000 employer firms with a response rate of 74 percent.

The unusual strength of the 2014 ASE, particularly relevant for this study, is its large number of innovation measures. These measures six types of each of product and process innovation, R&D activities, and intellectual property (copyright, trademarks, and patents), which serve as some of the dependent variables in our analysis.[3] We describe these variables in detail below.

The ASE also collects characteristics on up to four owners with the largest shares in the business. Our main variable of interest is an indicator for whether the business is owned by an immigrant, which is defined by the ASE as a non-citizen at birth. The information on multiple owners allows us to study entrepreneurial teams, including two types of diverse teams. The first type of diversity, "diverse native-immigrant," is defined as at least one immigrant and at least one native owner). The second type, "within-immigrant diversity," relies on the detailed race and ethnicity categories in the ASE that enable us to identify region and in most cases the specific country of origin and to identify cases where at least two immigrant owners have different origins). We construct five ownership categories: (1) "Any Immigrant" for firms with at least one immigrant owner; (2) "Only Immigrant" for firms with only immigrant owners, (3) "Diverse Native-Immigrant" when firms have mixed immigrant and native owners, (4) "Diverse Within-Immigrant" for firms with immigrants from different racial or ethnic backgrounds, and (5) "Only Native" for firms with only native owners. Because the samples for (3) and (4) are much smaller than for the other categories,

[3] Lee et al. (2022) also examine innovation measures from the ASE in the context of African-American owned firms.

we report results for them in a separate subsection.

We have linked the ASE with the Census Bureau Patent Crosswalk Data (CBPCD), the Business Register (BR), and Longitudinal Business Database (LBD). The CBPCD contains administrative records on the number of patents granted each firm by year (Dreisigmeyer et al., 2018; Graham et al., 2018). The BR provides number of employees and revenue for our employment and productivity analysis, and the LBD contains firm age (defined as entry of any of a firm's establishments), an essential control variable given the strong association between firm age and performance, and it allows us to aggregate establishments into firms. Together, these data provide additional measures of innovation performance.

We construct two firm-level samples for analysis. One is the regression sample based solely on ASE data. The second involves the linked ASE-LBD- BR-CBPCD regression sample. The first sample is used for the analysis of innovation activities, and the second sample is used to examine innovative outcomes. We restrict the samples to firms with non-missing values across both dependent and independent variables. The final ASE regression sample includes 199,000 firms, and the final sample of the linked ASE-BR-CBPCD data contains 135,000 firms. We also construct new weights addressing missing observations by multiplying the ASE sampling weight by the inverse probability of ASE firm being in the regression sample.

For our analysis with household data, our sources are the Decennial Census, American Community Survey (ACS) and Current Population Survey (CPS) [4] While the Decennial Census is conducted every ten years, the ACS is conducted every year since 2001. The earliest information on immigrant status is in the 1910 Decennial Census, and we calculate immigrant shares in the U.S. population, adult population, employment, and self-employment from that year until 2021. From 1970, further information on type of self-employment, including incorporation and full-time status, becomes available. The CPS, a nationally representative survey of the U.S. households, is conducted on a monthly basis, providing detailed demographics and labor force information. We use immigrant shares in population, employment, and self-employment in 1994, which is the first year that the CPS included regular question on immigration status. Then, we exploit new data on the number of employees reported from 2014 to 2019 by self-employed individuals in questions added to the Outgoing Rotation Groups (ORG) questionnaire since 2014.

In accordance with the definition of immigrants in the ASE, our analyses for Decennial Census and the ACS consider those foreign-born individuals with naturalized citizenship or non-citizenship as immigrants, and those born in the U.S., U.S. outlying areas, or abroad of American parents as natives according to the citizenship status. Since the 1910 and 1960 Decennial Census do not have complete citizenship information, we use only birthplace to

[4] We use 5% samples in the Decennial Census and 1% sample in the ACS.

define those born outside the U.S. as immigrants for these two years[5] As a result, 1910 and 1960 immigrant shares could be larger, as those born abroad of American parents are unable to be distinguished from immigrants without the citizenship status variable.

For employed or self-employed sample in the CPS and ACS analysis, we exclude those who have jobs in armed forces or public sectors because immigrants without citizenship do not have chance to work in such sectors. We also exclude agriculture as the self-employment contract is disproportionately high in this sector. This sample restriction makes the CPS and ACS analysis to be consistent with ASE-LBD analysis where it only includes non-farm private sector.

2.2 Variables and Descriptive statistics

Table 1a and Table 1b provide detailed definitions and sources for our main innovation measures: Table 1a contains product and process innovation and R&D activities, and Table 1b contains innovation outcomes in terms of intellectual property, employment, and productivity. The innovation count variable is a continuous variable that sums up the number of product and process innovation activities, from the 12 listed, that the firm reports carrying out in 2012-2014. Any innovation is a dummy variable for whether the firm reports any of the 12 activities, while any product and any process are dummies for carrying out any of the six product and six process innovation activities, respectively. The remaining product and process innovation, R&D, and intellectual property variables are all dummy variables. We have constructed the R&D variables by grouping detailed survey questions into "basic" and "applied" types, as shown in the table. Employment is the logged number of employees and productivity is calculated as the firm's log of (revenue divided by number of employees) minus the 4-digit NAICS industry mean of that variable in 2014. Employment top 5% and productivity top 5% are dummy variables for whether the firm was above the 95th percentile of employment and productivity in 2014, respectively. We provide means for all these variables by ownership type at the beginning of the results section.

Descriptive statistics for firm and owner characteristics by ownership type are shown in Table 2. Immigrant-owned firms and especially those owned only by immigrants tend to be younger than native firms, and a higher share of only immigrant-owned firms have one owner than only native-owned firms (67 percent compared to 59 percent), while most diverse firms, either diverse native-immigrant or within-immigrant, have two owners (65 percent and 58 percent, respectively). More than half of all firms are owned by only male owners, but diverse immigrant owner firms are more likely to have female owners compared to only native

[5]For 1970 Decennial Census, we use Form 1 which provides the citizenship question.

or only immigrant firms, possibly just because the former have more owners. Mixed-gender unrelated ownership is equally uncommon for only immigrant and only native firms (3.7 percent for both), but diverse native-immigrant firms (about 49 percent) are more likely to be owned by family members. Immigrant firm owners tend to be younger, with only 36 percent above 54 years old in only immigrant firms compared with 50 percent of only native. All types of immigrant ownership are more likely to have advanced degrees, but both types of diverse ownership are associated with the highest educational levels. Immigrant owners, especially diverse within immigrant firms, are more likely to have prior business experience. Not surprisingly, owners of only native firms are more likely to be U.S. veterans.

Table 3 contains further information on firm characteristics, showing differences in the amount and sources of startup capital and in industry by ownership type. Immigrant-owned firms tend to have have more startup capital compared to only native. This suggests that financial constraints may not be a bigger problem for immigrants, and it could reflect the different plans and aspirations the entrepreneur has on startup. Both types of diverse immigrant firms have still much larger amounts of start-up finance, with 31 percent of the diverse within-immigrants having at least 100k, compared to 18 percent of only native, although this could reflect from differences in the number of owners. Regarding sources of startup finance, immigrant firms are more likely to use personal savings with about 75 percent compared to only native firms with 67 percent. On the other hand, only native firms use more of bank loans compared to immigrant firms (19 percent vs. 14 percent). Interestingly, diverse within-immigrant firms are more likely to use finance from outside investors compared to other immigrant firms and only native firms.

In terms of industry, immigrant-owned firms are much more concentrated in accommodation and food industry or retail trade or health, whereas only native firms are more often in the professional services and construction sectors. Lastly, immigrant firms are more likely to be in the high-tech sector(here defined on the basis of narrower industries with either a large STEM workforce or high R&D) compared to only native firms (6.4 percent vs. 4.9 percent).[6] Both types of diverse ownership are more likely to be in high-tech, but the highest rate by far is for diverse within-immigrant firms, where the share in high-tech is 13 percent of firms.

[6]The high-tech sector consists of the following 4 digit NAICS industries: Oil and Gas Extraction (2111), Pharmaceutical and Medicine Manufacturing (3254), Computer and Peripheral Equipment Manufacturing (3341), Communication Equipment Manufacturing (3342), Semiconductor and Other Electronic Component Manufacturing (3344), Navigational, Measuring, Electromedical, and Control Instruments Manufacturing (3345), Aerospace Project and Parts Manufacturing (3364), Software Publishers (5112), Wired Telecommunications Carries (5171), Other Telecommunications (5179), Data Processing, hosting, and related services (5182), Other Information Services (5191), Architectural, Engineering and Related Services (5413), Computer System Design and Related Services (5415), and Scientific Research and Development Services (5417).

3 Methods

To understand the impact of immigrant ownership on innovation, we first quantify the raw gap in descriptive statistics. Next, focusing on differences in innovation between firms with any immigrant owner compared with only native owners, we estimate the gap and how it changes in regression specifications with various sets of controls. Results are shown for three different regression specifications. The first "base" specification includes firm age, ownership team size and family relationships, detailed characteristics of the entrepreneur (age, gender, education, prior business experience, etc.), and the indicator for having at least one immigrant owner (any immigrant) on the right-hand side. We have also estimated multiple versions of these equations, for instance excluding human capital variables, but these made little difference to the results, so we will show only a single "base" specification including all these variables. The second specification adds a set of variables measuring the amount of start-up finance, and the third adds 4-digit industry dummies. Both the amount of finance and the industry in which the firm operates are, to some extent choice variables, and thus may be endogenous in these equations, but the results help illuminate the degree to which these factors condition the immigrant-native differences.

We estimate the impact of immigrant ownership on innovations using linear regressions. The general specification of the regressions for immigrant gaps is the following:

$$Y_j = \beta_0 + \beta_1 AnyImmig_j + \boldsymbol{X_j}\boldsymbol{\gamma} + \boldsymbol{K_j}\boldsymbol{\alpha_K} + \boldsymbol{S_j}\boldsymbol{\alpha_S} + \epsilon_j \tag{1}$$

where Y_j are each measure of innovation activities (product and process), intellectual property, employment, or productivity for a firm j. $AnyImmig_j$ is an indicator for a firm with any immigrant owner, which is our main variable of interest. $\boldsymbol{X_j}$ is a vector of characteristics of firm j, which includes firm age, owner demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). $\boldsymbol{K_j}$ is the set of detailed categories of finance variables (amounts of start-up capital). $\boldsymbol{S_j}$ is the set of 4-digit NAICS industry dummies.

In the base specification, we control for only the pre-determined firm characteristics without finance ($\boldsymbol{K_j}$) and sectors ($\boldsymbol{S_j}$). In the second specification, we add start-up finance controls to see how they change the immigrant gap in innovation. As also found by Kerr and Kerr (2018), we showed in the Data Section that immigrants use higher levels of finance when starting up their businesses, which suggests that financial market discrimination is not a systematic problem for immigrants. It may instead reflect differences in demand for finance associated with the ideas and plans for the business. The finance variable may thus be

partly endogenous, which is why we exclude it from the base specification. Another potential control, also endogenous to planned outcomes, is the choice of industry in which the business operates. But firms are obviously quite heterogeneous across industries, so within-industry comparisons are of interest. Therefore, in the third specification, we add sector controls to address this heterogeneity.

In addition to the ASE, we use the data from the CPS ORG to examine the immigrants' propensity to become entrepreneurs. We estimate the following specifications.

$$Y_i = \theta_0 + \theta_1 Immig_i + \boldsymbol{X_i}\boldsymbol{\eta} + \boldsymbol{S_i}\boldsymbol{\mu_S} + \epsilon_j \tag{2}$$

where Y_i are measures of entrepreneurs, which include the self-employed, incorporated self-employed, employer self-employed, and employers with more than a certain number of employees (e.g., 5+, 10+, 20+, and 50+). $Immig_i$ is an indicator for an individual who is born outside of the U.S. and is either a naturalized citizen or non-citizen. $\boldsymbol{X_i}$ is a vector of characteristics of an individual i, including demographics (female, age, and married) and human capital variables (education and veteran). $\boldsymbol{S_i}$ is the set of 2-digit industry dummies.

To understand the differential impacts of ownership diversity, we replace any immigrant owner variable in equation (1) with three ownership indicators: only immigrant, immigrant-native diverse, and within-immigrant diverse. Then, we estimate linear regressions with these three variables using the following extension of the above equation:

$$Y_j = \delta_0 + \delta_1 OnlyImm_j + \delta_2 DivNatImm_j + \delta_3 DivWithinImm_j + \boldsymbol{X_j}\boldsymbol{\gamma} + \boldsymbol{K_j}\boldsymbol{\alpha_K} + \boldsymbol{S_j}\boldsymbol{\alpha_S} + \epsilon_j \tag{3}$$

where $OnlyImm_j$ is an indicator for a firm with only immigrant owners, $DivWithinImm_j$ is a dummy variable for a firm with differences in ethnicity or race among immigrant owners, and $DivNatImm_j$ is an indicator for a firm with both immigrant and native owners. As in the previous specifications, we start with the base specification containing only predetermined firm characteristics and successively add controls for finance and industry.

4 Results

This section describes our results for differences in innovation activities and outcomes by ownership type in four subsections: unconditional differences, regression results for any immigrant owner, results for high-tech and low-tech firms separately, and results for native-immigrant and within-immigrant diversity.

4.1 Unconditional Differences

Table 4a and Table 4b show mean differences by ownership type in innovation activities and innovation outcomes, respectively. Compared to only native firms, immigrant firms are more likely to conduct any innovation activity, both product and process innovation, and R&D activities. The one exception is new product for the firm, reflecting a lower rate of imitation by immigrants. Innovation activities are much higher for both types of diverse ownership, and R&D and intellectual property incidence are especially high among diverse within-immigrant firms. For example, the probabilities that the firm received at least one patent and that it received three or more in 2012-14 is about 10 times higher with diverse within-immigrant than with only native ownership.

As shown in Table 4b, immigrant firms have slightly lower employment on average and are less likely to be in the top 5 percent of the employment distribution. Both types of diversity are associated with larger employment, but this again could be associated with the number of owners. On the other hand, immigrant firm's average productivity is higher, and they are much more likely to be in top 5 percent of the industry-specific productivity distribution than only native firms, about 50 percent more likely to be industry leaders in this sense.

The employment results may be somewhat surprising, so we consider an alternative source for immigrant-native firm employment analysis: the CPS.[7] Unlike the ASE, it permits an analysis of relative propensities of immigrants to be self-employed, and for recent years it contains information on number of employees.

The first bars in Figure 3 shows similar results to those displayed above using decennial censuses and the ACS, including the rise in immigration since 1994 (the first year that immigration questions were included on the CPS), the substantially higher rate of self-employment for immigrants, and the lower rate of incorporation among immigrant self-employed. The share of immigrants among employers (self-employed who have employees) is 18.9 percent on average over 2014-19, which is higher than their share in employment (18.1) but lower than their share of self-employed (20.5). Studies of employer probabilities (e.g., Fairlie and Lofstrom, 2015) usually take existing businesses (including nonemployers) as the base, implying a comparison of the employer share and the self-employment share, but if the question is about immigrants' contributions, then the share in employment (18.1 percent) or population (14 percent overall and 16 percent among those age 16 and older) may be more appropriate. The relevant comparison group is an issue we will return to when analyzing

[7]Consistent with the definition of immigrant in the ASE, our analysis for the CPS defines those foreign-born persons with naturalized citizenship or non-citizenship as immigrants, and those born in the U.S., U.S. outlying areas, or abroad of American parents as natives.

firm data and in drawing conclusions on the role of immigrants in U.S. innovation.

How much job creation takes place in firms owned by self-employed immigrants? To compare with natives, Figure 3 shows the immigrant shares using various size thresholds. The immigrant share in firms with at least 5 employees (16.5 percent) is similar to their total employment share, but the immigrant share declines with size, so that among firms with 50 or more employees, the share is only 10 percent. The mean number of employees for immigrant self-employed is 6.7, compared with 8.9 for native self-employed; the difference is likely understated because the publicly-available variable is top-coded at 75, which is at or below the 99th percentile of the native distribution, while 72 is the 99th percentile for immigrants. These CPS data imply that immigrant-owned firms tend to be smaller, undercutting the conventional wisdom that immigrants create a disproportionate share of the largest firms. However, we hasten to add that the CPS is unlikely to capture larger businesses accurately, because of the small CPS sample size, the tiny share of such firms, and the presence of multiple owners, many of whom do not report themselves as self-employed operators of the businesses. However, these results are consistent with our firm-level analysis, which also show smaller numbers of employees in firms with only immigrant owners.

Furthermore, all of these comparisons of means do not control for other factors that may affect innovation activities and outcomes. To consider such factors, we next turn to regression results.

4.2 Regression-Adjusted Differences for Any Immigrant Owner

We organize the regression results by showing the unconditional mean for only native-owned firms, in the first column of each table, followed by coefficients and standard errors for the three regression specifications explained in the Methods Section. Table 5a shows results for any immigrant in regressions where the innovation activities are the dependent variables. The table includes three specifications for each dependent variable, including the base specification with only pre-determined explanatory variables, adding finance, and adding industry controls. In the base specifications, firms with any immigrant owner have statistically significantly higher propensities to engage in all the innovation activities with the exception of developing a product that is new to the firm, but not the market. Some of the effect magnitudes are quite large. For completely new product, the effect is 2.1 percentage points relative to a native-only mean of 4.7 percent (45 percent), and for the new use product innovation, the effect is 6.3 percentage points relative to a native-only mean of 7.9 (80 percent). For basic and applied R&D, the effects are 44 and 39 percent, respectively. The effects are smaller for other measures. The effect on the number of innovations is 0.37 of an innovation,

or an increase of 18 percent, and the effect on the incidence of any innovation is 6.5 percent.

Adding finance and industry controls reduces the size of the estimated effects. But they remain substantial and statistically significant in all cases, with the exception of upgraded technique.

The any immigrant effects on patenting are large and statistically significant, as shown in Table 5b. The effect is 54 percent on having a patent using the ASE question, 61 percent for receiving a patent in 2012-2014 in the CBPCD, and 70 percent for receiving a patent in 2015-2017 in the CPBCD. The results are nearly identical when including finance and industry controls. For copyrights or trademarks, the immigrant effect is small and only marginally significant, and it is insignificant when including finance and negative when including industry controls.

The immigrant effects on average employment and the propensity to be in the top five percent of the employment distribution are negative. The effect magnitudes increase when including finance and industry controls, suggesting that immigrants tend to own firms that have more start-up capital and in industries with larger average size. By contrast, the average and top five percent productivity effects are positive, large, and little affected by finance and industry controls. The propensity for an immigrant-owned firm to be in the top five percent of the productivity distribution is 40 percent larger than for an only native-owned firm.

Providing further information about job-creation by immigrant owners, Table 6 shows regression results based on the same CPS ORG data used for Figure 3, but with samples restricted to employed individuals for the self-employment analysis and to self-employed for the analysis of employers and their numbers of employees. The base specification has no controls. Demographic and human capital variables are included in the second specification, and the third adds 2-digit industry effects. Among employed individuals, immigrants are more likely to be self-employed in the base specification. When controlling for industry, the effect of being an immigrant on the propensity to be self-employed turns negative and statistically significant, suggesting that immigrants are more prevalent in industries where self-employment rates are high. Among the self-employed, immigrants are less likely to be employers, and that effect is increasing in firm size. The effect is about -60 percent in the 50 or more employee firm size class. The coefficients for the propensity to be an employer and to be an employer with higher numbers of employees are even more negative when controlling for industry. These patterns corroborate the employment results in Table 5b using the ASE.

4.3 Regression for High-tech and Low-tech Sectors

Much of the research on innovation focuses on the high-tech sector, perhaps because the most common measure of innovation is patents, which are much more common in that sector. Yet most of the economy (95 percent of the firms in our sample) is not high-tech, and innovation in what we label "low-tech" also affects welfare and growth. With this motivation, Tables 7a and 7b contain results for similar regressions to Tables 5a and 5b, separately for high- and low-tech sectors. To save space, we show only the base specification in the text. Results from specifications including finance and industry controls are qualitatively similar (except as noted below) and can be found in the appendix. We consider a limited set of innovation activity variables because of the small sample size in the high-tech sector together with the small means for some dependent variables.

In general, the immigrant advantage in the variables representing product and process innovation activities is much larger in the low-tech sector. As before, effects are attenuated somewhat when including finance and industry controls. The other product innovation and process innovation effects in the high-tech sector become insignificant. Both types of R&D show large immigrant effects in both sectors, however.

The immigrant effects on patents are positive in both the high- and low-tech sectors, but many of the coefficients in low-tech are imprecisely estimated. The high-tech sector effect size is generally larger for these variables, implying for several of them a doubling of patenting in firms with any immigrant ownership relative to only native ownership, results that are robust to including finance and industry controls.

It is notable that the negative immigrant employment effect we reported in5b is concentrated in the low-tech sector. The immigrant coefficients in the high-tech sector regressions for log employment and the probability of being in the top five percent of the employment distribution are statistically insignificant. Positive immigrant productivity effects are found in both sectors, implying about 8 percent higher in high-tech and 10 percent higher in low-tech, as well as much higher probabilities of being industry productivity leaders (in the top five percent of the industry-specific productivity distribution).

4.4 Ownership Diversity

In this final subsection we study the effects of ownership team diversity on innovation. Immigrant owners could have a high propensity to innovate because more innovative individuals are more likely to immigrate to the U.S.(selection) or because they benefit from different perspectives (diversity). Our regressions control for many characteristics that may be associated with innovativeness, including education and prior business ownership, which should

reduce the role of selection in the remaining immigrant-native gap in innovation. Moreover, some factors that we control for may be affected by innovativeness, such as finance. But selection and diversity may also be driven by unobservables, so they are difficult to disentangle empirically.

However, if the diversity mechanism is important in generating innovation, then it would stand to reason that diversity of ownership within a firm could increase diversity of perspective in the firm. If diversity of perspective is contributing to the immigrant owner effect on innovation, then one would expect diverse ownership teams to be more innovative. We test this diversity of perspective hypothesis by replacing the any immigrant dummy with dummies for ownership teams with only immigrant owners, teams with both immigrant and native owners (native-immigrant diversity), and those with immigrant owners whose country of origin (based on the very detailed race and ethnicity questions in the ASE) differs from one another (within-immigrant diversity). Note that only immigrant and diverse native-immigrant are mutually exclusive, but diverse within-immigrant is nested in either only immigrant (80 percent of the cases) or in diverse native-immigrant (20 percent), so that the diverse within-immigrant coefficient is additive with respect to those categories.

Tables 8b and 8b show the base specification, and specifications including finance and industry controls are in the appendix. For most innovation activities, the only immigrant and diverse native-immigrant coefficients are positive, statistically significant, and of similar magnitude, implying that native-immigrant diversity does not add much to the immigrant advantage. Most within-immigrant coefficients are large, however, showing additional gains to the other two categories when diverse immigrants are owners, although they are often imprecisely estimated. The magnitudes often imply a much higher rate - doubling or greater - in the immigrant advantage when diverse immigrants are owners. Both kinds of immigrant diversity, but especially within-immigrant, are strongly positively associated with basic and applied R&D.

With respect to innovation outcomes, immigrant diversity of both types is positively associated with owning patents, copyrights, and trademarks. The rate of patenting is much higher in firms with diverse within-immigrant ownership, for some variables more than 10 times that for only native-owned firms. However, diverse teams' firms are not estimated to be more productive and may even be less so than homogeneous immigrant-owned firms. Given all the positive results of diversity for innovation activities, R&D, and patenting, it seems inconsistent that productivity outcomes would not be higher. Thus, while the results for most innovation variables provide support for an important role for diversity, the productivity results are at best ambiguous on this question.

5 Conclusion

Overall, the review and extension of empirical evidence in this paper leads to the conclusion that immigrants are indeed more innovative, viewed from most perspectives. Among the interesting questions suggested for future research is the source of the immigrant advantage. We can distinguish three types of explanations based on differences in constraints, preferences, and skills. Kim (2018) has argued that immigrants become entrepreneurs because of greater difficulties finding jobs as wage-and-salary employees. Or perhaps immigrants have stronger preferences to "be their own boss" or a higher tolerance for risk. These explanations could account for higher self-employment rates, but have difficulty explaining the much higher productivity and innovation at immigrant-owned firms. Moreover, higher risk tolerance would seem to imply greater dispersion in outcomes resulting from riskier behavior, but we find no evidence of higher dispersion, either in the residuals from earnings regressions or in employment (whether CPS or firm-level data), productivity, or patents. Instead, we find immigrant and native entrepreneurs have similarly shaped distributions for all these outcome variables.

Thus, the more likely explanation for the mean differences in innovation seems to be related to skills. The regressions we have presented (specifications from "base") control for observables including education, former business ownership, and military experience. The relevant skills may be unobserved, but an interesting question is whether they reflect self-selection of immigrants with higher innovation skills than the general population or, alternatively, that there is a causal effect of immigration that increases innovativeness. The former could happen because immigration is itself an innovative act, involving risk-taking in hopes of improvement. The latter could occur if immigrants can more easily spy market opportunities, gaps that could be filled, as a result of their experience of different cultures and institutions. Yet another possibility is that the ability distribution of immigrants has a fatter right tail than for natives, and that entrepreneurs are drawn from that right tail, leading to more immigrants with higher skills entering entrepreneurship (Åstebro, Chen and Thompson (2011); Kahn, La Mattina and J MacGarvie (2017)), although our finding of similar dispersion in outcomes for immigrant and native entrepreneurs is inconsistent with that hypothesis. The results in this paper raise these all intriguing questions for future research.

Our conclusion that immigrants are more likely to carry out innovation activities, patenting, and raising productivity more than natives, suggests that along these dimensions immigrants may have positive externalities for U.S. economic growth. Of course, there may be displacement as well, and Fairlie and Meyer (2003) report evidence of crowding out of

native self-employed, although they also find positive effects on native self-employed earnings. As in the debate over the impact of immigration on native worker wages, the extent of displacement depends on the similarity of immigrant and native skills, and the degree of substitution versus complementary between them. Our findings concerning productivity and innovation suggest that immigrant skills are at least somewhat different, and that immigrant entrepreneurs make large contributions to the growth of the U.S. economy.

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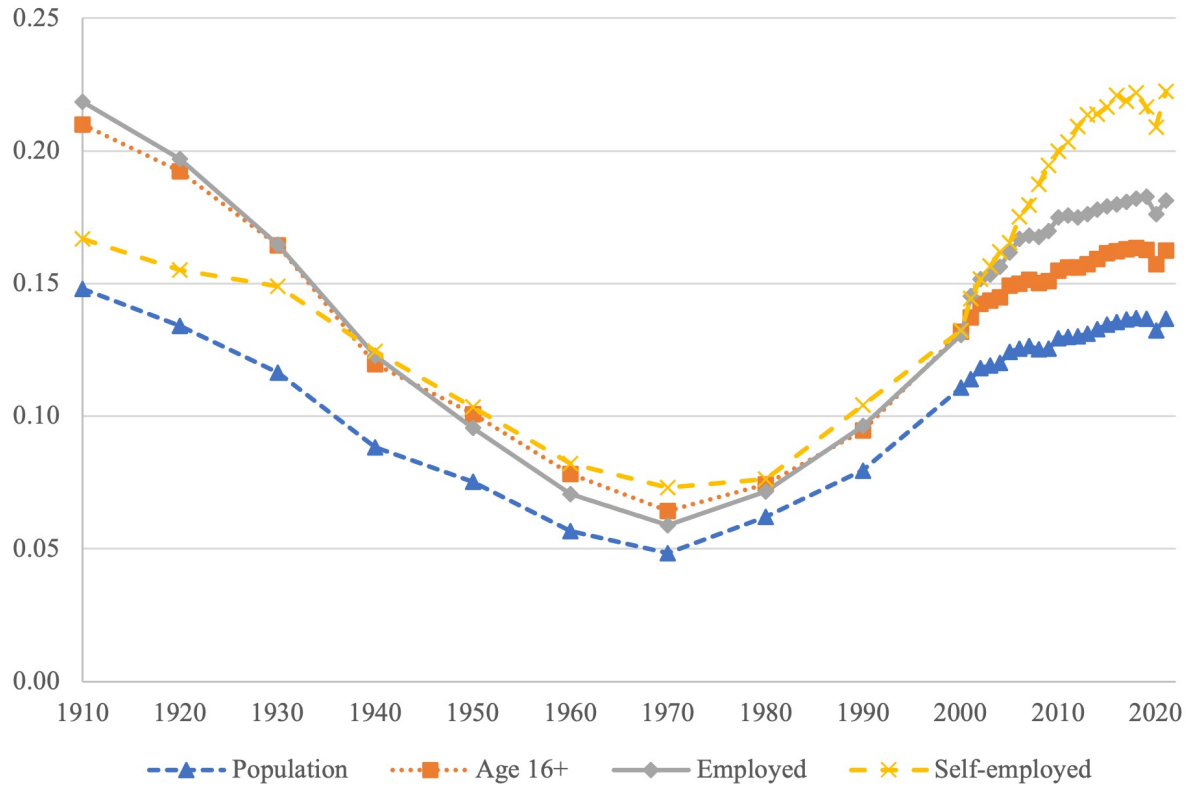
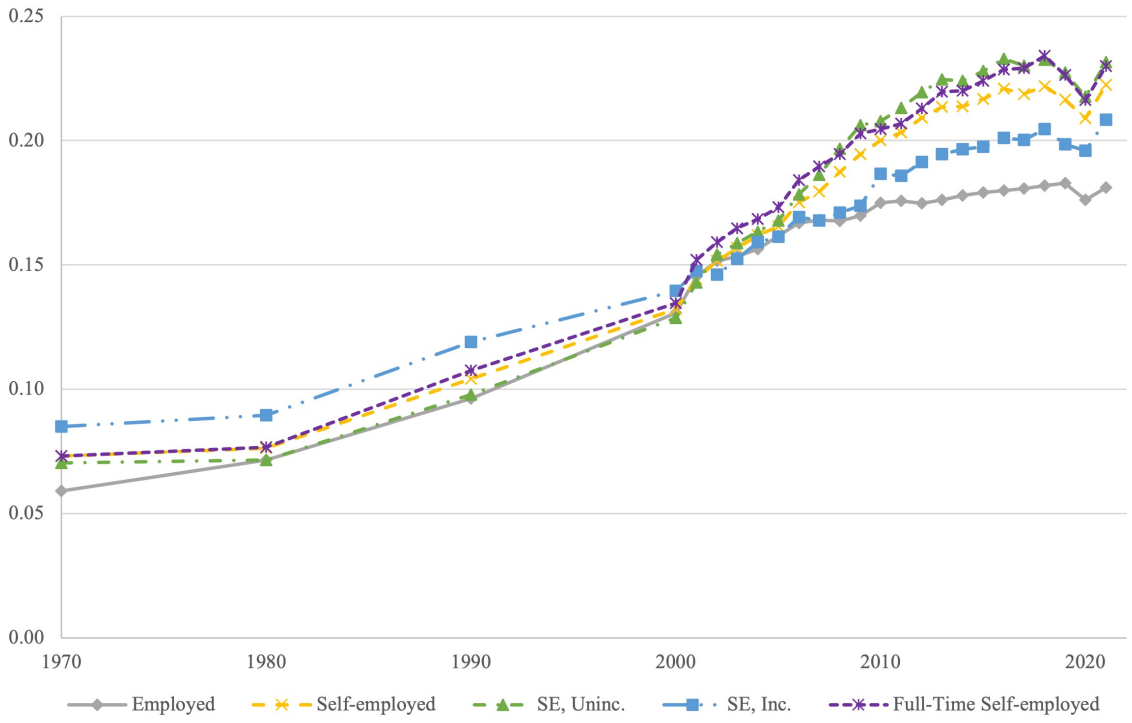
A Figures and Tables

Figure 1: Share of Immigrants by Population Sub-Group, 1910-2021



Note: Data sources: Decennial Census 1910-2000 and American Community Survey 2001-2021. Estimates are weighted by final person weights provided by the Census. Consistent with the ASE, immigrants are defined as foreign-born with naturalized citizenship or non-citizenship, while those who were born in the U.S., born in U.S. outlying areas, or born abroad of American parents are defined as natives. The exceptions are 1910 and 1960, when the Decennial Census do not have complete citizenship information, and we use birthplace (foreign-born) in place of immigrant. The true immigrant shares for 1910 and 1960 could be slightly larger because of the small group of those born abroad with American parents who cannot be distinguished from immigrants without citizenship at birth.

Figure 2: Share of Immigrants by Employment and Type of Self-Employment, 1970-2021



Note: Data sources include Decennial Census 1970-2000 and American Community Survey 2001-2021. Estimates are weighted by final person weights provided by the Census. Foreign-born persons with naturalized citizenship or non-citizenship are defined as immigrants, while those who were born in the U.S., born in the U.S. outlying areas, or born abroad of American parents as natives.

Table 1a: Definitions and Sources of Innovation Measures

Variable	**Description**	**Source**
Innovation count	Number of innovation activities (product or process)	ASE
Any innovation	Conducted any innovation activity (among the product/process activities listed below)	ASE
Product innovation activities		
Any product innovation	Made any product innovation (among those listed below)	ASE
Completely new product	Sold a new good or service that no other business has ever offered before	ASE
New product for firm	Sold a new good or service that this business has never offered before	ASE
Improved performance	Improved a good or service's performance by making changes in materials, equipment, software or other components	ASE
New use	Developed a new use for a good or service	ASE
New feature	Added a new feature to a good or service	ASE
Easy to use	Made it easier for customers to use a good or service	ASE
Process innovation activities		
Any process innovation	Made any process innovation (among those listed below)	ASE
New support activity	Applied a new way of purchasing, accounting, computing, maintenance, inventory control, or other support activity	ASE
Distribution improvement	Reduced costs by changing the way a good or service was distributed	ASE
Upgraded technique	Upgraded a technique, equipment, or software to significantly improve a good or service	ASE
Process improvement	Made a significant improvement in a technique or process by increasing automation, decreasing energy consumption, or using better software	ASE
Decreased production cost	Decreased production costs by improving the materials, software, or other components	ASE
Delivery improvement	Changed a delivery method to be faster or more reliable	ASE
R&D Activities		
Basic R&D	Produced findings that could be published in academic journals or presented at scientific conferences, created new scientific research or technical solutions that can be generalized to other situations, conducted work to discover previously unknown scientific facts, structures, or relationships, or conducted work to extend the understanding of scientific facts, relationships or principles in a way that could be useful to others	ASE
Applied R&D	Conducted work that might lead to a patent, developed and tested prototypes that were derived from scientific research or technical findings, or applied scientific or technical knowledge in a way that has never been done before	ASE

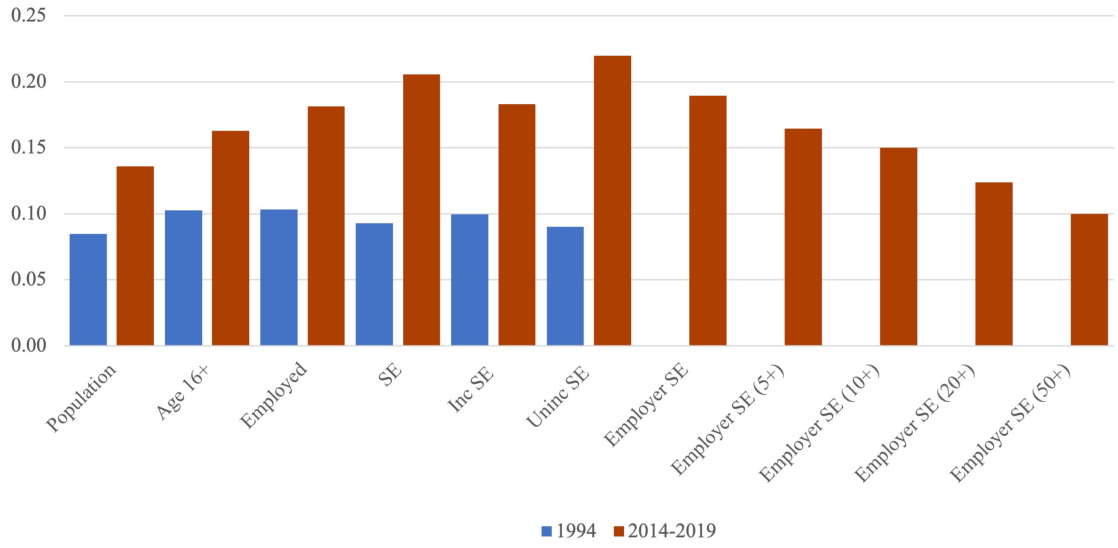
Note: All innovation and R&D activities are measured for the period 2012-2014. ASE = 2014 Annual Survey of Entrepreneurs.

Table 1b: Definitions and Sources of Intellectual Property, Employment, and Productivity Measures

Variable	**Description**	**Source**
Intellectual Property		
Copyright or trademark	Owned copyright or trademark in 2014	ASE
Patent pending	Applied a patent(pending) in 2014	ASE
Patent owned	Owned a patent(granted) in 2014	ASE
Patent>0 2012-14	Received at least 1 patent from 2012 to 2014	CBPCD
Patent>2 2012-14	Received at least 3 patents from 2012 to 2014	CBPCD
Patent>0 2015-17	Received at least 1 patent from 2015 to 2017	CBPCD
Patent>2 2015-17	Received at least 3 patents from 2015 to 2017	CBPCD
Employment & Productivity in 2014		
Log employment	Log (employees)	BR
Log productivity	Log (revenue/employees) - 4-digit industry mean	BR
Employment top 5%	Above 95th percentile of employment	BR
Productivity top 5%	Above 95th percentile of productivity	BR

Note: Intellectual property variables from the ASE are measured for the period 2012-2014. ASE = 2014 Annual Survey of Entrepreneurs; BR = Business Register; CBPCD = Census Bureau Patent Crosswalk Data.

Figure 3: Share of Immigrants in Population, Self-Employment, and Employer Size Groups



Note: Data sources are Current Population Survey (CPS) Monthly for 1994 and CPS Monthly Outgoing Rotation Groups (ORGs) for 2014-2019. The table reports the share of foreign born for each sample. The numbers are weighted by CPS final person weights. SE = Self-employed; Inc SE = Incorporated self-employed; Uninc SE = Unincorporated self-employed. Foreign-born persons with naturalized citizenship or non-citizenship are defined as immigrants, while those who were born in the U.S., born in the U.S. outlying areas, or born abroad of American parents as natives.

Table 2: Descriptive Statistics: Firm and Owner Characteristics by Ownership Type

Variables	Any Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Native
Firm Age (years)					
0-2	22.2	22.7	19.5	26.9	14.7
3-5	21.1	21.7	18.0	18.5	14.5
6-10	24.2	24.7	22.0	22.7	20.7
11-15	31.0	29.5	37.8	30.1	47.0
16+	1.6	1.3	2.7	1.7	3.2
Number of Owners					
1	55.3	67.4	0.0	0.0	59.2
2-4	39.8	29.0	88.6	84.0	36.9
2	32.3	25.2	64.8	57.7	30.6
3	4.8	2.6	15.0	16.1	4.4
4	2.6	1.2	8.8	10.2	1.8
5+	4.2	2.8	10.7	14.9	3.5
Gender					
Any female	44.2	39.0	67.9	62.8	40.7
Only male	55.8	61.0	32.1	37.2	59.3
Only female	17.8	20.9	3.9	3.8	16.6
Mixed gender - unrelated	5.8	3.7	15.4	24.1	3.7
Mixed gender - family	20.6	14.5	48.6	35.0	20.4
Owner Age					
<25	0.4	0.3	0.6	0.2	0.3
25-34	6.3	6.2	6.8	5.8	5.2
35-44	23.9	24.5	21.0	25.3	15.9
45-54	32.4	33.1	29.4	34.8	28.5
55-64	25.0	24.8	26.2	22.4	31.5
65+	12.0	11.1	15.9	11.4	18.6
Education					
Less than high school	8.7	9.6	4.8	4.7	2.4
High school	18.9	19.7	15.1	15.3	18.8
Some college	22.1	21.7	23.9	22.5	27.5
Bachelor's degree	24.5	23.2	30.6	24.1	28.1
Graduate	25.8	25.8	25.7	33.3	23.2
Experience					
Prior business	36.0	35.4	38.9	44.4	31.6
Veteran	2.4	1.5	6.5	2.7	11.3
Observations in ASE Sample	31,000	24,600	6,400	750	168,000
Weighted observations	1,021,000	837,000	184,000	23,000	4,320,000

Note: Data are firm-level, from the 2014 Annual Survey of Entrepreneurs (ASE). The table reports the percentages for each variable by ownership type: (1) any immigrant owner (Any Immigrant), (2) only immigrant owners (Only Immigrant), (3) mixed immigrant and native owners (Diverse Native-Immigrant), (4) with differences in ethnicity or race among immigrant owners (Diverse Within-Immigrant), and (5) only native owners (Only Native). The numbers are weighted by the ASE regression sampling weights and may not sum to 100% because of rounding or "don't know" responses. These results are approved for dissemination by the DRB (CBDRB-FY2020-CES005-034; CBDRB-FY23-CES019-010).

Table 3: Descriptive Statistics: Firm Characteristics by Ownership Type

Variables	Any Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Native
Start-up Finance Amount					
No capital needed	5.1	5.1	5.1	4.3	9.2
<5k	11.4	11.6	10.5	9.5	16.1
5k-10k	8.1	8.4	6.5	5.8	8.6
10k-25k	12.7	13.2	10.5	8.7	12.1
25k-50k	10.9	11.3	9.2	11.4	9.3
50k-100k	12.8	12.9	12.6	12.9	9.9
100k-250k	13.4	13.3	13.7	15.2	9.6
250k-1m	8.5	7.9	11.2	11.0	6.4
1m-3m	1.8	1.5	3.3	3.1	1.4
3m more	0.7	0.6	1.3	1.6	0.5
Start-up Finance Source(s)					
Savings	75.4	75.6	74.7	75.8	67.3
Assets	10.4	10.0	12.1	12.2	10.0
Home equity	8.2	7.9	9.1	12.0	7.2
Personal credit card(s)	11.5	11.5	11.6	13.6	10.5
Business credit card(s)	5.1	4.9	6.0	6.9	5.6
SBA loan	1.7	1.5	2.7	1.7	2.0
Bank loan	14.2	13.7	16.3	15.4	18.7
Government loan	0.4	0.4	0.5	D	0.4
Family loan	4.8	4.7	4.9	4.6	5.1
Outside investor	0.6	0.4	1.4	2.0	0.5
Grants	0.3	0.2	0.6	D	0.2
Other source	3.7	3.4	4.7	3.2	3.3
Industry					
Primary sector	0.3	0.2	0.6	0.0	1.1
Construction	6.8	6.6	7.5	5.0	13.5
Manufacturing	3.5	3.0	6.2	5.6	4.7
Wholesale trade	6.8	6.7	6.9	7.5	5.2
Retail trade	15.6	16.5	11.5	11.8	10.8
Transportation	3.2	3.3	2.6	3.6	3.0
Information and finance	2.9	2.6	4.3	4.6	6.1
Real estate	3.6	3.2	4.9	5.1	5.1
Professional	12.3	11.7	15.0	15.3	16.7
Administrative and support	4.6	4.5	5.1	3.1	6.5
Education	1.1	1.0	1.6	D	1.1
Health	13.5	13.9	11.2	16.6	10.9
Art and entertainment	0.8	0.7	1.3	D	1.9
Accommodation and food	16.9	17.3	14.9	14.4	6.2
Other services	8.2	8.7	6.2	6.1	6.6
High-tech sector	6.4	6.0	7.8	13.0	4.9
Observations in ASE Sample	31,000	24,600	6,400	750	168,000
Weighted observations	1,021,000	837,000	184,000	23,000	4,320,000

Note: Data are firm-level, from the 2014 Annual Survey of Entrepreneurs (ASE). The table reports the percentages of firms for each variable by ownership type: (1) any immigrant owner (Any Immigrant), (2) only immigrant owners (Only Immigrant), (3) mixed immigrant and native owners (Diverse Native-Immigrant), (4) with differences in ethnicity or race among immigrant owners (Diverse Within-Immigrant), and (5) only native owners (Only Native). The numbers are weighted by the ASE regression sampling weights and may not sum to 100% because of rounding or "don't know" responses. These results are approved for dissemination by the DRB (CBDRB-FY2020-CES005-034; CBDRB-FY23-CES019-010). The cells with "D" indicate the numbers cannot be disclosed due to the limited number of observations by the DRB.

Table 4a: Innovation Measures by Ownership Type

Variables	Any Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Native
Innovation count	2.5	2.5	2.8	3.2	2.1
Any innovation	56.4	55.5	60.5	64.7	52.7
Product Innovation					
Any product innovation	44.5	44.0	47.2	51.5	39.7
Completely new product	7.2	6.8	8.7	10.3	4.7
New product for firm	14.5	13.4	19.3	18.8	15.4
Improved performance	29.7	28.9	33.3	34.5	26.2
New use	14.7	14.8	14.3	18.3	7.9
New feature	23.1	22.4	26.0	30.6	18.6
Easy to use	31.6	31.6	31.7	37.5	25.4
Process Innovation					
Any process innovation	46.3	45.4	50.7	54.7	43.2
New support activity	22.4	21.6	26.0	28.5	19.5
Distribution improvement	21.4	21.1	22.6	25.3	14.7
Upgraded technique	34.6	33.4	39.7	45.1	33.7
Process improvement	21.2	20.2	25.5	28.1	19.7
Decreased production cost	16.1	15.7	17.9	22.8	12.9
Delivery improvement	15.7	15.4	16.7	22.3	12.1
R&D Activities					
Basic R&D	5.6	5.0	8.4	12.1	3.8
Applied R&D	5.4	4.9	7.4	10.0	3.7
Observations in ASE Sample	31,000	24,600	6,400	750	168,000
Weighted observations	1,021,000	837,000	184,000	23,000	4,320,000

Note: Data are firm-level, from the 2014 Annual Survey of Entrepreneurs (ASE). The table reports the percentages of firms for dummy variables and means for continuous variables by ownership type: (1) any immigrant owner (Any Immigrant), (2) only immigrant owners (Only Immigrant), (3) mixed immigrant and native owners (Diverse Native-Immigrant), (4) with differences in ethnicity or race among immigrant owners (Diverse Within-Immigrant), and (5) only native owners (Only Native). All variables are dummy variables except for innovation count. The numbers are weighted by the ASE regression sampling weights and may not sum to 100% because of rounding or "don't know" responses. These results are approved for dissemination by the DRB (CBDRB-FY2020-CES005-034; CBDRB-FY23-CES019-010).

Table 4b: Intellectual Property, Employment, and Productivity by Ownership Type

Variables	Any Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Native
Intellectual Property					
Copyright or trademark	8.3	7.0	14.3	13.3	8.0
Patent pending	1.1	0.8	2.5	4.9	0.7
Patent owned	1.4	1.0	2.9	4.4	1.1
Patent >0 2012-14	0.5	0.4	0.9	2.2	0.3
Patent >2 2012-14	0.2	0.1	0.3	1.1	0.1
Patent >0 2015-17	0.5	0.4	1.2	2.8	0.3
Patent >2 2015-17	0.2	0.1	0.3	D	0.1
Observations in ASE Sample	31,000	24,600	6,400	750	168,000
Weighted observations	1,021,000	837,000	184,000	23,000	4,320,000
Employment & Productivity					
Log employment	1.3	1.2	1.7	1.7	1.4
Log productivity	0.1	0.1	0.1	0.1	0.0
Employment top 5%	3.5	2.6	7.9	7.7	5.5
Productivity top 5%	6.9	7.0	6.6	6.8	4.6
Observations in ASE+LBD Sample	20,000	15,400	4,600	500	116,000
Weighted observations	1,006,000	813,000	193,000	16,500	4,331,000

Note: Data are firm-level, from the 2014 Annual Survey of Entrepreneurs (ASE), in the bottom panel linked to Business Registers (BR) and Census Bureau Patent Crosswalk Data (CBPCD). The table reports the percentages of firms for dummy variables and means for continuous variables by ownership type: (1) any immigrant owner (Any Immigrant), (2) only immigrant owners (Only Immigrant), (3) mixed immigrant and native owners (Diverse Native-Immigrant), (4) with differences in ethnicity or race among immigrant owners (Diverse Within-Immigrant), and (5) only native owners (Only Native). All variables are dummy variables except for employment, and productivity. The numbers are weighted by the ASE sampling weights and may not sum to 100% because of rounding or "don't know" responses. These results are approved for dissemination by the DRB (CBDRB-FY2020-CES005-034; CBDRB-FY23-CES019-010). The cell with "D" indicates the number cannot be disclosed due to the limited number of observations by the DRB.

Table 5a: Impact of Any Immigrant Owner on Innovation Activities

Dependent Variables	(1) Native Mean	(2) Base	(3) + Finance	(4) + Industry
Innovation count	2.1	0.372	0.290	0.224
		(0.022)	(0.022)	(0.023)
Any innovation	52.7	3.414	1.806	1.304
		(0.356)	(0.354)	(0.363)
Product Innovation				
Any product innovation	39.7	4.297	2.929	1.629
		(0.356)	(0.356)	(0.364)
Completely new product	4.7	2.127	1.989	1.350
		(0.180)	(0.181)	(0.186)
New product for firm	15.4	-1.591	-2.283	-3.787
		(0.254)	(0.256)	(0.263)
Improved performance	26.2	3.274	2.298	1.693
		(0.326)	(0.327)	(0.335)
New use	7.9	6.296	5.987	5.258
		(0.246)	(0.246)	(0.252)
New feature	18.6	3.905	3.142	1.847
		(0.299)	(0.299)	(0.307)
Easy to use	25.4	5.713	4.747	3.700
		(0.331)	(0.331)	(0.341)
Process Innovation				
Any process innovation	43.2	2.934	1.441	1.469
		(0.357)	(0.356)	(0.366)
New support activity	19.5	2.186	1.321	0.764
		(0.298)	(0.298)	(0.310)
Distribution improvement	14.7	6.214	5.499	4.766
		(0.290)	(0.290)	(0.299)
Upgraded technique	33.7	0.908	-0.317	0.022
		(0.339)	(0.339)	(0.349)
Process improvement	19.7	1.684	1.001	1.069
		(0.291)	(0.292)	(0.302)
Decreased production cost	12.9	3.127	2.608	2.669
		(0.261)	(0.262)	(0.269)
Delivery improvement	12.1	3.381	2.960	3.065
		(0.259)	(0.260)	(0.268)
R&D Activities				
Basic R&D	3.8	1.656	1.609	1.236
		(0.161)	(0.162)	(0.164)
Applied R&D	3.7	1.435	1.411	1.098
		(0.158)	(0.159)	(0.163)

Note: The first column reports unconditional means (percentages for dummy variables and the mean for the continuous variable Innovation count) of firms with only native owners (Native Mean). In the other columns, each cell of the table reports the coefficient (robust standard error in parentheses) from a separate linear regression of the innovation activity on Any Immigrant owner. Coefficients and standard errors are multiplied by 100 for ease of reading. The "base" specification includes firm age, demographic characteristics (gender, age, and race/ethnicity), ownership team characteristics (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Results are weighted by the ASE regression sampling weights. Observations = 199,000 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table 5b: Impact of Any Immigrant Owner on Intellectual Property, Employment, and Productivity

Dependent Variables	(1) Native Mean	(2) Base	(3) + Finance	(4) + Industry
Intellectual Property				
Copyright or trademark	8.0	0.346	0.148	-0.584
		(0.197)	(0.198)	(0.202)
Patent pending	1.1	0.302	0.278	0.190
		(0.071)	(0.071)	(0.073)
Patent owned	0.7	0.380	0.357	0.233
		(0.081)	(0.082)	(0.083)
Patent>0 2012-14	0.3	0.182	0.179	0.141
		(0.046)	(0.047)	(0.048)
Patent>2 2012-14	0.1	0.080	0.080	0.060
		(0.026)	(0.026)	(0.026)
Patent>0 2015-17	0.3	0.211	0.209	0.180
		(0.050)	(0.050)	(0.051)
Patent>2 2015-17	0.1	0.089	0.090	0.080
		(0.029)	(0.029)	(0.030)
Employment & Productivity				
Log employment	1.4	-0.067	-0.110	-0.141
		(0.009)	(0.009)	(0.009)
Log productivity	0.0	0.103	0.094	0.107
		(0.009)	(0.009)	(0.009)
Employment top 5%	5.5	-1.102	-1.213	-1.317
		(0.155)	(0.155)	(0.162)
Productivity top 5%	4.6	1.858	1.800	1.908
		(0.223)	(0.224)	(0.231)

Note: The first column reports unconditional means (percentages for dummy variables and the mean for the continuous variables) of only native owners (Native Mean). In the other columns, each cell of the table reports the coefficient (robust standard error in parentheses) from a separate linear regression of the innovation activity on Any Immigrant owner. Coefficients and standard errors are multiplied by 100 for ease of reading. The "base" specification includes firm age, demographic characteristics (gender, age, and race/ethnicity), ownership team characteristics (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Results are weighted by the ASE regression sampling weights. Observations = 199,000 firms for Intellectual Property regression and 135,000 firms for Employment and Productivity regression. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table 6: Impact of Immigrant Status on Probabilities of Self-Employment, Employer, and Employer Size Groups

Dependent Variables	(1) Native Mean	(2) No Controls	(3) + Controls	(4) + Industry
Sample: Employed				
Self-employed	10.8	1.649	0.576	-0.637
		(0.052)	(0.054)	(0.052)
Self-employed Incorporated	4.3	0.000	-0.359	-0.751
		(0.032)	(0.034)	(0.034)
Sample: Self-employed				
Employer Self-employed	24.3	-2.355	-2.059	-3.812
		(0.377)	(0.393)	(0.383)
5+ employees	10.6	-2.546	-2.255	-3.507
		(0.251)	(0.266)	(0.263)
10+ employees	6.0	-1.926	-1.728	-2.561
		(0.185)	(0.197)	(0.198)
20+ employees	2.9	-1.320	-1.222	-1.627
		(0.119)	(0.127)	(0.132)
50+ employees	0.9	-0.534	-0.454	-0.587
		(0.062)	(0.065)	(0.069)

Note: Data from the Current Population Survey (CPS) Outgoing Rotation Groups (ORGs) from 2014 to 2019. For the self-employed regressions, the sample is all employed; for the employer regressions, the sample is restricted to all self-employed. The first column reports the unconditional mean for native owners, and each cell of the other columns (2-4) reports the coefficient (robust standard error) on immigrant status from a separate regression, all expressed in percentage terms. Coefficients and standard errors are multiplied by 100 for ease of reading. The "No Controls" specification includes no control variables. The second ("+ Controls") specification includes individual demographic (female, age, and married), and human capital variables (education and veteran). The third ("+ Industry") specification includes 2-digit industry dummies. Results are weighted by the CPS individual weights. For self-employed regressions, observations = 3,611,965 for the "No Controls" specifications and 3,594,601 for the rest. For employer regressions, observations = 105,086 for the "No Controls" specifications and 104,976 for the rest.

Table 7a: Impact of Any Immigrant Owner on Innovation Activities by High & Low-Tech Sector

	High-Tech		Low-Tech	
Dependent Variables	Native Mean	Base	Native Mean	Base
Completely new product	11.2	0.701	4.3	2.055
		(1.023)		(0.180)
New product for firm	22.9	-1.279	15.0	-1.735
		(1.296)		(0.258)
Other product innovation	52.0	3.558	35.9	4.857
		(1.515)		(0.363)
Process innovation	57.7	2.152	42.5	2.875
		(1.501)		(0.367)
Basic R&D	17.7	2.973	3.1	1.198
		(1.246)		(0.149)
Applied R&D	14.9	2.773	3.1	1.029
		(1.190)		(0.148)

Note: The first and the third columns report unconditional mean (in percentage) of only native owners (Only Native). For the rest of columns, each cell reports the coefficient (with its standard error in parentheses) from a separate LPM regression of the Innovation activity dependent variables on Any Immigrant owner in high-tech and low-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations for high-tech and low-tech samples are 8,900 and 190,000 firms, respectively. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table 7b: Impact of Any Immigrant Owner by High & Low-Tech Sector: Intellectual Property, Employment and Productivity

	High-Tech		Low-Tech	
Dependent Variables	Native Mean	Base	Native Mean	Base
Intellectual Property				
Copyright or trademark	19.7	-2.560	7.4	0.319
		(1.159)		(0.196)
Patent pending	3.5	1.495	0.6	0.116
		(0.676)		(0.061)
Patent owned	4.2	1.017	0.9	0.246
		(0.659)		(0.075)
Patent>0 2012-14	1.6	1.160	0.2	0.085
		(0.450)		(0.039)
Patent>2 2012-14	0.5	0.832	0.1	0.019
		(0.305)		(0.019)
Patent>0 2015-17	1.5	1.556	0.2	0.079
		(0.492)		(0.041)
Patent>2 2015-17	0.6	0.515	0.1	0.045
		(0.297)		(0.023)
Employment & Productivity				
Log employment	1.2	-0.004	1.4	-0.066
		(0.036)		(0.009)
Log productivity	0.0	0.079	0.0	0.105
		(0.037)		(0.009)
Employment top 5%	5.1	0.716	5.5	-1.232
		(0.689)		(0.159)
Productivity top 5%	3.6	3.089	4.6	1.773
		(0.889)		(0.231)

Note: The first and the third columns report unconditional mean (percentages for dummy variables and means for continuous variables) of only native owners (Only Native). For the rest of columns, each cell reports the coefficient (with its standard error in parentheses) from a separate LPM regression of the Intellectual Property, Employment and Productivity dependent variables on Any Immigrant owner in high-tech and low-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). Coefficients and standard errors are multiplied by 100 for ease of reading. Results are weighted by the ASE regression sampling weights. Observations for high-tech and low-tech samples are 8,900 and 190,000 firms respectively for Intellectual Property regression, and 6,700 and 129,000 firms for Employment and Productivity sample. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table 8a: Immigrant-Native Diversity and Innovation Activities

Dependent Variables	Native Mean	Base		
		Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant
Innovation count	2.1	0.363	0.363	0.351
		(0.025)	(0.051)	(0.151)
Any innovation	52.7	3.412	2.912	3.368
		(0.393)	(0.753)	(2.079)
Product Innovation				
Any product innovation	39.7	4.451	3.170	2.912
		(0.393)	(0.766)	(2.171)
Completely new product	4.7	1.966	2.593	1.766
		(0.197)	(0.432)	(1.364)
New product for firm	15.4	-2.133	0.599	1.397
		(0.274)	(0.604)	(1.723)
Improved performance	26.2	3.027	4.112	1.720
		(0.359)	(0.721)	(2.075)
New use	7.9	6.600	4.675	2.068
		(0.275)	(0.534)	(1.711)
New feature	18.6	3.767	3.972	4.138
		(0.328)	(0.670)	(2.019)
Easy to use	25.4	6.245	2.961	2.654
		(0.366)	(0.714)	(2.118)
Process Innovation				
Any process innovation	43.2	2.848	2.811	3.379
		(0.393)	(0.768)	(2.157)
New support activity	19.5	2.018	2.547	2.368
		(0.325)	(0.673)	(1.968)
Distribution improvement	14.7	6.470	4.930	0.955
		(0.320)	(0.641)	(1.905)
Upgraded technique	33.7	0.378	2.412	6.503
		(0.372)	(0.748)	(2.165)
Process improvement	19.7	1.391	2.505	2.859
		(0.317)	(0.664)	(1.951)
Decrease production cost	12.9	3.194	2.267	3.860
		(0.286)	(0.585)	(1.861)
Delivery improvement	12.1	3.386	2.745	4.839
		(0.285)	(0.573)	(1.832)
R&D Activities				
Basic R&D	3.8	1.160	3.241	4.827
		(0.171)	(0.412)	(1.398)
Applied R&D	3.7	1.004	2.917	3.632
		(0.170)	(0.387)	(1.275)

Note: The first column reports unconditional mean (percentages for dummy variables and means for continuous variables) of only native owners (Only Native). For the rest of columns, each cell of the table reports the coefficient (with its standard error in parentheses) from a separate linear regression of the innovation activities dependent variable on Only, Diverse Native-, and Within-Immigrant owner. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 199,000 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004; CBDRB-FY23-CES019-010).

Table 8b: Immigrant-Native Diversity, Intellectual Property, Employment, and Productivity

Dependent Variables	Native Mean	Base		
		Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant
Intellectual Property				
Copyright or trademark	8.0	-0.433	3.486	1.683
		(0.205)	(0.527)	(1.432)
Patent pending	0.7	0.031	1.117	3.047
		(0.070)	(0.228)	(0.936)
Patent owned	1.1	0.146	1.116	2.153
		(0.080)	(0.245)	(0.891)
Patent>0 2012-14	0.3	0.125	0.253	1.371
		(0.048)	(0.131)	(0.643)
Patent>2 2012-14	0.1	0.042	0.139	0.837
		(0.028)	(0.076)	(0.423)
Patent>0 2015-17	0.3	0.084	0.540	1.825
		(0.051)	(0.153)	(0.712)
Patent>2 2015-17	0.1	0.061	0.097	D
		(0.033)	(0.074)	D
Employment & Productivity				
Log Employment	1.4	-0.091	0.009	0.017
		(0.010)	(0.020)	(0.051)
Log Productivity	0.0	0.109	0.081	-0.040
		(0.010)	(0.018)	(0.052)
Employment top 5%	5.5	-1.315	-0.484	-0.092
		(0.152)	(0.436)	(1.151)
Productivity top 5%	4.6	2.038	1.220	-1.014
		(0.250)	(0.474)	(1.304)

Note: The first column reports unconditional mean (percentages for dummy variables and means for continuous variables) of only native owners (Only Native). For the rest of columns, each cell of the table reports the coefficient (with its standard error in parentheses) from a separate linear regression of the innovation activities dependent variable on Only, Diverse Native-, and Diverse Within-Immigrant owner. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 199,000 firms for Intellectual Property and 135,000 firms for Employment and Productivity regression. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004; CBDRB-FY23-CES019-010). The cell with "D" indicates the number cannot be disclosed due to the limited number of observations by the DRB.

Appendix A

Table A.1: Impact of Any Immigrant Owner on Innovation Activities by High & Low-Tech Sector

	(1) High-Tech		(2) Low-Tech	
Dependent Variables	+ Finance	+ Industry	+ Finance	+ Industry
Completely new product	0.450	-0.722	1.903	1.472
	(1.018)	(1.026)	(0.181)	(0.187)
New product for firm	-1.544	-3.890	-2.505	-3.717
	(1.291)	(1.299)	(0.259)	(0.267)
Other product innovation	2.838	-0.800	3.405	3.024
	(1.502)	(1.495)	(0.363)	(0.374)
Process innovation	1.759	-0.262	1.184	1.670
	(1.486)	(1.490)	(0.367)	(0.378)
Basic R&D	2.604	1.019	1.116	1.182
	(1.233)	(1.204)	(0.150)	(0.155)
Applied R&D	2.476	1.978	0.978	0.950
	(1.184)	(1.155)	(0.149)	(0.156)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) from a separate LPM regression of the innovation activity dependent variable on Any Immigrant owner in high-tech and low-tech sector. All specifications include firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The first ("+ Finance") specification includes start-up capital and the second ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations for high-tech and low-tech samples are 8,900 and 190,000 firms, respectively. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table A.2: Impact of Any Immigrant Owner by High & Low-Tech Sector: Intellectual Property, Employment and Productivity

	(1) High-Tech		(2) Low-Tech	
Dependent Variables	+ Finance	+ Industry	+ Finance	+ Industry
Intellectual Property				
Copyright or trademark	-2.728	-4.309	0.082	-0.328
	(1.157)	(1.160)	(0.197)	(0.202)
Patent pending	1.334	1.070	0.090	0.095
	(0.663)	(0.650)	(0.061)	(0.064)
Patent owned	1.013	0.491	0.221	0.200
	(0.656)	(0.644)	(0.076)	(0.078)
Patent>0 2012-14	1.175	1.005	0.079	0.083
	(0.450)	(0.449)	(0.040)	(0.041)
Patent>2 2012-14	0.860	0.776	0.018	0.014
	(0.309)	(0.308)	(0.019)	(0.021)
Patent>0 2015-17	1.553	1.478	0.079	0.084
	(0.483)	(0.483)	(0.041)	(0.043)
Patent>2 2015-17	0.527	0.507	0.047	0.049
	(0.289)	(0.295)	(0.024)	(0.025)
Employment & Productivity				
Log employment	0.021	0.025	-0.115	-0.152
	(0.035)	(0.035)	(0.009)	(0.009)
Log productivity	0.082	0.085	0.094	0.108
	(0.037)	(0.037)	(0.009)	(0.009)
Employment top 5%	1.038	0.611	-1.372	-1.443
	(0.684)	(0.688)	(0.160)	(0.167)
Productivity top 5%	3.061	3.052	1.732	1.817
	(0.881)	(0.870)	(0.232)	(0.240)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) from a separate linear regression of the intellectual property, employment, and productivity dependent variable on Any Immigrant owner in high-tech and low-tech sector. All specifications include firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The first ("+ Finance") specification includes start-up capital and the second ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. Results are weighted by the ASE regression sampling weights. Observations for high-tech and low-tech samples are 8,900 and 190,000 firms respectively for Intellectual Property, and 6,700 and 129,000 for Employment and Productivity. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table A.3: Immigrant-Native Diversity and Innovation Activities

	(1) + Finance			(2) + Industry		
Dependent Variables	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant
Innovation count	0.274	0.308	0.370	0.214	0.227	0.312
	(0.025)	(0.051)	(0.150)	(0.025)	(0.049)	(0.147)
Any innovation	1.668	1.894	3.740	1.279	0.994	2.972
	(0.392)	(0.750)	(2.076)	(0.403)	(0.735)	(2.052)
Product Innovation						
Any product innovation	2.977	2.268	3.208	1.711	0.915	2.703
	(0.392)	(0.764)	(2.165)	(0.404)	(0.742)	(2.112)
Completely new product	1.822	2.485	1.778	1.205	1.783	1.295
	(0.197)	(0.431)	(1.362)	(0.204)	(0.421)	(1.337)
New product for firm	-2.881	0.145	1.563	-4.526	-0.914	1.642
	(0.275)	(0.605)	(1.708)	(0.285)	(0.578)	(1.686)
Improved performance	1.974	3.467	1.961	1.484	2.395	1.177
	(0.359)	(0.722)	(2.070)	(0.370)	(0.701)	(2.058)
New use	6.271	4.458	2.108	5.596	3.658	1.538
	(0.275)	(0.533)	(1.707)	(0.283)	(0.522)	(1.677)
New feature	2.951	3.442	4.279	1.685	2.041	3.930
	(0.328)	(0.668)	(2.010)	(0.339)	(0.651)	(1.981)
Easy to use	5.207	2.321	2.853	4.191	1.340	2.359
	(0.366)	(0.712)	(2.107)	(0.378)	(0.700)	(2.056)
Process Innovation						
Any process innovation	1.229	1.863	3.739	1.412	1.321	2.774
	(0.393)	(0.765)	(2.145)	(0.405)	(0.751)	(2.122)
New support activity	1.082	1.999	2.601	0.473	1.633	2.575
	(0.325)	(0.672)	(1.960)	(0.340)	(0.669)	(1.966)
Distribution improvement	5.701	4.457	1.110	4.946	3.883	1.187
	(0.320)	(0.640)	(1.899)	(0.331)	(0.635)	(1.897)
Upgraded technique	-0.953	1.639	6.812	-0.457	1.296	5.759
	(0.372)	(0.748)	(2.157)	(0.384)	(0.735)	(2.130)
Process improvement	0.663	2.028	3.016	0.846	1.690	1.870
	(0.318)	(0.664)	(1.947)	(0.330)	(0.652)	(1.930)
Decrease production cost	2.642	1.907	3.971	2.834	1.558	3.175
	(0.287)	(0.585)	(1.856)	(0.297)	(0.571)	(1.833)
Delivery improvement	2.935	2.457	4.918	3.113	2.315	4.654
	(0.286)	(0.574)	(1.821)	(0.296)	(0.565)	(1.809)
R&D Activities						
Basic R&D	1.117	3.177	4.804	0.898	2.291	2.907
	(0.173)	(0.412)	(1.398)	(0.176)	(0.382)	(1.233)
Applied R&D	0.982	2.876	3.611	0.823	2.041	1.726
	(0.171)	(0.387)	(1.273)	(0.177)	(0.365)	(1.181)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) from a separate linear regression of the innovation activities dependent variable on Only, Diverse Native-, and Diverse Within-Immigrant. The first ("+ Finance") specification adds start-up capital to the base specification, which includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience), and the second ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 199,000 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004; CBDRB-FY23-CES019-010).

Table A.4: Immigrant-Native Diversity, Intellectual Property, Employment, and Productivity

	(1) + Finance			(2) + Industry		
Dependent Variables	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant	Only Immigrant	Diverse Native-Immigrant	Diverse Within-Immigrant
Intellectual Property						
Copyright or trademark	-0.631	3.301	1.683	-1.300	2.161	1.390
	(0.205)	(0.527)	(1.426)	(0.212)	(0.503)	(1.359)
Patent pending	0.009	1.089	3.040	-0.028	0.815	2.350
	(0.069)	(0.228)	(0.937)	(0.072)	(0.217)	(0.866)
Patent owned	0.124	1.093	2.152	0.059	0.756	1.518
	(0.081)	(0.245)	(0.891)	(0.084)	(0.232)	(0.836)
Patent>0 2012-14	0.124	0.245	1.368	0.116	0.121	1.019
	(0.049)	(0.131)	(0.644)	(0.050)	(0.126)	(0.600)
Patent>2 2012-14	0.043	0.137	0.836	0.034	0.080	0.706
	(0.028)	(0.076)	(0.423)	(0.029)	(0.070)	(0.385)
Patent>0 2015-17	0.084	0.530	1.819	0.079	0.418	1.514
	(0.052)	(0.153)	(0.712)	(0.053)	(0.148)	(0.680)
Patent>2 2015-17	0.064	0.094	D	0.067	0.042	D
	(0.033)	(0.074)	D	(0.034)	(0.073)	D
Employment & Productivity						
Log employment	-0.14	-0.0054	0.0527	-0.1765	-0.0191	0.0463
	(0.009)	(0.019)	(0.049)	(0.010)	(0.018)	(0.052)
Log productivity	0.0977	0.0789	-0.0319	0.1141	0.0807	-0.0316
	(0.010)	(0.018)	(0.051)	(0.010)	(0.018)	(0.052)
Employment top 5%	-1.437	-0.5283	0.1886	-1.552	-0.5516	-0.182
	(0.153)	(0.434)	(1.148)	(0.162)	(0.417)	(1.177)
Productivity top 5%	1.968	1.214	-0.9421	2.141	1.126	-0.9821
	(0.250)	(0.473)	(1.302)	(0.260)	(0.471)	(1.294)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) from a separate linear regression of the intellectual property, employment, and productivity dependent variable on Only, Diverse Native-, and Diverse Within-Immigrant owner. The first ("+ Finance") specification adds start-up capital to the base specification, which includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience), and the second ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 199,000 firms for Intellectual Property and 135,000 for Employment and Productivity. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004; CBDRB-FY23-CES019-010). The cells with "D" indicate the numbers cannot be disclosed due to the limited number of observations by the DRB.

Table A.5: Low-Tech Immigrant-Native Diversity and Innovation Activities

Dependent Variables	(1) Base		(2) + Finance		(3) + Industry	
	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant
Completely new product	1.994	2.335	1.834	2.219	1.400	1.775
	(0.196)	(0.429)	(0.196)	(0.428)	(0.203)	(0.421)
New product for firm	-2.156	0.186	-2.983	-0.339	-4.328	-1.12
	(0.276)	(0.612)	(0.278)	(0.613)	(0.288)	(0.589)
Other product innovation	5.184	3.364	3.627	2.402	3.345	1.661
	(0.397)	(0.788)	(0.397)	(0.784)	(0.410)	(0.772)
Process innovation	2.971	2.434	1.150	1.337	1.778	1.207
	(0.402)	(0.797)	(0.401)	(0.794)	(0.415)	(0.784)
Basic R&D	0.977	2.204	0.893	2.125	1.031	1.823
	(0.158)	(0.371)	(0.160)	(0.371)	(0.166)	(0.361)
Applied R&D	0.834	1.915	0.780	1.875	0.813	1.531
	(0.160)	(0.350)	(0.160)	(0.350)	(0.168)	(0.343)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) for a separate LPM regression of the innovation activity and intellectual property dependent variable on Only and Diverse Immigrant owner in low-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 190,000 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table A.6: Low-Tech Immigrant-Native Diversity, Intellectual Property, Employment, and Productivity

Dependent Variables	(1) Base		(2) + Finance		(3) + Industry	
	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant
Intellectual Property						
Copyright or trademark	-0.299	3.138	-0.540	2.896	-0.891	2.065
	(0.204)	(0.524)	(0.204)	(0.523)	(0.211)	(0.503)
Patent pending	0.006	0.618	-0.020	0.588	-0.003	0.512
	(0.060)	(0.192)	(0.060)	(0.192)	(0.063)	(0.189)
Patent owned	0.144	0.707	0.120	0.675	0.115	0.561
	(0.076)	(0.216)	(0.077)	(0.216)	(0.080)	(0.211)
Patent>0 2012-14	0.092	0.052	0.087	0.041	0.099	0.013
	(0.041)	(0.103)	(0.042)	(0.103)	(0.044)	(0.102)
Patent>2 2012-14	0.024	-0.007	0.023	-0.010	0.022	-0.021
	(0.020)	(0.048)	(0.020)	(0.048)	(0.022)	(0.046)
Patent>0 2015-17	0.068	0.132	0.070	0.124	0.079	0.106
	(0.043)	(0.112)	(0.043)	(0.112)	(0.045)	(0.112)
Patent>2 2015-17	0.056	-0.009	0.059	-0.010	0.065	-0.020
	(0.025)	(0.053)	(0.026)	(0.052)	(0.028)	(0.053)
Employment & Productivity						
Log employment	-0.096	0.061	-0.150	0.035	-0.194	0.015
	(0.010)	(0.021)	(0.010)	(0.020)	(0.010)	(0.019)
Log productivity	0.108	0.093	0.096	0.088	0.112	0.090
	(0.010)	(0.018)	(0.010)	(0.018)	(0.010)	(0.018)
Employment top 5%	-1.533	0.045	-1.674	-0.102	-1.766	-0.179
	(0.155)	(0.456)	(0.156)	(0.452)	(0.166)	(0.433)
Productivity top 5%	1.904	1.216	1.858	1.200	2.013	1.050
	(0.255)	(0.492)	(0.256)	(0.492)	(0.267)	(0.489)

Note: Each cell of the table reports the coefficient (with its standard error in parentheses) for a separate LPM regression of the intellectual property dependent variable on Only and Diverse Immigrant owner in low-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations for intellectual property sample = 190,000 firms, and for employment and productivity sample = 129,000 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table A.7: High-Tech Immigrant-Native Diversity and Innovation Activities

Dependent Variables	(1) Base		(2) + Finance		(3) + Industry	
	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant
Completely new product	-0.124	3.495	-0.351	3.167	-1.429	1.613
	(1.111)	(2.140)	(1.100)	(2.129)	(1.124)	(2.074)
New product for firm	-2.938	4.348	-3.168	3.963	-5.759	2.281
	(1.418)	(2.579)	(1.410)	(2.577)	(1.442)	(2.476)
Other product innovation	3.349	4.265	2.608	3.618	-1.520	1.576
	(1.700)	(2.706)	(1.683)	(2.670)	(1.697)	(2.553)
Process innovation	0.646	7.255	0.205	7.032	-2.117	5.867
	(1.698)	(2.594)	(1.679)	(2.560)	(1.692)	(2.514)
Basic R&D	0.366	11.810	0.010	11.400	-1.141	8.151
	(1.362)	(2.523)	(1.346)	(2.502)	(1.330)	(2.329)
Applied R&D	0.410	10.790	0.116	10.480	0.229	7.755
	(1.303)	(2.460)	(1.291)	(2.452)	(1.274)	(2.309)

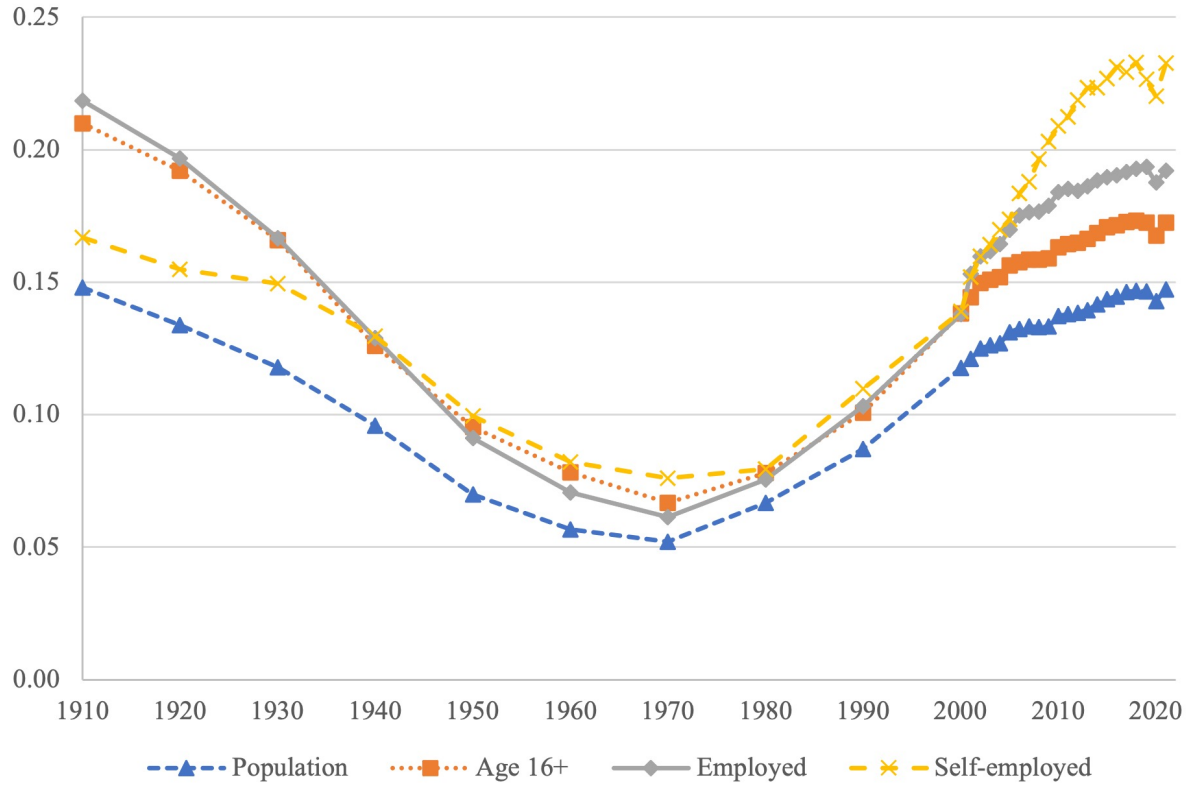
Note: Each cell of the table reports the coefficient (with its standard error in parentheses) for a separate LPM regression of the innovation activity dependent variable on Only and Diverse Immigrant owner in high-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations = 8,900 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Table A.8: High-Tech Immigrant-Native Diversity, Intellectual Property, Employment, and Productivity

Dependent Variables	(1) Base		(2) + Finance		(3) + Industry	
	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant	Only Immigrant	Diverse Immigrant
Intellectual Property						
Copyright or trademark	-5.373	6.980	-5.532	6.784	-7.297	5.560
	(1.212)	(2.565)	(1.207)	(2.566)	(1.228)	(2.492)
Patent pending	0.112	6.184	-0.041	6.000	-0.009	4.633
	(0.704)	(1.696)	(0.685)	(1.685)	(0.682)	(1.598)
Patent owned	-0.261	5.350	-0.266	5.354	-0.449	3.595
	(0.656)	(1.732)	(0.646)	(1.741)	(0.644)	(1.621)
Patent>0 2012-14	0.777	2.457	0.808	2.422	0.781	1.746
	(0.480)	(1.189)	(0.479)	(1.187)	(0.480)	(1.133)
Patent>2 2012-14	0.534	1.840	0.562	1.872	0.553	1.510
	(0.318)	(0.839)	(0.321)	(0.845)	(0.327)	(0.786)
Patent>0 2015-17	0.484	5.189	0.480	5.194	0.533	4.599
	(0.477)	(1.439)	(0.459)	(1.437)	(0.462)	(1.395)
Patent>2 2015-17	0.310	1.210	0.312	1.254	0.371	0.956
	(0.311)	(0.796)	(0.300)	(0.786)	(0.312)	(0.782)
Employment & Productivity						
Log employment	-0.026	0.065	0.001	0.083	0.012	0.064
	(0.040)	(0.070)	(0.039)	(0.068)	(0.039)	(0.067)
Log productivity	0.085	0.057	0.088	0.065	0.093	0.063
	(0.042)	(0.072)	(0.041)	(0.071)	(0.042)	(0.070)
Employment top 5%	0.472	1.474	0.805	1.765	0.347	1.410
	(0.693)	(1.606)	(0.689)	(1.603)	(0.695)	(1.598)
Productivity top 5%	3.339	2.316	3.328	2.231	3.289	2.336
	(1.017)	(1.663)	(1.008)	(1.646)	(1.008)	(1.628)

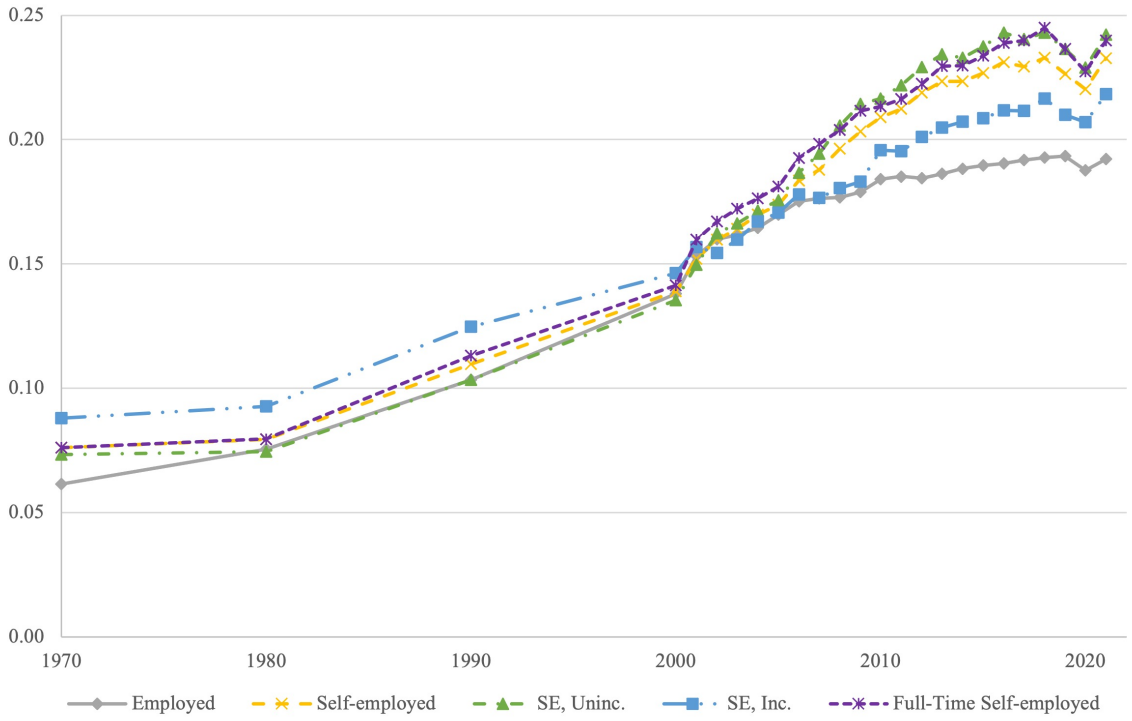
Note: Each cell of the table reports the coefficient (with its standard error in parentheses) for a separate LPM regression of the intellectual property dependent variable on Only and Diverse Immigrant owner in high-tech sector. The base specification includes firm age, demographic variables (gender, age, and race/ethnicity), ownership team variables (size and family relationships), and human capital (education, veteran, and prior business experience). The second ("+ Finance") specification adds start-up capital and the third ("+ Industry") additionally includes 4-digit industry. Coefficients and standard errors are multiplied by 100 for ease of reading. The numbers are weighted by the ASE regression sampling weights. Observations for intellectual property sample = 8,900 firms, and for employment and productivity sample = 6,700 firms. These results are approved for dissemination by the DRB (CBDRB-FY23-CES019-004).

Figure A.1: Share of Foreign Born by Population Sub-Group, 1910-2021



Note: Data sources: Decennial Census 1910-2000 and American Community Survey 2001-2021. Estimates are weighted by final person weights provided by the Census. Foreign born is defined as persons born outside the U.S. or U.S. outlying areas regardless of their citizenship status at birth.

Figure A.2: Share of Foreign Born by Employment and Type of Self-Employment, 1970-2021



Note: Data sources include Decennial Census 1970-2000 and American Community Survey 2001-2021. Estimates are weighted by final person weights provided by the Census. Foreign born is defined as persons born outside the U.S. or U.S. outlying areas regardless of their citizenship status at birth.