ETLA Working Papers | 63 1.2.2019

Immigrant Innovators and Firm Performance

Paolo Fornaro (corresponding author)
The Research Institute of the Finnish Economy
paolo.fornaro@etla.fi

Mika Maliranta
The Research Institute of the Finnish Economy
mika.maliranta@etla.fi

Petri Rouvinen
The Research Institute of the Finnish Economy
petri.rouvinen@etla.fi

Suggested citation:
Fornaro, Paolo, Maliranta, Mika & Rouvinen, Petri (1.2.2019). "Immigrant Innovators and Firm Performance".

ETLA Working Papers No 63.
http://pub.etla.fi/ETLA-Working-Papers-63.pdf

Abstract

We study immigrants' effects on firm-level innovativeness. Managers, innovators, and other employees are considered as separate groups both in firm employment and in local areas. For each, we estimate the effects of foreignness, the share of immigrants in each group, and diversity, while controlling for an extensive set of employment and other firm characteristics.

Pooled cross-section estimates suggest that a higher initial share of immigrant innovators is associated with a subsequently higher probability of a product innovation; the reverse holds for process innovation. In other words, product innovation benefits from a wider spectrum of innovator perspectives brought about by foreign influence, while process innovation suffers from it. The estimated effect for product innovation is modestly large but nevertheless indicates that a host of other covariates besides immigration are important for innovation. When measured by a fractionalization index, diversity among innovators does not promote product innovation. However, culturally the closest groups of migrants have a positive effect, when considered independently. Thus, in our interpretation, diversity does offer some benefits, provided that enough cultural homogeneity of the group is retained.

Tiivistelmä

Maahanmuuttajainnovaattorit ja yritysten menestyminen

Tutkimme maahanmuuttajien vaikutusta yritysten innovatiivisuuteen. Johtajia, innovaattoreita ja muita työntekijöitä käsitellään erillisinä ryhminä sekä yritys- että aluetasolla. Kunkin ryhmän osalta arvioimme maahanmuuttajaosuuden ja -monipuolisuuden vaikutuksia (muut innovatiivisuuteen mahdollisesti vaikuttavat seikat huomioiden).

Yhdistettyihin poikkileikkausaineistoihin perustuvat regressiokertoimet viittaavat siihen, että korkeampi maahanmuuttajaosuus tukee tuoteinnovaatioiden mutta haittaa prosessi-innovaatioiden syntymistä. Tuoteinnovaatioita koskevat kertoimet ovat melko suuria mutta viittaavat kuitenkin siihen, että monet muutkin tekijät ovat keskeisiä innovaatiotoiminnan kannalta. Fraktaatioindeksillä mitattaessa maahanmuuttajamonipuolisuus ei näytä tukevan tuoteinnovaatioiden syntyä. Toisaalta kuitenkin havaitsemme, että kulttuurinsa puolesta lähellä kantaväestöä olevilla maahanmuuttajaryhmillä on positiivinen vaikutus. Tulkintamme mukaan diversiteetillä voi olla positiivisia vaikutuksia, kunhan työntekijäryhmä pysyy riittävän yhtenäisenä.

Fornaro and Maliranta gratefully acknowledge the support of TT Foundation. Rouvinen’s work is conducted by SWiPE research consortium 303667, which is funded by Strategic Research Council at the Academy of Finland (http://www.smartworkresearch.fi/).

Fornaro ja Maliranta kiittävät Teollisuuden ja Työnantajain Keskusliiton säätiötä tuesta. Rouvisen työ tässä yhteydessä on osa SWiPE-konsortion tutkimusta 303667, jota rahoittaa Suomen Akatemian yhteydessä toimivia strategisen tutkimuksen neuvosto (http://www.smartworkresearch.fi/).

Key words: Immigration, Ethnicity, Diversity, Innovation, Knowledge production function, Finland

Asiasanat: Maahanmuutto, Etnisyys, Diversiteetti, Innovaatiotoiminta, Tietotuotantofunktio, Suomi

JEL: D22, F22, J61, O31

1. Introduction

Inflows of talented citizens and immigrants increase the human capital of an organization and a region. Firms may tab into these newly available pools of human capital both directly, by recruiting those individuals, and indirectly, through absorbing available knowledge externalities, e.g., through employees' social contacts. The indirect link has been studied extensively in prior literature, while the direct link has received less attention. In this paper, we study both direct and indirect effects of immigrant innovators on firm performance.

Potential performance impacts of hiring immigrants, as opposed to natives, stems from the fact that members of the two groups are intrinsically different and thus imperfect substitutes to each other (Lazear, 1999). A firm hiring an immigrant might be simply seeking an employee regardless of his/her immigrant status or it might additionally have an interest in capitalizing complementarities between immigrants and natives.

Ethnic and cultural heterogeneity has advantages and disadvantages for a firm's innovative activity (Horwitz & Horwitz, 2007; Jackson, Joshi, & Erhardt, 2003; Kochan et al., 2003). A more diverse team has a wider spectrum of perspectives and skills. In suitable circumstances, such a team can generate a more varying set of initial ideas and develop them in more imaginative ways (Berliant & Fujita, 2012; Hong & Page, 2004; Page, 2007; van Knippenberg & Schippers, 2007). Diversity may also expand the overall pool of external knowledge and resources – in the case of immigrants, through diasporas and co-ethnic groups – team members can mutually tab into (Kerr, 2008; Liu, Gao, Lu, & Wei, 2015; Moreira, Markus, & Laursen, 2018). Since innovation combines idea generation and development to commercialization, a more diverse group might also yield benefits in having insights to a larger number of target markets (Bresnahan & Gambardella, 2004; Hatzigeorgiou & Lodefalk, 2015; Kerr & Lincoln, 2010; Ottaviano, Peri, & Wright, 2018). On the other hand, a diverse team may be unable to build the same level of trust among its participants and it may face communication difficulties due to both language and culture (Alesina & La Ferrara, 2005; Ettlinger, 2003; Parrotta, Pozzoli, & Pytlikova, 2014). Social capital is often embodied in national, or even local, nuanced ways of conduct; introducing "foreign influence" might both erode social capital and diminish its importance. Diversity may lead to the birth of ethic sub-communities and induce incentives that are not aligned with the firm's overall objectives (Dahlin, Weingart, & Hinds, 2005; King et al., 2011). Immigrants may have higher labor market churning due to both difficulties in finding a suitable employer-employee match in the domestic labor market and a higher probability of migrating abroad either to one's home country or to another host country, which may reduce continuity and knowledge accumulation of a team.

Theoretically, the overall impact of migration on firm-level innovation performance is ambiguous. In empirical analysis, one is likely to observe the net effect of various forces. While the literature on the immigration–innovation link is somewhat scarce and at times conflicting, Nathan (2014, p. 13) concludes in his review that "… studies typically find small net positive effects of high skilled migrants on innovation and productivity, particularly through workforce diversity and in high-tech and/or export-intensive sectors…".

In the post war era, Finland has promoted immigration primarily for humanitarian reasons and many entering immigrants have been asylum seekers and refugees. Finland has not adopted major policy measures that would promote skill- or work-based immigration. The Finnish (public) higher-education system does attract some foreign students, but many of them leave the country upon graduation. Prevailing labor market policies and practices make it challenging for foreigners in the country to get a job and for local firms to hire individuals, who would like to enter the country upon receiving a job offer. Thus, Finland provides an interesting "contrarian" example to the UK and the US, which have positioned themselves better to benefit from skilled immigrants. Finland also differs form, e.g., the UK and the US when it comes to wage setting: union wages apply to all employees regardless of their union status; furthermore – even though immigrants could well be willing to work for less – both legislation and prevailing social norms inhibit employers to offer immigrants wages that would be drastically lower than those of comparable natives.

Looking at prime-age individuals (35–54 years), during the period going from 2010 to 2014 (the period of our analysis), in Finland is quite revealing. Out of the total prime-age population, around 6.5% are persons of foreign origin (the proportion is very similar when looking at both men and women). On average, among men, 23% of natives and 17% of immigrants have college-level education; 10% of natives and 31% of immigrants are either unemployed or outside the labor force. Among women, 29% of natives and 23% of immigrants have a college degree; 8.9% of natives and 35% of immigrants are not currently working. The lower share of immigrants with high-education reflects the institutional difficulty that Finland has had in attracting high-skilled migration. Looking at the employees covered in the Community Innovation Surveys considered in our analysis, around 3.5% of the total number of workers are of foreign origin.

We analyze the effect of firm-level foreignness, measured by the share of persons of foreign origins relative to the total number of employees, and diversity onto firm-level innovation. In particular, we control for possible local spillover effects, by including the municipal-level shares of immigrant workers. Importantly, we split the workforce in three main socio-economic groups: innovators, managers, and the rest of employees, in order to allow different types of immigrant workers to have differential effects on innovations. The analysis of the effects of foreignness on innovations at the micro level, while controlling for geographical spillovers, together with the possibility to test the impact of the presence of immigrants performing different types of jobs are key contributions to the existing literature.

We find that the degree of firm-level foreignness among innovators has a positive and statistically significant effect on the probability of a firm to make product innovations, even after controlling for local spillovers. On the other hand, higher geographical diversity among innovators has a negative effect on product innovation. A similar picture is gathered when looking at radical innovation, only now the key socio-economic group is the one covering managers. Overall, it seems that the presence of foreigners in a firm has a positive influence on innovative behavior, but a too fragmented workplace, in terms of cultural backgrounds, negatively affects innovation probability. While our focus is not on the effects at the city level (and we do not find statistical evidence for their presence), we do think it is important to address the direct firm-level and the indirect local effects in tandem.

The remainder of this work is structured as follows: in Section 2 we review the main studies concerning the effect of immigration and ethnic diversity on innovation in the host country, in Section 3 we describe the data used in the analysis and in Section 4 contains a brief description of the empirical methodology employed.

The results of the empirical analysis are reported in Section 5 and finally we discuss our results and draw few conclusions following our analysis, in Section 6.

2. Literature

The bulk of prior literature on immigration considers its effect on employment, wage and labor supply (Clemens, Lewis, & Postel, 2018; Docquier, Ozden, & Peri, 2014; Hedberg, 2009; Le, 2012; Nguyen & Duncan, 2017; Ottaviano & Peri, 2006; Roed & Schone, 2012; Ruiz & Vargas-Silva, 2015, 2018; Røed & Schøne, 2012; Sarvimaki & Hamalainen, 2016; Van De Ven & Voitchovsky, 2015). The immigration–innovation linked has been studied extensively at the regional and at the national level (Bratti & Conti, 2018; Canello, 2016; Chellaraj, Maskus, & Mattoo, 2008; Desrochers & Leppälä, 2011; Florida, Adler, & Mellander, 2017; Gagliardi, 2015; Hunt & Gauthier-Loiselle, 2010; Le, 2008, 2012; Maré, Fabling, & Stillman, 2014; Naz, Niebuhr, & Peters, 2015; Niebuhr, 2010). There is also considerable work at the level of individuals (Antonelli, Franzoni, & Geuna, 2011; Baruffaldi & Landoni, 2012; Giuliani & Rabellotti, 2012; Hunt, 2011; Malyutina, 2018; Pekkala Kerr, Kerr, & Lincoln, 2015; Scellato, Franzoni, & Stephan, 2015; Zucker & Darby, 2009, 2014). While this literature at large frames our discussion, in this section we review in some detail the most relevant prior literature, i.e., studies having explicit firm-level regression estimates on the link between immigrant employees and innovation outcomes. We do not review related case study work (Aggarwal, Hsu, & Wu, 2014; Malyutina, 2018; Molina, Martínez-Cháfer, Molina-Morales, & Lubbers, 2018; Saxenian, 2006) or literature on migrant and ethnic entrepreneurship (Bird & Wennberg, 2016; Kenney & Patton, 2015; Y. S. Lee & Eesley, 2018; Li, Isidor, Dau, & Kabst, 2018; Nikolinka, 2008; Saxenian, 2002), although they provide valuable further insights. Since prior work employing non-innovation firm-level performance measures is directly relevant, let us mention a few pieces of this literature before proceeding with our more in-depth review. Paserman (2013) looks how the mass high-skilled migration from the former Soviet Union in the 1990s impacted the productivity of Israeli firms; he finds a negative association between the immigrant share and productivity in low-tech but a positive one in high-tech industries. Trax, Brunow, and Suedekum (2015) use German establishment data to study the link between diversity and total factor productivity; they find that employing a larger share of foreign workers does not have a statistically significant effect.[1]

Lee (2015) tests for firm- and city-level links between diversity and innovation with a 2004–2005 cross-section of 2,223 small- and medium-sized enterprises in the UK. He separately employs six indicators of product or process innovation (for both types: any innovation, new to the firm, or new to the market) as the dependent variable in his probit regressions. The main firm-level diversity measure is the share of partners or directors born outside the UK (thus, the migrant status of management, rather than staff, is measured). Lee also considers the ethnicity of management, as opposed its migrant status, as an explanatory variable.[2] At the city level, he measures diversity by the migrant and ethnicity shares of the resident population. A further city-level diversity measure is the fractionalization index of country of birth calculated as one minus the Herfindahl index (Alesina, Devleeschauwer, Easterly, Kurlat, & Wacziarg, 2003). Due to its special role, London is also considered separately from other cities. Lee finds that firms with larger shares of migrant managers are more likely to introduce new products and processes. Since his quadratic terms have a negative sign, he suggests that this is indeed a diversity effect rather than simple benefits of migrant-run firms. Lee also finds evidence for the city effect of diversity.

Mohammadi, Broström, and Franzoni (2017) study how the diversity of high-skilled employees' ethnic and educational backgrounds contributes to the share of radical innovation sales of a firm. They pool five consecutive rounds of the Swedish Community Innovation Survey (CIS) from 2002–2004 to 2010–2012 (merged with employer-employee data) across higher-tech manufacturing and knowledge-intensive service sectors, which yields information on 3,888 firms and 7,389 time-year observations. The main dependent variable in their tobit regressions is the share of firm's sales derived from new-to-the-market products and services. Since the authors wish to measure the variety in ethnicity, they define Teachman's (1980) entropy

[1] There is also some firm performance literature on other measures such as growth and survival, which we do not discuss here.

[2] The other firm-level control variables are: age, legal status, sector, size; use of ICT; being a family business, being a multi-establishment firm; seeking advice, finance, growth; number of directors; having a graduate owner.

indices for the following two categories: place of birth in Sweden (native), other Nordics, Western Europe, other Europe, North America, Asia, or elsewhere; and lived in Sweden under 5 years, 5–15 years, or over 15 years.[3] The authors find that having a more internationally diverse workforce is positively correlated with the share of turnover generated by radical innovation (but not incremental innovation).[4]

Nathan and Lee (2013) consider how the diversity of a firm's management contributes to its innovation and other performance in London. They use a cross-section of 7,615 firms surveyed in 2005–2007. The primary dependent variable in their conditional logit regressions is one of four innovation measures: introducing a major new or a significantly modified product or service, introducing major new equipment, or introducing major new ways of working. Two dummy variables capture migrant management: having a mix of foreign- and UK-born owners/partners and having only foreign-born owners/partners.[5] The authors find that both measures of migrant management are associated with a higher probability to introduce new product innovations. Knowledge-intensive and other industries are also considered separately; the afore-mentioned observation is found to hold for both industry types.[6]

Ostergaard, Timmermans, and Kristinsson (2011) investigate the link between employee diversity – gender, age, ethnicity, and education – firm-level innovation. They merge the Danish 2003–2005 innovation survey with year 2002 employer-employee data and are left with a sample of 1,648 firms. The dependent variable their analysis is the introduction of a new product or service. To derive the ethnicity measures, the authors first divide the individuals into six groups by country of origin – Danish, Nordic, EU-15 and Swiss, other Europeans, other western countries, and the rest of the world – and then calculate a Shannon-Weaver

[3] The other explanatory variables are: Teachman's entropy index of educational background; external knowledge search breadth; the employment shares of women and PhD; firm age, size, and ownership type; location in one of the major metropolitan regions in Sweden.

[4] Structural equation modelling and instrumental variable regressions are used to addressed potential endogeneity, but solid evidence of causality could not be established.

[5] The other firm-level control variables: age, sector, size; export and R&D statuses; conducting R&D; collaborating externally; management competences (four measures); and the reason for establishing the firm (proactive or reactive).

[6] Shift-share instruments are constructed to study causality, but results are inconclusive.

entropy index.[7] The logistic regressions suggest that there is no statistically significant link between employee ethnic diversity and the firm's likelihood to innovate; the authors also test for a curvilinear relationship but find no evidence for it. The authors speculate that this might be due to the high share of Danes among the employees, and thus low entropy values, or that hiring immigrants might be highly dependent on the type of work (and this heterogeneity is not observed in statistical analysis). A firm's general openness towards diversity is nevertheless positively associated with innovativeness.

Ozgen, Nijkamp, and Poot (2013) consider, how both the share of immigrants among employees and their diversity impact firm-level innovation using the Dutch Community Innovation Survey (CIS) in 2000–2002; after merging CIS with employer-employee data, they are left with 4,582 observations. Three alternative dependent variables are employed in linear probability model regressions: performing innovative activity, introducing a product or a process innovation. The key dependent variables are two measures of immigrant intensity and to measures of the diversity among immigrant employees: the share of employees born outside the Netherlands and the share of the second-generation immigrants (based on parents' place of birth); a fractionalization index of employees' country of birth (Alesina et al., 2003) and a simple count of employees' countries of birth.[8] The authors find that firms employing a large share of immigrants are less innovative, which they attribute to lower wages of immigrants leading to use of more labor-intense production technologies. This effect is, however, less strong or even absent in the case of the second-generation immigrants. On the other hand, diversity contributes positively particularly to product innovations especially in sectors employing relatively more skilled immigrants. Instrumental variable regressions, with the historical density of immigrants and the past density of ethnic restaurants as instruments, largely confirm the linear probability model estimates.

[7] Besides the remaining three diversity measures, the other firm-level control variables include age, size, industry, having undergone a major organizational change, having high-intensity collaboration along the value chain, having high-intensity collaboration with knowledge institutes, and general openness towards diversity (as proxied by having an active approach in hiring old and/or foreign employees).

[8] The other firm-level control variables are: size, being a multi-establishment firm, having headquarters abroad, indicating openness to change, reporting lack of personnel/technology as obstacles to innovation, employee age/skill groups, and region/sector dummies.

Ozgen, Nijkamp, and Poot (2017) extend their afore-mentioned earlier work (Ozgen et al., 2013) primarily by employing panel data and having explicit consideration of age and skill composition of immigrant employment. Merging the Dutch Community Innovation Surveys of 2000–2002 and 2004–2006 (and administrative data yields a panel of 2,793 firms. The dependent variable in the pooled logit as well as fixed- and random-effect linear probability model regressions is either introducing a product or a process innovation. The diversity is measured by: a Simpson index (0 when all employees are from one country, 1 when equal shares originate from different countries), a co-location index (0 if no two immigrant employees share the same country of birth or if all employees are natives), and the simple count of employees' countries of birth (plus its square term). The intensity of immigrant employment is measured by: the share of foreign-born employees, foreignness among young and among high-skill employees. [9] In the authors' pooled cross-section estimates, cultural diversity and innovation are positively correlated –at times also when instrumented with 'deep lags' (Nickell & Nicolitsas, 1999). However, in the authors' words (p. S29), "no statistically significant traces of benefit for innovation from cultural diversity remain after introducing firm fixed effects".

Parrotta, Pozzoli, and Pytlikova (2014) study whether ethnic diversity boosts a firm's patenting with an unbalanced 1995–2003 panel of some 12,000 firms in Denmark. Their three alternative dependent variables are sourced from the European Patent Office: applying for a patent, the number of patent applications, and applying patents in multiple technology areas (conditional on patenting). Employer-employee data is used to derive the dependent variables. The key ethnic diversity measure is derived by first defining eight country of origin groups for foreign employees (excluding Danes; the share of non-Danish employees is controlled separately) – North America and Oceania, Central and South America, Africa, Western and Southern Europe, Formerly Communist Countries, East Asia, Other Asia, and Muslim Countries – and then calculating a Herfindahl index across the groups (the authors also experiment with a linguistic classifications and also

[9] The other firm-level controls are: size, reporting personnel/cost obstacles, shares of young/high-skill employees. The regional controls are: number of per job (Nuts 3), number of firms per municipality, unique number of birth countries per municipality, the number of persons in the municipality who have at least one foreign-born parent.

consider the Shannon-Weaver and the richness indexes).[10] Even though the authors have a sizable panel at their disposal, they do not employ panel estimators due to insufficient data variation. The probit and poisson regressions, with and without instrumental variables, suggest that ethnic diversity facilitates firms' patenting activity in all the three dimensions considered.

The above-discussed literature does not reach a consensus on the firm-level immigration–innovation link. Even reasonably comparable studies might yield opposite signs of statistically significant coefficients. It can nevertheless be concluded that the effects of immigrant quantity – e.g., the employment share of immigrants – might differ from the effect quality – in the above, mostly understood in terms of immigrants' occupational roles and diversity in the countries of origin. Furthermore, immigration's effect on product *versus* process and incremental *versus* radical innovation might be (very) different. The only study above that removes firm-specific effects, Ozgen et al. (2017), hints that some earlier findings might be driven by unobserved firm heterogeneity.

3. Data

Our analysis is based on several data sources. These include the Community Innovation Survey (CIS), the Business Register, the Finnish Longitudinal Employer-Employee Data (FLEED) and the firm-level financial statement data panel, all maintained by Statistics Finland.

Due to the large number of data sources and variables included in the analysis, we separate the discussion of different groups of variables in different subsections.

3.1. Dependent variables

Our dependent variables, i.e. the indicators of whether a firm innovates, are obtained from the CIS, in particular the 2010-2012 and the 2012-2014 waves. We investigate three types of innovations: product

[10] Other diversity measures included in regressions: age, demographics, education, and occupation. The other firm-level employee-related control variables are: the share of men, the share of occupations, age groups, employees' level of education, and average tenure. The remaining firm-level controls: capital stock, foreign-owned, multi-establishment, and spillovers variables based on both the technological distance and the geographical distance.

innovation, process innovation and radical innovation. The first innovation type comprises the creation of new goods or services which are novel to the firm, without the requirement of the innovation being new to the market. Process innovation refers to whether a firm introduced a new or significantly improved production process, distribution method or supporting activity, again without the requirement of the process being novel for the market. Finally, a radical innovation is defined as the firm introducing a good or service which is new to the firm market. These three variables are binary, and they refer to the three years included in the survey.

3.2. Main predictors

The main independent variables of interest are the firm-level diversity measures. These are divided in two main subgroups: (a) shares of immigrant workers in different types of tasks and (b) diversity measures similar to Alesina et al. (2003). Note that the independent variables included in the various regressions (either probit or fixed effects regressions) refer to the start year; for example, if we want to explain the pattern of innovations between 2010 and 2012, we use predictors referring to 2010.

To define the relevance of the immigrant workers within a firm, we initially split the firms' employees into three professional groups: innovators, managers, and the rest. This split is based on the socio-economic classification provided in FLEED, which is a dataset covering the whole population of persons living in Finland and are between 15 and 70 years of age. We then compute the foreign share for these three classes within a firm. Notice that our definition of immigrants includes persons, who obtained Finnish nationality and who are second-generation immigrants.

The second main group of predictors is related to work-place diversity measures. We first divide employees into different groups based on geographical origins, based on the World Bank classification (with slight modifications): Finnish, Western European, Eastern European (mostly covering ex-communist countries), Mediterranean countries, Nordics, Middle-East and North Africa, Sub-Saharan Africa, South Asia, East Asia and Pacific, North America and, finally, Latin America and Caribbean. After obtaining groups of employees of different geographical origins, we compute the share of each group out of the three different professional groups defined in the previous paragraph (managers, innovators and others). The diversity measure is defined as in Alesina et al. (2003), which is described in Section 2. Notice that in many firms, there may be no innovators or workers belonging to the managerial group. In this case we set the immigrant share of the different professional sub-groups to 0.

Notice that these shares and diversity measures are obtained from individual-level data (in this case the FLEED) and then aggregated at the firm-level.

3.3. Municipal-level diversity measures

While the main focus of our analysis is on firm-level diversity, previous literature has highlighted how local ethnic diversity and the share of immigrants in a location can have significant impact on innovation (see, e.g., Gagliardi, 2013). To control for possible geographical spillover effects, we include the share of immigrant residents belonging to the three socio-economic groups defined above, at the municipal-level. Moreover, we include the number of employees of foreign origins living in a given municipality, again divided by socio-economic groups. Again, the information described here are obtained from the FLEED and then aggregated at the municipal level.

3.4. Firm-level controls

Our analysis is carried at the firm-level, where we identify a firm using the legal unit identifier provided in the CIS, which can then be used to link CIS responses to the FLEED and to various firm-level datasets. To avoid omitted variables issues, we use a wide range of firm-level controls.

Firstly, we include a number of controls obtained from FLEED, i.e. the average employees' age, measured in years, the share of female employees, and the share of higher education workers (defined as having obtained at least a lower-degree level tertiary education). We use individual-level data to compute the share of managers, innovators, and the rest of employees working for a firm, out of the total number of employees. The share of innovators is especially useful, because it offers a nice proxy of a firm R&D spending. Finally, we include the total number of employees (winsorized at 2,000 employees) to proxy for firm size. Additionally, we include a quadratic term, to control for non-linearity. Notice that we obtain this measure from individual-level data which are subsequently aggregated, rather than from the business register. We do this to be consisted with the main predictors of interest, which can only be computed using individual-level information.[11]

We obtain firm age (which is also winsorized at 20 years) from the business registry, which is also the data source for determining the number of establishments of a given firm (we control for multi-establishment companies), and the municipality where the headquarters are located. For firm age, we add a quadratic term. Moreover, we control for whether a firm is located in one of the regions, where the largest metropolitan areas are located: Uusimaa (the region including the Helsinki area), Varsinais-Suomi (containing the Turku area), Pirkanmaa (the region of Tampere area) and North-Pohjanmaa (where Oulu is located). We measure the firm-level capital intensity using the financial statement data panel.

The remaining firm-level controls are obtained directly from the CIS. In particular, we control for whether a firm is an exporter, whether it belongs to a business group (we do not differentiate between firms belonging to Finnish and foreign business groups). Another important control obtained from the CIS is the measure of whether a firm has cooperated substantially with an external entity in matters of R&D. Finally, we use the CIS to determine the industry of operation of the firms considered.[12]

3.5. Descriptive statistics

We merge the various data sources described in this section, and subsequently pool the observations referring to the 2010-2012 period and the 2012-2014 one, which leaves us with a dataset containing more than 4500 observations and almost 3000 firms. We report the definition and the source of the indicators used in the empirical analysis in Table 1, while Table 2 includes some descriptive statistics for the dependent

[11] Unfortunately, the total employees number changes based on the data source adopted, but the difference is not dramatic (the median absolute difference is 3.2), so we are confident in our measure of firm size.

[12] We employ the roughly two-digit industrial classification devised by Giertz et al. (2015), as it carefully separates nationally important ICT manufacturing and ICT services (as defined by the OECD).

variables and for the main predictors of interest (i.e. the firm-level immigrant shares and the diversity measures).

Table 1: Variables definition and source

Name	**Definition**	**Source**
Innovation: Product	Firm developed a new good or service	CIS
Innovation: Process	Firm developed a new production process, distribution method or supporting activity	CIS
Innovation: Radical	Firm developed a new good or service to the market	CIS
Foreignness: Management	Firm-level share of foreign employees, out of managers	FLEED
Foreignness: R&D	Firm-level share of foreign employees, out of innovators	FLEED
Foreignness: Others	Firm-level share of foreign employees, out of the rest of employees	FLEED
Diversity: Management	Firm-level diversity measure (as in Alesina et al, 2003), managers	FLEED
Diversity: Innovators	Firm-level diversity measure (as in Alesina et al, 2003), innovators	FLEED
Diversity: Others	Firm-level diversity measure (as in Alesina et al, 2003), rest of employees	FLEED
Municipal foreign managers	Number of immigrant managers in a municipality	FLEED
Municipal foreign innovators	Number of immigrant innovators in a municipality	FLEED
Municipal foreign others	Number of immigrant employees (not managers and innovators) in a municipality	FLEED
Municipal foreign managers: share	Share of immigrant managers in a municipality, out of total managers	FLEED
Municipal foreign innovators: share	Share of immigrant innovators in a municipality, out of total innovators	FLEED
Municipal foreign others: share	Share of immigrant employees in a municipality, out of total employees (no managers and innovators)	FLEED
Emp. Share: Management	Firm-level share of managers	FLEED
Emp. Share: Innovators	Firm-level share of innovators	FLEED
Emp. Share: Others	Firm-level share of the rest of employees	FLEED
Personnel: Age	Firm-level average age of employees	FLEED
Personnel: Women	Firm-level share of female employees	FLEED
Personnel: Schooling	Firm-level share of high-education employees	FLEED
Firm: Age	Firm age, winsorized at 20 years	Business Register
Firm: Size	Total number of employees, winsorized at 2000 employees	FLEED
Firm: Exports	Binary indicator of whether a firm export	CIS
Firm: Part of Group	Binary indicator of whether a firm belongs to a business group	CIS
Firm: Multi-establishment	Binary indicator of whether a firm has multiple establishments	Business Register

Firm: Cooperation	Binary indicator of whether a firm has cooperated substantially with an external entity	CIS
Firm: Capital Intensity	Firm capital divided by total number of employees	Financial statement data and FLEED
Firm: Industry	Industry where firm operates (CITATION)	CIS
Firm: Region	Binary indicator of whether a firm is located in a major metropolitan area	Business Register

Notes: Innovation indicators refer to years 2010-2012 (first CIS wave considered) and 2012-2014 (second CIS wave considered). Independent variables refer to starting years (2010 and 2012).

Table 2: Means for dependent variables and main predictors of interest

Variable	Mean 2010-2012	Mean 2012-2014
Innovation: Product	0.36	0.39
Innovation: Process	0.33	0.36
Innovation: Radical	0.23	0.24
Foreignness: Managers	1.37	1.16
Foreignness: Innovators	1.60	1.55
Foreignness: Others	3.71	4.34
Diversity: Managers	1.21	1.42
Diversity: Innovators	2.06	1.95
Diversity: Others	6.21	7.11

Notes: Foreignness and diversity measures are in percentage points. For the dependent variables, the statistics are calculated based on the starting year.

Before we move to the empirical results, it is useful to talk a bit about our dependent variables (the innovation indicators) and the main predictors of interest (the firm-level foreignness and diversity indicators). As it can be seen from Table 2, less than half of the total firms report to have made any product, process, and radical innovation, for both CIS waves. Intuitively, there is a significantly lower share of firms making a radical innovation, because of the more stringent definition of innovation.

For the foreignness measures, we see that the average share of foreign employees is fairly similar when considering innovators and managers, with the former slightly larger. The share of foreign employees who are in the remaining socioeconomic groups is greater, which is intuitive. The diversity measures, which go from 0 to 100, where a larger number indicates a higher degree of diversity, follow a similar pattern as the foreignness indicators. Interestingly, all the variables considered here do not display a large shift when considering different survey waves, which can be explained by the short time difference between the two waves.

4. Empirical methodology

The main purpose of our analysis is to examine the effect of the presence of foreigners among different worker groups in a firm, controlling for the share of immigrants working in a municipality (in order to take into account possible local spillover effects) and the firm-level and municipal-level controls described in Section 3. Our dependent variables are the binary innovation indicators, which measures whether a firm has conducted a product, process, or radical innovation in 2010-2012 and in 2012-2014. The predictors are measured always on the starting years, which are 2010 and 2012.

The resulting specification can be represented as a probit model. We model the innovation indicator for firm *i* as taking value 1 if the latent variable *Z* is above 0. This can be formulated as

$$Inn_i = \begin{cases} 1, & Z_i > 0 \\ 0, & otherwise \end{cases} \tag{1}$$

In the probit formulation, the latent variable *Z* depends linearly on a series of explanatory variables. In our case,

$$Z_i = \alpha + \beta_1 foreignness_i \ + \beta_2 diversity_i + \beta_3 foreignness_{mun_i} + \beta_4 firm_{ctr_i} + \varepsilon_i \tag{2}$$

The dependent variable in (1), $Inn._i$ takes value 1 if firm *i* performs an innovation within the years covered by the corresponding CIS wave. $foreigness_i$ is a vector containing the share of foreign employees in firm *i* split between innovators, managers, and the rest. The other main predictors of interest are collected in vector $diversity_i$ which contains the Alesina et al. (2003) diversity measures for managers, innovators and the remaining workers, for firm *i*. Ultimately, our interest focuses on β_1 and $\beta_{2.}$ $foreignness_{mun_i}$ is a vector collecting 6 variables, specifically the number of foreign managers, innovators and other workers in the municipality of firm *i,* and the share of managers, innovators, and the rest of employees in the municipality of firm *i.* This set of variables is included to control for possible local spillover effects. Finally, $firm_{ctr_i}$ contains the firm-level controls described in Section 3.4, for firm *i.* The error term ε_i in (2) follows a normal distribution with mean 0 and standard deviation 1. The parameters in (2) are estimated via maximum likelihood.

5. Results

5.1. Correlation matrix

We start our empirical analysis by looking at the correlation coefficients between the main predictors of interest (the firm-level foreignness and diversity indicators) and the innovation measures.

Table 3: Pairwise correlation matrix between the innovation indicators and the firm-level foreignness and diversity indicators

	Innovation: Product	Innovation: Process	Innovation: Radical
Foreignness: Managers	0.04	0.02	0.03
Foreignness: Innovators	0.05	0.02	0.04
Foreignness: Others	0.003	0.001	0.01
Diversity: Managers	0.07	0.03	0.05
Diversity: Innovators	0.07	0.05	0.06
Diversity: Others	0.02	0.01	0.02

Table 3 gives us two broad indications. Firstly, the unconditional correlations between the foreignness and diversity measures and the innovation indicators are low. This is not entirely surprising given that the correlation between innovation and the share of employees belonging to the innovators' socio-economic group is only 0.11. One reason driving these results is that simple correlation coefficients between continuous and binary variables are not interpretable in a straightforward fashion, and proper modelling strategy (which we adopt in the rest of this section) is required. The other rather interesting fact gathered from Table 4 is that the correlation between a firm's innovation behavior and the predictors of interest is substantially higher when considering the innovators and the managerial group, compared to the rest of the workers. It is important to remember that the foreignness indicators represent the share of immigrant employees out of the group of interest, so these correlations point toward the importance of diversity being dependent on the socio-economic group.

5.2. Firm-level diversity and innovation

We now turn the core analysis of this paper, i.e., we model the firm-level innovation behavior by using a probit model estimated by pooling two CIS surveys (2010-2012 and 2012-2014 waves). The complete list of variables included is described in Section 3 and hence we concentrate on the firm-level foreignness and diversity indicators. In Table 4, we report their marginal effects, at the variables' means, obtained by estimating the probit model described in Section 2. The rest of controls are not reported but are available upon requests. The errors for the probit regressions reported in these sections are clustered at the regional level. Each specification contains a large set of firm and municipal-level controls so, while we cannot be sure of unveiling a true causal effect, we can be confident in the robustness of this conditional correlations.

Table 4: Marginal effects of foreignness and diversity measures onto innovation performance

	Innovation: Product	**Innovation: Process**	**Innovation: Radical**
Foreignness: Managers	0.0019	0.0017	0.0009*
Foreignness: Innovators	0.002***	-0.0026***	0.00008
Foreignness: Others	-0.002***	-0.0023*	-0,0001
Diversity: Managers	-0.0006	-0.0025**	-0.001*
Diversity: Innovators	-0.002***	0.0027***	-0.000
Diversity: Others	0.0006	0.001	-0.000
	Firm and municipal-level controls= Yes	Firm and municipal-level controls= Yes	Firm and municipal-level controls= Yes
N. Obs= 4,611	Pseudo R^2=0.27	Pseudo R^2=0.16	Pseudo R^2=0.23

*Notes: Estimation is carried by probit modelling, with standard errors clustered at the regional level. Independent variables refer to the CIS waves 2010-2012 and 2012-2014, while predictors refer to the starting years (2010 and 2012 respectively). *, ** and *** indicate significance at the 10, 5 and 1 percent confidence level.*

Let's start by examining the effect of firm-level foreignness and diversity on product and radical innovation, because they both involve the development of new services or products and because they show some a degree of similarity in the results. For product innovation, a higher share of foreigners among the firm's innovators has a positive, statistically significant, effect. In terms of economic significance, the estimated effect implies that one standard deviation increase in the share of foreigners is associated to a 2 percentage points increase in the probability of innovation, corresponding to an 8 percent increase with respect to the sample average. Interestingly, we find that higher degree of diversity among the innovators within a firm has a negative significant effect on the development of new products and services. This might signal that a firm benefit by the presence of foreign innovators but, the if the group becomes too disaggregated (in terms of geographical origins) issues can arise that can hinder the innovation process. It is also interesting that a higher degree of foreignness is associated to a strong negative effect on product innovation. Overall, it is important to separate the foreign share of workers into different groups depending on the type of position the employees have in the firm.

Regarding radical innovations, we find that a higher share of foreign origin persons in managerial positions has a positive and statistically significant (only at the 10 percent level) effect on innovating. However, the effect is minimal in economic sense, where one standard deviation higher share of foreign managers increases the probability of radical innovation by less than 1 percentage point (3 percent w.r.t the sample average). Similarly, as in product innovation case, a higher degree of diversity is associated to a lower probability of making a radical innovation.

The estimates related to process innovations are somewhat harder to interpret. On the one hand, we find that a higher degree of diversity among innovators brings a positive effect onto the probability of making a process innovation (something similarly found in the literature). The negative effect of a larger share of foreign employees who are not managers and innovators can be somewhat intuitive. A higher share of foreigners who are not innovators should not have an impact on the innovation capabilities of a firm. It is harder to explain the strong negative impact that a higher degree of foreignness among innovators has on the probability of making a process innovation. One possibility is that process innovations can depend more on the local context of the firm (its internal structure and market), which might be easier to understand for natives.

5.3. Knowledge intense industries analysis

So far, we have considered all firms appearing in the CIS survey, however, when discussing innovation performance, it can be particularly interesting to examine the behaviour of firms belonging to knowledge-intensive industries. In this subsection, we replicate the main probit analysis, but focusing only on firms belonging to the high-technology and medium-high-technology manufacturing industries and to the knowledge-intensive industry (to determine which industry belongs to these groups we follow the Eurostat classification).

After keeping exclusively firms belonging to knowledge-intensive industries, our sample size drops to around 1900 observations. To get a picture of how our focus on knowledge-intensive industries affect the main characteristics of the sample, we report averages as in Table 3, separating the 2010-2012 and 2012-2014 periods.

Table 5: Means for dependent variables and main predictors of interest, for firms belonging to knowledge-intensive industries

Variable	Mean 2010-2012	Mean 2012-2014
Innovation: Product	0.47	0.50
Innovation: Process	0.38	0.41
Innovation: Radical	0.28	0.32
Foreignness: Managers	1.52	1.69
Foreignness: Innovators	2.82	2.45
Foreignness: Others	3.77	4.53
Diversity: Managers	1.67	2.11
Diversity: Innovators	3.57	3.25
Diversity: Others	6.23	7.31

Notes: Foreignness and diversity measures are in percentage points. For the dependent variables, the statistics are calculated based on the starting year.

Looking at the innovation indicators, we find a general increase in innovation propensities, compared to the base sample. This comes as no surprise, given that we expect firms in knowledge-intensive industries to conduct more R&D and therefore innovate more. However, the increase in the innovation propensity is not uniform over the type of innovation. While the increase in the number of firms innovating is fairly contained for process and radical innovations (5 percentage points and 6.5 percentage points on average, respectively) it is much more substantial for product innovation (11 percentage points between the two sample periods).

Regarding the diversity and foreignness measures, we find a significant increase when considering the managers and innovators groups, while the rest of employees group does not show substantial differences in diversity when considering the base sample and the knowledge-intensive one. Firms belonging in high-tech industries seem to be more willing to hire immigrant, highly educated, workers in managerial and research positions, but do not hire more foreign origin persons to conduct other tasks, compared to the overall sample.

We now replicate the probit estimation covering only firms in knowledge-intensive industries. Again, we report the marginal effects for the main predictors of interest and the standard error are clustered at the regional level.

Table 6: Marginal effects of foreignness and diversity measures onto innovation performance, firms belonging to knowledge-intensive industries only

	Innovation: Product	**Innovation: Process**	**Innovation: Radical**
Foreignness: Managers	0.0043	0.0014	0.0002
Foreignness: Innovators	0.0022***	-0.003***	0.0002
Foreignness: Others	-0.0044**	-0.001	0.0006
Diversity: Managers	-0.003*	-0.002	-0.001
Diversity: Innovators	-0.001	0.003***	-0.0000
Diversity: Others	0.002*	0.001	-0.0001
	Firm and municipal-level controls= Yes	Firm and municipal-level controls= Yes	Firm and municipal-level controls= Yes
N. Obs= 1884	Pseudo R^2=0.27	Pseudo R^2=0.14	Pseudo R^2=0.23

*Notes: Estimation is carried by probit modelling, with standard errors clustered at the regional level. Independent variables refer to the CIS waves 2010-2012 and 2012-2014, while predictors refer to the starting years (2010 and 2012 respectively). *, ** and *** indicate significance at the 10, 5 and 1 percent confidence level.*

Based on the results in Table 6, it seems that concentrating on knowledge-intensive industries does not change by much the conclusions of the main analysis, at least for product and process innovation. For product innovation, we find a similar positive effect of the degree of foreignness of the innovators onto the probability of making a product innovation, while there is a negative effect in terms of foreignness in the rest of workers group. For process innovation we find again the negative effect of a larger share of foreign innovators, but a positive effect of diversity within that group. Finally, our main predictors of interest do not seem to have a significant effect onto the probability of bringing a new product or service to the market (radical innovation). This is different from what found in the main sample, although the coefficients reported in Table 4 are significant at the 10 percent level only.

5.4. Panel analysis

The structure of our datasets allows us to follow firms appearing in both CIS waves. In this fashion, we can use a fixed effect methodology, in order to account for unobservable firm-level characteristics which are fixed over time. In this analysis, we rely on a linear probability model.

Table 7: Coefficients of foreignness and diversity measures onto innovation performance, panel analysis.

	Innovation: Product	**Innovation: Process**	**Innovation: Radical**
Foreignness: Managers	0.001	-0.002	0.002
Foreignness: Innovators	0.006	-0.010	0.007
Foreignness: Others	-0.017	-0.004	0.002
Diversity: Managers	0.0003	-0.001	-0.003
Diversity: Innovators	-0.004	0.008	-0.006
Diversity: Others	0.012	0.005	0.00000
	Firm and municipal-level controls= Yes Firm-fixed	Firm and municipal-level controls= Yes Firm-fixed	Firm and municipal-level controls= Yes Firm-fixed
N. Obs= 1884	Pseudo R^2=0.22	Pseudo R^2=0.13	Pseudo R^2=0.17

*Notes: Estimation is carried by linear probability modelling, with robust standard errors. Independent variables refer to the CIS waves 2010-2012 and 2012-2014, while predictors refer to the starting years (2010 and 2012 respectively). *, ** and *** indicate significance at the 10, 5 and 1 percent confidence level.*

Looking at Table 7, we can see that relying on a panel of firms and controlling for firm-level fixed effects does not change the direction of effect of the predictors of interest. For example, the probability of making a product innovation is positively affected by the share of foreign innovators, while it is negatively affected by the ethnic diversity of the group. However, for all regressors of interest and innovation indicators the coefficients are not significant. The high uncertainty in the estimation of the regression coefficients is mainly due to the fact that very few firms change their pattern of innovation between the two waves, i.e. if a firm innovates between 2010 and 2012 it is highly likely that it will innovate between 2012 and 2014. This causes the variation in our dependent variables to be too small to have reliable estimates.

5.5. Robustness

We first check for possible non-linear effects of our foreignness and diversity measures. In particular, we conduct a likelihood-ratio test where the benchmark model is the probit model reported in Table 4, while the alternative specifications are obtained by simply adding the square of the foreignness and diversity measures, one by one for different socio-economic groups. In this fashion, we obtain six different likelihood-ratio tests. For each alternative specification, we do not find that adding quadratic terms improves the explanatory power of our model, meaning that the effect of our predictors of interest is adequately captured by a linear formulation.

We execute similar likelihood-ratio tests as in the previous robustness check, this time including shares of immigrants working in a firm, divided by the geographical origins specified in Section 3.2. We find that accounting for separate geographical groups when looking at the share of foreign employees does not improve the fit of our benchmark model, with the exception of immigrants coming from Western European countries. Specifically, we find that the coefficient related to the share of Western European workers in a firm is positive and statistically significant. We do not find similar significant effects when looking at immigrants from Nordic countries and North America. However, when we merge these three groups together, we find that the related coefficient is positive and strongly significant, and the likelihood ratio test indicates that adding this predictor improves the strongly the predictive performance of the model. These results indicate that cultural proximity with natives plays a positive role in the firm-level innovation patterns, which parallels the findings of the main analysis w.r.t the negative effect of the diversity indicators. While having foreign innovators and managers improves the chance of innovating, a more homogenous cultural background seems to be beneficial.

6. Discussion and conclusions

In this paper, we study the direct firm-level – and control for the indirect city-level – effects of immigrants on a firm's innovative performance. Importantly, managers, innovators, and other employees are considered as separate groups both in firm employment and in local areas; for each, we estimate the effects of *foreignness*, the share of immigrants in each group, and *diversity*. We control for employee characteristics at the firm level, since – besides ethnicity – age, gender, and education contribute to innovation performance (Ostergaard et al., 2011). Also more generally, ethnic diversity is just one potential aspect of a firm's innovativeness and it cannot substitute for other aspects, such as external search for ideas (Criscuolo, Laursen, Reichstein, & Salter, 2018; Laursen & Salter, 2006) – we control for this and for a number of other firm characteristics. In our reasonably robust setting, we find some evidence for a direct effect of immigration on innovation.

Pooled cross-section estimates suggest that a higher initial share of immigrant innovators is associated with a subsequently higher probability of a product innovation; the reverse holds for process innovation. When measured by a fractionalization index, diversity among innovators does not promote product innovation. However, culturally the closest groups of migrants – Nordics, Western Europeans, and North Americans – have a positive effect when considered independently.

The above observations are largely intact, when estimated for a sub-sample of knowledge-intensive industries. We test for curvilinearity of foreignness and diversity but find no evidence for it. A nonlinear effect of immigration on innovation is quite plausible (Dahlin et al., 2005; Nathan, 2013) but, in our context, the foreign exposure is rather modest – on average, less than 2% of innovators are immigrants and, on a 0–100 scale, diversity is around 2 –, which may make the effect linear in the relevant range. Fixed effect estimates retain the signs of pooled cross-section estimates but are not statistically significant, which may be due to insufficient variation across time (e.g., in the case of product innovation, the innovation status across time changes for only one-fifth of the firms).

Our observations suggest that immigration has distinct and opposite effects on product and process innovations; the former benefits from a wider spectrum of innovator perspectives, while the latter suffers from it. The observation on process innovation is consistent with a substitution effect: if immigrant employees are available for less than their “full quality price”, their increasing presence may make it less profitable to implement process innovations and to make related capital investments. The find regarding process innovation may also relate to how increasing foreignness plays out at the level of a team: on the basis of their meta-analysis, Stahl, Maznevski, Voigt, and Jonsen (2010) conclude that “… diversity leads to process losses through task conflict and decreased social integration, but to process gains through increased creativity...”. When it comes to product innovation, the estimated effect implies that one standard deviation increase in the share of immigrant innovators raises innovation probability by 2 percentage points, which corresponds to an 8 percent with respect to the sample average. This is a modestly large effect but nevertheless indicates that a host of other covariates besides immigration are important for innovation.

We interpret our somewhat deviating observations on immigrant diversity as follows: diversity does offer some benefits, provided that enough cultural homogeneity of the group is retained. At least in the context of Finland, firms seem to have difficulties in dealing with relatively small doses of heterogeneity.[13] Overall, the prevailing practice of just measuring the ethnic composition among countries or country groups appears somewhat unsatisfactory. Many of the measures employed, including ours, understate the heterogeneity across organizations: for example, introduction the first immigrant to a large native population is quite different from adding one more immigrant to an initially mixed team (obviously the national composition of a mixed team matters, as also our observations suggest). The introduction of just one immigrant to a team often brings about difficult choices; either the communication language switches to English (or, in the case of Finland, in some occasions to Swedish) or remains Finnish, which at least initially makes the immigrant somewhat isolated (given that Finnish is both rare and obscure, reaching professional fluency in it takes a

[13] This is hardly surprising; Finns have been physically and culturally relatively isolated for centuries – to the extent that it shows in a genetic make-up of the native population that is simultaneously globally unique and exceptionally monotonic (Kääriäinen, Muilu, Perola, & Kristiansson, 2017).

long time). Also, the role an immigrant fulfills is likely to matter: while we do capture native and immigrant managers and innovators statuses via their occupations, we do not know what their more specific roles are.

Even though our municipality-level foreignness and diversity measures are not statistically significant, this should not be interpreted as evidence against an indirect regional spillover effect. Our data has relatively low regional densities of skilled immigrants, which may be insufficient for nurturing local agglomeration benefits. Furthermore, many important aspects of local environment – such as the intensity of interaction and trust between ethnic groups – is unobserved in our data. Thus, there are certainly several useful extensions in delving deeper into regional aspects of innovativeness (Berliant & Fujita, 2012; Breschi & Lenzi, 2016).

We contribute to the still nascent literature on the firm-level effects of immigration on innovation. Our observations suggest that it is important to separate various types of innovation (Gatignon, Tushman, Smith, & Anderson, 2002) as well as pay a greater attention to immigrants' cultural proximity in the local context and *vice versa* – to the local context's ability to benefit from immigrants' expertise. Our findings also indicate that immigrants' various occupational roles should be acknowledge. There are clearly pros and cons of multiculturalism. Our findings inform this trade-off at the level of a firm. The composition of a firm's current employment influences the possible outcomes of increasing organizational foreignness and diversity.

Our study has some limitations. The employed empirical setting calls for caution in making causal interpretations and leaves somewhat open what is the role of unobserved firm-level effects. Our findings are similar to Ozgen, Nijkamp, and Poot (2017); the coefficients are no longer statistically significant, once firm-level fixed-effects are introduced; however, we offer somewhat different interpretation of this and point to the limited variation across time in the commonly employed dependent variables. Our findings suggest that further inquiries on the immigration–innovation link should be more nuanced on both the characteristics of migrating persons and on the local and organizational adaptability. Gaining benefits from increasing foreignness and diversity presumes a two-way match, i.e., having a right person in a right context (Jackson & Joshi, 2004). For example, certain cultural proximity between the person and his/her role in the team/organization is a prerequisite for positive outcomes (Cohen & Levinthal, 1990). Ostergaard, Timmermans, and Kristinsson (2011) usefully point out that a firm's general openness towards diversity contributes to innovativeness. While we do consider the effect of both native and immigrant managers on innovation, we do not observe what are managers' attitudes towards foreignness and diversity, although they are likely to be important (Pitcher & Smith, 2001) and could be a subject of further inquiry.

References

Aggarwal, V. A., Hsu, D., & Wu, A. (2014). R&D Production Team Composition and Firm-Level Innovation. *Academy of Management Annual Meeting Proceedings, 2014*(1), 1-1.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., & Wacziarg, R. (2003). Fractionalization. *Journal of Economic Growth, 8*(2), 155-194.

Alesina, A., & La Ferrara, E. (2005). Ethnic Diversity Economic Performance. *Journal of Economic Literature, 43*(3), 762-800.

Antonelli, C., Franzoni, C., & Geuna, A. (2011). The Organization, Economics, and Policy of Scientific Research: What We Do Know and What We Don't Know--An Agenda for Research. *Industrial and Corporate Change, 20*(1), 201-213.

Baruffaldi, S. H., & Landoni, P. (2012). Return mobility and scientific productivity of researchers working abroad: The role of home country linkages. *Research Policy, 41*(9), 1655-1665.

Berliant, M., & Fujita, M. (2012). Culture and Diversity in Knowledge Creation. *Regional Science and Urban Economics, 42*(4), 648-662.

Bird, M., & Wennberg, K. (2016). Why family matters: The impact of family resources on immigrant entrepreneurs' exit from entrepreneurship. *Journal of Business Venturing, 31*(6), 687-704.

Bratti, M., & Conti, C. (2018). The effect of immigration on innovation in Italy. *Regional Studies, 52*(7), 934-947.

Breschi, S., & Lenzi, C. (2016). Co-invention networks and inventive productivity in US cities. *Journal of Urban Economics, 92*, 66-75.

Bresnahan, T., & Gambardella, A. (2004). Old-Economy Inputs for New-Economy Outcomes: What Have We Learned? In T. Bresnahan & A. Gambardella (Eds.), *Building high-tech clusters: Silicon Valley and beyond* (pp. 331-358). Cambridge University Press.

Canello, J. (2016). Migrant entrepreneurs and local networks in industrial districts. *Research Policy, 45*(10), 1953-1964.

Chellaraj, G., Maskus, K. E., & Mattoo, A. (2008). The Contribution of International Graduate Students to US Innovation. *Review of International Economics, 16*(3), 444-462.

Clemens, M. A., Lewis, E. G., & Postel, H. M. (2018). Immigration Restrictions as Active Labor Market Policy: Evidence from the Mexican Bracero Exclusion. *American Economic Review, 108*(6), 1468-1487.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Criscuolo, P., Laursen, K., Reichstein, T., & Salter, A. (2018). Winning combinations: search strategies and innovativeness in the UK. *Industry & Innovation, 25*(2), 115-143.

Dahlin, K. B., Weingart, L. R., & Hinds, P. J. (2005). Team Diversity and Information Use. *Academy of Management Journal, 48*(6), 1107-1123.

Desrochers, P., & Leppälä, S. (2011). Opening up the 'Jacobs Spillovers' black box: local diversity, creativity and the processes underlying new combinations. *Journal of Economic Geography, 11*(5), 843-863.

Docquier, F., Ozden, C., & Peri, G. (2014). The Labour Market Effects of Immigration and Emigration in OECD Countries. *Economic Journal, 124*(579), 1106-1145.

Ettlinger, N. (2003). Cultural Economic Geography and a Relational and Microspace Approach to Trusts, Rationalities, Networks, and Change in Collaborative Workplaces. *Journal of Economic Geography, 3*(2), 145-171.

Florida, R., Adler, P., & Mellander, C. (2017). The city as innovation machine. *Regional Studies, 51*(1), 86-96.

Gagliardi, L. (2015). Does Skilled Migration Foster Innovative Performance? Evidence from British Local Areas. *Papers in Regional Science, 94*(4), 773-794.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. (2002). A Structural Approach to Assessing Innovation: Construct Development of Innovation Locus, Type, and Characteristics. *Management Science, 48*(9), 1103-1122.

Giertz, E., Rickne, A., Rouvinen, P., Ali-Yrkkö, J., Arvidsson, N., Broström, A., . . . Ylä-Anttila, P. (2015). Small and beautiful: The ICT success of Finland and Sweden. In *VINNOVA Analysis* (Vol. VA 2015:06). Stockholm: VINNOVA, Swedish Governmental Agency for Innovation Systems.

Giuliani, E., & Rabellotti, R. (2012). Universities in Emerging Economies: Bridging Local Industry with International Science--Evidence from Chile and South Africa. *Cambridge Journal of Economics, 36*(3), 679-702.

Hatzigeorgiou, A., & Lodefalk, M. (2015). Trade, Migration and Integration - Evidence and Policy Implications. *World Economy, 38*(12), 2013-2048.

Hedberg, C. (2009). Entrance, Exit and Exclusion: Labour Market Flows of Foreign-Born Adults in Swedish 'Divided Cities'. *Urban Studies, 46*(11), 2423-2446.

Hong, L., & Page, S. E. (2004). Groups of Diverse Problem Solvers Can Outperform Groups of High-Ability Problem Solvers. *Proceedings of the National Academy of Sciences of the United States of America, 101*(46), 16385-16389.

Horwitz, S. K., & Horwitz, I. B. (2007). The Effects of Team Diversity on Team Outcomes: A Meta-Analytic Review of Team Demography. *Journal of Management, 33*(6), 987-1015.

Hunt, J. (2011). Which Immigrants Are Most Innovative and Entrepreneurial? Distinctions by Entry Visa. *Journal of Labor Economics, 29*(3), 417-457.

Hunt, J., & Gauthier-Loiselle, M. (2010). How Much Does Immigration Boost Innovation? *American Economic Journal: Macroeconomics, 2*(2), 31-56.

Jackson, S. E., & Joshi, A. (2004). Diversity in social context: a multi-attribute, multilevel analysis of team diversity and sales performance. *Journal of Organizational Behavior, 25*(6), 675-702.

Jackson, S. E., Joshi, A., & Erhardt, N. L. (2003). Recent Research on Team and Organizational Diversity: SWOT Analysis and Implications. *Journal of Management, 29*(6), 801.

Kenney, M., & Patton, D. (2015). Gender, Ethnicity and Entrepreneurship in Initial Public Offerings: Illustrations from an Open Database. *Research Policy, 44*(9), 1773-1784.

Kerr, W. R. (2008). Ethnic Scientific Communities and International Technology Diffusion. *Review of Economics & Statistics, 90*(3), 518-537.

Kerr, W. R., & Lincoln, W. F. (2010). The Supply Side of Innovation: H-1B Visa Reforms and U.S. Ethnic Invention. *Journal of Labor Economics, 28*(3), 473-508.

King, E. B., Dawson, J. F., West, M. A., Gilrane, V. L., Peddie, C. I., & Bastin, L. (2011). Why Organizational and Community Diversity Matter: Representativeness and the Emergence of Incivility and Organizational Performance. *Academy of Management Journal, 54*(6), 1103-1118.

Kochan, T., Bezrukova, K., Ely, R., Jackson, S., Joshi, A., Jehn, K., . . . Thomas, D. (2003). The Effects of Diversity on Business Performance: Report of the Diversity Reserach Network. *Human Resource Management, 42*(1), 3-21.

Kääriäinen, H., Muilu, J., Perola, M., & Kristiansson, K. (2017). Genetics in an isolated population like Finland: a different basis for genomic medicine? *Journal of Community Genetics, 8*(4), 319-326.

Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal, 27*(2), 131-150.

Lazear, E. P. (1999). Globalisation and the Market for Team-Mates. *Economic Journal, 109*(454), C15-C40.

Le, T. (2008). 'Brain Drain' or 'Brain Circulation': Evidence from OECD's International Migration and R&D Spillovers. *Scottish Journal of Political Economy, 55*(5), 618-636.

Le, T. (2012). R&D Spillovers through Student Flows, Institutions, and Economic Growth: What can we Learn from African Countries? *Scottish Journal of Political Economy, 59*(1), 115-130.

Lee, N. (2015). Migrant and Ethnic Diversity, Cities and Innovation: Firm Effects or City Effects? *Journal of Economic Geography, 15*(4), 769-796.

Lee, Y. S., & Eesley, C. (2018). The persistence of entrepreneurship and innovative immigrants. *Research Policy, 47*(6), 1032-1044.

Li, C., Isidor, R., Dau, L. A., & Kabst, R. (2018). The More the Merrier? Immigrant Share and Entrepreneurial Activities. *Entrepreneurship: Theory & Practice, 42*(5), 698-733.

Liu, X., Gao, L., Lu, J., & Wei, Y. (2015). The Role of Highly Skilled Migrants in the Process of Inter-firm Knowledge Transfer across Borders. *Journal of World Business, 50*(1), 56-68.

Malyutina, D. (2018). Friendship in a 'Russian bar' in London: An ethnography of a young Russian-speaking migrant community. *Urban Studies (Sage Publications, Ltd.), 55*(3), 589-604.

Maré, D. C., Fabling, R., & Stillman, S. (2014). Innovation and the local workforce. *Papers in Regional Science, 93*(1), 183-201.

Mohammadi, A., Broström, A., & Franzoni, C. (2017). Workforce Composition and Innovation: How Diversity in Employees' Ethnic and Educational Backgrounds Facilitates Firm-Level Innovativeness. *Journal of Product Innovation Management, 34*(4), 406-426.

Molina, J. L., Martínez-Cháfer, L., Molina-Morales, F. X., & Lubbers, M. J. (2018). Industrial districts and migrant enclaves: a model of interaction. *European Planning Studies, 26*(6), 1160-1180.

Moreira, S., Markus, A., & Laursen, K. (2018). Knowledge diversity and coordination: The effect of intrafirm inventor task networks on absorption speed. *Strategic Management Journal, 39*(9), 2517-2546.

Nathan, M. (2013). Top team demographics, innovation and business performance: findings from English firms and cities 2008-9. *The London School of Economics and Political Science, SERC Discussion Papers, SERCDP0129*.

Nathan, M. (2014). The wider economic impacts of high-skilled migrants: a survey of the literature for receiving countries. *IZA Journal of Migration, 3*(1), 4. doi:10.1186/2193-9039-3-4

Nathan, M., & Lee, N. (2013). Cultural Diversity, Innovation, and Entrepreneurship: Firm-Level Evidence from London. *Economic Geography, 89*(4), 367-394.

Naz, A., Niebuhr, A., & Peters, J. C. (2015). What's behind the Disparities in Firm Innovation Rates across Regions? Evidence on Composition and Context Effects. *Annals of Regional Science, 55*(1), 131-156.

Nguyen, H. T., & Duncan, A. S. (2017). Exchange Rate Fluctuations and Immigrants' Labour Market Outcomes: New Evidence from Australian Household Panel Data. *Journal of International Economics, 105*, 174-186.

Nickell, S., & Nicolitsas, D. (1999). How Does Financial Pressure Affect Firms? *European Economic Review, 43*(8), 1435-1456.

Niebuhr, A. (2010). Migration and innovation: Does cultural diversity matter for regional R&D activity? *Papers in Regional Science, 89*(3), 563-585.

Nikolinka, F. (2008). The shadow of death: do regional differences matter for firm survival across native and immigrant entrepreneurs? *Empirica, 35*(1), 59-80.

Ostergaard, C. R., Timmermans, B., & Kristinsson, K. (2011). Does a Different View Create Something New? The Effect of Employee Diversity on Innovation. *Research Policy, 40*(3), 500-509.

Ottaviano, G. I. P., & Peri, G. (2006). The economic value of cultural diversity: evidence from US cities. *Journal of Economic Geography, 6*(1), 9-44.

Ottaviano, G. I. P., Peri, G., & Wright, G. C. (2018). Immigration, trade and productivity in services: Evidence from U.K. firms. *Journal of International Economics, 112*, 88-108.

Ozgen, C., Nijkamp, P., & Poot, J. (2013). The Impact of Cultural Diversity on Firm Innovation: Evidence from Dutch Micro-data. *IZA Journal of Migration, 2*.

Ozgen, C., Nijkamp, P., & Poot, J. (2017). The elusive effects of workplace diversity on innovation. *Papers in Regional Science, 96*, S29-S49.

Page, S. E. (2007). *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*. Princeton University Press.

Parrotta, P., Pozzoli, D., & Pytlikova, M. (2014). The nexus between labor diversity and firm's innovation. *Journal of Population Economics, 27*(2), 303–364.

Paserman, M. D. (2013). Do high-skill immigrants raise productivity? Evidence from Israeli manufacturing firms, 1990-1999. *IZA Journal of Migration, 2*(1), 6.

Pekkala Kerr, S., Kerr, W. R., & Lincoln, W. F. (2015). Firms and the Economics of Skilled Immigration. *Innovation Policy and the Economy, 15*, 115-152.
Pitcher, P., & Smith, A. D. (2001). Top Management Team Heterogeneity: Personality, Power, and Proxies. *Organization Science, 12*(1), 1-18.
Roed, M., & Schone, P. (2012). Does Immigration Increase Labour Market Flexibility? *Labour Economics, 19*(4), 527-540.
Ruiz, I., & Vargas-Silva, C. (2015). The Labor Market Impacts of Forced Migration. *American Economic Review, 105*(5), 581-586.
Ruiz, I., & Vargas-Silva, C. (2018). Differences in Labour Market Outcomes between Natives, Refugees and Other Migrants in the UK. *Journal of Economic Geography, 18*(4), 855-885.
Røed, M., & Schøne, P. (2012). Does immigration increase labour market flexibility? *Labour Economics, 19*(4), 527-540.
Sarvimaki, M., & Hamalainen, K. (2016). Integrating Immigrants: The Impact of Restructuring Active Labor Market Programs. *Journal of Labor Economics, 34*(2), 479-508.
Saxenian, A. (2002). Silicon Valley"s new Immigrant High-Growth Entrepreneurs. *Economic Development Quarterly, 16*(1), 20.
Saxenian, A. (2006). *The New Argonauts: Regional Advantage in a Global Economy*. Harvard University Press.
Scellato, G., Franzoni, C., & Stephan, P. (2015). Migrant scientists and international networks. *Research Policy, 44*(1), 108-120.
Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010). Unraveling the effects of cultural diversity in teams: A meta-analysis of research on multicultural work groups. *Journal of International Business Studies, 41*(4), 690-709.
Teachman, J. D. (1980). Analysis of Population Diversity. *Sociological Methods & Research, 8*(3), 341.
Trax, M., Brunow, S., & Suedekum, J. (2015). Cultural diversity and plant-level productivity. *Regional Science and Urban Economics, 53*, 85-96.
Van De Ven, J., & Voitchovsky, S. (2015). Skilled Migrants and Labour Market Integration: How Important Is the Selection Process? *IZA Journal of Migration, 4*.
van Knippenberg, D., & Schippers, M. C. (2007). Work Group Diversity. *Annual Review of Psychology, 58*(1), 515-541.
Zucker, L. G., & Darby, M. R. (2009). Star Scientists, Innovation and Regional and National Immigration. In D. B. Audretsch, R. E. Litan, & R. J. Strom (Eds.), *Entrepreneurship and Openness: Theory and Evidence* (pp. 181-211): Industrial Dynamics, Entrepreneurship and Innovation series. Elgar.
Zucker, L. G., & Darby, M. R. (2014). Movement of Star Scientists and Engineers and High-Tech Firm Entry. *Annals of Economics and Statistics/Annales d'Economie et de Statistique*(115-116), 125-175.

Elinkeinoelämän tutkimuslaitos

The Research Institute of the Finnish Economy

ISSN-L 2323-2420
ISSN 2323-2420 (print)
ISSN 2323-2439 (pdf)

Tel. +358-9-609 900
www.etla.fi
firstname.lastname@etla.fi

Arkadiankatu 23 B
FIN-00100 Helsinki