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ABSTRACT.

We blend the economics of diversity and evolutionary economic geography theories and study the relationship between the cultural diversity of foreign-born entrepreneurs and regional sectoral diversification, proxied by the sectoral variety of newborn firms. We focus on Italian evidence and use a unique dataset that stems from a combination of different sources of information, including the Union of the Chambers of Commerce, OECD and the National Institute of Statistics. The results confirm that cultural diversity of entrepreneurs is associated with greater sectoral variety of newborn firms, with an imbalance in favour of variety in unrelated activities vis-à-vis related ones.

Keywords: Cultural diversity, entrepreneurship, sectoral variety, immigrant entrepreneurs.

JEL Classification Codes : L26, M13, R11, O33,

1 Introduction

An established tenet of the evolutionary economic geography (EEG) approach is that *related variety*, both sectoral and technological, is positively associated to innovation, job creation, growth and international competitiveness (Content and Frenken, 2016; Frenken et al., 2007; Boschma and Iammarino, 2009; Quatraro, 2010; Boschma et al., 2012). The main explanation is that regional development is driven by innovation, while the recombinant dynamics behind this latter are easier and less risky when impinging upon domains that share related capabilities. Similar arguments support findings that *relatedness* drives the patterns of regional diversification (Frenken and Boschma, 2007; Neffke et al., 2011; Boschma et al., 2013; Colombelli et al., 2014; Montresor and Quatraro, 2017).

A new stream of literature has recently attempted to shift the analysis to investigate the drivers of the much-neglected regional unrelated diversification. As suggested by Figure 1[1], unrelated variety is positively correlated with long-term economic development. The literature ascribes this to reasons including the capacity to react to external shocks and the likelihood to open up new trajectories based on the broadening of capabilities (Saviotti and Frenken, 2008; Castaldi et al., 2015). Extant studies suggest that main drivers of unrelated diversification are non-local agents, primarily entrepreneurs or multinational corporations (Boschma et al., 2017; Neffke et al., 2018; Elekes et al., 2018).

>>> INSERT FIGURE 1 ABOUT HERE <<<

Although these studies provide interesting explorations of the connection between non-local agents and unrelated diversification, they leave aside an important implication concerning the role of migrants and the connected question as to how the heterogeneity in their birthplaces may affect regional patterns of related and unrelated variety. This paper aims at filling this gap, by blending two important strands of economic geography literature, i.e. economics of diversity and evolutionary economic geography (EEG), in order to shed light on the determinants of regional diversification.

Following Klepper's micro-level studies (Buenstorf and Klepper, 2009; Klepper, 2007), we acknowledge the key role of entrepreneurship in this framework and focus on the factors that can influence the sectoral variety of newborn firms. Although we acknowledge the importance of local factors, our focus is on the role of non-local ones, and in particular of migrants. Indeed, many studies emphasized the existence of a migration-entrepreneurship nexus (Nathan, 2015). Accordingly, our central research hypothesis concerns the impact of the cultural diversity of immigrant entrepreneurs on

[1] Figure 1 provides a snapshot of the relationship between the level of unrelated sectoral variety in 1999 and the average annual growth rate of GDP over the period 2000-2010, based on data about Italian NUTS 3 regions.

regional diversification in general, as well as on the balance between related and unrelated diversification. We argue that cultural diversity may foster sectoral diversity as a result of the heterogeneity in the opportunities perceived by culturally diverse entrepreneurs, the existence of sector-specific competencies of immigrants with different nationalities and the demand for diverse products and services that originate from culturally or ethnically specific needs.

The paper contributes to the extant literature in several ways. First, we contribute to the emerging debate on the EEG approach concerning the agents of local structural change. We do so by establishing a robust relationship between foreign-born entrepreneurs' diversity and regional diversification into related and unrelated activities. Second, although related to the previous point, previous analyses mainly measured the plurality of cultures in cities/regions by focussing on the diversity of nationalities in the local population or in the local workforce. We complement this indicator with information on the plurality of nationalities of foreign-born local entrepreneurs, which are more relevant agents of structural change in regional contexts. Third, we contribute to the literature on the determinants of entrepreneurship by focusing specifically on the analysis of the sectoral variety of newborn firms, while the extant literature mostly focused on entry rates. Fourth, we contribute to the literature on the economics of diversity by uncovering a potential role for immigrant entrepreneurs on regional diversification, whereas the extant literature mostly focused on their impact on regional economic performances.

We empirically test our arguments on the case of the Italian NUTS 3 regions over the 2002-2009 period. Specifically, our database combines information on new firm formation and incumbent firms at the three-digit NACE level, Chamber of Commerce data on immigrant entrepreneurs at the same level of disaggregation and patent applications data from the OECD RegPat database. These data allow us to measure the cultural diversity of both residents and entrepreneurs. We focus on the regional diversification in manufacturing sectors.

The case of Italy is particularly interesting since the Italian production system, based on small and medium enterprises, is a favourable environment for migrant entrepreneurship. In this context, where most regions are characterized by a mature industrial structure and comparatively weak innovation capacity (Quatraro, 2009b; Xiao et al., 2018), the role of external actors in triggering unrelated diversification dynamics may be more salient than in regions that have completed their transition to a knowledge economy. Moreover, as noted by De Arcangelis et al. (2015), migration in Italy has grown very rapidly in the last decades. Most importantly, the phenomenon has been characterized by a high diversification in terms of countries of origins, as compared to any other European countries, possibly because of the absence of strong colonial links.

The results of our analysis confirm that the cultural diversity of immigrant entrepreneurs is positively and robustly associated with the sectoral variety of newborn firms. Moreover, when the related and unrelated components are singled out, we find that cultural diversity is associated with a prevalence of the unrelated component.

The rest of the paper is organized as follows. Section 2 provides a review of the literature on new firm formation and on sectoral and cultural variety, and it develops the testable hypotheses. Section 3 presents the data, variables and the methodology. Section 4 discusses the econometric results, and the last Section concludes the paper.

2 Theoretical perspectives on regional diversification, migration and entrepreneurship

Over the last decade, the EEG approach has contributed to the understanding of the drivers, effects, and dynamics of the structural composition of regional economies. On the one hand, the importance of variety for economic development, originally emphasized by evolutionary economics, is now established in the regional domain, too. Variety is, in fact, necessary for the emergence of novelty in economic systems, as it feeds the restless process of capitalism (Metcalfe, 1992 and 2001; Saviotti, 1996). Moreover, the focus on related and unrelated variety has advanced the debate on the importance of Marshallian vis-à-vis Jacobian externalities, i.e., on the relative importance of specialization vs. urbanization economies, for regional economic performance[2]. Related variety has been found to drive regional growth in almost all of the different empirical settings (see Content and Frenken (2016) for a detailed review of the literature on this topic).

On the other hand, much literature has focused on another cornerstone of the evolutionary connection, i.e., the role of path dependence in the historical process of economic development (Antonelli, 2001). In this context, theoretical and empirical contributions have focused on the dynamics by which regions diversify their industrial and technological specialization portfolios, and on opening up new trajectories for development. This strand of analysis also stresses the relevance of relatedness in the emergence of new specializations and provides a conceptual and empirical framework to link regional (sectoral and technological) diversity and the process of diversification. In investigating this dynamic relationship,

[2] The so-called Marshall-Arrow-Romer (MAR) externalities refer to the advantages stemming from the specialization of industrial activities in a given area, while Jacobs' externalities stress the relevance of diversification as a source of location advantage for firms. In addition to these two concepts, Porter's externalities concern the positive dynamics engendered by competitive pressures in a local context (see Antonelli et al. (2011) for a critical appraisal).

EEG scholars have provided robust evidence of the constraining role played by dynamic irreversibilities, i.e., the local accumulation of competences. Accordingly, regions are more likely to enter into new specializations that are tightly related to the current structure of the local economic or technological activities (Boschma et al., 2013; Colombelli et al., 2014; Rigby, 2015; Montresor and Quatraro, 2017).

In short, relatedness drives regional diversification, which in turn favours the establishment of a structure of related activities in the local economies. From a dynamic viewpoint, this process risks constraining the scope of economic activities, thus creating the conditions for a region's lock-in.

In order to understand regional diversification dynamics, the main economic agents that are responsible for this process have to be identified. According to the microeconomic literature about industrial dynamics (Klepper and Simons, 2000; Klepper, 2007; Buenstorf and Klepper, 2009), modifications in the composition of regional economic activities are primarily due to supply-side dynamics, i.e., incumbent firms' diversification strategies and new firm formation by local entrepreneurs. These studies focus on the local dynamics of related diversification associated with the emergence of local districts.

While focusing on relatedness, the debate on variety has placed less emphasis on the importance of unrelated diversification, which is instead deemed to be a necessary condition for long-term economic development (Saviotti, 1996; Saviotti and Frenken, 2008). Unrelated diversification brings about novelty and radical changes in the structure of local economic activities and provides the basis for the accumulation of new knowledge and competences by restoring the conditions for regional growth and competitiveness. Moreover, as suggested by the portfolio theory, unrelated diversification also facilitates the reaction to adverse economic shocks.

Based on this renewed awareness, recent studies in the EEG approach have started to investigate the drivers of unrelated diversification patterns at the local level, stressing the importance of non-local agents like multi-national corporations and non-local entrepreneurs (Boschma, 2017; Neffke et al., 2018; Elekes et al., 2018; Trippl et al., 2018).

The grafting of the 'economics of diversity' approach (Nathan, 2015) onto the EEG framework can improve the understanding of the impact of non-local agents, and in particular entrepreneurs, on the unrelated diversification of regions. This growing strand of the literature proposes that cultural diversity affects the sectoral composition of local economies through three main channels, i.e., production, labor market, and consumption dynamics.

For what concerns the production side, a large body of literature links migrants and entrepreneurial dynamics at the micro-level and articulates the effects of cultural diversity on start-up creation at the local level (for extensive surveys see: Nathan, 2014 and 2015; Kemeny, 2017). On the one hand, the literature has shown that there is a high propensity to entrepreneurship and self-employment amongst migrants, because of both individual attitudes and difficulties in accessing local labor markets in the host economies. On the other hand, foreign-born entrepreneurs bring about variety in local economies by leveraging skills and competencies accumulated in their home regions. As a result, new industrial activities may emerge, and activities that were previously marginal may become more relevant. Moreover, the presence of migrant entrepreneurs in local contexts is also likely to engender significant externalities for prospective native entrepreneurs, by favoring a cross-fertilization of ideas on how to seize new market opportunities.

Proxying regional diversification with the sectoral variety of newborn firms, we can articulate our first hypothesis as follows:

H1: The cultural diversity of the entrepreneurs is positively associated with the sectoral variety of newborn firms.

The economics of diversity approach also stresses the relevance of labor market and consumption dynamics, suggesting a potential role for the cultural diversity of immigrants as a whole, beyond immigrant entrepreneurs, to contribute to sectoral diversification. In what follows, we will refer to this diversity as "cultural diversity of residents" to distinguish it from the more specific "cultural diversity of the entrepreneurs." It is worth noting that this literature has proposed to distinguish two channels through which cultural diversity may affect regional performance, i.e., size and distribution[3]. Ottaviano and Peri (2006) show that the effect of diversity on the productivity of US cities is mainly to be attributed to the "size" component. Alesina et al. (2016), instead, find evidence of a significant impact of both the size and the distribution effect.

Relevant channels through which cultural diversity may affect sectoral diversity through the labor market are the sector-specific competencies of immigrants with different nationalities. Several studies

[3] Alesina et al. (2016) have shown that the standard diversity index, which is the fractionalization index, can be decomposed into a "size" and a "distribution" component. The first is the share of the foreign-born population, and the second is a Herfindahl index computed on the shares of each country of birth over the total population. It is worth noting that size and distribution may operate in different ways. On the one hand, a larger foreign-born population increases the probability that new firms are founded. On the other hand, we expect that sectoral variety unambiguously increases if the immigrant population is more diverse in terms of countries of origin. We see at least two mechanisms through which this "distributional component" of diversity may affect regional diversification: one relates to the correlation between nationality and sectoral specialization and one to the possible synergies arising from the encounter of different nationalities.

find that native and foreign-born workers of comparable educational attainment might possess unique skills that lead them to specialize in different occupations, mitigating natives' wage losses from immigration (Ottaviano and Peri, 2006; Peri and Sparber, 2009). The occupational distribution of immigrant workers in metropolitan areas across the United States suggests that immigrants from a range of countries have developed local niches in specific occupations (Patel and Vella, 2013).

Moreover, the impact of cultural diversity on sectoral diversity may also be driven by demand. Indeed, population diversity leads to a more varied demand for products and services, thus bringing diversified market opportunities. Portes (1995) argues that culturally or ethnically specific needs bring specific market opportunities to businesses. For example, the demand from ethnic groups for specific goods and services from retailers not only creates market opportunities for them but, through backward linkages, might also generate additional market opportunities for distributors and producers. In light of this discussion, we can spell out our second hypothesis, again approximating regional diversification with the sectoral variety of newborn firms:

H2. The cultural diversity of the residents is positively associated with the sectoral variety of newborn firms.

In order to understand the differential impact of non-local entrepreneurs on diversification, Neffke et al. (2018) propose to extend the resource-based view (RBV) of the firm to the regional domain.

According to the resource-based theory, the firm can be considered as a bundle of competences, in which organizational and technological knowledge develops through the integration of formalized R&D activities and learning processes (Foss, 1997, 1998; Penrose, 1959). The development of distinctive competences and resources, and the ability to effectively combine them, represents the source of firms' comparative advantage. The development of competences and capabilities constrains firms' diversification strategies, making entry in closer markets more successful than entry in unfamiliar ones (Teece et al., 1997).

In a similar vein, regions can be viewed as the locus of accumulation of resources and competences, emerging from economic and technological activities that are carried out in a specific area (Lawson, 1999; Boschma, 2004; Quatraro, 2009a; Neffke and Henning, 2013). This process constrains a region's pattern of development, making diversification in related industries more likely to occur. These dynamics are mainly driven by local agents, who, on the one hand, have developed their own competences in that specific place relying on local capabilities, and on the other hand, have contributed themselves to the further development of the region-wide bundle of resources. In this context, local agents are more likely than non-local ones to benefit from the technical, pecuniary, and knowledge externalities that are engendered by industrial and technological specialization, due to the substantial matching between firm-level and regional-level capabilities. As a consequence, privileged access to local tangible and intangible assets influences the entry choice of firms onto new markets. In other words, such a perspective emphasizes the place-specific nature of resources and competencies, providing a micro-founded explanation of regional development through related diversification introduced by local entrepreneurs.

These mechanisms also lead to the theoretical prediction that unrelated diversification is brought about by non-local entrepreneurs, who have developed competencies and capabilities that are more coherent with the industrial structure of their home countries than with that of their hosting regions (Neffke et al., 2018; Elekes et al., 2018).

Theories about the determinants of the geography of new firm formation provide further arguments supporting the relationship between cultural diversity and unrelated diversification. In particular, the knowledge spillover and absorptive capacity theories of entrepreneurship provide useful explanations of the drivers of entrepreneurship at the local level (Acs et al., 2009; Qian and Acs, 2013). According to the knowledge spillover theory of entrepreneurship (KSTE), knowledge investments by incumbent firms or research institutions are not entirely commercialized, leaving room for start-ups to seize them as entrepreneurial opportunities. The absorptive capacity theory advances KSTE by introducing the absorptive capacity as a critical determinant of knowledge-based entrepreneurial activity. The extent to which the market value of new knowledge is discovered and exploited depends on the capability of the entrepreneurs to recognize such opportunities (Qian and Acs, 2013).

The previous discussion points, therefore, to different channels behind the relationship between the cultural diversity of immigrant entrepreneurs and unrelated diversification. The first one is related to the EEG argument on region-specific capability base, according to which foreign-born entrepreneurs are likely to introduce new activities that are closer to the capability base of their home region than to that of hosting one. The second one is related to the KSTE argument concerning the capacity to spot unseized opportunities. Such unseized opportunities might, on the one hand, be available in the home regions and exploited in the hosting one. On the other hand, they can be left unexploited in the hosting regions because of the inability of local agents to recognize the value and exploit them, due to insufficient absorptive capacity. If cultural diversity implies different cognitive approaches and heuristics (Hong and Page, 2001), it may lead to different perceptions of business opportunities that widen the range of sectors in which new business may be launched. Diverse backgrounds and perspectives embedded in a culturally diverse set of agents may lead foreign-born entrepreneurs to decide that an idea is potentially valuable while local ones do not.

Similarly to H1 and H2, we operationalize related and unrelated diversification, respectively, as the related and unrelated variety of newborn firms, and spell out our third hypothesis as follows:

H3a. The cultural diversity of the entrepreneurs is more strongly associated with the unrelated than with the related variety of newborn firms.

From the above discussion, we expect the main actors of such association to be entrepreneurs. However, our arguments about the capacity to trigger the emergence of home-country specializations in the host economy may apply at a larger extent to the foreign-born population as a whole. On the one hand, foreign-born residents bring about their capabilities in local labor markets. These capabilities are likely to be related with the economic activities in which their origin countries are specialized, while loosely related to those featuring the host region (Patel and Vella, 2013). Moreover, the cultural diversity of foreign-born residents is also likely to be associated to a varied demand for specific products and services, which in turn generates market opportunities in sectors that are unrelated with the specialisations of the hosting region and requires capabilities that are more distinctive of their home region than to that of the host one (Portes, 2005).

For this reason, we further specify our hypothesis as follows:

H3b. The cultural diversity of the residents is more strongly associated with the unrelated than with the related variety of newborn firms.

Overall, the literature on the economic impact of diversity points to a prevalence of the positive effects of cultural diversity. The EEG approach provides a framework to appreciate the differential impact of immigrant entrepreneurs vis-à-vis residents as drivers of unrelated diversification in local contexts. However, it is fair to note that some interdependencies and counteracting forces can affect these dynamics, providing grounds to consider cultural diversity as endogenous to the regional economy.

On the one hand, extant literature has indeed shown that immigrants tend to choose destination places in which their ethnicity is already strongly represented (Pedersen et al., 2008). As a consequence, this inertia may lead to gradual polarization or specialization. The emphasis on place-specific capabilities would suggest that also the local economic structure risks getting specialized in a narrower and narrower array of activities. On the other hand, some studies have shown that immigrants have a preference for culturally diverse places (Wang et al., 2016). In this case, diversification would be expected to bring about further diversification.

Based on these arguments, in the next Sections, we will present the research methodology and data, and then discuss the results of our empirical analyses.

3 Variables, Data and Methodology

We empirically test our arguments on Italian NUTS3 regions over the 2002-2009 period. This context appears instructive for several reasons.

First of all, a condition for the emergence of knowledge spillovers, firm formation, and ultimately regional diversification is the geographic proximity between natives and foreigners, which enables inter-cultural interaction (e.g., Ottaviano and Peri, 2006; Niebuhr, 2010; D'Ambrosio et al., 2018). Hence, to accurately capture the phenomenon of interest, the regional unit of analysis must be narrowly defined, yet large enough to statistically represent a region of knowledge spillovers (Colombelli and Quatraro, 2018; Audretsch and Lehmann, 2005). Italian provinces (NUTS3 regions) are among the smallest administrative units in the EU and display considerable heterogeneity in start-up rates, production structure and immigration rates.

Second, the role of external actors in triggering unrelated diversification dynamics may be relatively more salient in regions with a mature industrial structure and comparatively weaker innovation capacity, than in regions that have completed their transition to a knowledge economy. The former is the case for most Italian regions (Quatraro, 2009b; Xiao et al., 2018). A further advantage of investigating the impact of cultural diversity in the Italian context is the high diversification in terms of countries of origin (De Arcangelis et al., 2015). More specifically, we decided to focus on the manufacturing sectors within Italian NUTS3 regional economies, given the persistent role of manufacturing sectors in driving productivity growth and innovation (Quatraro, 2009b), as well as the relatively slow growth path of the services sector in Italy compared with other advanced countries (Antonelli et al., 2007). Moreover, Italy displays a remarkable concentration of foreign workers' employment in the manufacturing sectors compared to other EU and OECD countries (Istat, 2009). As to immigrant entrepreneurship, Infocamere data show that the sectoral distribution is geared towards low-skill sectors, such as construction, retail and wholesale trade, and agriculture, as it is frequently the case in other countries as well. Nonetheless, a peculiar feature of the Italian case is once again the comparatively high share of immigrant entrepreneurs that are active in the manufacturing sector. The manufacturing sector has been the main driver of the growth in immigrant entrepreneurship shares over the period that we study, mainly due to the increase in entrepreneurs of Eastern European origin (Bratti et al., 2019). In 2009, for instance, the share of immigrant entrepreneurs out of all individual firms was about 9.5%, but it grew to 11% for manufacturing; in the same year, the immigration rate was 7.6%.

For all these reasons, we decided to study the relationship between cultural diversity and sectoral variety of newborn firms with a particular emphasis on the manufacturing sectors[4]. Nonetheless, our arguments apply to other sectors as well. In principle, cultural diversity could be expected to widen the scope for regional diversification even in cutting-edge industries such as knowledge-intensive business sectors (KIBS). As we show in a set of robustness checks reported in Appendix Table B3, our empirical results hold across different sectoral subsamples.

3.1 Variables

3.1.1 Dependent variables

As discussed in Section 2, entrepreneurial dynamics drive regional diversification patterns. The investigation of the sectoral differentiation dynamics in new firm formation can therefore illuminate our understanding of regional patterns of diversification, differently from previous empirical studies that focused on the sectoral variety of employment. In this regard, we should remark that the short time span available for our empirical exercise only allows us to study relatively shorter-term phenomena. From this perspective, we focus on the sectoral variety in new firm formation, whose fast pace allows us to study them even in the short run. With this in mind, the dynamics in the sectoral variety of start-ups can be regarded as drivers of regional diversification. Nonetheless, we are aware that their implications for structural change in regional economies can be fully appreciated only in the longer run.

Hence, in what follows, our key dependent variable will be the sectoral variety in newborn firms, which we measure using the information entropy index, also known as the Shannon index. Entropy

[4] The way that we defined the sectoral diversity of newborn firms, *per se*, applies throughout to all sectors. However, if we studied the relationship between cultural diversity and sectoral variety of newborn firms without specifying the sectors of interest, our results would likely be driven by the concentration of foreign workers in sectors such as retail trade, construction and ethnic restaurants. More new businesses launched in these sectors, to the extent that they increase the portfolio of sectors in the region, would increase the sectoral diversification of the region according to our arguments. They would, however, add little to our understanding of the case for immigrants as possible path-breakers for new development trajectories.

measures the degree of disorder or randomness in a system; high entropy in a system implies high degrees of uncertainty (Saviotti, 1988). Informational entropy is a diversity measure which allows taking into account both variety and balance, where variety is the number of categories into which system elements are apportioned, and balance is the distribution of system elements across categories (Stirling, 2007).

Within each region r at time t, let p_i denote the probability that new firms are founded in sector i (NACE rev. 1 divisions, three-digit level). The sectoral variety of newborn firms is, therefore, defined as follows:

$$NBorn_{TV_{r,t}} = \sum_{i} p_i \, log_2 \left(\frac{1}{p_i}\right)$$

Among the properties of the information entropy index (Frenken and Nuvolari, 2004) is the possibility to be decomposed into "within" and "between" components, whenever the events of interest can be aggregated into a smaller number of subsets. "Within-entropy" measures the average degree of disorder or variety within the subsets; "between-entropy" focuses on the subsets and measures the variety across them. Following the extant literature, we take within- and between-entropy to represent, respectively, the related ($NBorn_{RV_{r,t}}$) and unrelated ($NBorn_{UV_{r,t}}$) components of the sectoral variety of newborn firms (Frenken et al., 2007; Boschma and Iammarino, 2009, Quatraro, 2010).

Let sector i fall into the two-digit sector (NACE rev. 1 sub-division) S_g. The probability of observing a newborn firm in this larger group, p_g, is defined as $p_g = \sum_{i \in S_g} p_i$. The unrelated sectoral variety is defined as follows:

$$NBorn_{UV_{r,t}} = \sum_{g=1}^{G} p_g log_2 \left(\frac{1}{p_g}\right)$$

Related variety is instead defined as the weighted sum of the entropy within each two-digit sector:

$$NBorn_{RV_{r,t}} = \sum_{g=1}^{G} p_g h_g$$

where:

$$h_g = \sum_{i \in S_g} \frac{p_i}{p_g} log_2 \left(\frac{1}{p_i / p_g}\right)$$

The above distinction provides us with a direct way to test our third hypothesis, i.e., that cultural diversity mainly affects sectoral variety of newborn firms via unrelated diversification. Indeed, based on the above decomposition, we can compute the ratio of related to unrelated sectoral variety

$NBorn_{RV/UV_{r,t}}$ and employ it as a dependent variable instead of total variety. In this way, we can study whether a given explanatory variable affects the relative importance of related over unrelated variety, e.g. whether it drives related diversification to prevail over unrelated diversification.

3.1.2 Independent variables

Cultural diversity of the entrepreneurs ($CDE_{r,t}$)

Hypothesis 1 concerns the link between the sectoral variety of new firms and the cultural diversity of foreign-born entrepreneurs. Accordingly, the cultural diversity of foreign-born entrepreneurs ($CDE_{r,t}$) is our focal regressor in the empirical analysis, which we proxy with the birthplace diversity of immigrant entrepreneurs. According to Alesina et al. (2016), birthplace diversity most accurately captures the differences in productive skills that are attributable to the cultural diversity, i.e., to the fact that people have been exposed to "different experiences, different school systems, different "cultures" and thus have developed different perspectives that allow them to interpret and solve problems differently" (p. 105). According to them, this measure is preferable over ethnolinguistic fractionalization, which is unable to distinguish between first and second-generation migrants[5]. Proxying the cultural origin with the birthplace implies emphasizing not only the role of "shared understandings arising from socialization and acculturation" (Williams, 2007, p. 8) but also of the sectoral specializations prevailing in the countries of origin as determinants of the entrepreneurial activity.

As pointed out by Kemeny (2017), there are different methodological approaches to the measurement of cultural diversity. The standard approach relies on the Fractionalization index, which is 1-H, where H is a standard Herfindahl index based on the concentration of nationalities in a place. Alesina et al. (2016) show that the Fractionalization index can be decomposed into a 'size' and a 'distribution' component, where the former is approximately equal to the share of foreign-born in the population and the latter is a Fractionalization index applied to the foreign-born population only. An alternative measure of cultural diversity is the Shannon entropy index, also based on the relative frequency of nationalities in a region.

The Fractionalization index is neither better nor worse than the Shannon index at measuring diversity; each of them is better suited to specific circumstances. The former is recommended when the different

[5] The flip side of this argument is that diversity based on birthplace equates second-generation immigrants with natives. Considering that second-generation immigrants are exposed to both the culture of their parents and of their country of birth, their contribution to the cultural diversity of their province of residence may be greater than the one of natives; in this sense, our measure underestimates the actual cultural diversity of entrepreneurs.

groups are of comparable sizes. By unbalanced group sizes, which is the case in regional and national economies, the Shannon index is preferred (Kemeny, 2017). Given our discussion about the different implications of size and distribution for regional diversification, we compute the Shannon index for the foreign-born entrepreneurs only and include it in our specification along with the regional immigration rate (see below). The cultural diversity of entrepreneurs *($CDE_{r,t}$)* is therefore measured as follows:

$$CDE_{r,t} = \sum_{c} s_c \, log_2 \left(\frac{1}{s_c}\right)$$

where s_c is the probability that, in each region *r*, one can observe foreign-born entrepreneurs from country *c*.

Cultural diversity of the residents ($CD_{r,t}$)

We test our second hypothesis by further including the cultural diversity of the residents ($CD_{r,t}$). The latter enters as an entropy index calculated on the nationalities of the foreign residents in the region. In this case, we have to equate cultural diversity with the diversity in national origins, rather than with birthplace diversity, due to limitations in the available data at the National Statistical Institute (ISTAT). As we discussed, birthplace diversity represents, according to Alesina et al. (2016), a better proxy for cultural diversity. Yet, to the extent that culture is mainly acquired in the country of citizenship, diversity based on nationality will still represent a reasonably accurate proxy. Hence, it will be appropriate for first-generation immigrants and for foreign-born immigrants that have not acquired Italian citizenship. It will, however, neglect foreign-born citizens who have acquired Italian citizenship due to long-term stay in Italy and second-generation immigrants with an Italian nationality but a multi-cultural background. The latter implies potentially underestimating the actual cultural diversity of residents[6]. Istat data suggest that this is unlikely to be the case in our setting: in 2008, about 87% of the residents with a foreign citizenship were also born abroad; the share increased to 99% for residents aged 15-74 (Istat, 2008). Hence, citizenship and birthplace can be taken to represent similar phenomena in our empirical setting.

Control variables

[6] More generally, both of our measures of cultural diversity suffer from the drawback that they are based on a relatively static perspective of acculturation (Brixy et al., 2020): they equate a person's culture with that of the country of origin, without considering that this may change during migration and that it may be the result of temporary, or circular, migration processes in different countries. Unfortunately, available data do not allow us to overcome this drawback.

Consistent with previous literature, we also include a set of control variables in the empirical analysis.

Sectoral diversity of the incumbents. Recognizing that the diversity of newly founded firms likely depends on the existing industrial structure of the economy (Audretsch et al. 2010), we include in our estimates a measure of the sectoral diversity of the registered stock of firms, calculated as their 3-digit NACE entropy index. Furthermore, controlling for the sectoral variety of incumbents allows studying our relationships of interest net of the effect that the sectoral variety of incumbents may play on cultural diversity.

Technological variety and patent intensity. As discussed in Section 2, the knowledge spillover and absorptive capacity theories of entrepreneurship provide useful explanations of the drivers of entrepreneurship at the local level. Accordingly, we expect a greater variety of new firms to arise in regions that are richer in knowledge. However, the extent that this technological knowledge spans across different technological realms may affect regional actors' ability to exploit such knowledge and launch new ventures (Audretsch et al., 2010; Colombelli and Quatraro, 2018). Ultimately, then, sectoral variety may depend on the technological variety within the region. We proxy the knowledge intensity of the region by patent intensity, i.e., the ratio of patent applications filed by a region over the regional population, and measure technological variety by an entropy index applied to the IPC sectors of regional patent applications. We include both as control variables in our regressions.

Population density. Many studies include the density of population to capture the impact of agglomeration economies that are not directly related to knowledge. Population density is generally found to have a positive impact on the start-up rate (Reynolds et al. 1994, Armington and Acs 2002, Fritsch and Falck 2007, Audretsch et al. 2010). More density is also likely to facilitate the interactions between economic agents and to spread information about business opportunities, among which opportunities to start-up firms in new sectors. Operationally, we define the variable as the ratio between the total population and the regional land-use area.

Employment rate. The effects of higher employment or unemployment on regional entrepreneurship rates are debated in the literature. Some authors argue that more employment proxies for more opportunities (e.g. Reynolds et al. 1994; Sutaria and Hicks 2004), while others suggest that entrepreneurship emerges as a survival strategy against unemployment (Wagner and Sternberg 2004). As regards its link with the sectoral variety of new firms, a comparatively dynamic and flourishing economy is likely to spread knowledge more quickly, leading to more start-up opportunities in a more differentiated set of sectors. This leads us to expect a positive relationship with the diversity of newborn firms. We measure the employment rate as the ratio of employed workers over the active population.

Per capita GDP. The literature on the determinants of firm demography stresses the importance of demand as an incentive for prospective entrepreneurs (Caree and Thurik, 1996). A wealthier region can be expected to display a broader range of tastes and stimulates sectoral variety. Moreover, income inequalities are associated with different preferences for diversity (Falkinger and Zweimuller, 1997). For this reason, we include per-capita GDP in the analysis, measured as the ratio between GDP (constant values at 2000 prices) and population.

Immigration rate. As discussed, considering that diversity mechanically increases with the size of the immigrant population, we include the share of residents with foreign nationality over the total resident population. This allows us to isolate the "size" component from the "distribution" component in our diversity measures. While the decomposition into size and distribution applies originally to the fractionalization index (Alesina et al., 2016), the two measures are similarly "color-blind" and distinguishing the mainstream category of natives from the share of each nationality does not introduce a conceptual difference in the two measures[7].

Entry/exit ratio. The turnover rate of firms may affect industry growth opportunities (Johansson, 2005). Accordingly, entry and exit rates may render some sectors more attractive than others for prospective entrepreneurs. In this direction, dynamics related to the demography of firms, i.e., greater start-up rates within a region, as well as lower firm closure rates, might drive greater sectoral variety among the newborn firms. To control for this possible confounding factor, we include the entry-to-exit rate among our regressors, which we expect to positively affect sectoral variety. Entry-to-exit rate is measured as the ratio of newly founded firms to closed firms in each province and year.

3.2 Data

To compute our dependent variable, we employ data on the number of new businesses registered for value added tax (VAT). The data are provided by the Union of the Chambers of Commerce (Unioncamere) through the Movimprese dataset. These statistics exclude some types of entrepreneurial activities, i.e., those that are not subject to compulsory registration with the Chamber of Commerce. Hence, our analysis excludes 'small entrepreneurs' - mainly artisans, small businesses based exclusively

[7] While the interpretation of the immigration rate as a "size" component for the cultural diversity of residents seems appropriate, it may be less accurate for the cultural diversity of entrepreneurs to the extent that the entrepreneurial rates of immigrants are heterogeneous across regions. Here, the "size" component would be represented by the ratio of immigrant entrepreneurs over total immigrants included along with the immigration rates. We have run our full set of estimates with and without the immigrants' entrepreneurship rates; the results are fully robust, as we show in Appendix B.

on the work of the members of the family that owns the business, sharecrop farmers and, more generally, ‘necessity entrepreneurs’[8]. The statistics about new registered firms provide details about their 3-digit NACE code sectoral classification. With this information, we calculated the variety indexes as well as their related and unrelated components. Based on the same dataset, we also computed the incumbent firms’ sectoral variety as well as the entry-exit ratio.

Data on foreign-born entrepreneurs originate from Infocamere data. We have information on the registered enterprises owned by individual foreign-born entrepreneurs with details on their fiscal code (from which we derive the country of birth), their sector of activity (3-digit NACE rev. 1) and the Italian NUTS3 region of work (103 provinces) over the 2000-2013 period.

Data about the residents’ diversity and the immigration rate are drawn from official ISTAT data on yearly stocks of the resident population with foreign citizenship. The data are disaggregated by NUTS3 regions and country of citizenship since 2002 and are publicly available[9].

The technological variety and patent intensity measures draw on the information contained in patent documents, and in particular that concerning technological classes. The information was extracted from the OECD RegPat Database (July 2015). The OECD- RegPat derives from the Patstat database, which ensures worldwide coverage; it provides bibliographic data on patents, citations, and family links. These data include applications to the European Patent Office (EPO) and applications to national patent offices, and they go back to 1920 in the case of some patent authorities. In this way, we can overcome the limitations of EPO data resulting from its recentness. We assign patent applications to NUTS 3 regions based on the inventors’ addresses. Applications with several inventors residing in different regions are assigned to the relevant regions based on their respective shares. Our study is limited to applications submitted by inventors residing in Italian regions, and uses the International Patent Classification (IPC), maintained by EPO, to assign applications to technological classes.

Finally, the data about employment, the total population, active population, and GDP originate from the Cambridge Econometrics regional database.

It is worth noticing that the period over which our data are available covers a change in the sectoral classification from NACE rev. 1 to NACE rev. 2. Due to our focus on the sectoral dimension, to avoid potential incoherence arising from to the change in the sectoral classification, we decided to concentrate on a period during which the sectoral classification remained uniform, i.e. up to 2009. Given that no data

8 Necessity entrepreneurs are distinguished from the more standard ‘opportunity entrepreneurs’ because, instead of creating businesses to grasp a business opportunity, they are forced into starting a business out of necessity due to the lack of other options in the labor market (Fairlie and Fossen, 2017).
9 Data are available at the address http://demo.istat.it.

are available on immigration stocks before 2002, the longest period available for the analysis is 2002-2009. Over these years, the data are available for 103 Italian NUTS3 regions, leading to a maximum of 721 observations to our empirical analysis. Missing data issues affecting mainly the patent-related variables in Southern regions limit our final estimation sample to 706 observations. In 16 cases, corresponding to 7 Southern regions, the value of the patent intensity is zero.

Table 1 reports the summary statistics of our variables. Our two key variables of interest, the cultural diversity of the residents ($CD_{r,t}$) and of the entrepreneurs ($CDE_{r,t}$), have similar means but different standard deviations, with the latter displaying more variation. In Appendix Table A.1, we report the summary statistics with the standard deviations decomposed into the within and between components. Most of our variables display more between- than within-variation. Coherently, the differences in the variation between $CDE_{r,t}$ and $CD_{r,t}$ appear to be mostly driven by between variation. Interestingly, though, the relatively marked changes in immigration stocks and start-up dynamics occurred over the considered period yield comparatively large within-variation in immigration rates and entry-exit rates; technological variety displays comparatively higher within-variation than other diversity measures.

Based on these considerations, to mitigate unobserved heterogeneity without absorbing too much variation in our phenomenon of interest, our identification strategy exploits the time variation along with the NUTS3-level cross-sectional variation within NUTS2 regions (see Section 3.3). Table 2 displays the correlation matrix. Some variables display relatively high correlations, such as per capita GDP with technological variety, employment rate, and immigration rate, but this is not the case for our variables of interest. More generally, no significant collinearity appears to affect our estimates, as we tested in a set of variance inflation factor (VIF) tests. We report the mean VIF associated with each of our regressions at the bottom of the estimation tables. All values are below the conventional value of 10. Closer inspection of the regression diagnostics reveals that the highest individual VIF values (not shown) are driven by the correlation between the province-level GDP and the fixed effects, while no relevant collinearity issues remain for the other variables. The individual VIF associated with our cultural variety variables are typically below 2.

>>> INSERT TABLES 1 AND 2 ABOUT HERE <<<

3.3 Methodology

The interpretation of the factors correlating with the sectoral variety of newborn firms would be more straightforward if the results could be interpreted as elasticities. To this end, one option is to employ a logarithmic transformation of both the dependent and the independent variables. However, the lower bound of the entropy index is zero, and this raises a problem by log-transformation. A better option is to resort to the inverse hyperbolic sine transformation of both dependent and independent variables, where each variable $x_{r,t}$ is transformed as $log\left[x_{r,t} + \left(x_{r,t} + 1\right)^{\frac{1}{2}}\right]$. This transformation is very similar to a logarithmic transformation but is preferred when the dependent variable assumes zero values for some observations. It also allows mitigating the influence of extreme observations (Johnson, 1949; Burbidge et al., 1988)[10].

Then, we estimated the following basic econometric models:

$$NBorn_{TV_{r,t}} = a + \beta_1 CD_{r,t-1} + \beta_2 CDE_{r,t-1} + Z_{r,t-1}\gamma + \theta_R\omega + \psi_t\vartheta + \varepsilon_{r,t}$$

$$NBorn_{RV/UV_{r,t}} = a + \beta_1 CD_{r,t-1} + \beta_2 CDE_{r,t-1} + Z_{r,t-1}\gamma + \theta_R\omega + \psi_t\vartheta + \varepsilon_{r,t}$$

These equations can be estimated by OLS. Z is the vector of the control variables discussed in the previous section, that enter the regression with a one-year lag, while θ_R and ψ_t are vectors of NUTS2 and year dummies. Finally, a, β_1, β_2 are parameters, and γ, ω and ϑ are parameter vectors to be estimated. Finally, $\varepsilon_{r,t}$ is the heteroscedasticity-robust random error component.

The dependent variable of the second model, $NBorn_{RV/UV_{r,t}}$, is the ratio between the related and unrelated sectoral variety of newborn firms in region *r* at time *t*. This index allows us to appreciate the effects of cultural diversity on the relative importance of the two components of total variety[11].

A final word of caveat is of order concerning the interpretation of our results. Although we included a wide range of control variables and lagged our values by one year to mitigate simultaneity concerns, we cannot interpret our results as causal effects, but rather as correlations.

10 This transformation is particularly useful when applied to dependent variables since it reduces extreme values and renders the assumption of normally distributed error terms on the right-hand-side reliable (MacKinnon and Magee, 1990).

11 We also report the results of two sets of regressions of the related and unrelated varieties, considered separately, in Table 5:

$$NBorn_{RV_{r,t}} = a + \beta_1 CD_{r,t-1} + \beta_2 CDE_{r,t-1} + Z_{r,t-1}\gamma + \theta_R\omega + \psi_t\vartheta + \varepsilon_{r,t}$$

$$NBorn_{UV_{r,t}} = a + \beta_1 CD_{r,t-1} + \beta_2 CDE_{r,t-1} + Z_{r,t-1}\gamma + \theta_R\omega + \psi_t\vartheta + \varepsilon_{r,t}$$

Although separate regressions are useful to appreciate the effects of our regressors on the different components of variety, it should be emphasized that the related and unrelated variety are inextricably linked and should not be interpreted as representing separate phenomena.

4 Econometric Results

In Table 3, we study the sectoral variety of newborn firms to test H1 and H2. As discussed, we restrict the analysis to the manufacturing sector. Column (1) reports the results of a control-only specification with region and time effects. Population density, patent intensity, and technological variety display positive and significant coefficients: as expected, the sectoral variety of newborn firms strongly correlates with the regions' innovation capacity and the diversification of its technological portfolio. This supports the interpretation that innovation capacity and technological diversification contribute to applying and recombining existing knowledge to new sectors. As to the immigration rate and entry/exit ratio, their negative signs seem to suggest that more dynamic regions attracting more immigrants tend to move towards greater specialization; this interpretation is, however, not supported, as the coefficients are only weakly significant and not robust in the other specifications. Per-capita GDP and employment rate are, according to our results, not significantly related to our dependent variable.

In Columns (2) - (4), we include our measures of cultural variety, i.e., the cultural diversity of residents ($CD_{r,t}$) and the cultural diversity of the entrepreneurs ($CDE_{r,t}$). Taken individually, the cultural diversity of the residents (Column (2)) and of the entrepreneurs (Column (3)) display the expected positive coefficients. When both are included (Column (4)), the cultural diversity of entrepreneurs prevails, consistent with our expectations of its more direct implications for sectoral variety. Interestingly, adding the cultural diversity of entrepreneurs also erodes the significance of technological variety, but not of patent intensity. We may interpret this result as an indication that regional diversification correlates with more technological knowledge, rather than with a more diversified technological knowledge. Strong innovation capacity, even accumulated in a single sector, may, in principle, associate with variety.

In Column (5), we further augment our specification with the sectoral variety of the incumbents. The latter, in turn, correlates strongly with technological variety, population density, patent intensity, as well as with both our variables of interest. As a result, this specification yields a positive, highly significant, and relatively large coefficient of the incumbents' variety and lower coefficients of the other variables. The qualitative implications of our previous results are, however, unchanged.

The last row of Table 3 reports the mean values of the VIF tests associated with each specification. As mentioned, all of them fall comfortably below the conventional value of 10. To provide further evidence that our results are not driven by collinearity, in Column (6), we exclude immigration rates from the specification. The coefficient of the cultural diversity of entrepreneurs is virtually unaffected.

>>> INSERT TABLE 3 ABOUT HERE <<<

Overall, the results in Table 3 robustly indicate that new firms operate in a broader range of sectors where the entrepreneurs are more culturally diverse. These results are consistent with our arguments. When resources and competencies in the host regions meet a broader set of sector-specific competencies and business perceptions from abroad, a broader range of new ventures emerges. The variety of existing firms, while important, is not attenuating this relationship. Our results confirm that the underlying mechanism is to be attributed to the distribution and not to the size of the foreign-born population.

Moreover, we find that the diversity of immigrant entrepreneurs prevails over that of residents. If their ventures reflect the sectoral specializations of their countries of origin, entrepreneurs are well suited to introduce new varieties into the region. Instead, the broader group of foreign residents includes employees in native-owned firms and people out of the labor force; hence their diversity is less likely to translate into new specializations. As we confirm in Appendix B, foreign residents' contribution to introducing new specializations seems to depend on their skills and technological specializations.

In Table 4, we study whether our results are affected by the level of technological intensity of the sectors. To this end, we recompute the variables for which we have sectoral detail (new firms' and incumbents' sectoral variety, entrepreneurs' cultural diversity, entry/exit ratio) separately for two subsets of manufacturing sectors: low-tech and mid-low-tech (Column (1)) and high-tech and mid-high-tech (Column (2)).[12] The remaining regressors are the same as in our most complete specification in Column (5) of Table 3.

Compared to the higher-tech sectors, the estimates obtained for the lower-tech sectors are much more similar to the aggregate ones, in line with our discussion about the relatively low innovation capacity of the Italian industry. In particular, the sectoral variety of new firms in lower-tech sectors significantly correlates with population density, patent intensity, sectoral diversity of the incumbents, as well as with the first of our variables of interest, the cultural diversity of entrepreneurs. Conditional on the latter, the correlation with the cultural diversity of the residents is insignificant. Moreover, for this subsector, the results indicate a weakly significant negative correlation of the dependent variable with technological variety.

As regards the higher-tech sectors, the positive coefficient of the cultural diversity of entrepreneurs holds. The coefficient of the sectoral variety of the incumbents is also robustly positive. At the same time, the results are quite different with respect to technological variety and the cultural diversity of the

[12] The classification is based on the standard Eurostat aggregation of NACE rev 1.1 3-digit sectors available at https://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm.

residents: the coefficient of the former is positive and significant, while the latter is negative and mildly significant. These results suggest that, while the positive relationship with the cultural diversity of the entrepreneurs holds across sectoral subsamples, the other drivers of sectoral variety change depending on whether we look at high or low-tech sectors.

>>> INSERT TABLE 4 ABOUT HERE <<<

In Table 5, we address our third hypothesis. We argued in H3 that cultural diversity mainly contributes to the variety in the industrial structure via unrelated, rather than related, diversification dynamics. To verify this hypothesis, we employ a different dependent variable, i.e., the ratio of the related (RV) to the unrelated (UV) component of the sectoral variety of new firms ($NBorn_{RV/UV_{r,t}}$). Clearly, the ratio increases in RV and decreases in UV. Hence, it enables us to study the relative importance of the RV and UV components in the correlation of each regressor with the sectoral variety of new firms.

The RV/UV ratio will bend towards higher values in regions where new firm formation concentrates within a relatively few macro-sectors (low unrelated variety) and displays comparatively high variety within macro-sectors (high related variety). Conversely, the RV/UV ratio will be smaller in regions where the distribution of new firms is relatively more spread across macro-sectors (high unrelated variety) and comparatively more concentrated within them (low related variety). If a given regressor correlates more strongly with RV than UV, it will show a positive coefficient. Conversely, a negative coefficient implies a stronger (relative) association with the unrelated component of variety. Based on these considerations and the discussion in Section 2, we expect negative coefficients for our cultural diversity variables.

We report the results of this exercise in Column (1) of Table 5. The included variables correspond to the ones in our richer specification, except for the sectoral variety of the incumbents, that enters as an RV/UV ratio. The cultural diversities of both residents and entrepreneurs display the expected negative coefficients, supporting the inference that cultural diversity correlates with sectoral variety of newborn firms mainly via unrelated diversification. As to the other regressors, our results are in line with previous findings in the literature. Specifically, the positive coefficient of the entry/exit ratio suggests that entrepreneurial dynamism correlates with related variety more strongly than with unrelated variety. In turn, the positive, significant, and large coefficient of the incumbents' RV/UV ratio could be interpreted as path-dependence. In regions where incumbents concentrate in a few macro-sectors, within which they are relatively diversified, we find new firms to follow similar patterns. Conversely, in regions where there is more marked sectoral diversification across macro-sectors than within, this is also the case for new firms.

To dig deeper into the nexus of our regressors with the different components of sectoral variety, in Columns (2) and (3), we examine related and unrelated variety as two separate dependent variables. Although illustrative, this analysis should be viewed as purely theoretical, as related and unrelated variety are inextricably linked and do not represent separate phenomena.

The results confirm that greater cultural diversity among the entrepreneurs correlates with both less related variety (Column (2)) and more unrelated variety (Column (3)). Hence, overall, it can be argued to correlate with a shift in the sectoral mix away from related towards unrelated diversification. Based on this, we can claim that the entrepreneurs' cultural diversity enables a region to grasp entrepreneurial opportunities in sectors that are not close to its pre-existing sectoral structure. The underlying mechanism, we argued, may be that different cultures provide a different economic evaluation of entrepreneurial opportunities.

The results are less clear-cut for what concerns the cultural diversity of residents. Conditional on the cultural diversity of the entrepreneurs, the coefficient is negative and significant in Column (2), but insignificant in (3). Hence, residents' cultural diversity correlates with less related variety but not significantly with more unrelated variety. Considering these results jointly with those in the previous tables, we would conclude that, conditional on the cultural diversity of the entrepreneurs, the residents' diversity does not correlate with sectoral variety but, to some extent, with specialization. In Appendix B, we show that this is particularly the case for low-skilled foreign residents, who represent the majority of foreign residents.

Overall, these results yield full empirical support to Hypothesis 3.a but not to 3.b, i.e., with regards to $CDE_{r,t}$ but not to $CD_{r,t}$. Moreover, our results confirm the path-dependency in regional diversification dynamics: incumbents' related and unrelated varieties, respectively, increase the relevant component of new firms' variety. They also highlight the crucial role of patent intensity for regional diversification, with strong correlations with both related and unrelated variety[13].

>>> INSERT TABLE 5 ABOUT HERE <<<

[13] Because the coefficients of patent intensity on both components of variety are of approximately the same magnitude, the one on their ratio $NBorn_{RV/UV_{r,t}}$ is much smaller and insignificant. This implies that patent intensity correlates with both components of sectoral variety, and not more strongly with either of the two.

The above results confirm that cultural diversity is robustly associated with the sectoral variety in new firms and that this association goes mainly through entrepreneurial diversity. In Appendix B, we confirm the robustness of our findings to the presence of nonlinearities in the variables of interest, the inclusion of immigrants' entrepreneurship rate, the kind of diversity measures adopted, the skill level of immigrants, and the impact of spatial dependence in the data. We also confirm that the results hold across sectoral subsamples.

5 Conclusions

In this paper, we merge EEG and the "economics of diversity" approaches to build a theoretical framework that links cultural diversity and regional diversification. We posit that the cultural diversity of foreign-born entrepreneurs and residents can contribute to this process mainly via unrelated diversification dynamics. We proxy short-run regional diversification dynamics by the sectoral variety of newborn firms, measured as an entropy index; we focus empirically on manufacturing sectors in Italian NUTS 3 regions.

Our results show that the cultural diversity of the entrepreneurs is positively and significantly associated with the sectoral variety of newborn firms, supporting our hypothesis that greater cultural diversity in a region is associated with a wider range of economic activities and thus of economic opportunities available to economic agents.

When we disentangle the related from the unrelated components of variety, we find the cultural diversity of entrepreneurs to be more strongly tied with unrelated than related variety. The relationship that we identify is remarkably robust across sectoral subsamples of differing technological and knowledge intensity.

Conditional on the diversity of the entrepreneurs, the cultural diversity of residents does not seem to affect sectoral variety. Opposite roles of the diversity of the high vs. the low-skilled may account for this. Indeed, we provide suggestive evidence that the diversity of the high skilled correlates with sectoral diversification, while the diversity of the low skilled correlates with specialization.

More generally, consistently with a resource-based view of the region and the firm, our results suggest that learning dynamics and the accumulation of competencies over time are place-specific, and create self-reinforcing dynamics of specialization – where the specialization is, in turn, the result of mutual feedbacks between firm-level activities and localized externalities. In this context, the entrepreneurship dynamics of foreign-born entrepreneurs may effectively break the specialization loop. Foreign-born entrepreneurs are more likely to have accumulated competences and benefited from externalities in their home countries. Hence, their skill sets are shaped by the economic context of their country of origin; yet, they may be quite different from those of the hosting regions. Overall, foreign-born entrepreneurs appear well suited to alter the structural composition of local economies in the hosting region. Our results strongly support the interpretation that this mainly operates through the “distribution” rather than the “size” component of diversity.

As we discussed, our empirical results are grounded in the context of an economy that strongly relies on the manufacturing sector as the main driver of growth and regional branching. The industrial structure mainly draws on small and medium-sized enterprises, with regional production systems and sectoral specializations that are relatively accessible to foreign workers and entrepreneurs. Hence, our results mainly generalize to countries with mature industries; they may be quite different if we focused on more advanced regional systems with higher intrinsic innovation capacity.

Whether the relationship between the cultural diversity of the entrepreneurs and the sectoral variety of new firms would carry over to higher-tech, more innovative contexts, appears ambiguous a priori. Indeed, if the innovation capacity of the region acts as a catalyzer for the flow of information attributable to cultural diversity, regional systems characterized as “knowledge hubs” may be expected to display an even stronger correlation. The results of our analyses by subsector support this interpretation, which should, however, be tested in a different empirical setting. On the other hand, indeed, the path-breaking role of foreign actors may be less salient in regions with higher innovation capacity because the access to non-redundant ideas is ensured via other channels; in this case, we may observe a weaker association.

Another aspect of the external validity of our results relates to the relatively low-skilled profile of the immigrant population targeting the Italian provinces. If the overall small effects of the residents' diversity were due to their predominantly low-skilled profile, our results would represent lower bounds of the considered relationship, and we would expect it to be stronger in other contexts attracting skilled migration.

Overall, this paper contributes to enlarging the scholarly debate on the determinants of regional diversification to encompass the role of migration flows. Avenues for future research include a more comprehensive appreciation of the role of migrants’ human capital in new firm formation and regional diversification. The findings of this study may be complemented by an analysis of the role of immigrant entrepreneurs in promoting knowledge flows and the emergence of new sectoral specializations. In particular, given the place-specific nature of capabilities, a natural extension of this work would be an investigation of the extent to which immigrant entrepreneurs contribute to the introduction of new specializations that do not match with the knowledge base of the hosting region.

At a more general level, the theory and evidence in this paper allow enlarging the scope of the geographical analysis of entrepreneurial dynamics, and contribute to the current debate about migration in Europe, as they ultimately identify a role of migration flows for regional competitiveness. Indeed, our results suggest that immigrants, particularly high skilled immigrants and entrepreneurs, can be a resource for local economies, for their presence may affect regional diversification, hence regional competitiveness in the medium and long term. This implies that migration policies should get to integrate the policy mix targeting entrepreneurship and regional development.

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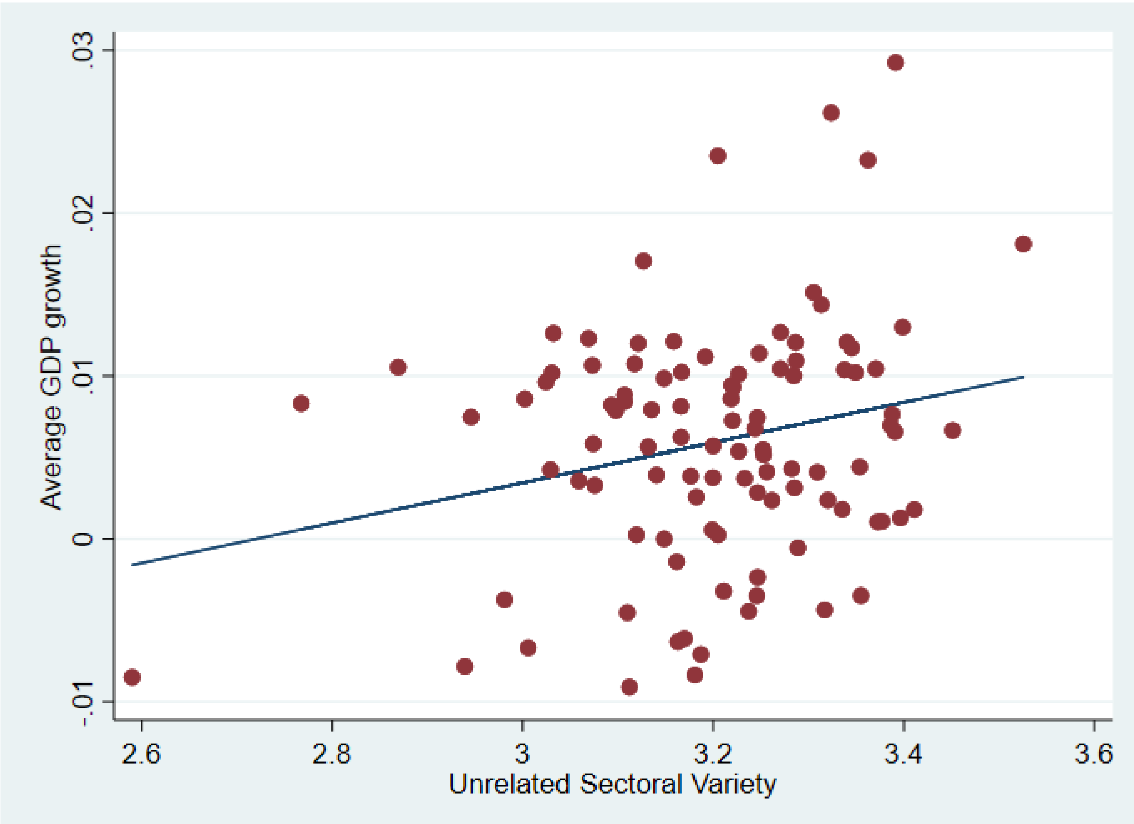
Figure 1 – Long run relationship of unrelated sectoral variety with GDP growth



Note: own elaborations on data provided by the Italian Institute of Statstics (ISTAT) and by the Union of Chambers of Commerce (Unioncamere). The variable on the y-axis is the average annual growth rate of GDP over the period 2000-2010, while the variable on the x-axis is the level of unrelated sectoral variety in 1999. Each point in the scatter-plot represents an Italian NUTS3 area. Outliers have been removed before the regression.

Table 1 – Summary Statistics

Variable	Obs.	Mean	SD	Min	Max
Total variety of newborn firms ($NBorn_{TV_{r,t}}$)	*706*	*1.878*	*0.086*	*1.238*	*2.042*
Ratio rel./unrel. variety of newborn firms ($NBorn_{RV/UV_{r,t}}$)	*706*	*0.084*	*0.052*	*0*	*0.568*
Related variety of newborn firms ($NBorn_{RV_{r,t}}$)	*706*	*0.239*	*0.102*	*0*	*0.657*
Unrelated variety of newborn firms ($NBorn_{UV_{r,t}}$)	*706*	*1.803*	*0.097*	*0.872*	*1.976*
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	*706*	*1.992*	*0.269*	*0.347*	*2.326*
Cultural diversity of the residents ($CD_{r,t}$)	*706*	*2.145*	*0.108*	*1.678*	*2.376*
Total sectoral variety of the incumbents	*706*	*1.967*	*0.057*	*1.595*	*2.073*
Technological variety	*701*	*2.448*	*0.508*	*0*	*3.159*
Population density	*706*	*0.236*	*0.250*	*0.037*	*1.691*
Employment rate	*706*	*0.812*	*0.065*	*0.635*	*0.970*
Per-capita GDP	*706*	*3.817*	*0.253*	*3.272*	*4.331*
Immigration rate	*706*	*4.385*	*0.739*	*2.320*	*5.558*
Patent intensity	*706*	*0.068*	*0.064*	*0*	*0.328*
Entry/exit ratio	*706*	*0.700*	*0.198*	*0.141*	*2.105*

Table 2 – Correlation matrix

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1. Total variety of newborn firms ($NBorn_{TV_{r,t}}$)	1.000													
2. Ratio rel./unrel. variety of newborn firms ($NBorn_{RV/UV_{r,t}}$)	-0.163	1.000												
3. Related variety of newborn firms ($NBorn_{RV_{r,t}}$)	0.292	**0.856**	1.000											
4. Unrelated variety of newborn firms ($NBorn_{UV_{r,t}}$)	**0.914**	-0.548	-0.113	1.000										
5. Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	0.493	-0.498	-0.261	**0.625**	1.000									
6. Cultural diversity of the residents ($CD_{r,t}$)	0.353	-0.053	0.117	0.320	0.266	1.000								
7. Total sectoral variety of the incumbents	**0.704**	-0.311	0.071	0.717	0.447	0.402	1.000							
8. Technological variety	0.345	0.269	0.413	0.181	0.144	0.416	0.380	1.000						
9. Population density	0.180	0.288	0.348	0.037	0.021	0.194	0.288	0.322	1.000					
10. Employment rate	0.208	0.209	0.281	0.091	-0.004	0.313	0.209	0.441	0.241	1.000				
11. Per-capita GDP	0.240	0.259	0.346	0.097	0.064	0.425	0.230	0.585	0.170	**0.708**	1.000			
12. Immigration rate	0.115	0.263	0.292	-0.011	0.063	0.206	0.134	0.524	0.109	0.559	**0.802**	1.000		
13. Patent intensity	0.300	0.211	0.359	0.163	0.098	0.396	0.290	0.585	0.157	0.535	**0.726**	**0.618**	1.000	
14. Entry/exit ratio	-0.043	0.096	0.040	-0.072	-0.096	0.038	-0.125	-0.098	-0.101	-0.123	-0.055	-0.173	-0.067	1.000

Table 3 - Sectoral variety of newborn firms (Dep. Var. NBornTVr,t) – Manufacturing sectors

	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$
	(1)	(2)	(3)	(4)	(5)	(6)
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)			0.1655***	0.1651***	0.0865***	0.0868***
			(0.0205)	(0.0204)	(0.0125)	(0.0125)
Cultural diversity of the residents ($CD_{r,t}$)		0.1371**		0.0041	-0.0340	-0.0363
		(0.0563)		(0.0363)	(0.0296)	(0.0282)
Total sectoral variety of the incumbents					0.8329***	0.8305***
					(0.0795)	(0.0778)
Population density	0.0322*	0.0284*	0.0351***	0.0350***	0.0152*	0.0152*
	(0.0171)	(0.0172)	(0.0108)	(0.0111)	(0.0089)	(0.0089)
Employment rate	0.0589	0.0195	0.0399	0.0388	-0.0132	-0.0107
	(0.0792)	(0.0786)	(0.0736)	(0.0732)	(0.0650)	(0.0633)
Per-capita GDP	-0.0201	-0.0189	0.0552	0.0550	0.0039	0.0063
	(0.0444)	(0.0448)	(0.0429)	(0.0429)	(0.0382)	(0.0384)
Immigration rate	-0.0281*	-0.0135	-0.0180*	-0.0176	0.0026	
	(0.0149)	(0.0125)	(0.0105)	(0.0109)	(0.0102)	
Patent intensity	0.4898***	0.4497***	0.3405***	0.3397***	0.2658***	0.2677***
	(0.0745)	(0.0672)	(0.0542)	(0.0543)	(0.0499)	(0.0497)
Entry/exit ratio	-0.0344	-0.0346*	-0.0142	-0.0142	-0.0092	-0.0088
	(0.0209)	(0.0205)	(0.0175)	(0.0175)	(0.0132)	(0.0131)
Technological variety	0.0266***	0.0199**	0.0020	0.0019	-0.0069	-0.0066
	(0.0090)	(0.0093)	(0.0084)	(0.0085)	(0.0081)	(0.0079)
Constant	1.9730***	1.6742***	1.3452***	1.3379***	0.1640	0.1192
	(0.1540)	(0.1845)	(0.1546)	(0.1753)	(0.1795)	(0.1758)
Observations	706	706	706	706	706	706
Adjusted r^2	0.231	0.249	0.444	0.443	0.590	0.591
Aic	-1606.4679	-1621.5121	-1833.5816	-1831.6006	-2047.6833	-2049.5887
Bic	-1451.4409	-1461.9256	-1673.9951	-1667.4545	-1878.9776	-1885.4425
Mean VIF	6.81	6.74	6.71	6.65	6.61	6.23

All regressors are lagged one year. Robust Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 – Sectoral variety of newborn firms (Subsamples)

	(1)	(2)
	Low- and mid-low tech	High- and mid-high tech
Dep. Var.	$\boldsymbol{NBorn_{TV_{r,t}}}$	$\boldsymbol{NBorn_{TV_{r,t}}}$
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	0.0721***	0.1559***
	(0.0119)	(0.0347)
Cultural diversity of the residents ($CD_{r,t}$)	-0.0267	-0.1279
	(0.0296)	(0.0783)
Total sectoral variety of the incumbents	0.8454***	0.7215***
	(0.0749)	(0.1040)
Population density	0.0206**	0.0301
	(0.0087)	(0.0222)
Employment rate	0.0204	0.0143
	(0.0640)	(0.2266)
Per-capita GDP	-0.0157	0.0679
	(0.0399)	(0.1066)
Immigration rate	0.0152	-0.0383
	(0.0103)	(0.0272)
Patent intensity	0.2377***	-0.0442
	(0.0563)	(0.1562)
Entry/exit ratio	-0.0027	-0.0263
	(0.0123)	(0.0363)
Technological variety	-0.0139*	0.0674*
	(0.0084)	(0.0360)
Constant	0.1789	-0.0855
	(0.1720)	(0.4257)
Observations	706	706
Adjusted r^2	0.545	0.350
Aic	-1947.5858	-490.3024
Bic	-1778.8800	-321.5966
Mean VIF	6.60	6.59

All regressors are lagged one year. Robust Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 – Ratio of the related to unrelated sectoral variety of newborn firms (Dep. Var. $NBorn_{RV/UV}$), *related* (NBornRV) *and unrelated* (NBornUV) *sectoral variety of newborn firms – All Manufacturing sectors*

	(1)	**(2)**	**(3)**
	$NBorn_{RV/UV_{r,t}}$	$NBorn_{RV_{r,t}}$	$NBorn_{UV_{r,t}}$
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	-0.0170**	-0.0295**	0.0989***
	(0.0066)	(0.0132)	(0.0144)
Cultural diversity of the residents ($CD_{r,t}$)	-0.0289***	-0.0858***	-0.0087
	(0.0108)	(0.0316)	(0.0264)
Ratio related/unrelated sectoral variety of the incumbents	0.9023***		
	(0.0578)		
Related sectoral variety of the incumbents		0.6351***	
		(0.0440)	
Unrelated sectoral variety of incumbents			0.3193***
			(0.0275)
Population density	0.0007	0.0243*	0.0019
	(0.0050)	(0.0134)	(0.0083)
Employment rate	0.0100	-0.0075	-0.0371
	(0.0252)	(0.0744)	(0.0565)
Per-capita GDP	0.0209	0.0656	-0.0170
	(0.0163)	(0.0469)	(0.0323)
Immigration rate	0.0038	0.0064	0.0004
	(0.0036)	(0.0103)	(0.0091)
Patent intensity	0.0438	0.2556***	0.2190***
	(0.0269)	(0.0758)	(0.0464)
Entry/exit ratio	0.0101*	0.0131	-0.0190
	(0.0054)	(0.0142)	(0.0121)
Technological variety	0.0034	0.0087	-0.0138**
	(0.0034)	(0.0098)	(0.0070)
Constant	-0.0617	-0.1152	0.7961***
	(0.0605)	(0.1699)	(0.1323)
Observations	706	706	706
Adjusted r^2	0.797	0.591	0.722
Aic	-3265.6521	-1813.2333	-2162.8246
Bic	-3096.9463	-1644.5276	-1994.1188
Mean vif	6.58	6.67	6.57

All regressors are lagged one year. Robust Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1 Appendix A

Table A.1 – Summary statistics with SD decomposed into within and between components

Variable		Mean	Std. Dev.	Min	Max	Observations
Total Variety of newborn firms ($NBorn_{TV_{r,t}}$)	overall	1.878039	.0864136	1.238116	2.042208	N = 706
	between		.0752467	1.415805	1.99851	n = 103
	within		.0430498	1.662173	2.02885	T-bar = 6.85437
Ratio rel./unrel. variety of newborn firms ($NBorn_{RV/UV_{r,t}}$)	overall	.083539	.0518059	0	.5675758	N = 706
	between		.0479746	.0208875	.480781	n = 103
	within		.0194658	.0011076	.1703338	T-bar = 6.85437
Related variety of newborn firms ($NBorn_{RV_{r,t}}$)	overall	.2385268	.102182	0	.6565687	N = 706
	between		.0870719	.0565536	.604992	n = 103
	within		.0546584	.0072647	.4423063	T-bar = 6.85437
Unrelated variety of newborn firms ($NBorn_{UV_{r,t}}$)	overall	1.802858	.0966777	.8729648	1.975846	N = 706
	between		.0885519	1.076211	1.926949	n = 103
	within		.0380554	1.599611	1.979605	T-bar = 6.85437
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	overall	1.991801	.2685186	.3468276	2.325872	N = 706
	between		.2660157	.5612049	2.317207	n = 103
	within		.0481892	1.777424	2.415684	T-bar = 6.85437
Cultural diversity of the residents ($CD_{r,t}$)	overall	2.144807	.1077538	1.678478	2.37583	N = 706
	between		.1004873	1.774916	2.33232	n = 103
	within		.039707	1.953161	2.284454	T-bar = 6.85437
Total sectoral variety of the incumbents	overall	1.967279	.0568294	1.595328	2.073004	N = 706
	between		.056268	1.617155	2.070322	n = 103
	within		.0085969	1.933813	2.118479	T-bar = 6.85437
Technological variety	overall	2.448077	.5074696	0	3.158631	N = 701
	between		.5195369	0	3.117824	n = 103
	within		.2121394	.6010172	3.517324	T-bar = 6.80583
Population density	overall	.2355346	.2502517	.0372511	1.691176	N = 706
	between		.2495383	.0381573	1.689219	n = 103
	within		.0047409	.2067261	.2655877	T-bar = 6.85437
Employment rate	overall	.8116994	.065188	.6354042	.970085	N = 706
	between		.0621738	.66396	.9502766	n = 103
	within		.0206632	.7212692	.9045733	T-bar = 6.85437
Per-capita GDP	overall	3.817396	.2534333	3.271689	4.331127	N = 706
	between		.2562456	3.306842	4.304744	n = 103
	within		.0334975	3.6898	3.892986	T-bar = 6.85437
Immigration rate	overall	4.384976	.7384883	2.320052	5.557814	N = 706
	between		.7087687	2.490883	5.306615	n = 103
	within		.2551668	3.806749	5.002154	T-bar = 6.85437
Patent intensity	overall	.068281	.064402	0	.3274729	N = 706
	between		.0627496	0	.2933237	n = 103
	within		.0156767	-.0394465	.1402581	T-bar = 6.85437
Entry/exit ratio	overall	.7001328	.1981735	.1411765	2.105263	N = 706
	between		.1069912	.5146089	1.038187	n = 103
	within		.1678218	-.1283487	2.089175	T-bar = 6.85437

2 Appendix B - Robustness Checks

The results in Section 4 of the paper confirm that cultural diversity is robustly associated with the sectoral variety in new firms and that this association goes mainly through entrepreneurial diversity. However, as a vast literature has pointed out, cultural differences may also cause conflicts and hamper social cohesion (e.g., Alesina and La Ferrara 2005; Lazear, 1999). Therefore, one could expect the relation between cultural diversity and the sectoral diversity of new firms to display non-linearities. We examine the possibility of diminishing returns of cultural diversity and the role of mediation factors in Table B1, where, for brevity, we only report the results for our variables of interest. The full specifications, including the full list of control variables, are available upon request.

In Column (1), we include a quadratic term for the cultural diversity of entrepreneurs, and in Column (2) a quadratic term for the cultural diversity of residents. The results in Column (1) suggest an inverted-U shaped relationship between the cultural diversity of entrepreneurs and the sectoral variety of new firms, confirming the expectation that, as the cultural diversity of entrepreneurs increases, it contributes less and less to the sectoral variety of new firms. Instead, coherently with our main results, the quadratic term of the cultural diversity of residents remains insignificant and leaves the other results unaffected.

In Column (3), we consider a different potential source of non-linearity. One could argue that the diminishing returns from the entrepreneurs' cultural diversity are associated with the social costs of cultural diversity. If this is the case, provinces that are more inclusive towards immigrants (Kemeny and Cooke, 2017) would also be better able to grasp the benefits of diversity - measured in this case in terms of sectoral diversification.

To test this idea, we include among our regressors a province-specific integration index, drawn from the 2004 CNEL report on the territorial inclusion of immigrants[1]. Its positive and significant interaction term with the cultural diversity of entrepreneurs, indeed, supports the above arguments. Interestingly, though, its main effect is negative and significant. We interpret this result as an indication that, when the cultural diversity of the entrepreneurs is low, inclusive regions tend to specialize – e.g., by integrating foreign workers and entrepreneurs in their core specializations. Instead, by higher levels of diversity,

[1] The report shows a province-level multidimensional immigrant inclusion index based on the following dimensions: concentration, diversity, social stability, and labor market inclusion. It is available to the public at http://www.dossierimmigrazione.it/listalibri.php?cid=51_69 .

integration magnifies the association between cultural diversity and the sectoral variety in new firms, as we posited.

>>> INSERT TABLE B1 ABOUT HERE <<<

In Table B2, we study whether our results are sensitive to the measure of diversity that we employ, and whether the coefficients of cultural diversity are sensitive to the level of skills[2]. In Column (1), considering that the cultural diversity of entrepreneurs may be mechanically related to the share of immigrants that become entrepreneurs, we add this share to our specification. The latter would represent a more accurate measure of the "size" component. The share of entrepreneurs among immigrants turns out positive and significant. Including this variable, the results about the cultural variety of entrepreneurs and residents remain the same, with the coefficient of the cultural variety of entrepreneurs slightly increasing.

In Columns (2)-(3), we study whether the results change by employing a fractionalization, rather than an entropy index, to measure cultural diversity. The results are qualitatively very similar and more precisely estimated. In particular, the positive relationship of the cultural variety of entrepreneurs with sectoral variety is robust to changing the diversity index. At the same time, a negative and significant coefficient emerges for the diversity of residents - which is not driven by collinearity, as confirmed when running the same regression separately for the two fractionalization indices. This set of estimates remains unaffected whether the share of immigrant entrepreneurs is included (Column (2)) or not (Column (3)).

A further aspect that we study in Table B2 is whether the relationship between cultural diversity and sectoral variety depends on the ability of foreign entrepreneurs and workers to originate knowledge spillovers and to grasp entrepreneurial opportunities. Along the lines of Suedekum et al. (2014), we expect this to be the case for highly skilled foreign workers and entrepreneurs.

In our setting, we can only address the above conjecture with some degree of approximation. Indeed, data about the educational attainment of foreign-born residents by country of origin can only be retrieved from the Census and are available at a less refined level of disaggregation than the one that we employ, i.e., the NUTS2, instead of NUTS3, level. Hence, to compute a diversity index by skill level for foreign residents, we assume that the skills distribution of immigrants remains stable over time and is similar

[2] We are grateful to an anonymous referee for suggesting this analysis.

across NUTS3 regions located within the same NUTS2 region. Given that no data are available about foreign entrepreneurs' skills, we cannot construct a comparable measure for foreign entrepreneurs.

More specifically, we construct the diversity indices of residents by skills as follows. From the 2001 Census data, we retrieve the share of immigrants of nationality *c* in NUTS2 region *m* that have attained a given level of education (primary, secondary, tertiary). Then, for each year and province in our sample, we impute the number of people who hold a given level of education based on the nationality-specific shares. Suppose, for instance, that the share of German residents in NUTS2 region *m* holding a tertiary degree is 30% according to the Census, and there are 100 German residents in NUTS3 region *r* (within NUTS2 region *m*) in year *t*. The imputed number of German residents with a tertiary degree for province *r* at time *t* will be 30, i.e., 30%×100. Based on the imputed residents by skill level, we can then compute skill-specific diversity measures using both the entropy and the fractionalization indices. We take as highly skilled all foreign residents holding a secondary or tertiary degree, and include the skill-specific diversity measures along with the cultural diversity of entrepreneurs.

We apply this procedure to construct skill-specific entropy indices (Columns (4)-(5)), and skill-specific fractionalization indices (Columns (6)-(7)) for residents. A first remark concerns the robustness of the coefficient for the cultural diversity of the entrepreneurs, which remains positive and significant. Once again, including (Columns (4) and (6)) or excluding (Columns (5) and (7)) the immigrant entrepreneurship rate does not make a difference in the estimates; again, it is only significant when included along with the entropy index, but not with fractionalization. Second, our skill-specific diversity measures support the conjecture that skill level operates as a mediator in the diversity effects. Indeed, the diversity of highly-skilled residents is positive and significant, while the diversity of the low-skilled residents is negative and significant - whether the diversity is measured as entropy or fractionalization.

These results shed light on the estimates for the cultural diversity of the residents reported above in Columns (2)-(3) of Table 7. Given the predominantly low skilled profile of foreign residents, the cultural diversity of residents as a whole appears insignificant or even negative, due to the prevalence of the diversity of the low-skilled. When the two are separated, the expected positive and significant relationship of cultural diversity with new firms' sectoral variety emerges. The negative sign of the coefficient for the diversity of the low skilled suggests that a more diverse low-skilled foreign-born population associates with a smaller range of sectors.

Moreover, concerning the distinction between size and distribution, the results strongly confirm our expectation that the positive relationship between diversity and sectoral variety is to be attributed to the “distribution” rather than to the “size” component of cultural diversity, for which the results are not robust.

>>> INSERT TABLE B2 ABOUT HERE <<<

As we discussed in Section 3 of the paper, immigrant entrepreneurs are typically operating in relatively low-tech industries. As we showed in Table 4 in the paper, however, a positive relationship between the entrepreneurs’ cultural diversity and sectoral variety holds even in higher-tech manufacturing sectors, despite the lower concentration of immigrant entrepreneurs. A possible explanation for this result is that the comparatively few immigrant entrepreneurs in high-tech sectors are more effective in promoting the realization of potential business opportunities than those operating in low-tech sectors. The relative magnitudes of the elasticities in the different subsectors are a priori ambiguous and may ultimately be regarded as an empirical issue.

More generally, our analysis so far suggests that we may observe positive elasticities of sectoral variety to the cultural diversity of entrepreneurs in a broader range of sectors beyond manufacturing. To test this interpretation, in Table B3, we perform our analyses on a quite differentiated set of sectoral aggregations: services+manufacturing, all services, knowledge-intensive business services (KIBS), and less knowledge-intensive business services (LKIBS). The coefficients of the cultural diversity of residents (which we take as a proxy of the cultural diversity of the workforce and local demand) and of the other regressors (not reported for brevity) change remarkably according to the sectoral aggregations, confirming the heterogeneity in regional diversification dynamics for different (sub-)sectors. Nonetheless, the elasticities of the cultural diversity of entrepreneurs remain positive and significant.

>>> INSERT TABLE B3 ABOUT HERE <<<

Finally, in studying how knowledge spillovers contribute to the emergence of new business ideas in a broad range of sectors (Section 2 of the paper), we must give careful consideration to sources of possible bias arising from the spatial structure of the data. Indeed, previous studies have shown that spatial dependence amongst units of observation can affect the empirical analysis of regional-level dynamics, most notably when the rate of creation of new ventures is the dependent variable (Andersson, 2005; Plummer, 2010; Colombelli and Quatraro, 2018).

Spatial econometrics models provide a suitable empirical framework to account for both spatial dependence and heterogeneity (Anselin, 1988; Le Sage, 1999). Different empirical models could be implemented. Following Elhorst (2014), we run a Spatial Durbin Model, i.e., an estimator including the spatial lag of both the dependent and the exogenous variables (Varga, 1998; Elhorst, 2003, 2010).

The results of the spatial econometrics estimations are reported in Table B4. Columns (1) to (3) present the results of the model in which the dependent variable is the total sectoral variety of new firms. Inspection of the coefficients of the spatially lagged variables suggests that spatial dependence affects data to a limited extent. Indeed, the coefficient for the spatial autocorrelation component (ρ) is not statistically significant in any of our estimated models.

The coefficients of the spatially lagged variables may capture knowledge spillovers or competition effects. In the case of knowledge spillovers, culture diversity in neighboring areas is expected to positively correlate with the sectoral diversity of newborn firms, while the opposite would occur in case of competition effects. The negative and significant coefficients for the cultural diversity of entrepreneurs can be interpreted as an indication of competition between neighboring regions. Given a fixed set of business opportunities, ceteris paribus, greater cultural diversity among the entrepreneurs in a region's neighborhood increases the probability that new businesses arise, hence that variety increases, in the neighboring regions rather than in the focal one.

The opposite appears to hold for what concerns the cultural variety of residents, which displays positive coefficients of the spatial lag indicating positive knowledge spillovers. For what concerns residents as a whole, being surrounded by provinces with more cultural diversity appears to increase the variety in new firms. This suggests that, parallel to the inter-regional competition animated by entrepreneurs' diversity, a more culturally diverse population contributes to the circulation of ideas, hence to the variety in new firms, with inter-cultural knowledge spillovers being subject to spatial decay.

Most importantly, though, the results of our main estimates concerning the relationship of the cultural diversity of entrepreneurs with sectoral variety remain robust.

>>> INSERT TABLE B4 ABOUT HERE <<<

Columns (4) to (6) show instead the results of the models using the ratio between related and unrelated variety of newborn firms as a dependent variable. Also in this case, the spatial autocorrelation coefficient (ρ) is insignificant in all of the models. The same applies to the spatial lag of the cultural diversity of residents. The spatial lag of the cultural diversity of the entrepreneurs is instead negative and significant[3]. This suggests that the competition between regions operates mainly as a reduction in the related variety component.

Overall, our set of robustness checks confirm the positive relationship between the cultural diversity of the entrepreneurs and the sectoral variety of newborn firms and suggest that the weaker role detected for residents' cultural diversity may be due to the relatively low-skilled profile of immigrants to Italy. Moreover, they confirm that the cultural diversity of entrepreneurs is more strongly tied to unrelated than related diversification.

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[3] Following Elhorst (2014), we have calculated the marginal effects of the variables, which account for the impact of neighbor regions' dynamics. The marginal effects confirm the positive direct impact of cultural diversity of foreign-born entrepreneurs, which is clear in the main panel. Indirect effects are instead negative, consistently with the coefficients shown in the panel reporting the results for spatially lagged regressors. The additional tables with marginal effects are available from the authors upon request.

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TABLES

Table B1 – Non-linearities in cultural diversity - Dep var: $NBorn_{TV_{r,t}}$ *–Manufacturing sectors*

	NON-LINEARITIES IN THE CULTURAL DIVERSITY OF ENTREPRENEURS	***NON-LINEARITIES IN THE CULTURAL DIVERSITY OF RESIDENTS***	***INTERACTION EFFECTS WITH INTEGRATION INDEX OF THE PROVINCE***
	(1)	(2)	(3)
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	0.2148***	0.0849***	0.0648***
	(0.0253)	(0.0126)	(0.0120)
Cultural diversity of the residents ($CD_{r,t}$)	-0.0224	-0.1458	-0.0269
	(0.0294)	(0.0916)	(0.0291)
$CDE_{r,t}$ (squared)	-0.0075***		
	(0.0012)		
$CD_{r,t}$ (squared)		0.0036	
		(0.0029)	
Integration index			-0.0964***
			(0.0278)
Integration index × $CDE_{r,t}$			0.0572***
			(0.0135)
Immigration rate	0.0081	0.0022	0.0037
	(0.0100)	(0.0101)	(0.0101)

All regressions include Population density, Employment rate, Per-capita GDP, Immigration rate, Patent intensity, Entry/exit ratio, Technological Variety, Total sectoral variety of the incumbents, as well as NUTS2 level fixed effects and time dummies. All regressors lagged one year. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B2 – Other diversity measures and skills - Dep var: $NBorn_{TV\,r,t}$ – Manufacturing sectors

	ENTROPY + IMMIGRANT ENTREPRENEURSHIP RATE	***FRACTIONALIZATION INDICES INSTEAD OF ENTROPY INDICES***		***ENTROPY OF HIGH SKILLED VS. LOW SKILLED***		***FRACTIONALIZATION INDICES INSTEAD OF ENTROPY INDICES (BY RESIDENTS' SKILL LEVELS)***	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cultural diversity of the entrepreneurs ($CDE_{r,t}$)	0.1158***	0.3474***	0.3534***	0.1162***	0.0873***		
	(0.0164)	(0.0941)	(0.0992)	(0.0164)	(0.0130)		
Cultural diversity of the residents ($CD_{r,t}$)	-0.0393	-0.1548**	-0.1561**				
	(0.0292)	(0.0628)	(0.0639)				
Immigration rate	0.0102	0.0010	0.0013	0.0215*	0.0131	0.0164	0.0153
	(0.0107)	(0.0104)	(0.0100)	(0.0126)	(0.0120)	(0.0121)	(0.0112)
Immigrant entrepreneurship rate	1.1196***	-0.0386		1.1114**		0.1393	
	(0.4292)	(0.3929)		(0.4477)		(0.4063)	
Cult. div. residents (high qualified)				0.1588**	0.1561**		
				(0.0732)	(0.0738)		
Cult. div. residents (low qualified)				-0.1512***	-0.1413***		
				(0.0507)	(0.0507)		
Nationality fractionalization of residents		-0.1548**	-0.1561**				
		(0.0628)	(0.0639)				
Nationality fractionalization of high-skilled residents						0.2463*	0.2454*
						(0.1432)	(0.1433)
Nationality fractionalization of low-skilled residents						-0.3414***	-0.3348***
						(0.0913)	(0.0892)
Birthplace fractionalization of entrepreneurs		0.3474***	0.3534***			0.3236***	0.3027***
		(0.0941)	(0.0992)			(0.0935)	(0.1006)
Share secondary/tertiary educated among immigrants				0.2257	0.1998	0.3804***	0.3701***
				(0.1411)	(0.1389)	(0.1451)	(0.1369)

All regressions include Population density, Employment rate, Per-capita GDP, Immigration rate, Patent intensity, Entry/exit ratio, Technological variety, Total sectoral variety of the incumbents, as well as NUTS2 level fixed effects and time dummies. All regressors lagged one year. Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B3 - Robustness checks – Diversity and sectoral variety of newborn firms in selected sectoral samples

	MANUF+SERV.	SERV.	KIBS	LKIBS
	(1)	(2)	(3)	(4)
	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$	$NBorn_{TV_{r,t}}$
CULTURAL DIVERSITY OF THE ENTREPRENEURS (*$CDE_{R,T}$*)	0.0644***	0.0600***	0.0506***	0.0618***
	(0.0139)	(0.0172)	(0.0145)	(0.0190)
CULTURAL DIVERSITY OF THE RESIDENTS (*$CD_{R,T}$*)	-0.0259*	-0.0524***	-0.0015	-0.0406*
	(0.0149)	(0.0172)	(0.0168)	(0.0213)
IMMIGRATION RATE	0.0091*	-0.0076	0.0125**	-0.0089
	(0.0050)	(0.0058)	(0.0061)	(0.0072)

All regressions include Population density, Employment rate, Per-capita GDP, Immigration rate, Patent intensity, Entry/exit ratio, Technological variety, Total sectoral variety of the incumbents, as well as NUTS2 level fixed effects and time dummies. All regressors are lagged one year. Robust Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B4 - Spatial Econometrics Estimations (manufacturing firms)

	(1) $NBorn_{TV_{r,t}}$	(2) $NBorn_{TV_{r,t}}$	(3) $NBorn_{TV_{r,t}}$	(4) $NBorn_{RV/UV_{r,t}}$	(5) $NBorn_{RV/UV_{r,t}}$	(6) $NBorn_{RV/UV_{r,t}}$
Cultural diversity of the entrepreneurs (*$CDE_{r,t}$*)	0.0933***		0.0962***	-0.0228***		-0.0205***
	(0.0107)		(0.0109)	(0.0051)		(0.0052)
Cultural diversity of the residents (*$CD_{r,t}$*)		0.0285	-0.0169		-0.0398***	-0.0245**
		(0.0271)	(0.0267)		(0.0111)	(0.0113)
Total sectoral variety of the incumbents	0.7498***	1.0218***	0.7402***	0.8855***	0.9944***	0.8838***
	(0.0614)	(0.0535)	(0.0615)	(0.0338)	(0.0251)	(0.0337)
Population density	0.0213**	0.0073	0.0225**	0.0056	-0.0016	0.0064
	(0.0107)	(0.0111)	(0.0107)	(0.0049)	(0.0047)	(0.0049)
Employment rate	-0.0363	-0.0814	-0.0274	-0.0156	-0.0094	-0.0099
	(0.0625)	(0.0650)	(0.0625)	(0.0264)	(0.0266)	(0.0264)
Per-capita GDP	-0.0303	-0.0110	-0.0275	0.0192	0.0349**	0.0217
	(0.0395)	(0.0408)	(0.0394)	(0.0166)	(0.0163)	(0.0166)
Immigration rate	0.0060	0.0070	0.0002	0.0092***	0.0040	0.0070*
	(0.0081)	(0.0090)	(0.0085)	(0.0035)	(0.0037)	(0.0037)
Patent intensity	0.2687***	0.3208***	0.2792***	0.0357	0.0337	0.0427*
	(0.0594)	(0.0614)	(0.0596)	(0.0250)	(0.0248)	(0.0251)
Entry/exit ratio	-0.0084	-0.0097	-0.0032	0.0054	0.0100**	0.0057
	(0.0112)	(0.0119)	(0.0114)	(0.0049)	(0.0049)	(0.0049)
Spatial lag regressors						
Cultural Diversity of the entrepreneurs (*$CDE_{r,t}$*)	-0.1924*		-0.2038*	-0.1940***		-0.1809***
	(0.1091)		(0.1102)	(0.0488)		(0.0509)
Cultural diversity of the residents (*$CD_{r,t}$*)		0.4892**	0.5127**		-0.1406	-0.0216
		(0.2473)	(0.2364)		(0.0941)	(0.0965)
Total sectoral variety of the incumbents	-0.6656	0.2832	-1.1590	-1.1948***	-0.2333	-1.1256***
	(0.7302)	(0.7049)	(0.7544)	(0.3712)	(0.3299)	(0.3736)
ρ	-0.1612	-0.3096	-0.1960	-0.0345	0.0667	-0.0399
	(0.2070)	(0.2201)	(0.2101)	(0.2007)	(0.1931)	(0.2008)
Variance σ^2	0.0030***	0.0033***	0.0030***	0.0005***	0.0006***	0.0005***
	(0.0002)	(0.0002)	(0.0002)	(0.0000)	(0.0000)	(0.0000)
N	707	707	707	707	707	707
AIC	-1925.2415	-1857.1343	-1923.3701	-3141.2174	-3119.8251	-3138.0547
BIC	-1514.7487	-1446.6415	-1494.6332	-2730.7246	-2709.3323	-2709.3178

Spatial Durbin Model. All regressors are lagged one year.
Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.