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Mit der Reihe „IAB-Discussion Paper“ will das Forschungsinstitut der Bundesagentur für Arbeit den Dialog mit der externen Wissenschaft intensivieren. Durch die rasche Verbreitung von Forschungsergebnissen über das Internet soll noch vor Drucklegung Kritik angeregt und Qualität gesichert werden.

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Content

Abstract

The study analyses the impact of different ethnic compositions of start-ups in Germany on the innovativeness of the new businesses. We are able to distinguish between the ethnicity of the founders and that of the early employees following new results that demonstrate the importance of including all new firms' stakeholders for the firm's success. We make use of a measure introduced by Ruef (2002) and Ruef et al. (2003) which not only takes into account the number of different ethnicities involved, but also includes the unusualness of the ethnic compositions. Our results first reveal that foreigners are an important source of both entrepreneurs and employers. Second, we can show that only really rare combinations, of the founders and employees together, lead to more innovative businesses whereas the more common minorities are even found to have a negative impact on firms' innovativeness.

Zusammenfassung

Diese Studie untersucht den Einfluss der ethnischen Zusammensetzung des Gründungsteams und der Mitarbeiter auf die innovativen Tätigkeiten junger Unternehmen. Für den Erfolg dieser Unternehmen sind, wie jüngere Untersuchungen gezeigt haben, alle Beteiligten (also Gründer und Mitarbeiter) wichtig. Wir nutzen eine von Ruef (2002) und Ruef et al. (2003) eingeführte Methode, die nicht nur auf der Anzahl der beteiligten Ethnien rekurriert, sondern die Wahrscheinlichkeit, dass eine bestimmte ethnische Zusammensetzung zustande kommt, berücksichtigt. Unsere Ergebnisse zeigen erstens, dass Ausländer eine wichtige Rolle als Unternehmer aber auch als Beschäftigte junger Unternehmen spielen. Zweitens können wir zeigen, dass nur wirklich seltene ethnische Kombinationen einen positiven Einfluss auf die Innovationswahrscheinlichkeit junger Unternehmen haben. Die Beteiligung relativ häufiger ethnischer Minderheiten dagegen wirkt sich tendenziell negativ auf die Innovationswahrscheinlichkeit aus.

JEL-Klassifikation: J15, J21, L26, M13, M14

Keywords: diversity, innovation, structural events analysis, start-ups

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1 Introduction

The relationship between ethnic diversity and economic performance, in particular innovation, is mostly seen as a fundamental trade-off (Lazear, 1999; Alesina and La Ferrara, 2005). Diversity contributes to innovation by providing a "cognitively differentiated" pool of problem solvers. A group of individuals of different origins and cultural backgrounds are supposedly more creative and better able to identify optimal solutions to complex problems than more cognitively homogeneous teams (e.g. Hong and Page, 2004, Cox and Blake, 1991, Alesina and LaFerrara, 2005, Niebuhr 2010, Cooke and Kemeny, 2017; Kemeny and Cooke 2017; Ozgen et al., 2014, 2017). This is of special value in the high-tech sector and for tasks requiring high qualification levels (Richard et al., 2002; Brunow and Nijkamp, 2012; Brunow and Stockinger, 2013; Cooke and Kemeny, 2017). Yet ethnic heterogeneity can also negatively impact innovation, e.g. by increasing the costs of communication and coordination within firms and workgroups. Thus, reaping the benefits from an improved problem-solving capacity while keeping potential drawbacks of heterogeneity under control usually requires "mediating factors" such as, primarily, proactive diversity management efforts and policies (Garfinkel, 2004), conducive firm environments (Richard et al., 2007), larger firm size and qualification of employees (e.g. Buche et al., 2013; Venturini et al., 2012).

An aspect of ethnic diversity that is largely neglected empirically is that (cultural) distance matters. The more unusual the ethnic composition of a team is, the more likely it is that unusual ideas will evolve. So far, research has only considered measures like the fractionalisation index, which treats all kinds of ethnic combinations alike, disregarding the idea that it is the unlikely mix that should create new ideas. To overcome this we make use of a “structural events analysis” (SEA) (Ruef 2002 and Ruef et al. 2003). This approach makes it possible to create weights according to the probability of a specific combination of ethnicities occurring in teams given the frequencies of the ethnicities in the regions where the firms are located. This allows us to integrate a measure of “rareness” of any given ethnic composition of teams into the estimations explaining the innovativeness of newly founded businesses. We expect that the more unusual a team-mix is, the higher its problem-solving capacity should be.

Focusing only on the diversity of the management team, i.e. the founder(s), is too short-sighted, however. Especially employees that are hired at an early stage or even right at the beginning of the firm start-up, are also part of this small, new entity. These “joiners” (Roach and Sauermann, 2015) have more in common with entrepreneurs than with individuals who are not considering entrepreneurship as a career path either as a founder or an employee, so Roach and Sauermann (2015) call them “non-founding entrepreneurial actors”.

Moreover, the hiring strategies of young firms differ from those of incumbent firms. Human resource management is one of the last activities to be formalised (Aldrich and Ruef, 2006). Early employees are typically recruited using strong network ties, so

these employees share similar backgrounds and personal aspirations with the founders. Only later, if the business is successful and growing, are staff hired using regular channels (Leung et al., 2006). As many routines are not yet developed or fully implemented, early employees are not to be neglected especially when they possess competencies that are complementary to those of the founders.

The possibility to observe firms right from the beginning of their life cycle enables us to examine the consequences of diversity in the correct chronological sequence and without any unknown history effects of the firm[1] and to control efficiently for a possibly moderating influence of the tenure of the teams: the negative impacts associated with diversity becoming smaller "because people get to know each other and have a greater appreciation for and understanding of the differences in the group" (Webber and Donahue, 2001 p.157). In contrast to analyses observing ethnic diversity in existing firms of different ages, the 'exposure time' of the diverse team is automatically under control. There is likely to be no reverse causality in the sense that innovative firms perform better and can therefore invest more in research that leads to more innovations (Raymond et al. 2010; Clausen et al. 2011).

Another point in favour of analysing the effects of diversity using newly founded firms is that, even before a firm's business activities actually begin, the firm's main purpose and its strategies for achieving its goals are settled on, especially in the high-tech sector where detailed business plans are required in order to obtain funding from banks or other investors.

Thus, start-ups, i.e. newly-founded firms, are particularly suited for exploring the relationship between diversity and innovation. Analysing newly founded firms controls by design for the heterogeneity of firms of different ages and to a great extent also of different sizes. Preconditions for any effects to emerge are, first, that the individuals analysed are working on the same problems and are in close contact and continuously exchanging ideas, and second, that these individuals must be the ones who are in charge of the decisions leading to the firms' innovations. Researchers must be able to control this to avoid analysing false diversity, meaning diversity within a firm but on different levels or in different functions, e.g. native executives employing immigrant workers. Usually studies avoid these problems by dealing with management teams only.

Newly founded firms provide unique possibilities for observing the effects that a team's ethnic composition has on its innovative output. Most studies (apart from qualitative case studies) have difficulty defining the place at which the interactions are supposed to occur and use establishments as a proxy for workplaces (e.g. Kemeny and Cooke, 2017). At least in larger establishments, and that is where most employ-

[1] However, the authors are aware that a firm's history begins partly before founding.

ees work, this can only be regarded as a rough estimate of the notion of the "workplace". Choosing small new firms right at the beginning of their life cycle provides a magnificent and unique opportunity to define the workplace far more precisely. It is more than likely that all (qualified) team members work together in close collaboration. But apart from this, there is presumably already a hierarchy: it is likely to be the founders that make the crucial decisions whereas the influence of the (early) employees is likely to be of an advisory nature. It is therefore necessary to differentiate between the statuses within the team.

Solving complex problems is a task which is not evenly distributed across all industries. Especially high-tech industries are involved in innovative activities that need to solve complex problems (e.g. Kemeny and Cooke, 2017). Thus, our analysis benefits from the use of a stratified sample of newly founded businesses, about 50 percent of which are newly founded businesses in high-tech industries.

In a first step we analyse the ethnic composition of the new firms and in the next its impact on the firms' innovative activities. In doing this we differentiate between three groups of stakeholders: the founding teams, consisting of those who own and manage the business, the employees (if any) and, as a third category, these two groups together.

The results regarding the composition of the management team together with their employees show that foreigners are more likely to start a firm and are also more likely than Germans to hire foreigners as employees. These employees often share the same cultural background as the founders.

Regarding the impact of the ethnic composition on the likelihood of innovating we found no significant effect of ethnic diversity measured by a standard fractionalisation index. However, firms with rarer or exotic compositions are significantly more likely to innovate. In this regard, the results show that the effect is to be attributed to the ethnic composition at the level of the whole extended founding team, rather than to separate impacts of the ethnic composition of the founding team and that of the employees. This result is in line with the observation that foreign founders prefer to employ Germans, especially if they are seeking highly qualified staff.

This study is innovative in three main respects.

First, it studies the relationship between diversity and innovation in the firms where diversity is most likely to have a positive effect, i.e. in high-tech start-ups. It is hoped that this approach will shed some light on the partially inconclusive results of the firm-level literature.

Second, to achieve this objective, we apply a methodologically quite innovative approach. We apply structural events analysis (Ruef et al., 2003; Ruef, 2002) to analyse the firm's ethnic composition and we derive from it a novel measure of diversity that takes into account the probability of a given combination of ethnicities occurring in the

firm. This measure of rareness overcomes deficits of standard indices such as the fractionalisation or entropy indices as it reflects not only the distribution of nationalities present in a firm, but also its unusualness with respect to the local population.

Third, with a view to better articulating the diversity-innovation argument and to take into account firm-specific mediating factors appropriately, it distinguishes between four levels of diversity: firm-level diversity, employer-employee diversity; managing-team diversity and employee diversity.

These new perspectives can be applied to empirical analysis thanks to a unique longitudinal employer-employee database developed jointly by the Centre for European Economic Research (Zentrum für Europäische Wirtschaftsforschung (ZEW)) in Mannheim, the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung (IAB)) in Nuremberg and the KfW banking group (Kreditanstalt für Wiederaufbau (KfW)). Access to the KfW/ZEW/IAB database is restricted to the IAB for data confidentiality reasons.

2 Evidence from literature – theoretical framing

The trade-off underlying the relationship between diversity and innovation is not specific to ethnic diversity and applies to other demographic characteristics such as age and gender. While we attempt to take into account diversity in other ascribed and achieved dimensions, ethnic diversity is the main focus of this study. Most scholars agree that demographic diversity is a good proxy for cognitive diversity, i.e. the actual variety in perceptions and problem-solving attitudes expressed in work relationships (see for example Kilduff et al., 2000 for a discussion).

In his seminal paper “Structural Holes and Good Ideas”, Burt (2004) states that “brokerage provides social capital” and that “people who stand near the holes in a social structure are at higher risk of having good ideas” (p.349). This points directly to the potential of migrants in responsible positions. Because they are rooted in two cultures, they are ideally suited as between-group brokers. On average they should be more likely than natives to have access to new ideas and solutions that are valuable for organisations like firms. This is supposed to be of particular value for the creation of knowledge and therefore for all kinds of R&D activities (Berliant and Fujita 2008, Niebuhr 2010).

Studies adopting a regional perspective and controlling for possible reverse causation have identified complementarity effects between different cultures as well as a positive and robust contribution of ethnic and cultural diversity to productivity (Ottaviano and Peri, 2006; Haas and Lucht, 2013), innovation (Niebuhr, 2010; Brunow and Nafts, 2013; Cooke and Kemeny, 2017), income (Brunow and Brenzel, 2012) and labour market integration (Damelang and Haas, 2012). Trax et al. (2012) identify an important role of extra-firm complementarity effects affecting firm productivity through knowledge spillovers. Of particular relevance to this study, Audretsch et al. (2010)

highlight that, at the regional level, ethnic and cultural diversity positively affects entrepreneurship and the probability of establishing technology-oriented start-ups.

At the firm level, however, the evidence of the relationship between diversity and innovation is less straightforward. The empirical evidence often remains inconclusive unless the diversity measures are interacted with specific "mediating factors", such as skill levels (Brunow and Stockinger, 2013; Brunow and Nijkamp, 2012; Cooke and Kemeny, 2017), open management structures (Kochan et al., 2003; Garfinkel, 2004), open firm culture (Østergaard et al., 2011) or a conducive economic environment (Richard et al. 2007). Focusing exclusively on managing teams, Lee and Nathan (2013) find a positive and significant effect of diversity on innovation.

The basic tenet that diversity breeds innovation is less controversial in the high-tech sectors with a particularly skilled workforce (Williams, 2007; Brunow and Nijkamp, 2012; Fassio et al., 2015; Wadhwa et al., 2008; Cooke and Kemeny, 2017). Buche et al. (2013) find that the effects of cultural diversity differ by firm size and labour force qualification level, with larger firms with more qualified employees benefiting more from diversity and smaller firms being harmed by diversity. With reference to this study, the high average qualification level in high-tech start-ups should be expected to contribute to a positive link between diversity and innovation.

Most of the studies on the relationship between innovation and diversity have focused on diversity at the level of the management team, especially of multinationals, assuming that top management diversity is more likely to affect firm strategies and behaviour (Finkelstein and Hambrick, 1990). A number of studies, however (Reagans and Zuckerman, 2001; Laursen et al., 2005; Østergaard et al., 2011), stress the importance, for innovation studies, of looking at diversity among the employees and not just at management-team diversity in order to take into account the overall human capital available in the firm. The firm's ability to develop new products and processes then also depends on its ability to absorb external knowledge.

Nevertheless, ethnic diversity also comes at a cost. In particular communication can be hampered by different languages and cultures. Especially analyses at the firm level provide evidence of increasing coordination costs, conflicts and ambiguity associated with diversity (Kilduff et al. 2000), a result that may be inferred from other studies, too, when focusing on diversity among the lower-skilled (see, for instance, the results in Brunow and Stockinger, 2013). In their literature review, DiTomaso et al. (2007) emphasise that the number or likelihood of conflicts rises with increasing workforce diversity. These conflicts are caused by the emergence of homogeneous sub-groups that fight each other. But as Webber and Donahue (2001) point out, this is unlikely to happen in a small firm. Moreover, a founding team is likely to be very eager to cooperate efficiently and the same should apply for employees that are hired at an early stage. Nevertheless, there is no doubt that the performance of teams is positively correlated with internal homogeneity. But as diversity widens teams' external scope in many ways, in principal two different and contradicting effects of diversity are to be

expected (Buche et al., 2013) such that Milliken and Martins (1996, p.403) speak of diversity as a “double-edged sword”.

Nonetheless, the classical argument that "birds of a feather flock together" and that people tend to associate with those similar to themselves (McPherson et al, 2001) has been found to apply strongly to firm composition in the US (Ruef et al., 2003, Steffens et al., 2011) and is likely to apply to German start-ups, too. Hence, a priori we expect to observe that firm composition dynamics reflect more general social dynamics and lead to homophilous firm compositions. Another possibility is that we could observe that ethnically diverse compositions are relatively more frequent among start-ups because of inherent dynamics driving start-up formation.

Importantly, the results seem to respond to the measure of diversity applied: variety in ethnic backgrounds measured by fractionalisation indices or entropy indices is more frequently found to spur innovation than simpler measures of diversity such as the share of non-native workers (see the discussion in Østergaard et al., 2011 and in Brunow and Stockinger, 2013).

2.1 Measuring diversity

Diversity is by definition a structural property of aggregates and follows from the composition of individual attributes. Hence, the level of aggregation has a significant impact on the results. Which individuals are considered for an aggregate depends on the research topic. The selection must first be complete in the sense that everyone who has responsibility in the matter analysed must be included. Second, the unit must be precise, meaning it should not include individuals that are not in charge. In our case, we want to study the impact of the start-ups’ diversity on innovation. A great advantage of start-ups in this respect is that they are clearly defined units, and founders are clearly in charge of a firm’s innovation strategy. In view of the small size of the firms and the newness of their processes and routines, this also includes employees, at least those that are highly qualified (Aldrich and Ruef 2006).

Ruef (2002) and Ruef et al. (2003) highlight that each observed combination of ascribed and achieved characteristics in the firm should be analysed in relation to the likelihood of each specific combination occurring randomly. In the case of ethnicities, the issue is crucial: the foreign-born population remains a minor proportion of the overall population; the relatively high qualifications required to found a start-up are an even smaller proportion. Hence, the likelihood of observing a German-German composition is, by default, the greatest, even when homophily dynamics are disregarded. Moreover, path dependency and preferential attachment dynamics bias migration flows in such a way that some ethnic groups grow faster than others. This implies, for example, that the large proportion of people of Turkish origin living in Germany makes it per se more likely to observe firms that have a German-Turkish managing team

than, say, a German-Scandinavian managing team[2]. Hence, the preliminary question that we will pursue in this paper is whether the entrepreneurial spirit and the creativity generated by the encounter of different ethnicities lead to firm compositions that are significantly more or less diverse than one would observe in a random allocation of people to firms. To this end, we apply structural event analysis (Ruef et al. 2003; Ruef, 2002) to the analysis of the ethnic composition of German start-ups. Then, we study the effects of ethnic diversity on economic performance[3].

This way of framing the research question also suggests a different and innovative way of looking at ethnic diversity within firms. Most studies linking diversity to innovation make use of a fractionalisation index (Easterly and Levine, 1997; Alesina and La Ferrara, 2005), calculated as one minus a Herfindahl concentration index of the squared shares of each nationality.

$$Div = 1 - \sum_{i=1}^{I} (s_i)^2$$

Clearly, such a measure basically treats all ethnicities equally, is "colour blind" and is likely to fall short of measuring a firm's actual cognitive diversity.

Many "diverse" teams include individuals from neighbouring countries or individuals from large minorities as is the case, for example, with Turkish nationals in Germany. Many of those with a Turkish passport have lived in Germany for a long time or were even born there. Thus, although we acknowledge that German-Turkish teams are diverse, we assume that they differ from team compositions that are more unlikely to occur. Especially in R&D, these "exotic" compositions can be expected to be the ones that really bring in something new. Thus, we assume that not all "structural holes" are alike – some are bigger than others. Our approach to measure the degree of diversity, the structural event analysis, is therefore different because it explicitly links the frequency of a national group within a regional population with the likelihood of corresponding team compositions. We suggest adopting a more neutral perspective which is similar in its intuition to that used by Hidalgo et al. (2007) to measure technological proximity within regions. In their case, a measure of technological proximity is the conditional probability of observing one technology in a region, given that the other technology has also been observed. Our measure of cultural proximity would be the probability of observing a given combination of ethnicities in a firm located in a particular region, given the marginal distribution of ethnicities in that region. The less likely

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2 Data availability issues underlie the definition of ethnicity that we apply in this study. As regards the managing team, the categories are based on a question in the German Start-up Panel asking "What national origins are represented in the founding team?" As regards the Employment History Panel (BeH)), we have data on the nationality of the employees in the firms. This implies possibly underestimating the actual ethnic diversity in the firms as we will neglect the proportion of foreign-born workers who have acquired German nationality. However, this is a standard problem in migration studies.

3 The structure of this study is similar to that in Steffens et al. (2011) and Kaiser and Müller (2013), who, however, focus on other dimensions of diversity.

the combination, the greater the cultural "distance" and, presumably, the cognitive diversity, thus, the potential gains for innovation according to the literature.

3 Data

To investigate the significance of each part of the young firms' knowledge base, a database is needed that provides information on the social and professional background of entrepreneurs and early employees. To this end, we constructed a unique linked employer-employee database (LEED) on start-ups that allows us to compare the effects of diversity at different levels within the same firm: employer-employee diversity; diversity in the owner/manager founding team; diversity in the employees' teams; and overall diversity in the start-up.

This database combines information on the founders' origins, the origin of the employees, the human capital in the firm both among employees and at the founding-team level as well as the firms' innovative outcomes (e.g. product and process innovations). The database was jointly developed by the Institute for Employment Research (Institut für Arbeitsmarkt- und Berufsforschung (IAB)), the Centre for European Economic Research (Zentrum für Europäische Wirtschaftsforschung (ZEW)), and the KfW banking group (Kreditanstalt für Wiederaufbau (KfW)). It combines data from a panel survey of 13,400 start-ups between 2005 and 2012 (IAB-ZEW-Start-Up Panel (IAB-ZEW-*Gründungspanel)*,[4]) with administrative data from the Employment History Panel (*Beschäftigungshistorik*, referred to as BeH below) of the Federal Employment Agency on all employees that enter one of the firms surveyed. The resulting LEED contains information about the nationality of both employers and employees and about other demographic or "ascribed" attributes that are likely to affect their cognitive diversity, such as gender and age. It also contains data on the skills and tenure within the organisation, which are likely to affect the "acquired" dimension of cognitive diversity. In the construction of the questionnaire, particular emphasis was placed on the firms' innovative activities. Start-ups in the high-tech sector are oversampled in this database: some 50 percent of the firms surveyed belong to this sector. The above-mentioned variables are available for a total of 4,062 firms, 2,825 of which are employers. The summary statistics of the variables used in the analyses in the next sections are reported in table A1 in the appendix.

4 Methodology: Structural events analysis

As mentioned above, the structural events analysis (SEA) is based on the works by Ruef (2002) and Ruef et al. (2003). Applying SEA to the analysis of firms' ethnic compositions means studying the likelihood of a given combination of ethnicities, or structural event, occurring, given the marginal distributions of the ethnicities in the population. For tractability, we aggregate the potential ethnicities to a set of six roles corresponding to the most frequent regional areas of origin in Germany: Germany, western

[4] See: http://www.gruendungspanel.de/en/mannheimer-gruendungspanel/results.html

Europe, eastern Europe, Middle East and Central Asia, Southeast Asia, other[5]. The total number of potentially observable structural events, i.e. the risk set, is calculated as the sum of combinations for each possible rank of the system $r(H)$, which is the maximum number of actors represented in any given group. If structural events are drawn from a population of entrepreneurs that is 80 percent German, 10 percent Turkish and 10 percent Chinese, the risk set of a start-up team of three people will contain the following combinations:

$s(H) = \{GGG, TTT, CCC, GTT, GGT, GCC, GGC, TCC, TTC, GTC\}$. The probability of occurrence of each structural event is calculated on the basis of probability theory, assuming statistical independence among the roles, i.e. the national origins, given the marginal distribution of ethnic origins in the population. In other words, we calculate the likelihood of a given combination of national origins occurring at random, conditional on the size of the group. The roles (or role combinations) in a node set N are designated as elementary events for purposes of statistical analysis and the rule of multiplication is applied to determine the probability of joint events. Provided that the roles included in a particular structural event are events in N occurring with probability $p(n_1), p(n_2), \ldots, p(n_k)$, the sampling distribution of joint structural events is given by the multinomial formula:

$$P(E \mid r) = \frac{r!}{\mid n_1 \mid ! \mid n_2 \mid ! \ldots \mid n_k \mid !} \times [p(n_1)^{\mid n_1 \mid} \times p(n_2)^{\mid n_2 \mid} \times \ldots \times p(n_k)^{\mid n_k \mid}] \quad (1)$$

where $r = \mid n_1 \mid + \mid n_2 \mid + \ldots + \mid n_k \mid$ and corresponds to the size of the group. Going back to the previous example, we define the number of Germans in the team as n_1, of Turkish nationals as n_2, and of Chinese nationals as n_3, and the respective probabilities as:

$p(n_1) = 0.8$, $p(n_2) = 0.1$ and $p(n_3) = 0.1$.

Then the expected probability of obtaining, say, a three-member founding team with one German and two Chinese participants under an assumption of statistical independence is: $p(E \mid 3) = (3!/(2! \times 1!))(0.80^1 \times 0.10^2) = 0.024.$

The event probability reflects the fact that there are three different ways of drawing the participants. By comparison, the probability of obtaining a three-member team that consists only of German participants is: $p(E \mid 3) = (3!/3!)(0.80^3) = 0.512$.

[5] There were originally nine geographic categories; we aggregated North America, Central and South America, North Africa, Sub-Saharan Africa into "other" due to their low shares across the immigrant populations. We isolated German origin from western Europe for obvious reasons.

Knowing the ethnic composition of the teams, we are thus able to calculate the probability that this composition would have occurred at random.

The objective of structural event analysis is to predict the number of groups matching some set of compositional characteristics, considering all possible groups (not just those that actually form). The expected frequency of each combination, which is simply derived by multiplying the size of the team by the theoretical probability, is then compared with the observed frequency of that combination. The counts of the frequencies are predicted via Poisson regression:

$$P[f(E_i) = y] = e^{-\lambda}(\lambda^y / y!) \quad (2)$$

where λ is defined in terms of the conditional probability of structural event occurrence $\lambda = f(p[E \mid r], r)$, and r specifies the size of each team. A baseline probability for each group, under an assumption of random population mixing, is included as a fixed parameter in each Poisson regression. Hence, the dependent variable can be interpreted as the deviation between the observed and the theoretical frequency of each combination. All other design parameters reflect deviations from random mixing and are estimated using maximum-likelihood techniques.

It should be noted that in our application of the SEA we depart from Ruef et al. (2003) in an important respect. To obtain the marginal distribution of nationalities, Ruef et al. (2003) use the marginal distribution of nationalities across all observed teams. In our case, this would imply using the marginal distribution of nationalities in the start-up founding teams summing up all start-ups across Germany. While this is certainly a valid measure, it may be that the distribution of nationalities in founding teams diverges from the distribution of nationalities in the population due to self-selection of the founders. Moreover, due to the availability of the employment histories in Germany, which include data about employees' nationalities, we have a much more accurate measure of the distribution of the active population by nationality compared to what could be provided by the survey data derived from the Start-up Panel. Moreover, we realise that the probability of achieving the same ethnic composition may be quite different in a very cosmopolitan city like Berlin than it would be in a relatively ethnically homogeneous rural region. Based on all these considerations, we use the marginal distribution of employees' nationalities in the NUTS3 region to compute the probabilities $p(n_i)$[6]. However, in a set of unreported analyses, we also computed the probability of the combinations using the original computation of marginal probabilities as in Ruef

6 Even where there is agreement about our main arguments, the question arises as to whether the marginal distribution of residents' nationalities (rather than of employees' nationalities) by NUTS3 region would not be an accurate measure for our purpose. We consider the labour market pool from which entrepreneurs emerge when founding teams to be more accurately represented by the population of employees than by the population of residents, which includes a range of inactive people. Unfortunately, disaggregated data on residents by labour market status and nationality are not available at the NUTS3 level, hence we conclude that our measure is the best possible given existing data constraints.

et al. (2003). The corresponding probability density turns out to have a more erratic distribution with only a subset of values actually observed, which confirms our strong preference for the probability calculation based on the regional distribution of nationalities that we propose here. At any rate, the main results of our analysis are not radically affected when the other measure is used.

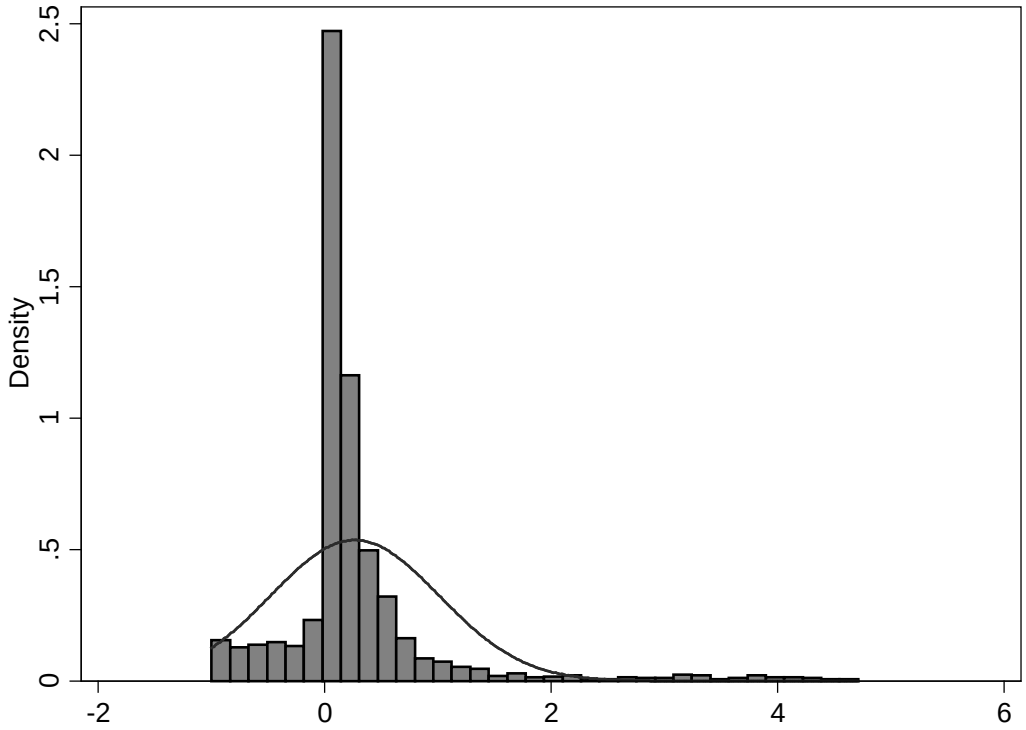
5 Results

5.1 The ethnic composition of German start-ups: a structural events analysis

This section focuses on the ethnic[7] composition of start-ups and compares the observed frequencies of ethnic combinations (reweighted using sampling weights) with the frequencies that would be expected under the hypothesis of a random allocation of ethnic origins in newly-founded firms. The correlation between the expected and the observed frequencies of ethnic combinations is 0.49: thus, randomness cannot be excluded in the determination of the firm-level combinations. This is shown graphically in Figure 1, which reports the relative differences between the observed and expected frequencies: small relative differences are by far the most common.

7 As mentioned above, we use the term “ethnic composition” for simplicity. We use data on the founders’ self-declared country of “national origin” and about the employees’ present nationality, reported in the Employment History Panel. We aggregate the countries into nine macro-regions, reflecting as far as possible the results of the GLOBE Study (House, R.J. et al., 2004) and, of these, we take the four most strongly represented ones and aggregate the others into a residual category. We use these five categories plus the German origin as the set of roles for our “ethnic composition”. So a more precise wording for what we call “ethnic composition of start-ups” would be the “composition of start-ups by macro-areas of origin”.

Figure 1
Distribution of the observed frequencies minus the expected frequencies



Note: n=3,655; 407 outside values excluded
Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

These differences between observed and expected frequencies represent a highly interesting measure of the rarity of the ethnic combinations in teams given the frequencies of the corresponding combinations in the population. According to the theory, especially atypical combinations should lead to the creation of unusual mixtures of knowledge, which should in turn lead to innovations.

As discussed earlier, our dependent variable is the observed frequency of each combination of origins in our sample (reweighted using sampling weights). Poisson models are estimated where the expected frequencies enter as a fixed parameter, so that the regressors essentially explain the deviations from these expected frequencies. For this reason, a positive and significant coefficient would have to be interpreted as a factor that causes the observed frequencies to exceed those expected. Because foreigners are distributed very differently across Germany, the regional distribution of foreigners' areas of origin at NUTS3 (district) level is used as the baseline. The median expected and observed frequencies of each combination across the different NUTS3 regions and years are given in Table A2 in the appendix. We report the results of the estimations in Table 1.

Table 1
Poisson regression for the ethnic composition of start-ups (firm level) - firms with employees only.

Variable	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Founder-team composition: (ref.: German only)					
Foreigner(s) only	2.124***	2.643***	1.818***	1.625***	1.802***
	-0.21	*-0.54*	*-0.65*	*-0.62*	*-0.65*
Foreign-German mix	2.044***	1.501***	0.744	1.173***	0.724
	-0.2	*-0.37*	*-0.63*	*-0.41*	*-0.63*
Employee composition: (ref.: German only)					
Foreigner(s) only	-0.285***				
	-0.1				
Foreign-German mix	1.393***				
	-0.45				
Relationship between founders' and employees' culture:					
German founder(s) (ref.: German-mix)					
German employee(s)		-0.258***	-0.259***	-0.260***	-0.257***
		-0.09	*-0.09*	*-0.09*	*-0.09*
Foreign employee(s)		0.764	0.771	0.756	0.768
		-0.55	*-0.54*	*-0.54*	*-0.54*
Foreign founder(s) (ref.: foreigner(s)-mix)					
German employee(s)		-1.005*	-0.182	0.015	-0.157
		-0.58	*-0.68*	*-0.65*	*-0.69*
Foreign employee(s)		1.754***	1.248**	1.190*	1.256**
		-0.63	*-0.64*	*-0.64*	*-0.64*
Mixed German-foreign founder(s) (ref.: mix-mix)					
German employee(s)		0.529	1.278*	0.826*	1.288*
		-0.42	*-0.66*	*-0.46*	*-0.67*
Foreign employee(s)		3.344***	2.640***	1.948***	2.649***
		-0.36	*-0.61*	*-0.51*	*-0.61*
Homophily: all individuals are of the same foreign nationality			1.486**	1.749***	1.502**
			-0.71	*-0.66*	*-0.71*
Human capital of founders and employees:					
Highly qualified founder(s) ref: no highly qualified				0.043	
				-0.04	
Highly qualified employee(s) ref: no highly qualified				0.02	
				-0.03	
Highly qualified in the firm ref: no highly qualified					0.051
					-0.04
Constant	0.362***	0.327***	0.322***	0.310***	0.303***
	-0.11	-0.1	-0.1	-0.1	-0.11
log L	-141046	-138627	-135941	-134471	-135794
Pseudo R2	0.309	0.321	0.334	0.341	0.335

No. observations: 2,825

Note: Poisson regression with an exposure value for the theoretical expectation; robust s.e. in (); * 0.10, ** 0.05, *** 0.01. Control variables included are: firm-size dummies, NUTS3 region-type dummies, industry dummies, as well as binary controls for firms with a legal form equivalent to an incorporated company, firm size (>10), founder's motive for start-up, foreign ownership, industries and a specific stratification variable.

Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

In all the specifications we include a firm-size dummy (<10)[8], as well as industry dummies to control for systematic differences in the composition across industries. Further controls are a binary variable indicating whether or not the firm is incorporated, and a binary variable about the founders' motive for starting the venture: whether the business was founded due to a lack of job alternatives (necessity-start-up) or not[9]. A joint parameter significance test supports the hypothesis of the general significance of all variables present.

The base model (first column) shows that foreign founders and mixed teams, in other words founding teams consisting of Germans and foreigners, are more common than expected. This shows a homophilous behaviour pattern of non-native founders: foreigners more often look for other foreigners when forming a start-up team. In contrast, German founders show no signs of homophily. But this also indicates that foreign founders are more common than expected, thus underpinning the fact that foreigners start up firms more often than the native population.

Germans are also employees in young firms less frequently than expected, whereas foreigners are observed more often than expected under the assumption of randomness. This shows that Germans are comparatively seldom involved in any kind of entrepreneurial activities – not only as founders themselves but also as early employees. This is in line with the observation that start-up rates in Germany are among the lowest measured in the Global Entrepreneurship Monitor (GEM) (Global Entrepreneurship Research Association, 2017) and that fear of failing with a start-up is one of the highest measured in the GEM in innovation-based economies (Sternberg et al. 2013). Employees joining new firms very early are significantly more venturesome than employees in incumbent firms (Roach and Sauermann, 2015). This also is in line with the well-known fact that migrants are more risk-tolerant than non-migrants (Heitmueller 2005; Jaeger et al. 2010; Bonin et al. 2009). However, as it is similarly clear that on average small and young firms pay lower wages than large incumbent firms (Nyström and Elvung 2014, Nyström and Elvung 2015, Schnabel et al. 2011, Brixy et al. 2007), we also assume a negative selection of foreigners into new small businesses. On the side of the founders though, we aim to control this by including a dummy for the reason why they started the business (necessity vs. opportunity entrepreneurs), which turns out to be positively significant (90%), meaning that a necessity-background does in fact play a role.

The next question is therefore whether there is a tendency to form homophilous groups when hiring staff, in other words: a tendency for foreign founders to hire foreigners. The process of forming a business idea and bringing it to life demands high levels of trust (Caliendo et al. 2012) and diversity entails high coordination costs due to different cultural perspectives (Lazear,1999). It can be argued that the opportunity

8 We also test firm size as a metric variable and as a 10-staged dummy

9 We also include a dummy variable to control for a specific oversampling in some years.

costs of managing a diverse group should be particularly high when the group is newly formed, that means in the early phases of a start-up existence. Furthermore, the lack of stability and resources of newly founded firms could lead founders to recruit employees through less formalised selection procedures, to rely more on trust relationships, commitment and on their own social networks rather than on monetary incentives. All these factors make early employees part of an "enlarged founder team" and give reason to expect founders to tend to hire employees of their own nationality to a disproportionately large extent.

In the next step (column two) we interact the founders' origins with those of their employees (column 2). This yields two main results. First, it shows that Germans tend not to hire Germans as often as predicted and, second, that foreign founders and founding teams with diverse compositions prefer to hire foreign employees[10]. Thus, a tendency towards forming ethnically homogeneous groups can only be confirmed for non-German founders or mixed teams. It is an obvious assumption that this preference of foreign founders for homophilous groups means a preference not only for members of the same broad cultural background, but of the precise nationality. To verify this, a binary variable "national match" is included (column three) which indicates whether, within a firm, the same non-German nationality is observed both in the founding team and among the employees - but it is not said that this nationality is the only one in the firm. This variable turns out to be positive and significant, implying that combinations of the same – but not exclusive – nationality are more frequently observed than under randomness. Thus, we observe a pronounced tendency of foreign founders to employ foreigners of their own nationality.

In column four, we include human capital measures using a dummy variable that controls for the presence of at least one university graduate in the founding team and a variable indicating the share of employees involved in complex analytic tasks. The results are not significant; the combination of nationalities in the firms is not driven by the human capital of either the founder(s) or the employee(s).

Even if highly qualified, foreign founders sometimes lack specific certified skills which are necessary to carry out certain orders or to be able to formally train apprentices etc. To examine this, the human capital variables are interacted with the two foreign categories, founders and employees, with no significant results (not shown). The same applies to the share of women and corresponding interactions with the foreign categories and the human capital dummies (also not shown).

Overall, our results first imply a tendency towards homophily of foreign founders forming ethnically homogeneous groups. Second, Germans are less likely than expected to work in newly founded firms whereas the opposite applies for foreigners.

[10] There is also a tendency for foreigners to hire Germans less frequently but this is only significant at the 10% level and only in the first model.

5.2 Diversity, innovation and productivity in start-ups

In the next step we use the results of the structural events analysis to compute a variable showing the probability of the observed combination of nationalities in the firm occurring by random allocation of people to the firm. This is a very context-specific measure of diversity: how "usual" is the observed combination of nationalities in the firm given the ethnic composition of the region? We argue that what matters for innovation is not so much the sheer number of national origins or the relative shares of ethnicities in the firm as captured in more standard fractionalisation indices. Rather, it is reasonable to assume that the extent to which the combination of nationalities, and, arguably, of cognitive perspectives, is unusual not in absolute terms but with respect to its (local) context is what matters for producing unusual ideas that lead to innovations. To provide an example, in view of the large and long-lasting settlement of Turkish people in Germany, could we really expect the combination of a German and a Turkish person in a German start-up to produce cognitive diversity? The SEA provides us with a variable of the rareness of the observed combinations ($1-P(E \mid r)$) that can be used as a measure of diversity.

In what follows, we first apply a relatively standard measure of diversity based on the fractionalisation index (e.g., Easterly and Levine, 1997; Alesina and La Ferrara, 2005; Ottaviano and Peri, 2006; Niebuhr, 2010; see also the discussion in Alesina et al., 2016). Then we extend the model by including our measure of rareness of the ethnic combination in the firm. We expect that innovation will be observed more frequently in firms that depart more significantly from the "norm", i.e. in firms that would have had a smaller likelihood of occurring by chance. To the best of our knowledge, such a measure has not been used in this way to date for analysing the effect of diversity and innovation.

Table 2 and Table 3 report the results of a first set of estimates explaining the likelihood of a new firm innovating within the first year of its existence. For the dependent variable, we combine all kinds of innovative activities into a dummy variable: new patents introduced by the firm in its first year of existence, placement of a new product or service or the introduction of a process-innovation, all of which are all based on answers given in the questionnaire.

First of all we estimated the innovation probability depending on the diversity of the founders using the same binary variable as in the SEA, which is given the value of one if at least one founder is non-German. We include two measures of ethnic diversity. First, a classic fractionalisation index that is based on the number of different ethnicities present in the founding team and second, the rareness measure described above. The results of the estimates show no impact of the fractionalisation index (Table 2), whereas we do find a positive impact of the rareness variable. But this is only significant at the 10percent level, so its influence appears debatable.

In all the specifications we used the same controls as in the SEA estimations plus the logarithm of turnover and investments, dummies for whether at least one of the owners is a woman, has management experience or had a patent registered before the start-up of the firm which is connected with the firm's purpose. A joint parameter significance test supports the hypothesis of the general significance of all variables present.

Table 2
Logit regression on the innovativeness of the start-ups (founding team level)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
At least one foreigner among founders	-0.642	-0.509	-0.546	-0.568	-0.571	-0.569
	(0.46)	(0.48)	(0.47)	(0.47)	(0.47)	(0.47)
University graduate among founders	0.321***	0.321***	0.260**	0.318***	0.318***	0.319***
	(0.09)	(0.09)	(0.11)	(0.09)	(0.09)	(0.09)
Fractionalisation index (founders)	-0.195	-0.235	-0.914	-8.305	-7.937	0.510
	(0.57)	(0.59)	(1.17)	(6.65)	(6.98)	(0.73)
Rareness (founders)	0.895*	0.693	0.651	0.819*	0.824*	0.692
	(0.48)	(0.50)	(0.56)	(0.49)	(0.49)	(0.53)
Dummy Large firm * Rareness		1.468				
		(0.97)				
Dummy Large firm * Fractionalisation		-0.896				
		(2.09)				
University * Rareness			0.355			
			(0.41)			
University * Fractionalisation			0.544			
			(1.34)			
Rareness*Fractionalisation				8.591		
				(7.04)		
Small firm*Rareness*Fractionalisation				8.084		
				(7.43)		
Large firm*Rareness*Fractionalisation				9.595		
				(7.70)		
High-tech*Rareness						0.397
						(0.44)
High-tech*Fractionalisation						-1.570
						(1.05)
Constant	-2.960***	-2.960***	-2.940***	-2.959***	-2.970***	-2.977***
	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)
log L	-2350	-2348	-2349	-2349	-2349	-2349
Pseudo R2	0.077	0.078	0.077	0.077	0.077	0.077

No. observations: 4,062

Note: Logit regression; robust s.e. in (); * 0.10, ** 0.05, *** 0.01. Control variables included are: firm-size dummies, industries, a specific stratification variable, NUTS3 region-type dummies, industry dummies, as well as binary controls for firms with a legal form equivalent to an incorporated company, firm size (>10), founder's motive for start-up, foreign ownership, logarithm of turnover and investments, dummies for whether at least one of the owners is a woman, has management experience or had a patent registered before the start-up of the firm which is connected with the firm's purpose.

Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

This changes if we widen the view and take the enlarged founder team into account (Table 3). The classic fractionalisation-type diversity is still found to have no significant

impact on the innovativeness of the young businesses at all, but the positive impact of the rareness variable now becomes highly significant and very robust.[11] But now, in contrast to the founder-team estimates, the presence of foreigners in a firm has a negative impact on the firm's likelihood of innovating. This effect seems mainly due to collinearity with the rareness measure (foreign-owned firms have on average rarer ethnic combinations) and indeed disappears when this is re-centred by the foreign origin of the workers in the firm. In any case, as the negative effect is only half of the size of that of the rareness variable, foreigners that are uncommon in the region continue to exert a positive impact on innovation. This shows how important it is to consider the frequencies with which nationalities occur within the population. Only a combination of unusual ethnicities leads to more frequent innovations, while businesses that include more "common" non-German ethnicities tend to innovate less than new firms involving only Germans.

In addition, we find a significant positive impact of the interaction between the high-tech and the rareness variables. Especially innovative high-tech firms benefit from having foreigners that are relatively rare in the region where the new business is situated. Thus, the unusualness that leads to innovations comes mainly into effect if both sides of the new firms' human capital are taken together. This can be seen as a further indication of how important a start-up's early employees are.

[11] To check the robustness of these results we conducted several different estimates, including separate models for high-tech and low-tech businesses, random-effects models and models with firm-specific fixed effects. The results are robust and confirm the positive effects of diversity mainly in high-tech firms. To disentangle the effect of diversity from that of specific nationalities, we also estimated models with our diversity measures included along with dummies for each of the six nationality groups indicating that there is a member of the respective nationality group working in the firm. These models confirmed the effect of diversity as a whole while showing no separate impact of specific nationalities.

Table 3
Logit regression on the innovativeness of the start-ups (enlarged founding-team level)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
At least one foreigner in the firm	-0.323**	-0.323**	-0.180	-0.321**	-0.321**	-0.312*
	(0.16)	(0.16)	(0.33)	(0.16)	(0.16)	(0.16)
University graduate in the firm	0.325***	0.325***	0.324***	0.309**	0.324***	0.327***
	(0.09)	(0.09)	(0.09)	(0.13)	(0.09)	(0.09)
Fractionalisation (firm-level)	-0.612	-0.598	-0.390	-0.482	2.738	-0.306
	(0.47)	(0.49)	(1.00)	(0.72)	(3.48)	(0.58)
Rareness (firm-level)	0.760***	0.750***	0.787***	0.710**	0.759***	0.486*
	(0.24)	(0.25)	(0.29)	(0.33)	(0.24)	(0.29)
Dummy Large firm * Rareness		0.084				
		(0.69)				
Dummy Large firm * Fractionali-sation		-0.069				
		(1.64)				
Foreigners in the firm* Rareness			-0.202			
			(0.52)			
Foreigners in the firm* Fraction-alisation			-0.194			
			(1.12)			
University * Rareness				0.083		
				(0.38)		
University * Fractionalisation				-0.211		
				(0.89)		
Rareness*Fractionalisation					-3.587	
					(3.69)	
High-tech*Rareness						0.699*
						(0.38)
High-tech*Fractionalisation						-0.880
						(0.89)
Constant	-	-	-	-	-	-
	2.687***	2.687***	2.678***	2.675***	2.693***	2.806***
	(0.47)	(0.47)	(0.47)	(0.48)	(0.47)	(0.48)
No. obs	4062	4062	4062	4062	4062	4062
log L	-2347	-2347	-2347	-2347	-2346	-2345
Pseudo R2	0.079	0.079	0.079	0.079	0.079	0.079

No. observations: 4,062

Note: Logit regression; robust s.e. in (); * 0.10, ** 0.05, *** 0.01. Control variables included are: firm-size dummies, industries, a specific stratification variable, NUTS3 region-type dummies, industry dummies, as well as binary controls for firms with a legal form equivalent to an incorporated company, firm size (>10), founder's motive for start-up, foreign ownership, logarithm of turnover and investments, dummies for whether at least one of the owners is a woman, has management experience or had a patent registered before the start-up of the firm which is connected with the firm's purpose.

Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

6 Conclusions

To assess the significance of the presence of foreign ethnicities on the innovativeness of new firms it is not sufficient to focus only on the founder(s). It is essential to take all stakeholders into account. Early employees are a very distinct group (Roach and Sauerman 2015) and are important for the success of the firm.

There is also already evidence that the ethnic background of the individuals involved plays a role for firm success and innovation. We are now able to show that the impact of foreigners depends on the relative frequencies of the specific ethnic group in the regional population. A positive impact on firms' innovativeness only exists for those ethnicities that are unusual not in absolute terms but with respect to the regional context. For the larger minorities, we even find a negative impact on firms' innovativeness.

Moreover, we do not find any impact of the concentration of ethnic groups involved in a firm on innovation as measured with an index of fractualisation.

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Appendix

Table A1
Summary Statistics

Variable	Mean	SD	Min.	Max.
Innovation (dummy)	0.32	-	0	1
Industry-dummies		-		
High-technology manufacturing	0.05	-	0	1
Technology-intensive services	0.23	-	0	1
Software supply and consultancy	0.06	-	0	1
Non-high-tech manufacturing	0.11	-	0	1
Skill-intensive services	0.06	-	0	1
Other business-oriented services	0.05	-	0	1
Consumer-oriented services	0.11	-	0	1
Construction	0.13	-	0	1
Retail & wholesale	0.14	-	0	1
Year-dummies		-		
2008	0.18	-	0	1
2009	0.19	-	0	1
2010	0.20	-	0	1
2011	0.15	-	0	1
2012	0.15	-	0	1
Log(turnover)	12.12	1.35	6.22	20.03
Log(investments)	10.17	1.31	5.30	16.12
incorporated firm (dummy)	0.57	-	0	1
Founded to avoid unemployment	0.12	-	0	1
>=10 persons including founders and employees (dummy)	0.07	-	0	1
At least partly in German pocession (dummy)	0.06	-	0	1
At least one founder with management experience	0.44	-	0	1
Patent registered before the start-up of the firm	0.03	-	0	1
At least one women founder (dummy)	0.18	-	0	1
At least one non-German founder (dummy)	0.07	-	0	1
At least one univ.graduate founder (dummy)	0.47	-	0	1
Fractionalization-index of founder-team	0.02	0.08	0	0.67
Rareness-variable (founder team)	0.16	0.24	0.00	1
At least one women founder or employee (dummy)	0.49	-	0	1
At least one non-German founder or employee (dummy)	0.15	-	0	1
At least one univ.graduate founder or employee (dummy)	0.58	-	0	1
Fractionalization-index of firm	0.04	0.12	0	0.69
Rareness-variable (founder firm	0.29	0.30	0.00	1
Observed frequencies	357.90	684.63	2.34	7277.79
Expected frequencies	342.00	682.40	0.01	7022.73
Founder-team composition				
Only German founders	0.93	-	0	1
Only foreign founders	0.04	-	0	1
Diverse team of founders	0.03	-	0	1

Variable	Mean	SD	Min.	Max.
Employee composition				
No employees	0.29	-	0	1
Only German employees	0.57	-	0	1
Only foreign employees	0.01	-	0	1
Diverse employees	0.13	-		
Homophily: all individuals are of the same foreign nationality (dummy)	0.02	-	0	1
Firm size (number of founders & employees)				
1	18.93	-	0	1
2	24.42	-	0	1
3	17.60	-	0	1
4	11.18	-	0	1
5	7.93	-	0	1
6	4.87	-	0	1
7	3.57	-	0	1
8	2.24	-	0	1
9	2.07	-	0	1
10 and more	7.19	-	0	1

Number of observations: 4,062

Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

Table A2
Expected and Observed frequencies of ethnic compositions by firm-level combination of national origin across districts and years

Firm-level combination of national origins 1 German 2 Eastern European 3 Western European 4 Middle-East 5 Central Asian 6 Other	**Expected frequency** (median)	**Observed frequency** (median)	**Difference** observed minus expected
1	133.86	113.99	-19.87
2	23.04	216.57	193.53
3	2.62	34.15	31.53
4	7.65	62.60	54.95
5	6.10	270.28	264.18
6	1.85	303.97	302.12
1-2	15.91	25.97	10.06
1-3	7.22	23.17	15.95
1-4	6.27	30.74	24.47
1-5	6.84	27.40	20.56
1-6	10.99	33.18	22.19
2-3	0.18	242.26	242.08
2-4	0.02	152.46	152.44
2-5	0.03	402.76	402.73
3-4	0.00	44.82	44.82
3-5	0.80	173.36	172.56
3-6	0.01	0.00	-0.01
1-2-3	1.50	23.02	21.52
1-2-4	0.79	20.72	19.93
1-2-5	2.22	17.75	15.53
1-2-6	3.96	23.66	19.7
1-3-4	23.21	40.28	17.07
1-3-5	0.35	14.41	14.06
1-3-6	0.45	18.95	18.5
1-4-5	0.03	950.96	950.93
1-4-6	1.17	230.36	229.19
1-5-6	4.94	34.88	29.94
1-2-3-4	0.02	24.06	24.04
1-2-3-5	0.17	24.49	24.32
1-2-3-6	0.62	26.69	26.07
1-2-4-5	3.63	899.58	895.95
1-2-4-6	11.17	110.07	98.9
1-2-5-6	0.01	70.68	70.67
1-3-4-6	1.00	763.94	762.94
1-3-5-6	0.00	9.47	9.47
1-2-3-4-5	5.41	15.13	9.72
1-2-3-5-6	0.27	26.60	26.33
1-2-3-4-5-6	0.00	30.74	30.74

Source: Linked employer-employee data of the IAB-ZEW Start-Up Panel

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