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An evaluation of the role of spatial selection and agglomeration

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JENA ECONOMIC RESEARCH PAPERS · # 2021-009

The JENA ECONOMIC RESEARCH PAPERS
is a publication of the Friedrich Schiller University Jena, Germany (www.jenecon.de).

Jena Economic Research Papers # 2021 - 009

The early development of new establishments: An evaluation of the role of spatial selection and agglomeration

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June 2021

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Abstract

This paper analyzes the early development of new establishments evaluating the role of spatial selection and agglomeration. The analysis shows a clear and strong selection of more productive new establishments into larger regions, regardless of the foundation type. While at the end of the time-period analyzed new establishments located in larger regions still show higher productivity levels as compared to those located in smaller regions, the role of an agglomeration is very distinct depending on the foundation type. Spin-offs in larger regions tend to keep the higher productivity level shown in the first time period, but start-ups suffer negative agglomeration effects over time.

JEL classification: L26 · L25 · R30 · R12

Keywords: Entrepreneurship, agglomeration, firm selection, productivity

The author is grateful to the Research Data Center of the Institute for Employment Research (IAB) in Nuremberg, Germany, for assistance during virtual access to the datasets. Comments from Michael Fritsch, Igor Asanov, Viroj Jienwatcharamongkhol and Alex Coad were very helpful to improve this paper. Financial support from the Research Center of the Universidad Espíritu Santo to attend the 5th Geography of Innovation conference is gratefully acknowledged.

1. Introduction

According to the resource based view of the firm, the competitive advantage of firms depends to a great extent on their internal resources and capabilities (Penrose, 1959; Barney, 1991). In this regard, there is extensive literature that relates the performance of entrepreneurial activities to the attributes, skills and motives of entrepreneurs (Miner, Smith, & Bracker, 1992; Ray, 1993; Frank, Lueger, & Korunka, 2007; Parker, 2009). Besides these internal resources and capabilities, the performance of firms are also influenced by external factors, such as the externalities that arise from the geographical location. Regions differ from each other with regard to the type and degree of externalities that can provide to firms. A main factor that might derive from the geographical location refers to agglomeration economies, associated with external scale economies arising from large and dense agglomerations.

Duranton and Puga (2014) argue that firms settled in larger regions are able to produce more outputs with the same inputs. Agglomeration externalities deliver productivity advantages and provide firms located in such agglomerations with a competitive advantage compared to isolated firms (Appold, 1995). This rationale explains the persistent geographical concentration of firms and individuals. Nonetheless, Richardson (1995) argues that while cities grow, agglomeration economies might start to diminish. In line with this argument, Arikan and Schilling (2011) and Pouder and StJohn (1996) argue about negative performance effects of geographical agglomerations. Shaver and Flyer (2000) provide empirical evidence of such negative effects which are generally associated with an increased local competition (Sorensen & Sorenson, 2003) or competition for land, workers and utility services (Flyer & Shaver, 2003; Folta et al., 2006) as well as congestion costs, specifically traffic congestion resulting from commuting, higher costs of living and doing business (Pouder & StJohn, 1996).

The relationship between agglomerations and productivity has been extensively investigated at the aggregated regional level (i.e. Glaeser et al., 1992, Henderson et al., 1995). More recently, there is a growing number of papers that relate agglomerations with firm performance (Henderson, 2003; Andersson & Lööf, 2011; McCann & Folta, 2011; Knoben et al., 2016). Turning to new businesses, their performance is also linked to their local environment (Fotopoulos & Louri, 2000); in fact, there is evidence of the role of the geographical location on the survival of new firms (Audretsch & Lehmann, 2005; Delgado et al., 2010). This has motivated more recent research that investigate how agglomeration

externalities influence the survival of new firms paying special attention to the role of time, type of firm and technological relatedness (Neffke et al., 2012), or the distinct survival benefits based on the heterogeneity in firm's resources and capabilities (Pe'er & Keil, 2012), or analyzing the various types of agglomeration externalities and the changes of survival (Tavassol & Jienwatcharamongkhol, 2016).

Even though these papers argue that a certain agglomeration externality favors the survival chances of a new firm, a straightforward conclusion that agglomerations positively influence the performance of new firms might not be possible without considering the possibility of a spatial selection mechanism of better performing new businesses into agglomerations. In this regard, Baldwin and Okubo (2006) introduced a model of spatial selection of most productive firms into larger regions. Based on this model, I hypothesize that such a mechanism could be in place for new businesses. If this hypothesis is truth and agglomerations attract best performing new businesses, how do agglomerations influence the performance of those highly performing entries over time (in early stages)? Do agglomerations further enhance, maintain or reduce the performance level of new businesses over time? Does the foundation type of a new business play a role in the way and degree to which agglomerations influence their performance?

In this paper I provide answers to these questions and make the following main contributions to the literature to the fields of entrepreneurship, spatial selection and the role of agglomeration. First, I show that there is a spatial selection of more productive new establishments into agglomerations. Very interestingly, this selection effect occurs among all types of foundation of new businesses that I am able to distinguish in my study, namely, start-ups, spin-offs, and new establishments that result from the change in proprietorship. Second, I investigate if besides a spatial selection effect, agglomerations stimulate the performance of new establishments by analyzing the productivity of establishments that are up to 7 years old (early stage) by means of panel hierarchical linear regressions. This part of the analysis shows that at the end of the time-period analyzed new establishments located in larger regions still show higher productivity levels as compared to those located in smaller regions, which could be questionably interpreted as overall positive agglomeration effects. However, introducing two relevant characteristics of new businesses in the analysis clearly shows that the role of agglomerations is very distinct depending on the type of foundation and age of the new businesses.

The reminder of the paper is organized as follows. Section 2 describes the theoretical framework of the analysis that is the basis of my hypotheses. The description of the methodology, data and variables follows in Section 3. Empirical results are provided in Section 4. In Section 5 I discuss the limitations of my study, formulate policy implications and provide avenues for further research. The final section concludes.

2. Theoretical framework

2.1 Spatial selection

While Melitz (2003) and Melitz and Ottaviano (2003) consider selection as the elimination of the least efficient firms within a nation, in this paper I am concerned with the spatial dimension of selection as proposed by Baldwin and Okubo (2006). Spatial selection refers to the idea of most efficient firms having a stronger preference to locate in the big market as compared to inefficient firms. Indeed, Baldwin and Okubo (2006) show in their model that the most efficient firms from a small market are the first to relocate to the bigger market. The consideration of spatial selection in economic geography has strong implications for agglomeration economies. Basically, the average higher productivity evident in large cities might not result exclusively from agglomeration economies but rather from better performing firms that self-select to locate in agglomerations. This argument is analogous to the selection of better performing firms into export markets modelled by Melitz (2003).

The consideration of heterogeneous firms in the framework of economic geography is necessary to argue about spatial selection effects. In this sense, there is extensive empirical literature about the enormous differences of firms in terms of size (Cabral & Mata, 2003) as well as in terms of productivity and trade behavior (Bernard et al., 2003). Taking in consideration firm heterogeneity, previous evidence suggests that big plants are more likely to be found in clustered areas that are specialized in a particular sector (Lafourcade & Mion, 2003; Alsleben, 2005). There is evidence of spatial selection based on micro data as well. For example, Combes et al. (2004) show that differences in individual skills play an important role in explaining the existing spatial wage disparities. Moreover, they provide strong evidence of workers sorting themselves geographically.

Baldwin and Okubo (2006) provide the following rationale behind this selection mechanism of most efficient firms into the bigger region. Basically, more productive firms

have lower marginal costs which allow them to sell more. In such situation, the agglomeration forces related to forward and backward linkages are more attractive to the more productive firms as they will be able to save on trade costs. Additionally, the intensive competition existing in the bigger market will be easier to deal with for highly productive firms. While the corresponding literature talks about the location or move of more productive firms into agglomerations, in the setting of my paper the argument is that such a spatial selection of better new business into agglomerations occurs too. Indeed, the higher local competition existing in larger markets (Sorensen & Sorenson, 2003), the intensified competition for inputs (Flyer & Shaver, 2003; Folta et al., 2006) and the higher costs of living and doing business (Pouder & StJohn, 1996) that characterize agglomerations should not only set a preference for founders with better perspectives to locate in an agglomeration but even act as a selection mechanism. Given these arguments, I expect:

H1: The initial performance level of new businesses that locate in an agglomeration is higher than those that locate in a small region due to a spatial selection mechanism of best performing new establishments into agglomerations.

A confirmation of this hypothesis will indicate that a probable higher productivity of firms in agglomerations does not necessarily result exclusively from the role of an agglomeration enhancing their productivity of the firms located there, but rather new businesses with higher performance level being more likely to locate in large regions.

2.2 Agglomeration and productivity of new businesses

Marshall (1920) argues that firms benefit from locating in an agglomeration due to external economies of scales that are expected to result in productivity advantages. A central argument in this literature refers to the generation, accumulation and diffusion of knowledge. For instance, urban agglomerations are associated with more intense knowledge flows which becomes evident in innovation activities being more geographically concentrated than standard production activities as argued by Audretsch and Feldman (1996). There is evidence that more knowledge spillovers lead to more learning opportunities and innovation in a region (Feldman 1994; Anselin et al., 1997; Castaldi et al., 2015). An important assumption in Marshallian externalities is that knowledge is predominantly industry-specific (Marshall 1920). The specialization of a region in a narrow set of industrial sectors give rise to localization economies consisting of knowledge and information spillovers, labor pooling

(advantages of thick markets for specialized skills) and backward and forward linkages (Marshall 1920). On the other hand, Jacobs (1969) argues that the most important sources of knowledge spillovers are external to the industry in which the firm is active. Glaeser et al. (1992) coined the term "Jacobs' externalities" to refer to inter-industry spillovers arising from local diversity.[1] These arguments have motivated a considerable amount of research investigating the prevalence of Jacobs or Marshall theories.[2]

Since the seminal article by Glaeser et al. (1992), there has been extensive research about the relationship between the geographical concentration of economic activity and performance of local industries and firms. For example, Henderson (2003) estimate total factor productivity based on plants in high-tech and machinery sectors. Andersson and Lööf (2011) find that firms located in larger regions are more productive which the authors attribute to learning effects. In these studies, the role of the external environment shifts the production function of firms in the corresponding region. The argument to expect an effect of the external local environment on the performance of firms is that the theory behind agglomeration economies is micro-economic (Rosenthal & Strange 2004). In this regard, Duranton and Puga (2004) argue about the following three mechanisms how firm productivity may be enhanced in urban agglomerations. The first mechanism refers to the gains that arise from larger regions related to the larger variety of input suppliers, sharing invisible facilities, benefits from the narrower specialization and sharing risks. Secondly, agglomerations improve the quality of matches or the probability of matches that alleviates hold-up difficulties. Lastly, agglomerations favor the generation, diffusion and accumulation of knowledge.

The argument that relates agglomeration with the generation, accumulation or diffusion of knowledge is relevant for entrepreneurial firms as well. Indeed, new ventures require various knowledge inputs, which can be generated internally or internalized in the new firm through knowledge spillovers (Tavassoli et al., 2016). Helsley and Strange (2011) propose a model according to which high market thickness compensate the lack of

[1] Rosenthal and Strange (2004) provide a comprehensive review of the literature about agglomeration externalities.

[2] Beaudry and Schiffaunrova (2009) provide a review of the empirical evidence underlying the debate about the Marshall or Jacobs theories. While I acknowledge that agglomeration externalities might be related with Marshall or Jacobs theories, determining whether it is diversity or specialization that plays a major role in the performance of new businesses is beyond the scope of this paper. Basically, I am interested in the association between the productivity level of new businesses and the size of the region in which they locate.

entrepreneurial skill balance and Bublitz et al. (2015) provide empirical evidence that entrepreneurs with low skill balance get greater benefits of being located in cities than their counterparts with high sill balance. Andersson and Karlsson (2007) argue that external knowledge considerably comes from the same region in which a firm locates because the complexity of the entrepreneurial activities involves the exploration of tacit knowledge (Polanyi, 1967) which is favored by face-to-face interaction of economic agents in geographical proximity (Storper & Venables, 2004; Rodríguez-Pose & Crescenzi, 2008).

In line with these arguments, some studies have incorporated the role of regional-level characteristics in the analysis of the survival of new firms (Fotopoulos & Louri, 2000; Fritsch et al., 2006; Brixy & Grotz, 2007). Falk (2007) argues that the role of regional-level characteristics is even more important than firm-level characteristics. More recently, Neffke et al. (2012) and Tavassol and Jienwatcharamongkhol (2016) have investigated the role of the different building blocks of agglomerations on the survival of new firms. While the focus of this literature has been the analysis of the link between agglomeration externalities and the survival of new firms, in this paper I focus on new businesses' productivity effects attributed to the size of the region in which a business locates. Based on these arguments, hypothesis H2 states:

H2: The level of agglomeration of a region has a positive association with the productivity level of new businesses.

2.3 The role of the age and foundation type

In section 2.1, I acknowledge the relevance of considering firm heterogeneity in my analysis. In this section, this heterogeneity will be exploited, looking into potentially different agglomeration effects associated with the age and type of foundation of a new business.

According to the industry life cycle (ILC) concept (e.g. Utterback & Suárez, 1993; Klepper, 1997), young industries differ in their characteristics from intermediate or mature industries. For example, in young industries there is a large number of small firms that experiment with different product designs. Additionally, in young industries there is high uncertainty about technology and market demand. Building on this ILC concept, Neffke et al. (2011) argue that the role of different types of agglomeration externalities systematically differ depending on the maturity of the technology. Basically, industries in different stages of development have different agglomeration needs because of the changing nature of the

competition mode, innovation intensity and learning opportunities. The authors find that Jacobs' externalities are positive for young industries but become negative for mature industries and Marshall–Arrow–Romer (MAR) externalities steadily increase as industries grow older.

Duranton and Puga (2001) propose the *nursery cities* model, framed in the tradition of urban economics, which considers the differences in technological maturity existing between firms. In this case, the view of the firm evolution is based on the product life cycle that is closely related to the ILC concept presented above. The authors consider that at the time of entering a market firms only have a prototype that they hope to bring into mass-production. In their aim to reach mass-production, firms need to define the optimal production process. To do so they can imitate locally available production technologies. Such process of imitation is facilitated in diversified cities given that several different processes that should be available without the need to relocate. Then, diversified regions should lower the search costs of new technologies. Neffke et. al (2012) provide empirical evidence of how agglomeration externalities change with the age of plants. In line with the nursery cities model by Duranton and Puga (2001), the authors find that Jacob's externalities benefit only young plants since they drop as plants grow older.

Since Duranton and Puga (2000) consider that larger regions tend to be more diversified and Henderson (1997) state that large metropolitan areas have a considerably more diversified production composition, I expect that the benefit of locating in a large region is more pronounced for establishments in earlier years. Moreover, Henderson (1997) also argue that the more diversified production composition available in large metropolitan areas is more focused on activities concerned with research and the development of new products which also favors the exploration activities of new businesses. Then, according to the arguments of the nursery cities model and the empirical evidence provided by Neffke et al. (2011) and Neffke et al. (2012), larger regions should favor the productivity of new businesses especially in earlier years. Then, hypothesis H3a states:

H3a: The positive effect of agglomeration on young businesses' productivity is more pronounced in earlier years since a larger region facilitates the exploration activities of new ventures.

Apart from the age of new businesses, the degree to which different types of businesses depend on the regional environment might determine the degree of the agglomeration effect. In this sense, Dunning (1993) considers that local firms are more dependent on the local environment than multinational firms. The type of firm, in the sense of being a corporate or a non-affiliated business also shapes the role of agglomeration. Indeed, Henderson (2003) uses the total factor productivity of US plants and provides evidence that non-affiliated plants experience higher agglomeration externalities as compared to corporate plants. The author considers that corporate plants (those that belong to larger corporations) rely less on the local environment (as compared to non-affiliated plants) because they possess channels within the corporation to access knowledge. Besides, the corporation helps this sort of new plants organize supplier and client relations.

Neffke et al. (2012) also provide empirical evidence that the role of agglomeration externalities in the survival chances of plants varies between corporate and non-affiliated plants. Looking specifically at non-affiliated plants, the authors find that Jacobs' externalities can be solely attributed to the non-affiliated sample. Indeed, Jacobs' externalities increase survival rates of non-affiliated plants. Taking in consideration these differences, I investigate three types of new businesses, namely, establishments that spun off an existing company (spin-offs), real start-up businesses and new establishments that originate from the change of proprietors. In the context of the literature reviewed in this section, spin-offs will correspond to corporate plants. Then, based on these arguments and empirical evidence discussed I expect:

H3b: The positive effect of agglomeration on young businesses' productivity is less pronounced for spin-offs as compared to other types of new business foundations.

3. Methodology

3.1 Spatial framework and data

I investigate the role of spatial selection and agglomeration on the early development of new establishments in German NUTS-3 regions.[3] The spatial framework of my analysis comprises

[3] NUTS stands for Nomenclature of Units for Territorial Statistics and corresponds to a hierarchical regional classification system subdividing the economic territory of the European Union (EU) into regions at three levels. While the NUTS-1 regions are the national states, the NUTS-3 regions are considerably smaller.

then German "Kreise" (districts) as well as "kreisfreie Städte" (cities that are districts on their own right). In Germany there are in total 401 NUTS-3 regions. German "Kreise" are roughly equivalent to counties in the United States and correspond to the lowest level of regional classification after German States (*Länder*) and Government regions (*Regierungsbezirke*). In year 2018 the district with the highest population in Germany is Berlin (kreisfreie Stadt) with 3'644.826 inhabitants, whereas Zweibrücken is the district with the lowest number of inhabitants (34.209).

I use data from the IAB Establishment Panel, a yearly survey conducted by the Institute for Employment Research (IAB, Nuremberg), a research unit of the German Federal Employment Agency. This survey provides information on a representative sample of establishments from 1993 to 2017; however, since key information needed for my analysis, such as the type of formation of a new establishment is consistently available only since year 2000, I consider in my analysis the waves from 2000 to 2017. Other key establishment-level variables needed for the purpose of my analysis, such as productivity, are obtained from this dataset as well.[4]

Performing the analysis at the establishment level is convenient for identifying regional effects. Basically, in a firm level analysis the effects cannot be clearly assigned to regions given the possibility of firms with multiple plants in different regions. I focus on new manufacturing establishments for the following reasons. Firstly, relevant information, such as the state of the machinery and equipment that I use as a control variable in my empirical models is mainly available for manufacturing establishments and not for those establishments active in the service sector. Second, many representatives of establishments in the service sector have problems in answering the corresponding question in the survey about their share of intermediate inputs causing many missing observations for the calculation of labor productivity of these establishments. Lastly, focusing on manufacturing establishments avoids problems related to measuring productivity in the service sector.[5]

[4] The average number of establishments in the survey is about 15,000 each year. Since I exclude from the analysis the public sector, as well as establishments active in the service sector and construction and keep only manufacturing establishments that are up to 7 years old, and due to missing values for independent variables, the average number of observations in my analysis is 5525 (Table 3). While the survey is representative at the national level and at the level of Federal States, there is no indication that the survey does not also represent districts, the level of analysis in this paper (for details see Fischer et al. 2009; Kölling 2000).

[5] For an overview of such potential problems see Biege et al. (2013), Bosworth and Triplett (2003), Hulten (2010).

In order to test the spatial selection mechanism I consider establishments that are one year old since I aim to determine if the starting performance level of establishments that locate in larger regions is higher than those establishments that locate in smaller regions. In order to test the role agglomeration I analyze the development of new establishments in early stages. In this regard, I focus on establishments that are up to 7 years old. Verhoeven (2004) identified that start-ups in The Netherlands require a period of 7 to 8 years to reach the average productivity level of incumbents. Then, I consider the period of 7 years a plausible time period for new businesses to be considered in early stages. The IAB Establishment Panel is unbalanced due to changes in the establishments participating in the survey. Therefore, I have no reliable information as to why an establishment is no longer in the panel.[6]

3.2 Measurement of key variables

The dependent variable for all estimations in my analysis is the productivity level (lnP) of new manufacturing establishments. Productivity is measured in terms of value added per full-time employee. Value added corresponds to the sales of an establishment minus intermediate inputs and external costs in the respective time period. Some papers concerned with the role of agglomeration economies are based on regional employment growth or regional employment levels (e.g. Glaeser et al., 1992; Henderson et al., 1995). However, declining employment levels are not necessarily associated with a decline in productivity or weaker agglomeration externalities. For example, if a firm decides to pursue labor saving investments, this will lead to higher productivity with fewer employees. Therefore, I use establishment productivity data as Henderson (2003), as a better dependent variables to identify the role of agglomeration. However, this data is not free of potential disadvantages. For example, establishment productivity data is sensitive to business cycles. I account for such potential problem introducing control variables at the industry level as explained in section 3.5.

As mentioned before, my interest in this paper is on the productivity effect of agglomeration, associated with the size of a region, without inquiring into the specific agglomeration externality. Then, the main independent variable of the analysis is the size of the region in which an establishment is located. Regional size is assumed to capture the

[6] For a detailed description of the data, see Fischer et al. (2009) and Kölling (2000).

potential of agglomeration and it is measured in terms of the total number of inhabitants in a certain region. Indeed, the size of a region relates to relevant aspects that can increase the potential for a positive role of agglomerations. For example, larger regions have a more diverse production composition as argued by Duranton and Puga (2000) and Henderson (1997). Additionally, larger regions have a larger local supply of advanced business services as argue by Klaesson and Larsson (2008). Finally, the workforce in larger regions have higher average education-level and larger regions have more knowledge sources, such as universities. This variable is obtained from the German Federal Statistical Office.

3.3 Estimation strategy of the effects of entry on incumbent productivity

I start examining a probable selection mechanism of better performing new establishments into agglomerations. Then, I analyze the role of agglomeration looking at the relationship between region size and the productivity of establishments in early stages. Finally, I investigate if the role of agglomeration differ depending on the type of foundation of a new establishment and its age. In this section I present the econometric issues involved in my analysis and the strategy I consider to tackle them.

A relevant issue of the analysis refers to the fact that establishments are nested within regions. Then, all establishments located in a particular region gets the same values for the main explanatory variable, region size. To account for potential problems due to the repetitive observations of region size for establishments located in the same region, I estimate hierarchical linear models (HLMs) also known as mixed models or multilevel models that contain fixed and random effects. HLMs are specially recommended for dataset consisting of multiple levels of nested groups because they allow for the inclusion of random deviations (effects) apart from those associated with the overall error term. In order to test Hypothesis 1 that refers to the selection mechanism of better performing new establishments into agglomerations, I specify the following model.

$$lnP_{jr}^{new} = \beta_0 + \beta_1 RegSize_r + X_j + W_s + u_r + \varepsilon_{jr} \quad (1)$$

Model (1) is a two-level model, where lnP_{jr}^{new} is the productivity level for an establishment *j* within region *r*. Establishments comprise the first level and the regions comprise the second level of the model. The fixed portion of the model $\beta_0 + \beta_1 RegSize_r + X_j + W_s$ is analogous

to the linear predictor of a standard OLS regression and states that I want one overall regression line (population average). β_1 is the regression coefficient to be estimated. X_j is a set of control variables at the establishment level. W_s represents control variables at the industry level. The model considers a random intercept at the regional level (u_r) and the overall error term (ε_{jr}).

While the first moment of the analysis corresponds to investigate a probable self-selection mechanism of better performing new establishments into agglomerations, the second moment of the analysis is to investigate the development of new establishments by tracking their productivity level. Then, to test Hypothesis 2 that refers to the role of agglomeration, I consider establishments that are up to 7 years old and run multilevel *panel* estimations. In this case the data is nested into two levels of clustering, namely, the establishment and the region, creating three-level model. The single productivity-level observations (level 1) are nested within establishments (level 2), clustered in a certain region (level 3). I fit a three-level mixed model with two random-effects equations. The first is a random intercept at the region level (level 3) and the second is a random intercept at the establishment-within-region level (level 2).

The empirical model is the following.

$$lnP_{ijrt}^{new} = \beta_0 + \beta_1 RegSize_{rt} + X_{jt} + W_{st} + u_r + v_{jr} + \lambda_t + \varepsilon_{ijrt} \quad (2)$$

On top of the baseline empirical model (1), in this case I model random effects at the regional level (u_r) and the between-establishment variability including, therefore, a random-intercept term at the establishment level (v_{jr}). This random effect (random intercept) at the establishment level represents each establishment's *j*, located in region *r*, vertical shift from the overall mean (β_0). In model (2) *t* denotes the year of observation and I also include year dummies (λ_t) in the estimations in order to control for common macroeconomic developments. ε_{ijrt} is the overall error term.

Finally, to test for a possible differential role of agglomeration conditional on the type of foundation and age, I split the sample in start-ups, spin-offs, and new establishments that result from change in proprietors, similarly to Neffke et al. (2012), and introduce an interaction term between region size and establishments age. All variables, except the categorical, such as type of foundation, age and the state of machinery, are included in

logarithmic form so that the coefficients can be interpreted as dimensionless quasi-elasticities that allow directly assessing the relative importance of the different effects, and making comparisons between the different models.

3.5 Control variables

There are a number of additional variables that might influence the productivity of establishments which I account for in the empirical analysis. For example, a relevant characteristic that I consider in the analysis refers to the *type of foundation* of a new establishment. The IAB Establishment Panel allows to distinguish between spin-offs, start-ups and new establishments that resulted from the change in proprietorship. In the multivariate analysis start-ups and new establishments that result from change of proprietors are included as two dummy variables, while spin-offs are considered the reference category. I account for the type of foundations not only to control for a probable influence on the productivity of establishments but also to determine probable differences in the role of agglomerations depending on the type of foundation.

The *size* of an establishment may provide opportunities referring to scale economies (Badunenko, 2010; Schiersch, 2013; Yang & Chen, 2009). Accordingly, I expect higher productivity levels in larger establishments. I measure the establishment size by the total number of employees in the corresponding year. Knowledge or the level of *human capital* available in an establishment may also be an important source of productivity as it might enhance the ability of establishments to absorb knowledge spillovers (von Hippel, 1988; Cohen & Levinthal, 1990). Based on these considerations I expect high human capital to be positively related to establishment productivity level. The measure of human capital that I use in the multivariate regression analysis is the share of employees with a tertiary degree out of the total number of employees. I also account for export activities by including the establishment's export intensity in the analysis, measured by the share of foreign sales out of total sales. I expect a positive relationship between the export intensity and the productivity level of establishments (Redding, 2011; Wagner, 2012) due to a probable self-selection of relatively productive firms into exporting or learning-by-exporting implicit in the relatively intense competition going on in international markets.

In the data base IAB Establishment Panel, presented in Section 3.1, there is no direct information about the capital stock of establishments.[7] Nevertheless, the data base contains information about the total sum of all *investments* in the respective period. I expect investments to be positively related with the productivity level since particularly investments in machinery and equipment is expected to generate improvements in the total output. I control for an establishment *state of machinery* using the subjective perception of an establishment representative as to the state of their machinery and equipment. This information is available in the IAB Establishment Panel as a categorical variable assuming values from "1 = state-of-the-art" machinery to "5 = obsolete" machinery".[8] Then, higher values of this variable represent less modern machinery. In the multivariate regression analysis, categories 2 to 5 are included as four dummy variables and the level of 1 (= state of the art) is used as the reference category. Since my study focuses on manufacturing establishments, I expect that those with more modern machinery have higher productivity levels than those with equipment that is going to obsolescence.

Finally, in the multilevel panel estimations included to test the role of agglomeration (Hypothesis 2), I also control for the age of an establishment. I expect that an establishment age is positively related with its productivity level. Coad et al. (2013) find evidence that firms improve with age. In their analysis of Spanish manufacturing firms the authors find that ageing firms show steadily increases of their productivity level, in addition to higher profits, higher equity rations and larger size. Similarly, based on a sample of Indian firms, Majumdar (1997) finds that older firms are more productive. In Section 4.3 I do not only consider age as a control variable but use it to interact with region size in order to check if the role of agglomeration varies over time as discussed in Section 2.3.

At the industry level I include three relevant control variables. First, I include the yearly *industry employment change* as a proxy of the overall development of an industry. The role of the characteristics of the industry and the stages of the industry life cycle in the survival of new firms has been investigated by Fritsch et al. (2006). I consider that the overall development of an industry may reflect the level of market and/or technological

[7] This is a common limitation of establishment-level data sets as mentioned by Mueller (2008).

[8] This information is delivered from the following question: "How do you assess to overall technical state of the plant and machinery, furniture and office equipment of this establishment compared to other establishments in the same industry? "1" indicates that the establishment has state-of-the-art equipment. "5" indicates that the equipment is obsolete.

opportunities, and the stage of an industry in its life cycle (Klepper, 1997). Industries in early stages, characterized by a growing number of employees, are expected to offer more technological opportunities for gains in efficiency of firms active in such industries. Secondly, I also include in the analysis the level of R&D activity in the respective industry in which an establishment is active. The measure of the R&D activity level corresponds to the industry share of engineers and scientists out of the total number of employees. I expect that the R&D activity of an industry might positively relate with establishments productivity (Mohnen & Hall, 2013). Basically, higher levels of R&D activity may eventually lead to innovation activity that in turns favors higher productivity levels. Finally, another relevant factor that may affect the level new establishments' productivity refers to the overall intensity of competition in the respective industry. We control for the intensity of competition in an industry considering the number of establishments in the industry in which a new establishment is active. Assuming that a large number of establishments in the respective industry favors a relatively high intensity of competition that forces new establishments to keep up their productivity, we expect a positive relationship between this variable and new establishments productivity. These control variables are obtained from the Establishment History Panel (BHP), a dataset containing information about number of employees as well as employees in R&D activities for all establishments in Germany. This dataset is also hold by the Institute for Employment Research (IAB, Nuremberg).

Table 1: Definition of variables

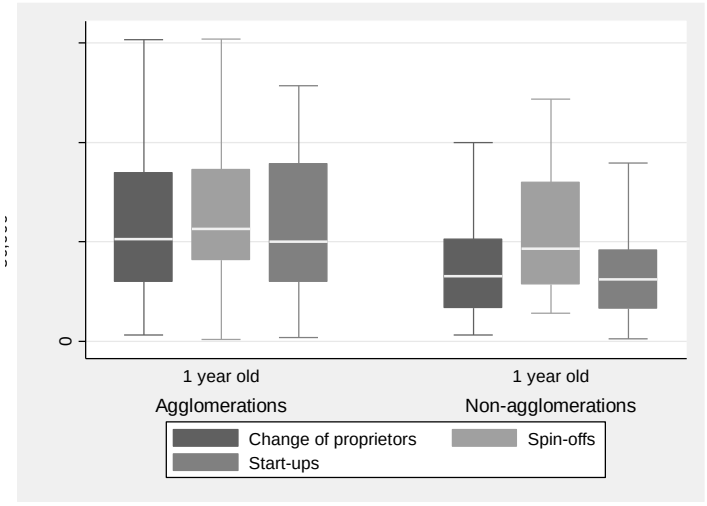
Variable	*Definition*
Establishment-level variables	
Productivity level	Level of an establishment's productivity. Productivity corresponds to value added per employee and value added is defined as sales minus intermediate inputs.[a]
Founding type	Two dummy variables for the founding type of each establishment. It is possible to distinguish between spin-off, start-ups and new establishments that resulted from the change of proprietors.[a]
Age	Six dummy variables ranging from 1 (= 1 year old) to 7 (= 7 year old).[a]
Size	Number of employees.[a]
Human capital	Share of employees with a tertiary degree.[a]
Export intensity	Share of the total sales to foreign countries.[a]
Investments	Total sum of investments.[a]
State of machinery	Four dummy variables for the overall technological state of the plant and machinery based on an ordered categorical variable ranging from 1 (= state of the art) to 5 (= obsolete).[a]
Regional-level variables	
Region size	Total population in the region where the new establishment is located.[c]
Industry-level variables	
Industry employment change	Ratio of year-over-year industry employment (t=0/t-1).[b]
Industry R&D activity	Industry share of engineers and scientists out of the total number of employees.[b]
Industry number of establishments	Number of establishments in the respective industry.[b]
Data sources: a: Establishment Panel; b: Establishment History File; c: Federal Statistical Office.	

4. Results

4.1 Spatial selection

Figure 1 presents the productivity level of new establishments that are one year old, distinguishing by type of foundation and location in regions with above the median population (agglomerations) and below-median (non-agglomerations). It is evident that the productivity level reported in the first year of existence by new establishments located in agglomerations is higher than those located in non-agglomerations. Very interestingly, this result holds for each type of foundation analyzed in this paper but it is more pronounced for start-ups and new establishments that result from the change in proprietors than for spin-offs.

Figure 1 Establishments productivity level in the first year of existence by type of foundation and location



After adjusting for the nested-level error structure of the data by HLMs with a random intercept at the regional level, Table 2 presents the results corresponding to Hypothesis H1 that refers to the self-selection of best performing new firms into agglomerations. To test this hypothesis I start the analysis examining the relationship between region size and the productivity of new establishments in the first year of existence (Model I). I find a positive and statistically significant relationship between these variables which indicates that new establishments that locate in agglomerations show a higher productivity level as compared to those located in less populated regions already in the first year of existence. Since this part of the analysis considers only the first reported productivity level of new establishments, it signals that the best performing new establishments self-select into agglomerations.

In Table 2, Model II I add to the multilevel regression analysis the establishment-level control variables. Very interestingly, it is possible to observe that there is no statistically significant difference in the productivity level reported in the first year of existence between start-ups, spin-offs and new establishments that result from proprietorship change. This finding is consistent with Figure 1, in which it is possible to observe that the productivity level reported by establishments that are one year old, located in agglomerations, is higher than those establishments located in non-agglomerations; however, there is no difference of the productivity level between the different foundation types. Then, the starting performance level of new establishments seems to be comparable among the different foundation types but different between those that locate in agglomerations and non-agglomerations. This self-selection does not discriminate different types of new establishment foundation types. More productive spin-offs, start-ups and new establishment that result from proprietor change decide to locate in larger regions.

In Model II it is possible to observe that other establishment level variables, such as export intensity and investments, are positively and significantly related with the productivity level of new establishments. New establishments with an international orientation and also those with higher initial investments show higher productivity levels. In regard to the state of machinery, it is possible to observe that there is a negative and statistically significant coefficient for those new establishments reporting machinery of category 4 as compared to those reporting machinery of category 1 (reference category = State-of-the-art machinery). This result indicates that new establishments starting operations with machinery away from the state-of-the-art will show lower productivity levels (at least for those in category 4).

In Table 2, Model III, I add control variables at the industry level to the multilevel regressions. The coefficient for industry employment change is positive but only statistically significant at the 10% level. In this full model, I observe that region size, the main variable of interest, remains positive and statistically significant at one percent level even when establishment and industry-level control variables are included in the analysis. These results confirm my Hypothesis 1 that argues about the self-selection of more productive new businesses into agglomerations. More interestingly, I also show that this selection of more productive firms into agglomerations is not specific to a certain type of foundation of new establishment. Every type of new establishment, that locates in a larger region show a higher productivity level in the very first period.

Given the results from this section that provide evidence of spatial selection according to Hypothesis 1, the concern that average firm productivity in larger regions should be higher even if the role of agglomeration is negligible still holds and will be tested specifically in Section 4.3.

Table 2 New establishments' level of productivity (1 year old) and regional level of agglomeration (Spatial selection − Hypothesis 1)

		Model I	Model II	Model III
Region size		0.272***	0.229***	0.258***
		(0.074)	(0.091)	(0.091)
Type of foundation	Spin-offs		Reference category	
	Start-ups		0.013	-0.020
			(0.117)	(0.115)
	Change of proprietors		-0.008	0.161
			(0.114)	(0.126)
Size			-0.039	-0.026
			(0.052)	(0.051)
Human capital			0.067*	0.042
			(0.038)	(0.041)
Export intensity			0.0391***	0.0284***
			(0.007)	(0.007)
Investments			0.0394***	0.0407***
			(0.014)	(0.014)
State of machinery	1		Reference category	
	2		-0.076	-0.116
			(0.129)	(0.126)
	3		-0.139	-0.189
			(0.125)	(0.122)
	4		-0.581***	-0.755***
			(0.219)	(0.206)
	5		-0.288**	-0.531
			(0.136)	(0.369)
Industry employment change				4.163*
				(2.512)
Industry R&D activity				0.131
				(0.320)
Industry number of establishments				-0.725
				(0.429)
Constant		9.467***	9.273***	8.147***
		(0.228)	(0.358)	(2.328)
Number of observations		404	404	404
Industry-fixed effects		Yes	Yes	Yes
Log likelihood		-790.10	-503.10	-407.70

Notes: all independent variables, except the type of foundation and the measure for state of machinery, are included with their logarithmic values. Multilevel *cross-sectional* regressions. Robust standard errors clustered at the level of industries in parentheses. *** Statistically

significant at the 1% level; ** statistically significant at the 5% level; * statistically significant at the 10% level.

4.2 Agglomeration and productivity of new businesses

In this section I analyze the productivity of new establishments that are up to 7 years old, paying attention to the role of the size of the region in which they are settled. By doing so, I examine if apart from spatial selection the agglomeration play a role in the performance of establishments in their early years of existence. In Table 3 I present the results of the multilevel *panel* estimations. I start the analysis examining the relationship between region size and the productivity level of establishments (Model I). I show that region size has a positive and statistically significant relationship with the productivity level of establishments.

In Model II of Table 3 I present the results of the panel estimations including the establishment level control variables. Model III presents the result of the model that includes all the control variables of the analysis. In this model it is possible to observe different results in comparison to the results presented in Table 2 (spatial selection) in regard to key variables of interest. For example, the variable type of foundation revels different results from those presented in Section 4.1. If I consider establishments that are up to 7 years old, I observe that start-ups have a negative coefficient that is statistically significant at the 1 percent level as compared to spin-offs (reference group). Similarly, new establishments that result from the change of proprietor have a negative coefficient that is, however, only statistically significant at the 10 percent level when all the control variables are included (Model III). This result indicates that running HLM panel estimations, considering establishments of up to 7 years of existence, I identify differences in the performance between new establishments that emerge from the change of proprietors, start-ups and spin-offs.

Taking in consideration that in the analysis of the productivity reported in the first period of existence of establishments no difference was identified in the performance between the different types of foundation (Table 2), it is possible to expect that factors, such as agglomeration, play a role in the differences identified in the productivity level between the different foundation types of establishments that are up to 7 years old (Table 3). The next necessary step will then be to determine the probable role played by agglomeration in the performance differences identified among the types of foundation of new establishments that I show in Table 3. I further dig into this topic in Section 4.3.

In regard to the relationship between age and productivity level, I observe that those establishments that are 5, 6 and 7 years old, as compared to those 1 year old (reference category), show a positive coefficient that is, however, only statistically significant at the 5% level. This result indicates that to some extend establishments show improvements in their productivity associated with aging. However, this is the only the main relationship between age and productivity. In Section 4.3 I show the role of age in the investigated relationship between region size and establishment performance. In regard to other control variables, it is very interesting to see that the size of the establishment (number of employees) is not significantly related with their productivity level; however, the level of human capital (number of employees with tertiary education) is positively related with productivity. This indicates the relevance for young establishments of having qualified employees. Export intensity and investments are also positively and significantly related with the productivity level.

In regard to an incumbent's state of machinery and equipment and its relationship with productivity level, I considered category 1 (state-of-the-art machinery and equipment) as the reference point. The estimated significantly negative coefficients obtained for categories 2 to 5 suggest that establishments with machinery in those categories are able to accomplish lower productivity levels than those with state-of-the-art machinery (category 1). Hence, having machinery that is not state- of-the-art negatively relates to incumbents productivity. These results are very plausible given that the sample corresponds to manufacturing establishments. Finally, the industry-level variables are not statistically significant.

It is possible to observe that after including the establishment and industry-level control variables in Table 3 Model III, region size, the main variable of interest, remains positive and statistically significant. Based on these results I can argued that new establishments that are up to 7 years old and locate in larger regions are more productive than those in smaller regions. However, I cannot directly conclude about the existence of positive agglomeration effects taking in consideration that in Section 4.1 I argue about a clear selection effect. Then, the higher productivity shown by the new establishments up to 7 years old and located in larger regions could relate with the legacy of the selection mechanism, namely, the higher productivity level observed for establishments in larger regions in the first period. Additionally, so far I have not identified how agglomeration influence each specific type of foundation considered in the analysis over time. In order to clearly determine the role of agglomeration in the early stages of new establishments, an analysis that includes the role

of age and type of foundation in the relationship between region size and establishments productivity is necessary. I present this analysis in Section 4.3.

Table 3 New establishments' level of productivity (up to 7 years old) and regional level of agglomeration (Agglomeration and productivity of new businesses − Hypothesis 2)

		Model I	Model II	Model III
Region size		0.187***	0.146***	0.152***
		(0.033)	(0.030)	(0.029)
Type of foundation	Spin-offs		Reference category	
	Start-ups		-0.154***	-0.138***
			(0.040)	(0.038)
	Change of proprietors		-0.130***	-0.0828*
			(0.046)	(0.047)
Age	1		Reference category	
	2		0.0678*	0.048
			(0.038)	(0.037)
	3		0.062	0.038
			(0.044)	(0.042)
	4		0.0980**	0.0746*
			(0.040)	(0.039)
	5		0.123***	0.1000**
			(0.044)	(0.043)
	6		0.112***	0.088**
			(0.042)	(0.041)
	7		0.118***	0.0862**
			(0.044)	(0.043)
Size			-0.023	-0.023
			(0.017)	(0.017)
Human capital			0.0870***	0.0809***
			(0.013)	(0.014)
Export intensity			0.0214***	0.0193***
			(0.002)	(0.002)
Investments			0.0178***	0.0163***
			(0.004)	(0.004)
State of machinery	1		Reference category	
	2		-0.0963***	-0.0962***
			(0.029)	(0.029)
	3		-0.131***	-0.127***
			(0.033)	(0.032)
	4		-0.236***	-0.223***
			(0.052)	(0.051)
	5		-0.227**	-0.226**
			(0.105)	(0.100)
Industry employment change				0.242

			(0.288)
Industry R&D activity			-0.068
			(0.076)
Industry number of establishments			-0.115
			(0.160)
Constant	10.04***	10.12***	10.58***
	(0.106)	(0.135)	(0.583)
Number of observations	5525	5525	5525
Industry-fixed effects	Yes	Yes	Yes
Log likelihood	-8531.10	-5580.60	-5359.20

Notes: all independent variables, except the type of foundation, age and the measure for state of machinery, are included with their logarithmic values. Multilevel *panel* regressions. Robust standard errors clustered at the level of industries in parentheses. *** Statistically significant at the 1% level; ** statistically significant at the 5% level; * statistically significant at the 10% level. Year dummies are included in all models.

4.3 The role of age and foundation type

Up to this point of the analysis I have shown evidence of a selection mechanism in the sense that better performing establishments locate in larger regions. Additionally, considering only the productivity level reported by establishments in the first year of existence, there is no difference in the performance among the different types of foundations. Considering establishments that are up to 7 years old and running multilevel panel data regressions I still find a significantly positive relationship between region size and establishment productivity level. It is possible to conclude, then, that establishments in early stages (less than 7 years old) that locate in highly populated regions are more productive than those in low populated regions. However, the reason behind this result is that new establishments benefited in their early stages from locating in an agglomeration or because of the higher productivity level shown in the first period (spatial selection)? At this point it is actually is not possible to directly conclude that young establishments in agglomerations are more productive because of a positive role of agglomeration. Basically, it can be that the new establishments that are up to 7 years old are in agglomerations more productive because the agglomeration enhanced their productivity or it can also be legacy of the clustering of more productive new establishments in agglomerations. To disentangle this issue, I include in the analysis the role of foundation type and the age of an establishment.

Figure 2a Start-ups' productivity in early years in high and low populated regions

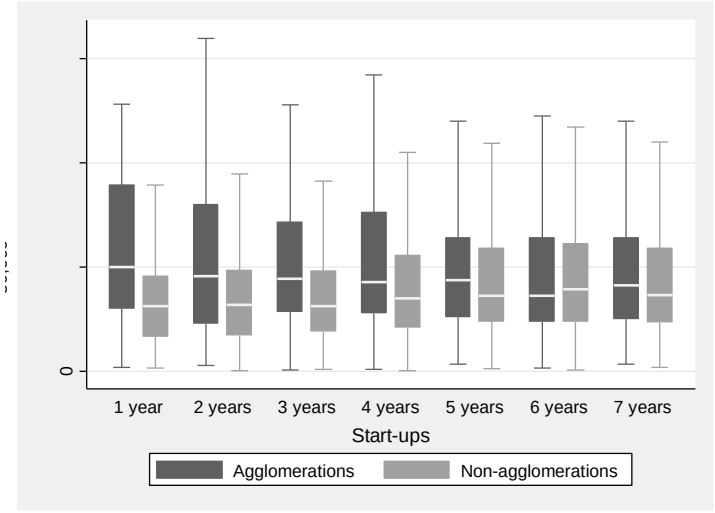
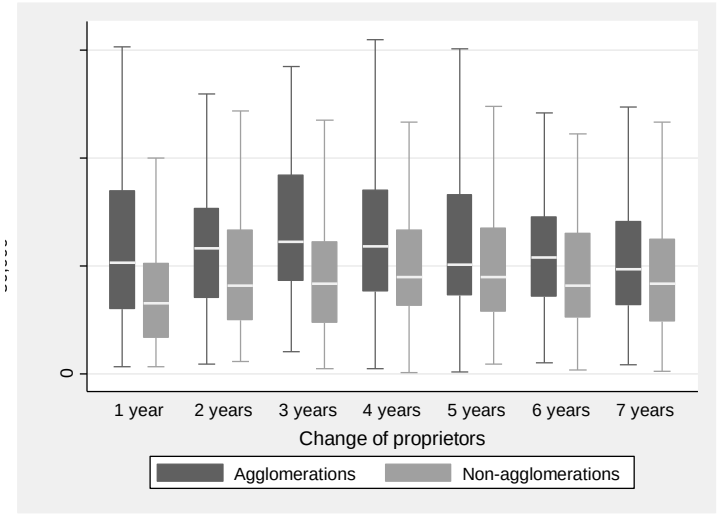


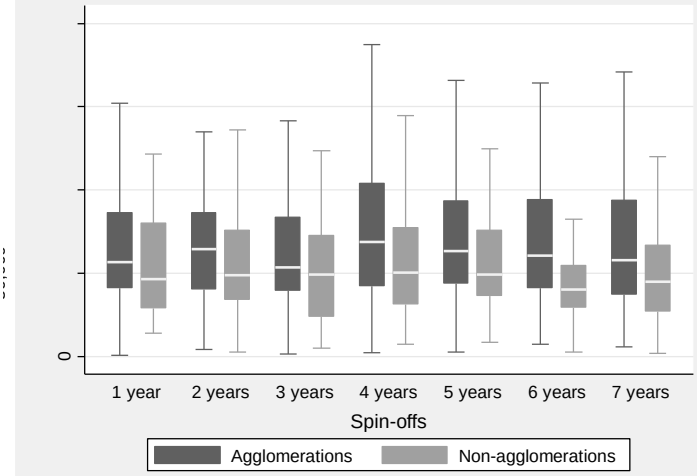
Figure 2b New establishments that result from change of proprietors' productivity in early years in high and low populated regions



In Figure 2a, 2b and 2c I present the productivity of new establishments that are up to seven years old by type of foundation and location in agglomerations (above the median of region size) and non-agglomerations. In Figure 2a I focus on start-ups and observe in year one a considerable gap in the productivity level between those start-ups that locate in agglomerations as compared to those located in non-agglomerations. The new establishments in the sample founded as start-ups and located in agglomerations show a considerably higher productivity level than those located in low populated regions. However, it is very interesting to observe that the gap in the productivity level decreases over time, mainly due to a decline

in the productivity level of those start-ups located in agglomerations. This situation replicates to some extent in the group of new establishments that result from the change in proprietors. Indeed, in Figure 2b I observe that the median of the productivity level of these new establishments that locate in highly populated regions reports the highest level in year 3. After this year it is possible to observe a consistent decline in the productivity level of this group of new establishments that locate in agglomerations.

Figure 2c Spin-offs' productivity in early years in high and low populated regions



In Figure 2c I show the productivity level of spin-offs in high and low populated regions over the period of 7 years. Contrary to start-ups or new establishments that result from the change in proprietorship, the productivity level of spin-offs that are 2 to 7 year old and locate in agglomerations are comparable or higher than those of the reference group (1 year old). Additionally, based on the comparison of the first quartile, median, third quartile or the upper whisker, it is possible to observe a stable or even increasing productivity gap between spin-offs located in agglomerations as compared to those located in low populated regions.

Table 4 New establishments' level of productivity (up to 7 years old) and regional level of agglomeration – subsample of spin-offs, start-ups and new establishment that originate from proprietorship change (The role of age and foundation type − Hypothesis 3a and 3b)

		Model I Spin-offs	Model II Start-ups	Model III Change of proprietors
Region size x Age	1		Reference category	
	2	0.034	-0.139*	-0.040
		(0.062)	(0.0833)	(0.067)

	3	0.037	-0.143	-0.042
		(0.062)	(0.092)	(0.073)
	4	0.043	-0.166*	-0.042
		(0.069)	(0.086)	(0.072)
	5	-0.040	-0.260**	-0.116
		(0.071)	(0.101)	(0.071)
	6	0.061	-0.318***	-0.044
		(0.071)	(0.0938)	(0.069)
	7	-0.026	-0.263***	-0.062
		(0.066)	(0.095)	(0.067)
Region size		0.094*	0.377***	0.132*
		(0.055)	(0.088)	(0.069)
Age	1		Reference category	
	2	-0.114	1.701*	0.319
		(0.359)	(1.015)	(0.414)
	3	-0.100	1.488	0.351
		(0.373)	(0.337)	(0.444)
	4	-0.039	0.696**	0.340
		(0.393)	(0.314)	(0.433)
	5	0.462	0.811**	0.715*
		(0.417)	(0.326)	(0.423)
	6	-0.174	0.963***	0.331
		(0.417)	(0.330)	(0.418)
	7	0.287	0.905***	0.435
		(0.397)	(0.321)	(0.409)
Size		-0.030	-0.0395*	0.015
		(0.037)	(0.024)	(0.035)
Human capital		0.0609***	0.0714***	0.0493*
		(0.022)	(0.020)	(0.026)
Export intensity		0.0219***	0.0234***	0.0101**
		(0.005)	(0.003)	(0.005)
Investments		0.0264***	0.0148***	0.0303***
		(0.007)	(0.005)	(0.007)
State of machinery	1		Reference category	
	2	-0.072	-0.130***	-0.020
		(0.080)	(0.037)	(0.068)
	3	-0.085	-0.180***	-0.013
		(0.087)	(0.042)	(0.070)
	4	-0.151	-0.225***	-0.163
		(0.124)	(0.063)	(0.112)
	5	-0.149	-0.304***	0.296*
		(0.345)	(0.105)	(0.169)
Industry employment change		-0.204	-0.031	-0.045
		(0.758)	(0.245)	(0.617)
Industry R&D activity		-0.155	0.172**	-0.333**
		(0.191)	(0.077)	(0.157)
Industry number of establishments		0.576	-0.616***	-0.088
		(0.456)	(0.165)	(0.344)

Constant	10.85***	7.917***	11.71***
	(1.460)	(0.634)	(1.209)
Number of observations	1217	3130	1178
Industry-fixed effects	Yes	Yes	Yes
Log likelihood	-1019.30	-3203.50	-949.90

Notes: all independent variables, except the type of foundation, age and the measure for state of machinery, are included with their logarithmic values. Multilevel panel regressions. Robust standard errors clustered at the level of industries in parentheses. *** Statistically significant at the 1% level; ** statistically significant at the 5% level; * statistically significant at the 10% level. Year dummies are included in all models.

In order to statistically test the descriptive results presented in figures 2a, 2b and 2c, I run the same multilevel panel estimations separately for each establishment foundation type, considering an interaction term between Region size and Age. One way to read the results presented in Table 4 refer to how agglomeration relates to the productivity of early stage establishments in different stages of existence. Model I of Table 4 shows the multilevel panel estimations corresponding to the subsample of spin-offs. In this model I am especially interested in the result of the interaction term between Region size and Age. For this subsample of new establishments the coefficients for the interaction terms are positive for most of the years but not statistically significant. Then, it is possible to observe that the productivity level of the subsample of spin-offs that are two to seven years old are not statistically different compared to those one year old. I can conclude, then, that spin-offs up to seven years old, located in agglomerations, are as highly productivity as those one year old.

In Table 4 Model II I show the result of the interaction term between Region size and Age for the subsample of start-ups. The results for start-ups show a negative coefficient for the interaction term that is statistically significant at the 1 percent level for the group of establishments that are 6 and 7 year old. For the group of establishments that are 4 and 5 year old, the interaction term is significant at the 5 percent level and for establishments that are 2 years old, the coefficient is significant at the 10 percent level. These results indicated that the main effect of positive effect of Region size shown in Table 3, diminishes with age for the subsample of start-ups. These results deliver a similar message of Figure 2a, namely, start-ups in larger regions start with a higher productivity level compared to those located in low populated regions; however, start-ups in agglomerations rather experience a decrease in their

productivity level over time. This is evident in the negative and statistically significant coefficients shown in the interaction terms.

As for start-ups, for the subsample of establishments that result from the change in proprietorship, the coefficients of the interaction terms are negative. Nevertheless, these coefficients are not statistically different as compared to the reference category (Age=1). Then, the differences observed in Figure 2b regarding the productivity of establishments in agglomerations conditional on their age do not seem to be remarkable to become evident in the statistical significance of the interaction term. For this subsample, then, I can conclude that the better performing new establishments self-select into agglomerations and over time seem to decrease their performance but not to a degree that results evident in the regression analysis. Since the results of this section show a positive but not statistically significant role of agglomeration for the performance of spin-offs and a rather detrimental role for start-ups or new establishments that result from proprietorship change, Hypothesis 3a, that claimed a more pronounced positive role of agglomerations in earlier years, is rejected. Similarly, there is no evidence that spin-offs benefit less from agglomerations. Contrary, spin-offs are the only sub-sample of new establishments that at least maintain or even increase (but not to a statistically significant level) their performance over time. Then, I reject Hypothesis 3b.

5. Discussion and conclusions

5.1 Research contributions

In this paper I analyze the early stage performance of new establishments taking in consideration a mechanism of selection of better performing new businesses into agglomerations. To test this mechanism I relate the productivity level of those establishments that are 1 year old to the size of the region where they locate by means of cross-sectional HLMs. Additionally, I analyze the role of agglomeration on the performance development of new establishments. To do so I relate the productivity level of establishments that are up to 7 years old with region size considering panel HLMs. Finally, I investigate a differential role of agglomeration conditional on the type of foundation and time. The main findings that arise from this analysis are the following.

First, better performing new establishments self-select into agglomerations. More importantly, this mechanism of self-selection holds for all foundation types of new

establishments analyzed in this paper. Then, the first plausible conclusion that I can derive from my analysis is that the decision of location of new businesses is not random. Entrepreneurs behind new businesses with better perspectives, that from the very first year of existence show higher productivity levels, prioritize larger regions.

Secondly, there is also a positive and significant relationship between region size and the productivity of establishments that are up to 7 years old. Then, establishments in early stages, located in larger regions that are up to 7 years old are more productive than those that locate in smaller regions. At a first glance this could be interpreted as an overall positive role of agglomeration on the development of new establishments. However, lastly, when I perform the analysis distinguishing by the foundation type of the new establishments and considering the role of time, I find that only the subsample of spin-offs, that are up to 7 years old, show a productivity level as high as those 1 year old spin-offs. This does not hold for start-ups. Indeed, I find that start-ups that are 2 to 7 year old are less productive than those 1 year old. For the subsample of new establishments that result for the change in proprietorship and are 2 to 7 year old, I find that their productivity level is no statistically significant less than those 1 year old. Then, while there is a general selection mechanism of better establishments into larger regions regardless of the time of foundation, the role of the agglomeration on the development of new establishments is rather different conditioned by the different types of foundation and age.

5.2 Implications for theory development

Baldwin and Okubo (2006) argue that agglomeration economies are overestimated. In line with this argument, Combes et al. (2004), using micro data about workers, show that they appear to sort themselves geographically and indicate that not controlling for heterogeneity among workers might deliver estimates biased upward. In my analysis, I show that taking in consideration the heterogeneity of a new establishment's foundation type, it is possible to identify not only an overestimated role of agglomerations but a detrimental role in a specific type of new establishments, namely, start-ups. Then, a main implication for theory that can be derived from the findings presented in this paper is that the customary perception of a positive influence of agglomerations on the performance of firms needs to be balanced by a perspective that includes detrimental effects for certain new businesses, namely, start-ups.

Secondly, there is a common notion that entrepreneurs tend to start their business in their home regions (e.g., Katona & Morgan 1952, Mueller & Morgan 1962). Nonetheless, the results I present in this paper argue in favor of a mechanisms of spatial self-selection of better performing new ventures into larger regions, which implies that those entrepreneurs, able to set up new firms with higher productivity levels, in many cases should decide in favor of a larger region, looking for agglomeration benefits, rather than the home region. Finally, Baldwin and Okubo (2006) model that those firms that move to the big market are systematically more efficient than the firms that stay behind. In this paper, I add to this literature showing that the spatial selection model of these authors holds for new businesses and, very interestingly, this spatial selection does not discriminate the type of foundation of new businesses.

5.3 Policy implications

The results obtained in this analysis provide information on the role of spatial selection and agglomeration in the early development of individual establishments. Specifically, it provides information about the type of new businesses that benefits from being located in an agglomeration but also those that experience detrimental effects. The idea that agglomeration provide benefits for the firms located in those regions have motivated agglomeration policy (Braunerhjelm & Feldman, 2006). Nonetheless, the results provided in this paper indicate that a particular type of new establishments rather experience negative effects which delivers an important message in terms of policy implications. Indeed, policy should avoid the formulation of generic policy towards fostering agglomerations associated with the idea of favoring, in the particular case analyzed in this paper, the early development of the majority of new businesses observable in a market, namely, start-ups. However, it is also very important to reveal if a specific building block of agglomeration economies, such as related variety or localization economies, has a rather enhancing effect on the productivity of start-ups in early stages.

5.4 Limitations and avenues for further research

While this paper contributes to the understanding of the early development of new businesses paying particular attention to the role of an external factor such as location, there are relevant questions that remain open for future studies. A main open question refers to the effect of the

various building blocks of agglomeration externalities on the performance of newly established firms. So far, the relation between the various agglomeration externalities and the survival of new firms has been analyzed in a few papers (see, e.g., Neffke et al., 2012; Peer & Keil, 2013; Tavassoli & Jienwatcharamongkhol, 2016). However, survival might be a crude measure of performance that does not favor the understanding of the development of new ventures. Additionally, since surviving does not allow to determine a starting performance level, these studies might suffer from a sorting problem. Basically, only analyzing the survival of new firms it is difficult to determine if new firms choose their location randomly or if they self-select into a region characterized by certain agglomeration externalities, such as diversified or specialized locations. These are, then, questions to be investigated.

Additionally, as mentioned in Section 3.1, a limitation of the dataset considered in this paper is that we cannot identify when an establishment has left the market. While I show that start-ups located in agglomerations rather experience a decreasing productivity level over time, it would be interesting and important, especially from a policy perspective, to include such a measure in the analysis. Finally, apart from investigating the different building blocks of agglomeration externalities, another relevant question that remains open refers to the role of other regional factors, such as institutional factors, in the performance of new businesses. Salinas et al. (2020) associate institutional factors to the level of entrepreneurial activity; however, how institutional factors influence the early development of new businesses, distinguishing by the different types of foundation, is an open question.

6. Conclusion

The overall conclusion that is possible to derive from the analysis refers to the relevance of location of a new business for entrepreneurs. The varying role of agglomerations, conditioned by the characteristic of a new business, clearly indicates that indicates that entrepreneurs need to analyze beyond the “urban productivity premium”. There is a clear role of the geographical location in the early development of a new business. In this role, it is remarkable the detrimental effect of the agglomeration for start-ups, given that this type of foundation constitute the majority of new businesses observed in a market. This identified detrimental role of agglomerations for start-ups could be associated with the increased prices of certain inputs such as land and floor and congestion effects that derive in an increase of the cost of production that reduces productivity.

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Appendix

Table A1: Descriptive statistics

			Mean	Minimum	Maximum	Standard Deviation
1	Productivity level		59310.53	249.27	1800000.00	68454.69
2	Region size		230427.50	35719.00	3644826.00	256365.90
3	Founding type	Spin-offs	0.22	0.00	1.00	0.41
		Start-ups	0.57	0.00	1.00	0.50
		Change proprietors	0.21	0.00	1.00	0.41
4	Age	1	0.0731	0.00	1.00	0.24
		2	0.1224	0.00	1.00	0.33
		3	0.1345	0.00	1.00	0.34
		4	0.1500	0.00	1.00	0.36
		5	0.1625	0.00	1.00	0.37
		6	0.1739	0.00	1.00	0.38
		7	0.1835	0.00	1.00	0.39
5	Size		154.08	1.00	14465.00	620.11
6	Human capital		37.48	0.90	6535.00	225.24
7	Export intensity		14.57	0.01	100	23.86
8	Investments (in millons)		1.850.000	1.00	5.20E+08	1.43E+07
9	State of machinery	1	0.18	0.00	1.00	0.38
		2	0.45	0.00	1.00	0.50
		3	0.32	0.00	1.00	0.47
		4	0.04	0.00	1.00	0.20
		5	0.00	0.00	1.00	0.07
10	Industry employment change		1.00	0.59	1.98	0.05
11	Industry R&D activity		9585.31	20.00	52046.00	10720.77
12	Industry number of establishments		9091.08	24.00	167118.00	11696.62

Note: In the regression analysis all variables are log-transformed except the state of machinery, age and foundation type. In this table, however, variables are presented before log-transformed to allow for direct comparison of magnitude and variance

Table A2: Correlations between variables

			1	2	3 (1)	3 (2)	3 (3)	4 (2)	4 (3)	4 (4)	4 (5)	4 (6)	4 (7)	5	6	7	8	9 (2)	9 (3)	9 (4)	9 (5)	10	11
1	Productivity level		1.00																				
2	Region size		0.17	1.00																			
3	Founding type																						
	(1) Start-ups		-0.17	-0.14	1.00																		
	(2) Spin-offs		0.15	0.16	-0.61	1.00																	
	(3) Change proprietors		0.05	0.01	-0.60	-0.28	1.00																
4	Age	2	-0.01	0.02	-0.02	0.02	0.00	1.00															
		3	0.00	0.00	-0.02	0.02	0.00	-0.15	1.00														
		4	0.01	0.01	0.01	-0.01	0.00	-0.16	-0.17	1.00													
		5	0.02	0.01	0.02	-0.02	-0.01	-0.16	-0.17	-0.19	1.00												
		6	0.00	-0.02	0.02	-0.02	0.00	-0.17	-0.18	-0.19	-0.20	1.00											
		7	-0.01	-0.03	0.03	-0.01	-0.03	-0.18	-0.19	-0.20	-0.21	-0.22	1.00										
5	Size		0.31	0.16	-0.38	0.31	0.14	-0.03	0.00	-0.01	0.00	0.01	0.01	1.00									
6	Human capital		0.32	0.20	-0.30	0.30	0.06	-0.02	0.01	-0.01	0.01	0.00	0.00	0.81	1.00								
7	Export intensity		0.31	0.13	-0.20	0.17	0.06	-0.02	0.00	0.00	0.00	0.02	-0.01	0.50	0.46	1.00							
8	Investments		0.29	0.05	-0.23	0.17	0.10	0.03	0.00	-0.02	0.00	-0.02	-0.02	0.55	0.46	0.33	1.00						
9	State of machinery	2	0.02	-0.01	0.02	0.00	-0.02	-0.02	-0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.00	0.03	1.00					
		3	-0.07	0.00	-0.09	0.05	0.06	0.00	0.03	-0.01	-0.03	-0.01	-0.01	-0.04	-0.05	0.00	-0.08	-0.62	1.00				
		4	-0.07	0.02	-0.02	0.00	0.03	0.02	-0.02	0.00	-0.01	0.00	-0.01	-0.03	-0.05	-0.01	-0.08	-0.19	-0.14	1.00			
		5	-0.02	-0.01	0.02	-0.01	-0.02	0.01	-0.01	0.00	0.03	-0.02	0.00	-0.04	-0.03	0.00	-0.03	-0.06	-0.05	-0.01	1.00		
10	Industry employment change		0.03	0.05	0.02	0.00	-0.03	0.01	0.01	0.02	-0.01	-0.03	0.00	0.03	0.04	0.04	-0.01	0.02	-0.02	-0.01	0.00	1.00	
11	Industry R&D activity		0.16	0.13	-0.01	0.08	-0.06	0.00	0.04	0.02	-0.01	-0.01	-0.04	0.25	0.28	0.30	0.14	0.00	-0.02	-0.03	-0.01	0.25	1.00
12	Number of establishments		-0.05	0.02	0.07	-0.02	-0.06	0.01	0.01	0.006	-0.01	-0.005	-0.02	-0.12	-0.13	0.03	-0.01	-0.01	0.02	-0.002	-0.01	0.12	0.17

IMPRESSUM
Jena Economic Research Papers
ISSN 1864-7057
Friedrich Schiller University Jena
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Email: office.jerp@uni-jena.de
Editor: Silke Übelmesser
Website: www.wiwi.uni-jena.de/en/jerp