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**Working Paper**

## Balanced skills and the city: An analysis of the relationship between entrepreneurial skill balance, thickness and innovation

Jena Economic Research Papers, No. 2013-010

**Provided in Cooperation with:**

Max Planck Institute of Economics

*Suggested Citation:* Bublitz, Elisabeth; Fritsch, Michael; Wyrwich, Michael (2013) : Balanced skills and the city: An analysis of the relationship between entrepreneurial skill balance, thickness and innovation, Jena Economic Research Papers, No. 2013-010, Friedrich Schiller University Jena and Max Planck Institute of Economics, Jena

This Version is available at:

<https://hdl.handle.net/10419/85038>

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# JENA ECONOMIC RESEARCH PAPERS



# 2013 – 010

## **Balanced Skills and the City: An Analysis of the Relationship between Entrepreneurial Skill Balance, Thickness and Innovation**

by

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[www.jenecon.de](http://www.jenecon.de)

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact [markus.pasche@uni-jena.de](mailto:markus.pasche@uni-jena.de).

Impressum:

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# **Balanced Skills and the City: An Analysis of the Relationship between Entrepreneurial Skill Balance, Thickness and Innovation**

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February 2013

## **Abstract**

Being a “jack-of-all-trades” increases the probability of running an entrepreneurial venture successfully; but what happens to “jack-of-few-trades” who lack sufficient skills? This paper investigates a possible compensation mechanism between balanced skills and cities, and how this compensatory measure relates to performance. Specifically, we test and find support for the idea put forward by Helsley and Strange (2011) that high market thickness, such as that found in cities, can compensate for a lack of entrepreneurial skill balance. The results indicate that entrepreneurs with low skill balance benefit more from locating in cities than their counterparts with high skill balance. Innovative firms do not differ from other businesses in this respect.

JEL classification: R1, L26, J24, O31

Keywords: Agglomeration, Entrepreneurship, Balanced Skills,  
Thick Markets, Urban Diversity

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## 1 Introduction

Starting a business in a city, as opposed to a rural area, can be advantageous for founders but also poses certain challenges. What is known about the relationship between agglomeration and start-ups is largely based upon studies that investigate how firms and their environments interact. For instance, the availability of resources in cities can spur start-up activity (Vernon, 1960) and facilitate the implementation of entrepreneurial innovation projects (Audretsch and Feldman, 1996). At the same time, the presence of a higher number of firms in cities implies intensified competition (Fritsch and Schroeter, 2011). Lazear (2004, 2005) presents a general approach to the question how founders can meet the multiple challenges of starting a new business. He argues that founders benefit from having a balanced skill set or being “jack-of-all-trades” who are knowledgeable in all important business tasks. Combining the theories on agglomeration advantages and skill balance leads to the question of whether having access to many external resources might compensate for a lack of own qualifications. Helsley and Strange (H&S, 2011) formally model the relationship between market thickness, skill balance, and complexity, providing a theoretical link between characteristics of founders and firms, and the regional environment. They suggest that thick markets can help to overcome a lack of entrepreneurial skill balance and that the completion time of projects, a measure for firm performance, rises with complexity but decreases with market thickness.

An empirical test of the mechanisms suggested by H&S is not only of interest to urban economists, with regard to location of entrepreneurial activities, but it also contributes to our knowledge of the role of balanced skills for success in business. Studies of the influence of skill balance on the income of entrepreneurs have produced contradicting results (Hartog, van Praag, and van der Sluis, 2010; Åstebro and Thompson, 2011; Bublitz and Noseleit, forthcoming). The picture remains unclear when replacing income with other firm performance measures (progress in the venture creation process: Stuetzer, Obschonka, and Schmitt-Rodermund, forthcoming; self-employment duration: Oberschachtsiek, 2012). Hence, whether balanced

skills are conducive to improving firm success still needs further investigation. Another issue in the jack-of-all-trades literature concerns the origin of balanced skills. Research either argues more in favor of acquiring balance primarily via learning (Lazear, 2005) or possessing skill balance due to a genetic predisposition (Silva, 2007). Some evidence shows that it might be the result of both, hence, a combination of innate traits and acquired skills (Stuetzer, Obschonka, and Schmitt-Rodermund, forthcoming). In both cases, the leeway for increasing skill balance is likely to be limited by ability. Thus, entrepreneurs could try to substitute their lack of balance with skills of other individuals and other resources, a process that, according to H&S, is facilitated in thick markets that can be found in cities.

This paper seeks to address the interaction between the individual founder and the regional environment. To this end, we investigate how firm success is affected, individually and jointly, by the skill sets of entrepreneurs and their location choice. The contribution of this paper is threefold. First, the empirical investigation of the propositions of the H&S model may help to better understand the spatial distribution of entrepreneurial activity. Second, an additional option in the discussion on the acquisition of balanced skills, namely tapping into the resources of cities, is presented. Third, in this context we test project completion time as a performance measure, following the suggestion by H&S.

The H&S model offers a good starting point for our analysis. The dynamics of the model, as sketched above, are to a large extent driven by the interaction between market thickness, which can, for example, be understood as the degree of agglomeration and skill balance of entrepreneurs. Innovation, as a measure of complexity, is additionally included in order to distinguish between the types of businesses that founders run. For a more fine-grained empirical analysis recent insights from the balanced skill literature are then used to complement the H&S model. It is, thus, taken into account that the widely used measure for balanced skills, that is knowledge in a variety of skill areas, could also be the result of a general taste for variety instead of a strategy targeted towards entrepreneurship (Åstebro and Thompson, 2011).

For the empirical analysis, we use data that we collected from founders in German regions with different degrees of agglomeration. The regression results show that entrepreneurs with more balanced sets of skills need less time to finish projects. On average, the completion time is lower among entrepreneurs in cities than among entrepreneurs in rural areas. Entrepreneurs with less balanced skill sets benefit more from the positive relationship between agglomeration economies and completion time than entrepreneurs with a higher balance. Complexity, measured as innovative activity of entrepreneurial ventures, shows no significant relationship with completion time. Our results are robust to using alternative city categories. Furthermore, we can show that sorting into cities and sample selection does not affect our results. In an extension of our analysis, we find that the industrial diversity of cities seems to be a crucial factor for making the compensation mechanism work. This is in line with the general idea of the H&S model.

The remainder of this paper is organized as follows. After presenting the theoretical background and the hypotheses (Section 2), the data and methodology are introduced (Section 3). The results of the empirical analyses are reported in Section 4 and Section 5 concludes.

## **2 An urban compensation mechanism for entrepreneurs with unbalanced skills**

Previous research shows that what drives locational advantages of cities for entrepreneurs can at the same time lead to considerable disadvantages. Due to a high density of population and economic activity, agglomerated areas have thick local markets that can spur entrepreneurial activity (e.g., Vernon, 1960; Sato, Tabuchi, and Yamamoto, 2012) and increase the success rate of entrepreneurial projects (Helsley and Strange, 2011). The advantages of market thickness for entrepreneurship include the availability and diversity of specialized inputs or services, access to larger markets, and a large regional knowledge base that results in a relatively high level of regional knowledge and technological spillovers (Armington and Acs, 2002; Duranton and Puga, 2004; Glaeser, 2007). One crucial trigger for the working of such

agglomeration externalities is the (face-to-face) interaction among heterogeneous actors which provides the basis for serendipitous labor market matching, sharing of knowledge and effective learning (e.g., Jacobs, 1969; Helsley and Strange, 1991; Storper and Venables, 2004).

A high competition in cities caused by intense economic activity can also facilitate the process of market selection and stimulate chances of success for entrepreneurial projects of surviving firms (Fritsch and Schroeter, 2011). Accordingly, survival rates of businesses set up in agglomerations are found to be relatively low (Fritsch, Brixey, and Falck, 2006; Renski, 2008), which is probably a result of comparatively intense regional competition in thick markets. In sum, there is no clear-cut answer to the question of whether locating in a city will ultimately benefit entrepreneurs. Nonetheless, a variety of advantages are associated with thicker markets. Thus, the focus of our investigation remains on whether urbanization externalities compensate for individual deficiencies like a lack of skill balance.

The concept and the advantages of balanced skills were first formalized by Lazear (2004, 2005). He argues that having a generalized or balanced skill set maximizes the income of entrepreneurs. This idea builds on the assumption that entrepreneurs carry out a variety of tasks and need to be well equipped for each task since their outcome is determined by their weakest skill. Lazear's model defines full balance as having the same level across skills. The degree of balance is usually proxied with count indices that measure the diversity of education or experience. Research has confirmed that entrepreneurs show a higher skill balance than employees (Wagner, 2003, 2006; Elfenbein, Hamilton, and Zenger, 2010; Bublitz and Noseleit, forthcoming). Regarding the question whether skill balance is the result of an innate trait or acquired ability, Silva (2007) finds that controlling for unobserved individual heterogeneity renders the effect of the balance variable on the likelihood of becoming self-employed insignificant. This indicates that an innate trait should be driving skill balance but it is not known what trait this is. Lazear is more in favor of the argument that individuals with entrepreneurial intentions tend to increase their skill balance by following a balanced investment strategy. Stuetzer, Obschonka, and Schmitt-

Rodermund (forthcoming) confirm that both the endowment with certain traits and the investment in skills increase the overall balance. In sum, all studies find significant differences between employees and entrepreneurs in terms of their skill set composition, although the origin of more or less balanced skills is not yet known. If the acquisition of balanced skills was not feasible for everyone, for instance, due to a lack of innate traits, then it should be asked whether factors outside the individual may substitute a lack of skills. This could help to further understand different dynamics behind skill balancing mechanisms.

We use the H&S model to establish a connection between the individual skill set of entrepreneurs and the location of their firm. H&S combine a multi-task coordination model of entrepreneurship with a model of agglomeration. This approach aims to explain entrepreneurial activity in metropolitan areas by exploring how the availability of inputs can compensate for a lack of entrepreneurial balance, thus, focusing on the advantages of agglomerations. H&S argue that thick local markets decrease entry barriers for entrepreneurs who lack skill balance. Input markets in their initial model are comprised of all available resources and are assumed to be structurally balanced.

Lazear's model (2004, 2005) does not include a detailed formalization of the function of the entrepreneur or the underlying entrepreneurial process with regard to balance. H&S propose two definitions that both understand the role of the entrepreneur as that of a generalist who acquires specialized inputs, that is, hiring employees who are specialists which seems in line with Lazear's approach. In the first case, the entrepreneurs' responsibility is the *evaluation* of specialized skills. The more entrepreneurs know in each field, the better they can judge the applicants' qualifications during the recruitment process. In the second case, which is favored by H&S, the entrepreneurs' role is the *management* of specialized skills. The goal of entrepreneurs is to combine own skills with those of employees in such a way that they achieve a better outcome. Here, H&S define "the entrepreneur [as] an agent who uses her own skills to *adapt* the best available local input to better meet the



needs of a particular task” (H&S, 2011, 552). Note that inputs are not solely focused on personnel.

It may be helpful to distinguish the two concepts in the model, but in practice they are obviously interwoven as can be shown in the following examples. First, entrepreneurs have to decide what types of workers are needed (management). Second, they need to hire qualified employees (evaluation). Third, they manage their staff and divide tasks adequately (management). Alternatively, one could think of acquiring financial capital where apart from choosing the right investor (evaluation), entrepreneurs must use their financial resources wisely (management). This illustrates that being a jack-of-all-trades matters at all times. However, it plays a particularly important role in the start-up process when everything still depends on the founders themselves.

In their model, H&S begin by describing the relationship between project completion time, market thickness, and complexity. Firm success is seen here from a process perspective in that each completed project is viewed as a success. The less time it takes to finish a project, the more successful a firm is assumed to be. The variable project completion time as a measure for success is new in this literature. It can be influenced by either the entrepreneur or employees, and can be regarded as an adequate measure to test the relationship between skills and success during different growth stages of a business.

If not stated otherwise, the following hypotheses are derived from the H&S model and justified according to their arguments. This implies that the H&S propositions are directly tested in our empirical analyses. For comparison, an overview of the hypotheses and H&S propositions can be found in Table 1. We start by looking at the relationship between characteristics of firms and regions. H&S argue that when looking at entrepreneurs with high skill balance the time required to complete a project decreases with market thickness and increases with the complexity of the project. Thickness is highest in densely populated areas like cities because of the rich availability of many different types of resources. A thick regional

environment should, therefore, be associated with shorter project completion times (H1).<sup>1</sup> H&S suggest measuring and interpreting complexity with innovation activities of firms. Innovation can be a key driver of business success (Coad, 2009) which implies that, in general, innovative firms should tend to be more successful than their non-innovative counterparts. This raises the question whether a positive relationship between business performance and innovation can also be detected in our context. Since innovation is, by definition, the introduction of something new into the market, associated tasks will not yet comprise a high proportion of routine activities. Therefore, innovation increases the complexity of tasks and, due to the time needed for the innovation process, innovative firms take longer to finish projects (H2). Thus, innovation and our measure for business success are assumed to correlate negatively.

Next, the entrepreneur is added to the equation in that it is argued that individuals with low skill balance take the longest to complete projects. As they lack some of the necessary skills, their work will be less efficient and of a lower quality which will increase completion time. Conversely, this means that a higher skill balance increases performance, that is, it decreases completion time, because balanced entrepreneurs know how to best adapt their inputs (H3). The H&S model assumes that ex ante it is not exactly known which of the future project tasks will be critical. Therefore, with more balanced skills there is less risk that an important task is matched with little ability.

Next, differences among entrepreneurs with regard to the magnitude of the effect of thickness are analyzed. It is reasonable to assume that entrepreneurs with high skill balance require few external resources in order to achieve short completion times because of their high qualification. Therefore, the less balanced entrepreneurs can benefit to a greater extent from the availability of resources in thick markets. Accordingly, we investigate

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<sup>1</sup> An alternative explanation would suggest that less skilled entrepreneurs in thick markets can hire employees more quickly to substitute own weaknesses. In that case, completion time decreases when skill balance decreases. This opposite effect could weaken or cancel out the relationship suggested by H&S. However, there is no risk that it would lead to an overestimation in our regressions.

to what extent the benefit of being located in a city depends on the individual skill balance (H4). An alternative but related explanation can be based on the division of labor. Entrepreneurs with a lack of skill balance cannot comply with business tasks and, therefore, have to divide labor among employees who are qualified to carry out these tasks. Thickness facilitates the search for labor and, thereby, the process of the division of labor.

The relationships explained above were in accordance with the propositions of the H&S model. However, in the literature on balanced skills the direction of the balance effect on income is ambiguous. Hartog, van Praag, and van der Sluis (2010) and Bublitz and Noseleit (forthcoming) confirm a positive relationship between skill balance and income for entrepreneurs. Åstebro and Thompson (2011) find, however, that a higher skill balance decreases income. These differences in results could be explained by varying measures for skill balance in previous studies that use as proxy for skill balance diversity of experience or knowledge. As pointed out by Åstebro and Thompson, there could be an excess of variety that outweighs the positive effect of knowing more. Individuals end up (unintentionally) in self-employment after having tried out many other things (taste for variety) by which they accumulated a diverse knowledge set. To account for such an effect it is necessary to include a variable that captures the joint effect of experience and skill balance. This follows the idea that a learning process targeted towards entrepreneurship and skill balance will take less time. A high balance at an older age is more likely to be the consequence of more experience or a taste for variety. It is, thus, argued that younger individuals who have already achieved a high skill balance are expected to perform better than older individuals with the same level of skill balance (H5).

Table 1: Comparison of our hypotheses and the H&amp;S propositions

	<i>Hypotheses</i>		<i>H&amp;S propositions</i>
1	The completion time decreases when thickness increases.	1	“Completion time, complexity and thickness: Expected completion time rises with the complexity of the project, and decreases with the thickness of the local input market.”
2	The completion time increases when complexity increases.		
3	The completion time decreases when balance increases.	3	“Completion time and balanced skills: Expected completion time is minimized when entrepreneurial skills are balanced.”
4	Entrepreneurs with low skill balance benefit more from thicker markets than entrepreneurs with high skill balance.	4	“Balance and thickness: The benefit at the margin of operating in a thicker market is larger for an entrepreneur with unbalanced H skills.”
5	The completion time is longer for older entrepreneurs with high skill balance.		

*Notes:* The remaining three propositions by H&S, which are not listed above, either include a variable on the feasibility of projects or are related to balance of cities; neither is the focus of this paper.

To sum up, according to the model, an unbalanced entrepreneur in a city, in comparison to an unbalanced entrepreneur in a rural area, could compensate for a lack of skill by locating in a thick market. In the analytical model, the focus is placed on the most important relationships to highlight their effects. The empirical analysis allows us, however, to include additional variables that may otherwise bias results. The following section provides a comprehensive empirical framework to analyze the relationship between balanced skills and the city, including a short description of the relationship between our control and main variables of interest.

### **3 Data and empirical strategy**

#### **3.1 Data set**

From October 2010 to February 2011, data from 1,105 founders in Germany was collected with computer-assisted telephone interviews. The sample is based on information provided by the Establishment History Panel (BHP) of the Institute for Employment Research of the German Federal Employment

Agency (see Spengler, 2008, for a description of this data base). The BHP is an administrative data set that comprises all establishments that employ at least one person obliged to pay Social Insurance contributions. We obtained access to firms' addresses via the BHP and contacted founders subsequently. In the survey, we collected personal information about founders, for example their educational attainment and work experience, as well as information about firm characteristics. Businesses in the sample are active in manufacturing and knowledge-intensive business services (KIBS) in six German regions which are roughly comparable to labor markets in the US. The selection criterion for the sample regions was their overall degree of agglomeration, resulting in two rural areas, two moderately agglomerated, and two agglomerated areas. Within the sample regions, there are city and non-city areas, which are the unit of analysis.

The BHP only includes firms with employees, disregarding solo-entrepreneurs. Therefore, the selection of firms into our sample needed to be based on the year of first hire as opposed to the year of founding. First hires took place between 2003 and 2008.<sup>2</sup> The year of founding is defined as the year in which the first sales took place, a question asked during the interviews. The date of founding can be an earlier year or the same as the one of the first hire. The telephone interview was not continued if the founder answered that the first sales took place prior to 1990. Thus, all businesses of our sample were founded between 1990 and 2008. In total, we contacted 5,139 establishments which amounts to approximately 80 percent of all establishments (100 percent for manufacturing) that had their first hire and had less than 20 employees in that period in the respective regions.

One important feature of our sample is that it is unlikely to comprise a large number of pure necessity entrepreneurs, since building a workforce at a certain stage of the venture development can be regarded as an indication that these founders identified and seized an opportunity. Such ventures, that is, opportunity entrepreneurs, are also likely to be the ones that fit the notion of growth stimulating entrepreneurship as inferred from economic theories

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<sup>2</sup> The only exception is the sample region *Oberes Elbtal* in which firms with their first hire in 2002 were included due to an otherwise very low number of cases.

(e.g., Schumpeter, 1934) and that are necessary for the H&S model with regard to performance measures. Furthermore, due to the relatively young age of most firms, it is unlikely that they have active projects in more than one place. The construction of the questionnaire further ensures that the firm is not part of a larger company. Therefore, it is safe to assume that resources are primarily accessed in local input markets, which is an assumption of the H&S model.

### **3.2 Completion time**

As dependent variable, the time span needed to complete a project (*com\_time*) is used to evaluate how productive a firm is. The faster it goes, the more productive the firm is. Here, completion time is measured with the number of years elapsed between the foundation of the firm and the first hire. The advantages and disadvantages of this proxy for project completion will now be discussed.

Firms have to reach a minimum efficient size (MES) as soon as possible in order to be able to survive in the market (e.g., Mansfield, 1962; Audretsch, 1995; Coad, 2009). Previous research has taken this to an extreme by stating that a firm comes into being only once workers are employed (Coase, 1937). Thus, recruiting personnel is not just related to an idiosyncratic decision to grow but constitutes a necessity for survival. Put differently, reaching the MES via hiring employees can be regarded as a challenge that every entrepreneur faces and a project that should be completed as soon as possible. Certainly, this argument does not hold for very small scale services or freelancers. It can, however, be expected to apply to the industries of this study.

Also, first hire might not concur with projects such as producing a television program, an example given by H&S. However, H&S mention the hiring of actors or other staff members as part of the production which indicates that progress is being made in completing the program by taking that step. More generally, one might regard first hire not only as a specific project, for instance, reaching MES, but also as an indicator for the

successful completion of a number of tasks leading up to that project. These tasks include the accumulation of sufficient financial resources to pay wages.

Completion time can be zero if the year of founding is equal to the year of the first hire, but it can also be 18 years if the founding took place in 1990 and the first hire occurred in 2008. However, for establishments with their first hire in 2003 (the earliest possible date for firms in our sample), the maximum value is 13 years since those who started prior to 1990 have been excluded from the survey right from the beginning. To alleviate this truncation problem and in order to sort out those firms with extremely long time spans between founding and first hire, firms with a completion time exceeding 10 years are not considered.<sup>3</sup> This is done on the basis of the selection criterion “first hire” from which we move back in time to determine the foundation date. Thus, every firm in our sample could theoretically reach a completion time between zero and ten years. This has the further advantage that we exclude those East German ventures that were created in the early 1990s immediately after the shock transition to a market economy and the beginning of mass privatization (Brezinski and Fritsch, 1995). Ventures founded during this time might be peculiar due to “transition noise”.

### **3.3 City, balance, and innovation**

The following section presents our main variables of interest (thickness, balance, and complexity) and some descriptive evidence on their relationship with completion time.

*Cities:* H&S leave open to discussion whether market thickness is determined by city size or industry concentration. Nevertheless, the title of their paper and the formulation of their hypotheses consistently refer to cities which, in our data, are best captured with indicators for the degree of agglomeration. The businesses in our sample are located in areas with distinct degrees of agglomeration which are defined in accordance with the classification of the German Federal Institute of Building, Urban Affairs, and

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<sup>3</sup> Approximately 90 percent of the respondents had a completion time of 10 years or less (see Table A2 in the Appendix for summary statistics and Figure A2 for the distribution of the variable).

Spatial Development (BBSR; for a definition of agglomeration areas, see Table A1 in the Appendix). The main variable for measuring thickness is a dummy for district-free cities ("kreisfreie Städte") that are located in agglomerated and urbanized planning regions (roughly comparable to US labor market areas). Thus, we focus on central locations within comparatively thick functional areas. Cities are centers of commercial, manufacturing, trading, business, consumer, and public sector activities. Our dummy, therefore, comprises qualitative information that is not necessarily captured by measures like population density. Nevertheless, other definitions and measures of thickness, including population density, are tested to see for which type of agglomeration the thickness argument holds.

*Balance:* To capture the degree of skill balance of entrepreneurs, they were asked for the number of professional fields in which they have been active before becoming self-employed. It was explained in the interview that this does not mean the number of previous employers but professional fields like, for instance, accounting, facility management, or production. This count index is the standard measure used in the literature (Lazear, 2005; Wagner, 2006; Åstebro and Thompson, 2011).<sup>4</sup>

The fourth proposition of the H&S model states that the benefit at the margin of operating in a thicker market is larger for an entrepreneur with unbalanced skills (see also hypothesis 4). H&S suggest that, from this, one could infer that the average entrepreneurial skill balance should be lower in thicker markets. However, although an unbalanced entrepreneur might benefit to a larger extent from locating in thick markets, this does not necessarily mean that the majority of founders in such an environment are comparatively unbalanced. Nonetheless, mean comparison tests show significant differences of balance in cities and in other areas, giving some tentative evidence that entrepreneurs in cities tend to be less balanced before entering the market when compared to entrepreneurs in other areas (see Table 2). Furthermore, if entrepreneurs benefit from cities via a compensation mechanism, as described in hypothesis 1, then their

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<sup>4</sup> The maximum value of balance is chosen to be 10 which covers 98% of our respondents. The remaining observations can be regarded as outliers.



completion time should also be shorter, despite the fact that they might be on average less balanced in city environments. The results of mean comparison tests of Table 2 give some support to the conjecture.

Table 2: Mean Comparison for Skill Balance and Completion Time

	<i>Thickness of markets</i>	<i>N</i>	<i>Skill Balance (Mean)</i>	<i>Significance</i>	<i>Completion Time (Mean)</i>	<i>Significance</i>
I	Cities	246	2.36	**	2.24	n.s.
	Other areas	681	2.65		2.50	
II	Cities	203	2.47	*	2.06	*
	Other areas	608	2.74		2.48	

*Notes:* \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level. Row (I) compares all respondents for which we have information on skill balance. Row (II) presents results for those respondents who were included in the regression analyses because they had no missing values for other variables of interest and controls.

*Innovation:* The degree of complexity is measured by a binary marker indicating whether a firm is innovative or not. If a firm is innovative, the complexity of processes and products is expected to be higher. This is captured by a dummy variable that has a value of 1 in case the firm has introduced a new product in the market.

*Age\*balance:* To test the relationship between performance, experience, and the degree of skill balance, the variables *age* of the founder and the interaction term between age and balance are included. This is based on the argument that a high balance at a young age can be the result of a strategy targeted towards entrepreneurship. Compared to that, a higher balance at a higher age might simply reflect that, as age increases, so does experience, which could be associated with a taste for variety.

### 3.4 Control variables

The interplay of thickness, balance, and complexity can be expected to depend on context, particularly the network of the founder and entrepreneurial human capital. The role of local networks is assessed by

employing a dummy variable that indicates with a value of 1 whether founders had either close contact with other self-employed friends or whether they had self-employed parents before entering the market (*contact\_selfemp*). Previous research has shown that entrepreneurial role models positively influence the decision to become self-employed (e.g., Bosma et al., 2012) and that networks enhance the resource access of entrepreneurs which can be a crucial success factor (e.g., Sorenson and Audia, 2000; Stam, 2007). Additionally, we control for whether the firm was founded by a team (*founder team*) which in the past has produced ambiguous results. Having a team provides more resources and external network relations (Thakur, 1999). Furthermore, teams might have a higher heterogeneity of functional backgrounds (Hayton and Zahra, 2005; Cantner, Goethner, and Stuetzer, 2010) which might compensate for a lack of balanced skills. Teams also have a higher joint work experience that might affect success positively but, nevertheless, a larger group might also imply more conflicts that negatively affect performance (Eisenhardt and Schoonhoven, 1990). Our control variable is a dummy variable that indicates with a value of 1 that there was more than one founder involved in the start-up process of the venture.

Moreover, not only the balance of skills but human capital in general might be important for success. Entrepreneurs with higher human capital should have a higher productivity that allows them to seize entrepreneurial opportunities and to run ventures more successfully (Brüderl, Preisendörfer, and Ziegler, 1992; Shane, 2000; Baron, 2004; Ucbasaran, Westhead, and Wright, 2009; Unger et al., 2011). These productivity enhancing effects might also reduce the time to complete projects within entrepreneurial ventures. Qualification levels of founders are measured by their highest educational attainment. We distinguish with dummy variables between holding a tertiary degree (*edu\_high*), having completed vocational education (*edu\_medium*), and having no completed training (*edu\_low*). Human capital related to work experience is also measured in three dimensions. A dummy indicates whether the founder has experience in the same industry where the firm was founded (*exp\_ind*). It is further controlled for prior self-employment

(*prior\_self*) and for management experience (*exp\_manage*). All these variables are expected to exert a positive influence, which means, higher education and more experience should reduce completion time.

In addition, firm size of the last employer, before the founder entered the market, (*prior firm size < 20/50/200*) is included in order to assess the role of small firm experience which has been shown to improve abilities in tasks related to the entrepreneurial profile (Wagner, 2004; Hyytinen and Maliranta, 2008; Elfenbein, Hamilton, and Zenger, 2010). The variable *unemp* indicates whether a founder was unemployed right before entering the market. This may be important because, for instance, previously acquired human capital might have depreciated due to the unemployment which could, thus, have a negative influence.

All models include completion year dummies in order to control for general macroeconomic conditions. Sample region dummies to capture regionally fixed effects and industry controls are employed as well. All analyzed subjects are Germans. Additional socio-demographic controls comprise the place of residence in East or in West Germany in the year 1989 (*east\_1989*), gender (*male*), and marital status (*married*). Due to missing values for some variables our final sample consists of 821 observations.<sup>5</sup>

#### 4 Results

The results will be presented in two subsections. First, we report our findings with regard to the formulated hypotheses. This includes additional tests with alternative thickness measures to gain a better understanding of whether cities or a higher thickness in general is of advantage for entrepreneurs. The second part presents different robustness checks to control for sorting. Additionally, we extend the analysis to investigate whether the city effect is related to a diverse industry structure.

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<sup>5</sup> For summary statistics, see Table A2 and, for the correlation matrix, see Table A3 in the Appendix.

#### 4.1 Benefits of cities for entrepreneurs with varying skill balance

For direct tests of the derived hypotheses a negative binomial regression is the method of choice because the dependent variable, completion time in years, is measured as a count.<sup>6</sup> All hypotheses are simultaneously tested in a baseline model which is later refined to account for alternative explanations. First, the definition of cities in agglomerated and urbanized areas is applied (see Table 3). Model 1 includes the main variables of interest and controls for industry, sample region, and year of completion. The results show that cities and balance are both negatively associated with completion time.<sup>7</sup> Older entrepreneurs need less time to complete projects. However, older founders with more balanced skills benefit less from balance than younger founders, showing the importance of controlling for the interaction between age and balance. Innovativeness of the business has no significant effect.

Model 2 contains additional controls for socio-demographic characteristics and human capital of the founder. The size of the balance coefficient increases; the other previously included variables remain more or less the same. Education and industry experience are insignificant, possibly because these dimensions are already captured by the balance and age variables. Previously unemployed founders show a longer completion time. The other variables are insignificant.

Model 3 includes the whole set of independent variables with controls for the local network and whether there is a founder team. Founders who had close contacts with entrepreneurs before market entry have a significantly lower completion time. Being in a founder team shows a weakly significant negative relationship with completion time. The coefficients of cities and balance become a little smaller but remain statistically significant.

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<sup>6</sup> As alternative regression method a Poisson model was run. However, there was overdispersion and the test statistics (likelihood ratio test, goodness of fit) showed that negative binomial regressions are more suitable. Nonetheless, the results stay virtually the same when running Poisson models which is important with regard to robustness checks that are calculated later on. Results can be obtained upon request.

<sup>7</sup> It might be that certain activities within industries are located primarily in cities (e.g., headquarters, R&D labs). However, the effect of the city dummy hardly changes in models with *city x industry* interactions. Results can be obtained upon request.

The relationship between balance and city can be more directly assessed by calculating marginal city effects at different levels of skill balance. Figure 1 shows the respective results based on Model 3. The marginal city effect on completion time decreases with skill balance. In fact, it shows a concave relationship. Put differently, the figure reveals that entrepreneurs with a low skill balance benefit most from agglomeration advantages. Being in a city is associated with a reduction of completion time by, on average, one year, if an entrepreneur has a skill balance of one, and by half a year, if the skill balance is five. The confidence intervals show that the city effect is not statistically significant for entrepreneurs who have never been active in a professional field before, a group that is not explicitly addressed by H&S. Also, no significant association can be found for those entrepreneurs, who report a very high number of professional fields. Thus, the city effect is zero for those individuals who are not in need of a compensation mechanism due to their already high balance and for those who do not achieve a minimum of own balance (for more details, see Table A4 in the Appendix).<sup>8</sup>

As a robustness check for the idea that cities are main drivers of the compensation mechanism, an alternative definition of agglomeration is used that only includes core cities. This strict definition does not take into account cities in urbanized but only in agglomerated planning regions. All other variables remain the same as in the previous model specifications. The thickness variable core city is significant and the coefficient is larger than in any of the previous model specifications (Models 4-6 in Table 3). The marginal effect of being located in a city on completion time at different levels of skill balance shows approximately the same relationship as before (Table A4 in the Appendix and Figure 2,). Balance and age also continue to show a

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<sup>8</sup> An alternative way to test H4 would be to use market thickness as a continuous variable and interact it with a dummy indicating whether the skill level is balanced. Apart from the fact that interpreting interaction effects in non-linear models is not straightforward (Norton, Wang, and Ai, 2004), defining a cut off value for skill balance is arbitrary when the latter is implemented as continuous variable as done in our survey. Further, the city effect at different levels of skill balance can be interpreted more easily than a balanced skill effect at different levels of population density.

significant negative association with completion time. Compared to Model 1-3, no important changes can be found with regard to the other variables.

Table 3: Influence of cities, balance, and innovation on completion time (negative binomial regression)

<i>Variables</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>Cities</i>	-0.651*** (0.251)	-0.663*** (0.254)	-0.652*** (0.252)			
<i>Core city</i>				-0.816** (0.332)	-0.787** (0.339)	-0.762** (0.341)
<i>Balance</i>	-0.457** (0.215)	-0.503** (0.229)	-0.470** (0.221)	-0.432** (0.216)	-0.478** (0.230)	-0.446** (0.222)
<i>Age</i>	-0.116*** (0.0196)	-0.113*** (0.0206)	-0.114*** (0.0203)	-0.116*** (0.0194)	-0.113*** (0.0205)	-0.113*** (0.0201)
<i>Age*balance</i>	0.0123** (0.00510)	0.0132** (0.00541)	0.0125** (0.00523)	0.0118** (0.00512)	0.0126** (0.00543)	0.0119** (0.00525)
<i>Innovation</i>	0.219 (0.248)	0.224 (0.257)	0.279 (0.257)	0.207 (0.248)	0.205 (0.256)	0.261 (0.255)
<i>Edu_low</i>		0.612 (0.465)	0.630 (0.490)		0.575 (0.455)	0.597 (0.478)
<i>Edu_medium</i>		-0.102 (0.232)	-0.118 (0.230)		-0.101 (0.231)	-0.117 (0.229)
<i>Unemp</i>		0.797*** (0.284)	0.750** (0.291)		0.742*** (0.284)	0.693** (0.291)
<i>Exp_ind</i>		-0.420* (0.253)	-0.392 (0.247)		-0.437* (0.252)	-0.409* (0.245)
<i>Prior_self</i>		-0.431 (0.263)	-0.408 (0.262)		-0.424 (0.262)	-0.401 (0.262)
<i>Exp_manage</i>		-0.0215 (0.205)	0.00840 (0.210)		-0.0193 (0.205)	0.00844 (0.211)
<i>Prior firm size &lt; 20</i>		-0.148 (0.251)	-0.100 (0.254)		-0.155 (0.252)	-0.107 (0.255)
<i>Prior firm size &lt; 50</i>		-0.217 (0.311)	-0.137 (0.313)		-0.229 (0.311)	-0.149 (0.312)
<i>Prior firm size &lt; 200</i>		-0.0255 (0.295)	-0.0243 (0.296)		-0.0470 (0.295)	-0.0461 (0.296)

<i>East_1989</i>	-0.0721	-0.136	-0.0580	-0.125
	(0.348)	(0.354)	(0.347)	(0.352)
<i>Male</i>	0.132	0.131	0.123	0.121
	(0.277)	(0.277)	(0.276)	(0.276)
<i>Married</i>	-0.0816	-0.0796	-0.0755	-0.0737
	(0.226)	(0.224)	(0.224)	(0.222)
<i>Contact_selfemp</i>		-0.503**		-0.491**
		(0.204)		(0.204)
<i>Founder team</i>		-0.406*		-0.420*
		(0.223)		(0.223)
<b>Wald Chi2</b>	<b>118.06***</b>	<b>141.57***</b>	<b>155.04***</b>	<b>117.95***</b>
	<b>136.94***</b>	<b>145.16***</b>		

Notes: Number of observations: N = 821. Robust standard errors in parentheses. \*\*\*: statistically significant at the 1 percent level; \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level. All models contain sample region dummies (jointly: not significant), year of completion dummies (\*) as well as NACE 1-Digit industry dummies (\*\*\*).

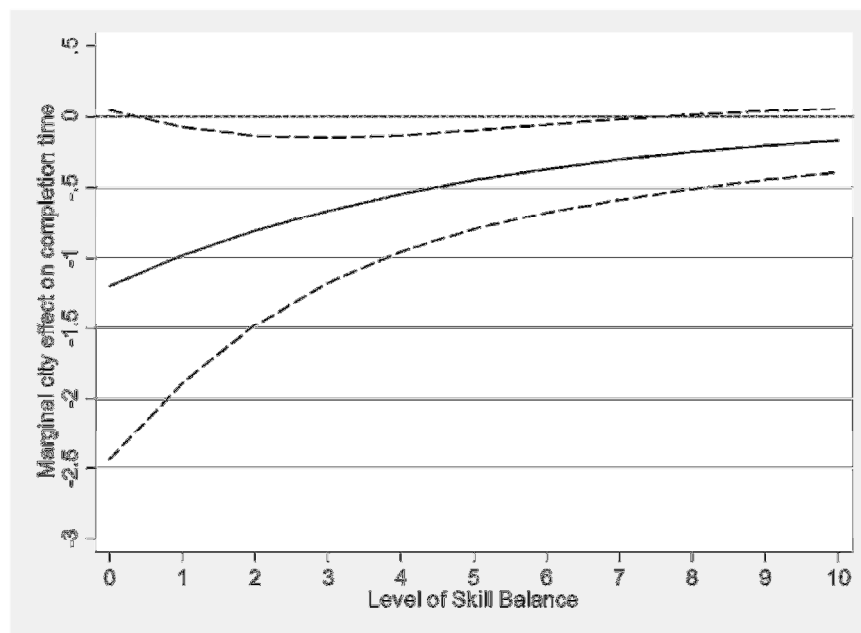


Figure 1: Marginal effects of being located in a city on completion time at different levels of skill balance (Model 3) with 95% confidence interval (dashed lines)

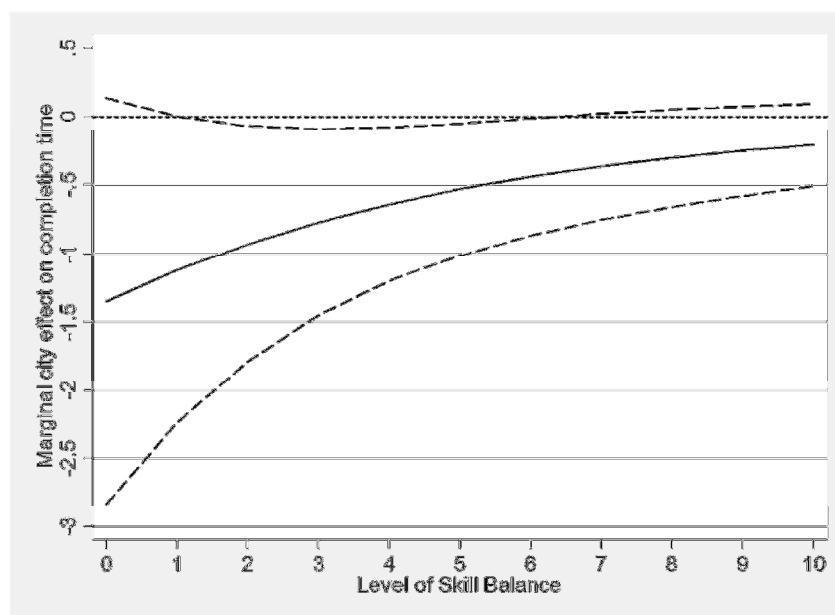


Figure 2: Marginal effects of being located in a core city on completion time at different levels of skill balance (Model 6) with 95% confidence interval (dashed lines)

So far, our analysis shows that completion times are negatively associated with thickness (hypothesis 1) and skill balance (hypothesis 3). A lack of balanced skills does not have to prevent individuals from becoming self-employed because thick markets can serve as a compensation mechanism. Furthermore, entrepreneurs with low skill balance benefit more from being located in cities than entrepreneurs that have high skill balance (hypothesis 4). The interaction of age and balance confirms that the advantages of balance are smaller for older founders, indicating the importance of taste for variety (hypothesis 5). Innovativeness as measure for complexity does not show up significantly and, therefore, we cannot confirm our hypothesis 2. This should, however, not be taken to mean that complexity does not increase completion time. Instead, it is possible that whether innovation can increase complexity depends on the type of project.<sup>9</sup> All in all,

<sup>9</sup> Since innovations in the service sector tend to differ considerably from those in manufacturing (Castro, Montoro-Sanchez, and Ortiz-De-Urbina-Criado, 2011; Pires, Sarkar, and Carvalho, 2008), an interaction of *innovation* and a dummy indicating whether the firm is active in the service sector was included in an additional analysis. All innovation variables remained insignificant.



the results confirm four of our hypotheses and thereby two out of three tested propositions of the H&S model.

After having tested the basic relationships of the model, we now run the model with alternative thickness measures. While, in their interpretations, H&S focus on entrepreneurial activities in cities, in the propositions of the model they replace cities with market thickness. To see whether the compensation mechanism is really driven by cities, two alternative specifications are implemented. These specifications measure thickness by referring to the more aggregate level of German Planning Regions in which cities are located. The first specification includes only cities and districts ("Kreise") located in agglomerated Planning Regions (*high density*, see Table 4, Model 7). The second one comprises cities and highly and medium agglomerated districts in agglomerated and urbanized planning regions (*high & medium density*, Model 8). The model specification is the same as the full model in earlier calculations (Table 3). Balance is significant and negatively associated with completion time. Being located in a highly and medium agglomerated district shows only a weakly significant relationship with completion time whereas being located somewhere in an agglomerated planning region is insignificant. These results can be taken to mean that the compensation mechanism of thickness is driven by cities and not by the overall density of the larger planning regions in which the entrepreneurs set up their firms.

Table 4: Influence of alternative thickness measures on completion time  
(negative binomial regression)

<i>Variables</i>	(7)	(8)	(9)
<i>High density</i>	0.201 (0.685)		
<i>High &amp; medium density</i>		-0.551* (0.309)	
<i>Population density</i>			-0.210** (0.103)
<i>Balance</i>	-0.464** (0.220)	-0.456** (0.219)	-0.471** (0.222)
<i>Age</i>	-0.111*** (0.0200)	-0.110*** (0.0200)	-0.114*** (0.0205)
<i>Age*balance</i>	0.0124** (0.00527)	0.0124** (0.00524)	0.0125** (0.00529)
<i>Innovation</i>	0.237 (0.256)	0.225 (0.256)	0.227 (0.256)
Wald Chi2	134.95***	146.93***	148.27***

*Notes:* The models are based on model (3). Results on human capital and socio-demographic controls are not reported for brevity. Number of observations: N = 821. Robust standard errors in parentheses. \*\*\*: statistically significant at the 1 percent level; \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level. All models contain sample region dummies (jointly: not significant), year of completion dummies (\*) as well as NACE 1-Digit industry dummies (\*\*\*).

Next, we explore population density as a measure of thickness instead of using a direct category for cities. The results are reported in Model 9. Using this measure provides more imprecise estimates than the city dummy in Models 1-3 (Table 3) because the city dummy is significant at the 1 percent level and density at the 5 percent level. Also, the coefficient of density is much smaller. Furthermore, a comparison with Models 4-6 in Table 3 shows that, although the significance levels are the same, the coefficient of core city is larger than that of population density. From these results one can conclude

that population density only partly captures resources and characteristics that cities display and that are necessary to benefit from the compensation mechanism between skill balance and thickness. Therefore, if one attends to the spirit of the H&S model, location in cities, instead of population density, should be taken as a proxy.

#### **4.2 Sorting mechanisms and the role of industry structure**

Since the relationships identified above could be driven by other variables or sorting mechanisms, we perform a series of robustness checks. In particular, we want to find out whether a certain characteristic of cities is especially relevant for compensation of a lack of skill balance.

One possible sorting mechanism that may have influenced our results could be non-random selection into our final sample. Firstly, certain entrepreneurs might have systematically chosen to participate in our survey. Secondly, missing values for items asked in the survey and employed in the analysis might not occur at random. To account for this possible sample selection problem, we apply a procedure that analyzes the likelihood that an observation enters our analysis (for details, see Miranda and Rabe-Hesketh, 2006). In the first step of this procedure, we run a selection model based on the information that we have for respondents and non-respondents of our full sample, which, as previously mentioned, comprises approximately 80% of all completed first hire projects in the sample regions. The binary selection variable takes the value one if we have information on all relevant items of a respondent and zero otherwise. Selection is explained by dummies for the sample regions, years of first hire, and a marker that indicates whether a firm belongs to manufacturing or to the KIBS sector. Accounting for sample selection in our main model does not change the findings (see Table A5 in the Appendix, models A1-A3). The likelihood-ratio tests reveal that entrepreneurs are not selected randomly into the final sample. However, the coefficients of city and balance become even larger when taking into account this kind of sorting. Further sample selection models assess whether a problem arises from non-random missing information on variables needed in the regression analysis for all respondents for which data on completion time

are available (see Table A5 in the Appendix, models A4-A6). The models show that there is indeed sample selection but this, again, does not affect the results.

Another possible sorting mechanism that might shape our results is locational choice of founders. Potential entrepreneurs in rural areas with a low skill balance might decide to locate in cities, right before entering the market, in order to benefit from agglomeration economies instead of remaining in thin markets and making costly investments in order to enhance their skill balance. This influx of potential entrepreneurs with low skill balance into the city has several implications. First, the lower skill balance of entrepreneurs in cities found might be driven by these rural-urban migrants. Second, the relationship between city and completion time might not reflect a general compensation mechanism but only something which is relevant for those entrepreneurs who migrated to cities in order to better compensate for their lack of skill balance. The findings of our study are much more important if a general compensation mechanism that holds for all entrepreneurs exists.

Our dataset allows accounting for this sorting pattern because we know the founder's place of residence before he or she started a firm. With this information we can identify entrepreneurs who, in the year before starting their firm, did not reside in the same region in which the start-up took place. Entrepreneurs who lived in rural areas just before starting their firm in a city make up for only two percent of our respondents. The small share is in line with findings of previous literature according to which entrepreneurs start their firm where they reside and where they are integrated in personal networks since this enhances their access to local resources (Sorenson and Audia, 2000; Stuart and Sorenson, 2003; Michelacci and Silva, 2007; Stam, 2007). Be that as it may be, excluding these rural-urban migrants from the regression does not lead to any remarkable changes the results (see Table A6 in the Appendix, models B1-B3).<sup>10</sup>

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<sup>10</sup> In additional regressions, we restricted the analysis to founders who did not change their place of residence during the last 3, 5, or 10 years before starting their business. The significance levels remain the same; the coefficients of the city dummy become larger. Results can be obtained upon request.

The question remains whether certain city characteristics are especially important for explaining the compensating effect of cities on a lack of skill balance. To this end, H&S extend the concept of balance to cities by arguing that diverse cities generate favorable conditions for certain entrepreneurial activity (Jacobs, 1969). We cannot directly test their propositions on balanced cities with the dataset at hand but we can assess the general “diversity-is-valuable” argument that is motivating their theoretical considerations. To this end, we follow Rosenthal and Strange (2003) and calculate the relative specialization of cities with a Herfindahl-index that is based on aggregate employment shares of 28 industries. With this information, we construct a diverse city dummy variable that becomes one when a city’s diversity is above the median.<sup>11</sup> This is in line with our previous city variable that was also constructed as a dummy variable. Diverse city shows a negative relationship with completion time and compared to earlier models the average marginal effect for the diverse city dummy becomes even stronger (see Table A6 in the Appendix, models B4-B6). Being located in a diverse city is associated with a reduction of completion time of about 2 years if the level of skill balance is one and of approximately 0.8 years for a skill balance of five (see Figure A1 and Table A7 in the Appendix). Thus, it seems to be diversity that partly explains the city mark-up found in our analyses. Put differently, setting up an entrepreneurial venture in a diverse city might compensate for a lack of skill balance.

## 5 Conclusions

This paper analyzes the relationship between the diversity of resources on the individual and regional level, namely balanced skills and the city. To this end, several propositions of a model by Helsley and Strange (H&S, 2011) are tested. According to this model, thick markets should compensate for a lack of entrepreneurial skill balance. Furthermore, the completion time of projects should increase with complexity but decrease with market thickness. Understanding such compensation mechanisms is especially relevant if the

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<sup>11</sup> Accordingly, other cities are regarded as specialized.

acquisition of skill balance requires innate traits, as theorized by some scholars (Silva, 2007; Stuetzer, Obschonka, and Schmitt-Rodermund, forthcoming).

The results reveal that cities and skill balance show a negative relationship with the time entrepreneurs need between founding their firm and the first hiring of employees. The advantages of being located in a city are largest for entrepreneurs with relatively low skill balance. Thus, the size of the coefficient of balanced skills seems to depend on the regional context. Agglomeration economies can apparently compensate for a lack of skill balance. Additionally, while older entrepreneurs show, on average, shorter completion times, this association becomes smaller for older entrepreneurs with more balanced skills.

The findings of this paper have several implications. First, prospects of successfully getting a new venture going are higher in a city as compared to regions with only thin markets. This pertains particularly to persons with a relatively low skill balance that could circumvent skill related obstacles by locating in agglomerated areas where they have access to required labor. However, starting a successful firm is often only possible with the integration into a network. This is indicated by our control for networks and the low share of entrepreneurs that indeed move from rural areas to cities before starting their venture. Thus, entrepreneurs might be ill-advised to move to thick markets before founding a business if they did not set up a functioning network there. Thickness cannot necessarily compensate for a lack of networks. Nonetheless, it is important to remember that entrepreneurial success also depends on other personal characteristics and abilities, such as industry experience and human capital investments.

A second implication of our findings is that investors, who base their decisions to fund entrepreneurial projects primarily on the balance of entrepreneurs' skill sets, fall short of identifying promising new ventures. They should also consider the location of the entrepreneur. If an entrepreneur is located in a city and has an established network, less weight should be put on skill balance for the investment decision. Naturally,

investors need to keep in mind that start-ups in agglomerated areas have lower survival prospects (Fritsch, Brixy, and Falck, 2006; Renski, 2008), probably resulting from more intensive competition.<sup>12</sup> The positive association between new business formation and regional development (Fritsch and Schroeter, 2011) could be driven by a higher quality of start-up projects in cities, whereby quality is increased by access to resources and market selection.

Lower survival prospects of firms located in cities may imply that several projects in cities are not completed in terms of achieving a first hire. So far, previous studies have neglected what happens before the first hire but it appears reasonable that selection already plays a role during this time period. The lack of information on unsuccessful projects presents a potential bias and thus a limitation of our study. Be as it may, the same city that might play a role for high failure rates of projects in the early stage, systematically helped other entrepreneurs to achieve a relatively short completion time. Furthermore, our results show that the average entrepreneurial balance in cities is lower than that in rural areas. Thus, we already capture a possible lack of qualification that may explain the higher rates of failure in cities and, nonetheless, can confirm our hypotheses. Even more so, less qualified entrepreneurs in terms of balance benefit most from locating in cities.

In future work it would be interesting to investigate H&S remaining propositions, for instance with regard to the role of balanced cities. Our empirical investigations suggest that balance in the sense of industrial diversity drives the compensation mechanism. We have to leave it to further research to investigate the precise compensation mechanism between unbalanced entrepreneurs and unbalanced cities. According to H&S, the two elements should complement each other (see H&S proposition 6). Testing this requires detailed information on the tasks the firm needs to perform, the skills of the entrepreneur, and the skills available in the city. In addition, the development of alternative measures for complexity would be helpful. All things considered, a lot more research is clearly warranted.

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<sup>12</sup> The lower survival prospects in cities might explain why start-up rates are in general lower in cities than in rural areas (see Fritsch and Falck, 2007).

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Appendix

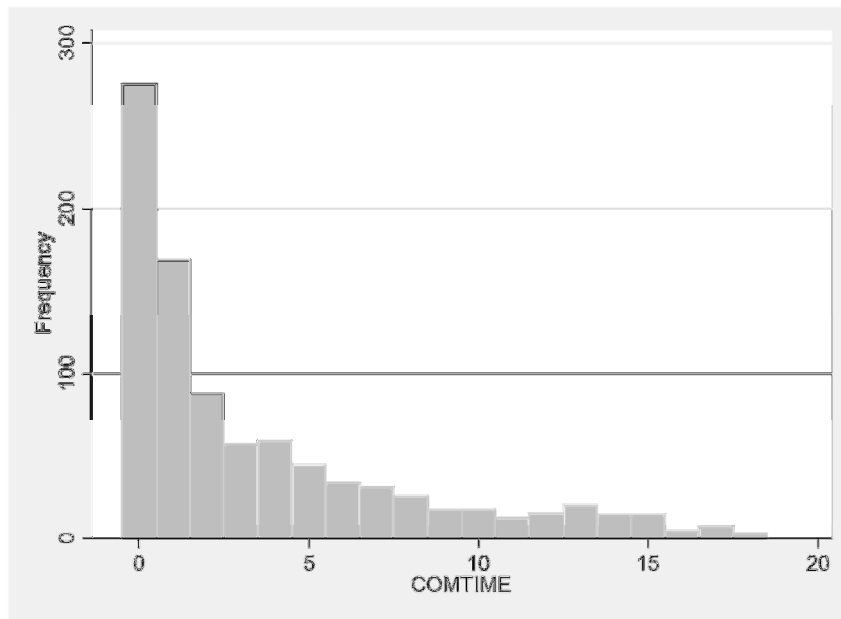


Figure A1: Distribution of variable completion time

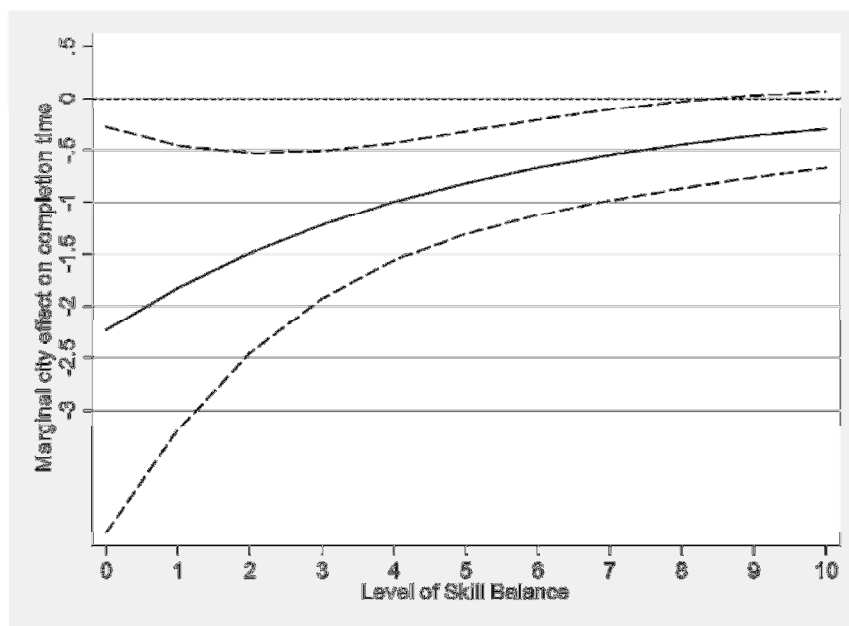


Figure A2: Marginal effects of being located in an industrially diverse city on completion time at different levels of skill balance (Model B6) with 95% confidence intervals (dashed lines)

Table A1: Area types according to settlement structure and definition of thickness dummy\*

Label	Code	Population density	Cities	Core cities	High density	High & medium density
<i>Agglomeration areas</i>						
Central Cities	1	> 100.000 inhabitants	X	X	X	X
Highly agglomerated districts	2	> 300 inhabitants/km <sup>2</sup>			X	X
Agglomerated districts	3	> 150 inhabitants/km <sup>2</sup>			X	X
Rural districts	4	< 150 inhabitants/km <sup>2</sup>			X	
<i>Urbanized areas</i>						
Central cities	5	> 100.000 inhabitants	X			X
Agglomerated counties	6	> 150 inhabitants/km <sup>2</sup>				X
Rural counties	7	< 150 inhabitants/km <sup>2</sup>				
<i>Rural areas</i>						
Rural districts with higher density	8	> 100 inhabitants/km <sup>2</sup>				
Rural districts with lower density	9	< 100 inhabitants/km <sup>2</sup>				

*Notes:* Counties identify German "Kreise". Areas are defined in a two-step procedure by the German Federal Institute of Building, Urban Affairs, and Spatial Development (BBSR). First, the degree of agglomeration of the Planning region with a county/city is assessed. This leads to three main groups, namely agglomeration areas, urbanized areas, and rural areas. In a second step, the within-variation of density in the Planning regions on the county-level is taken into account which finally leads to the sub-groups coded as 1 through 9. The last four columns show the definition for the thickness dummy, as applied in the analysis, where rural areas are always defined as all categories that are left over.

Table A2: Summary statistics and definitions of variables

<i>Variable</i>	<i>Mean</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Definition</i>
<i>Com_time</i>	2.373	1	2.738	0	10	Completion time: Number of years elapsed between the foundation of the firm and the first hire
<i>Cities</i>	0.247	0	0.432	0	1	See Table A1 for definitions
<i>Core city</i>	0.136	0	0.343	0	1	
<i>High density</i>	0.325	0	0.469	0	1	
<i>High &amp; medium density</i>	0.458	1	0.499	0	1	
<i>Diverse city</i>	0.139	0	0.346	0	1	
<i>Specialized city</i>	0.108	0	0.311	0	1	
<i>Population density</i>	5.749	5.996	1.113	3.657	7.608	
<i>Balance</i>	2.675	2	1.834	0	10	Number of professional fields in which founders were active before becoming self-employed
<i>Age</i>	39.678	39	9.064	19	74	Age of founders in years
<i>Age*balance</i>	108.391	88	85.455	0	630	

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						Dummy variable that indicates with a value of 1 whether...
<i>Innovation</i>	0.213	0	0.41	0	1	...firm has introduced a new product in the market
<i>Contact_selfemp</i>	0.62	1	0.486	0	1	...founders had either close contact with self-employed friends or whether they had self-employed parents before entering the market
<i>Founder team</i>	0.331	0	0.471	0	1	... more than one founder was involved in the start-up process of the venture
<i>Edu_low</i>	0.038	0	0.191	0	1	...founder has not completed vocational training
<i>Edu_medium</i>	0.346	0	0.476	0	1	...a completed vocational training is the highest degree
<i>Edu_high</i>	0.616	1	0.487	0	1	...tertiary degree is highest degree
<i>Exp_ind</i>	0.879	1	0.326	0	1	...founder has work experience in the industry of the start-up
<i>Unemp</i>	0.05	0	0.218	0	1	...founder was unemployed directly before becoming self-employed
<i>Prior_self</i>	0.234	0	0.424	0	1	...founder has previously been self-employed
<i>Exp_manage</i>	0.603	1	0.49	0	1	...founder has prior management experience
<i>Prior firm size &lt; 20</i>	0.395	0	0.489	0	1	...the last employer had employed less than 20/50/200 employees
<i>Prior firm size &lt; 50</i>	0.158	0	0.365	0	1	
<i>Prior firm size &lt; 200</i>	0.167	0	0.373	0	1	
<i>East_1989</i>	0.495	0	0.5	0	1	...founder resided in East Germany in 1989
<i>Male</i>	0.848	1	0.359	0	1	...founder is male
<i>Married</i>	0.714	1	0.452	0	1	...founder is married

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Table A3: Correlation matrix for main variables of interest

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) <i>Com_time</i>	1											
(2) <i>Cities</i>	-0.066*	1										
	(0.060)											
(3) <i>Core city</i>	-0.04	0.693***	1									
	(0.254)	(0.000)										
(4) <i>High density</i>	0.017	0.277***	0.573***	1								
	(0.634)	(0.000)	(0.000)									
(5) <i>High &amp; medium density</i>	0.04	0.108***	0.432***	0.755***	1							
	(0.251)	(0.002)	(0.000)	(0.000)								
(6) <i>Diverse city</i>	-0.062*	0.701***	0.661***	0.323***	0.196***	1						
	(0.074)	(0.000)	(0.000)	(0.000)	(0.000)							
(7) <i>Specialized city</i>	-0.022	0.608***	0.227***	0.026	-0.069**	-0.14***	1					
	(0.534)	(0.000)	(0.000)	(0.465)	(0.048)	(0.000)						
(8) <i>Population density</i>	-0.011	0.705***	0.564***	0.57***	0.409***	0.549***	0.368***	1				
	(0.763)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
(9) <i>Balance</i>	0.006	-0.065*	-0.059*	-0.024	-0.025	-0.067*	-0.015	-0.05	1			
	(0.870)	(0.064)	(0.090)	(0.486)	(0.475)	(0.055)	(0.666)	(0.151)				
(10) <i>Age</i>	-0.221***	-0.028	-0.056	0.016	0.061*	-0.071**	0.04	-0.014	0.136***	1		
	(0.000)	(0.418)	(0.111)	(0.641)	(0.081)	(0.041)	(0.252)	(0.693)	(0.000)			
(11) <i>Age*balance</i>	-0.044	-0.055	-0.061*	-0.009	0.004	-0.078**	0.011	-0.04	0.933***	0.415***	1	
	(0.203)	(0.115)	(0.080)	(0.806)	(0.901)	(0.025)	(0.762)	(0.247)	(0.000)	(0.000)		



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(12)	<i>Innovation</i>	0.012	0.06*	0.044	0.039	0.017	0.006	0.077**	0.05	0.11***	0.046	0.126***	1
		(0.738)	(0.085)	(0.204)	(0.269)	(0.626)	(0.863)	(0.028)	(0.156)	(0.002)	(0.187)	(0.000)	

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*Notes:* \*\*\*: statistically significant at the 1 percent level; \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level.

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Table A4: Statistics on marginal effects of being located in cities on completion time at different levels of skill balance (Model 3 &amp; 6)

<i>Model 3</i>				
Level of skill balance	d(com_time)/ d(city)	Standard error	Confidence interval (upper bound)	Confidence interval (lower bound)
0	-1.196101	0.6328339	0.0442533	-2.436456
1	-0.9824083	0.46237	-0.0761631	-1.888654
2	-0.8068934	0.3424124	-0.1357652	-1.478022
3	-0.6627356	0.2614528	-0.1502881	-1.175183
4	-0.5443327	0.2095316	-0.1336508	-0.9550146
5	-0.4470834	0.1775416	-0.0991018	-0.7950649
6	-0.3672085	0.1576027	-0.0583072	-0.6761097
7	-0.3016038	0.1439185	-0.0195236	-0.583684
8	-0.2477199	0.132981	0.0129229	-0.5083627
9	-0.2034628	0.1230299	0.0376759	-0.4446015
10	-0.1671126	0.1133518	0.0550569	-0.389282
<i>Model 6</i>				
Level of skill balance	d(com_time)/ d(core city)	Standard error	Confidence interval (upper bound)	Confidence interval (lower bound)
0	-1.348215	0.7575586	0.1366002	-2.83303
1	-1.118473	0.5717114	0.0020815	-2.239027
2	-0.9278802	0.4390921	-0.0672597	-1.788501
3	-0.7697653	0.3474266	-0.0888093	-1.450721
4	-0.6385939	0.286009	-0.0780164	-1.199171
5	-0.5297747	0.2454079	-0.0487751	-1.010774
6	-0.4394987	0.2178452	-0.0125222	-0.8664753
7	-0.3646062	0.1976624	0.0228122	-0.7520245
8	-0.3024757	0.1812901	0.0528529	-0.6578043
9	-0.2509325	0.1667638	0.0759244	-0.5777895
10	-0.2081725	0.153146	0.0919936	-0.5083386

Table A5: Sample selection poisson regressions

<i>Variables</i>	(A1)	(A2)	(A3)	(A4)	(A5)	(A6)
	<i>Control group 1</i>			<i>Control group 2</i>		
<i>Cities</i>	-0.240** (0.115)	-0.250** (0.115)	-0.235** (0.114)	-0.241** (0.115)	-0.250** (0.115)	-0.235** (0.114)
<i>Balance</i>	-0.235** (0.100)	-0.238** (0.103)	-0.222** (0.101)	-0.234** (0.0999)	-0.237** (0.103)	-0.222** (0.101)
<i>Age</i>	-0.0563*** (0.00871)	-0.0533*** (0.00918)	-0.0535*** (0.00910)	-0.0565*** (0.00870)	-0.0535*** (0.00916)	-0.0537*** (0.00908)
<i>Age*balance</i>	0.00615*** (0.00235)	0.00613** (0.00242)	0.00587** (0.00238)	0.00615*** (0.00234)	0.00614** (0.00242)	0.00589** (0.00237)
<i>Innovation</i>	0.0816 (0.112)	0.0777 (0.116)	0.107 (0.116)	0.0795 (0.112)	0.0779 (0.116)	0.107 (0.116)
Constant	2.872*** (0.460)	3.023*** (0.511)	3.173*** (0.510)	2.900*** (0.461)	3.049*** (0.511)	3.202*** (0.510)
Wald Chi2	133.89***	171.93***	186.89***	137.96***	174.96***	190.14***
N	5,139	5,139	5,139	940	940	940
rho	0.30	0.32	0.33	0.45	0.48	0.49
LR-Test for rho=0	471.85***	570.19***	555.99***	512.51***	577.00***	562.84***

*Notes:* The models are based on model (1)-(3) of Table 3 and numbered accordingly. Results on human capital and socio-demographic controls are not reported for brevity. Control group 1 (N=5,139) reflects the total number of observations that we contacted during our survey (respondents and non-respondents). Control group 2 (N=940) is the number of observations for which we have information on completion time but not full information on all variables of interests and controls. Robust standard errors in parentheses. \*\*\*: statistically significant at the 1 percent level; \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level. All models contain sample region dummies, year of completion dummies as well as NACE 1-Digit industry dummies. Coefficients rather than marginal effects are displayed since the latter cannot be calculated with ready-made commands of the employed statistical software. The sample selection procedure is not available for negative binomial regressions. Therefore, the models shown in this table are based on Poisson for which the results are virtually the same as for negative binomial regression when not controlling for sample selection.

Table A6: Control for self-selection into cities (Model B1-B3) and analysis of Industrial diversity of cities (Model B4-B6) (negative binomial regression)

<i>Variables</i>	<i>(B1)</i>	<i>(B2)</i>	<i>(B3)</i>	<i>(B4)</i>	<i>(B5)</i>	<i>(B6)</i>
<i>Cities</i>	-0.570** (0.264)	-0.571** (0.266)	-0.574** (0.265)			
<i>Diverse city</i>				-1.217*** (0.346)	-1.192*** (0.348)	-1.199*** (0.346)
<i>Specialized city</i>				-0.0760 (0.354)	-0.127 (0.354)	-0.104 (0.350)
<i>Balance</i>	-0.491** (0.221)	-0.537** (0.236)	-0.508** (0.229)	-0.475** (0.212)	-0.516** (0.225)	-0.481** (0.218)
<i>Age</i>	-0.118*** (0.0205)	-0.118*** (0.0216)	-0.118*** (0.0212)	-0.119*** (0.0198)	-0.115*** (0.0207)	-0.116*** (0.0204)
<i>Age*balance</i>	0.0131** (0.00526)	0.0140** (0.00556)	0.0133** (0.00540)	0.0125** (0.00504)	0.0133** (0.00532)	0.0125** (0.00516)
<i>Innovation</i>	0.249 (0.259)	0.223 (0.267)	0.272 (0.266)	0.196 (0.247)	0.207 (0.255)	0.259 (0.254)
Wald Chi2	114.86***	133.75***	143.40***	123.84***	146.82***	158.93***

*Notes:* The models are based on (1)-(3) of Table 3 and numbered accordingly. Results on human capital and socio-demographic controls are not reported for brevity. The number of observations in the models B1-B3 is N=789 since for some respondents the information on last place of residence before starting their venture is lacking. Running all the models presented in this paper only with respondents where this information is available hardly changed the results (Number of observations: N = 821). Robust standard errors in parentheses. \*\*\*: statistically significant at the 1 percent level; \*\*: statistically significant at the 5 percent level; \*: statistically significant at the 10 percent level. All models contain sample region dummies (jointly: not significant), year of completion dummies (\*) as well as NACE 1-Digit industry dummies (\*\*).

Table A7: Statistics on marginal effects of being located in an industrially diverse (balanced) city at different levels of skill balance (Model B6)

Level of skill balance	d(com_time)/ d(balanced city)	Standard error	Confidence interval (upper bound)	Confidence interval (lower bound)
0	-2.22803	0.9946955	-0.2784266	-4.177633
1	-1.82175	0.6954374	-0.4586929	-3.184807
2	-1.489555	0.490643	-0.5278952	-2.451216
3	-1.217936	0.3605295	-0.5112984	-1.924574
4	-0.9958465	0.2870961	-0.4331381	-1.558555
5	-0.8142547	0.2509157	-0.3224599	-1.306049
6	-0.665776	0.2336511	-0.2078199	-1.123732
7	-0.5443723	0.2229436	-0.1074029	-0.9813417
8	-0.4451064	0.2128361	-0.0279476	-0.8622653
9	-0.3639416	0.2012978	0.030602	-0.7584853
10	-0.2975772	0.1881013	0.0711013	-0.6662557