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INTRAPRENEURSHIP AND ABSORPTIVE CAPACITIES: THE DYNAMIC EFFECT OF LABOR MOBILITY

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Abstract

While the importance of absorptive capacities for the engagement in innovative activities has been addressed in numerous studies, the drivers remain an open question. As absorptive capacities are indispensably linked to an individual's human capital, the management of these capacities needs to consider the mobility of individuals. We focus on absorptive capacities as an operationalization and essential part of firms' intrapreneurial capabilities that enable firms to both understand and exploit existing internal and external knowledge and generate and implement new ideas to enhance competitiveness. Considering both the labor stock and mobility on a regional and firm level, our results suggest that the firm/regional labor stock and the firm/regional labor mobility on their own do not have a positive effect on firms' absorptive capacities. Rather, it is the interaction of the firm and regional labor stock and especially firm and regional labor mobility that positively influence firms' absorptive capacities, indicating that labor mobility may only have positive effects if fluid labor markets facilitate adequate matches between employees and employers. We conclude by positing an agenda for future research and discussing implications for both firm managers as well as policymakers.

Keywords

Intrapreneurship; Absorptive Capacities; Human Capital; Labor Stock; Labor Mobility

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1. Introduction

The importance of new venture creation and entrepreneurship in pursuing new opportunities in technology intensive industries is undisputed (see Teece & Linden, 2017). It is the digital economy that facilitates and stimulates ideas for innovation, and hence offers a wide range of opportunities, new business models and start-ups. The extensive entrepreneurship literature concludes that it is the entrepreneur who exploits opportunities originating from knowledge almost overlooked or neglected by incumbents (Acs et al., 2009, 2013, 2016). Individuals not only play an important role as entrepreneurs in exploiting new ideas to actualize the economic value from knowledge spillovers, but also in established firms, as intrapreneurs. While the 'entre'preneurship literature has focused on the mechanisms to exploit opportunities from external sources of knowledge, the 'intra'preneurship literature has remained focused on the management of innovation as well as the access and utilization of both external and internal ideas and sources of knowledge, given sufficient absorptive capacities (Cohen & Levinthal, 1990; Qian & Acs, 2013).

Intrapreneurship refers to a firm's ability to engage in innovative activities within its existing organizational boundaries (see Braunerhjelm et al., 2018). Blenker and Christensen (2004, p. 4) describe intrapreneurial firms as firms that keep learning in a complex and dialectic way in order to identify new opportunities: "The question of learning […] has both internal and external aspects. The external aspects have to do with how […] the organisation learns to recognise and follow opportunities in the environment. The internal aspects are related to the way the intrapreneurial organisation structures and manages its learning processes, not only to see opportunities, but also to "co-create" opportunities". To address these internal and external opportunities effectively, it requires the development and deployment of appropriate intrapreneurial capabilities, constituting the prerequisite for respective innovations. However, because the concept of "intrapreneurial capabilities" is new, the extant literature has yet to

identify the sources and conditions that are conducive to intrapreneurial capabilities. The purpose of this paper is to fill this gap in the literature by providing a focus on absorptive capacities as an operationalization and essential part of intrapreneurial capabilities, which enable firms to both understand and exploit existing internal and external knowledge and generate and implement new ideas to enhance competitiveness. As absorptive capacities are indispensably linked to an individual's human capital, the management of these capabilities needs to take the stock but especially the mobility of individuals into account. While firm performance, in particular in high-tech and knowledge intensive industries, is closely linked to a firm's absorptive capacity (Lehmann et al., 2017), the question arises of how firms' absorptive capacities are shaped by individuals, along with other factors.

This paper considers labor mobility as a major mechanism in shaping firms' absorptive capacities. We assume that a firm's absorptive capacity is not only affected by a firm's labor stock but also by its labor mobility, in that highly qualified employees move between firms and thereby diffuse knowledge and generate more ideas and innovations. Just as locations differ in their ability to promote new venture creation by attracting entrepreneurs, organizations differ in their absorptive capacity by attracting intrapreneurs. However, little is known about the links between labor mobility and a firm's innovation and absorptive capacity. Theoretically, as Braunerhjelm et al. (2018) demonstrate, labor mobility may either increase or decrease a firm's absorptive capacity and performance. One of the first studies examining the inter-firm mobility of engineers in Silicon Valley was conducted by Almeida and Kogut (1999). They show that the mobility of major patent-holders influences the local transfer of knowledge that is embedded in regional labor networks. More recently, these findings have been corroborated by Kaiser et al. (2015) and Braunerhjelm et al. (2018), who find that firms receiving knowledge workers from other firms, as well as those losing knowledge workers, improved their absorptive capacities as measured by patent applications. In addition, Oettl and Agrawal (2008) show that

knowledge flows accrue not only to the firms receiving employees but also to the firms that lose workers. While it is rather obvious that firms may increase their absorptive capacities by hiring R&D workers and patent holders, the opposite also holds, in that knowledge flows also occur when firms are losing workers, which is less obvious but corroborated by several studies.

Matching theory, which describes the formation of mutually beneficial relations, is one explanation for this puzzle: In his article on equilibrium in the labor market, Pissarides (2011) depicts that "it is not only the worker who is concerned to find a good match […], but the firm is also as concerned with locating a good match before hiring someone" (Pissarides, 2011, p. 1093). Under these circumstances, losing workers may be the result of a mismatch, which in turn serves to enhance absorptive capacities.

Our primary interest in this paper is to examine the influence of labor mobility on a firm's absorptive capacity and how this influence is moderated by variables at the firm, regional, university and policy levels, in order to investigate the drivers of absorptive capacities. Labor mobility could thereby act as both an antecedent and as a consequence of intrapreneurial activities of organizations in the region, implying a tentative inverse relationship. We base our study on insights derived from the entrepreneurship literature, showing how and why entrepreneurial behavior and the chance to exploit opportunities, thus engage in entrepreneurial activities, is shaped by environmental or contextual factors, like the existence of knowledge spillovers (Audretsch & Feldman, 1996, 2004), a fruitful and inspiring environment (Acs et al., 2017, Sussan & Acs, 2017, Audretsch et al., 2019a), entrepreneurial culture (Stuetzer et. al, 2017, Lehmann & Seitz, 2017), entrepreneurial architecture (Dolan et al., 2019), policy issues supporting new venture creation (Audretsch et al., 2016, Stam, 2015), efficient governance mechanisms (Cunningham et al., 2019b), past experience (Guerrero & Peña-Legazkue, 2019) or the existence of role models, like parents (Bosma et al., 2012). Due to these various influencing factors, our analysis not only takes into account the firms' labor stock and labor

mobility, but also the regional labor stock and mobility as well as further contextual parameters. Our dataset consists of 450 knowledge intensive publicly listed and traded firms, which have their core business activities in Germany, encompassing a time frame ranging from 1998 to 2012.

While labor mobility is only one mechanism shaping a firm's absorptive capacity, our study provides a number of insights regarding the relationship between labor mobility, innovation and how and why the local and environmental characteristics affect the absorptive capacities of firms. Our results suggest that both the firm labor stock and firm labor mobility significantly influence the respective absorptive capacities, while especially the interaction between regional labor mobility and firm labor mobility enhances firms' absorptive capacity, indicating the dynamic effect of labor mobility, which we designate as a revolving door effect. In the context of efficient labor markets, the revolving door effect thereby describes the phenomenon that another employee with an even better match with regard to the position might replace a leaving employee. We further show that universities play a particularly important role in the ecosystem in which the firm is embedded in, and provide a particularly fertile source of knowledge enhancing absorptive capacities (see Guerrero et al., 2016).

Our study adds to the literature by offering a more holistic analysis of the influence of labor mobility and its dynamic effects on firms' absorptive capacities. Taking a human capital point of view, we consider both the stock as well as the mobility of labor from the perspective of the firm as well as from the region, while controlling for the density of the region (Becker et al., 1999; Ellison et al., 2010), the characteristics of universities as sources of knowledge spillovers and providers of human capital (Anselin et al., 1997, Audretsch, 2014), as well as the impact of innovation policy approaches (Cunningham et al., 2019a; Leyden & Link, 2015). We further provide a first attempt to define intrapreneurial capabilities as a set of means enabling the discovery, evaluation and exploitation of opportunities to create value through new goods and

services. We thereby offer an operationalization of intrapreneurial capabilities by focusing on absorptive capacities as an essential part of firms' intrapreneurial capabilities.

The remainder of the paper is organized as follows. In the next section, we present the links between intrapreneurship, absorptive capacities, human capital and labor mobility. The third section describes our dataset, provides descriptive statistics, and explains our methodology. Section four presents our main results. Section five discusses our findings. A final section concludes and derives recommendations for both firm managers as well as policymakers.

2. Literature Review and Theory Building

2.1 Foundations of Intrapreneurial Capabilities

The purpose of this section is to posit that there are several key components comprising intrapreneurial capabilities. Intrapreneurship has been characterized as entrepreneurial behavior generating innovative activity. According to Griliches (1979), in the knowledge production model of innovation, the key force driving innovative activity is knowledge. As Audretsch et al. (2006) suggest, for entrepreneurial firms this knowledge is often created in other firms. Thus, to access such knowledge and ideas created in both external organizations as well as internally, entrepreneurial firms typically have a proficient absorptive capacity. The knowledge spillover theory of entrepreneurship posits and provides robust compelling empirical evidence that the entrepreneurial opportunities are actually created by incumbent firms investing in but unable to commercialize the new knowledge accruing from those investments. Thus, the ability to absorb knowledge, both externally as well internally created, has been identified as a key source of entrepreneurial capabilities. In this section, we adapt the arguments linking entrepreneurial capabilities to absorptive capacity to the context of intrapreneurship and intrapreneurial capabilities.

The key feature characterizing intrapreneurship is the propensity to innovate through entrepreneurial behavior. The entrepreneurship literature generally defines entrepreneurial behavior as the ability and willingness to recognize and/or create new opportunities and to act on those opportunities by implementing and commercializing them. The recognition of new opportunities is facilitated through the capacity to absorb new ideas and knowledge, created both externally in other firms as well as by the firm itself. A high absorptive capacity is conducive to understanding, recognizing and implementing such opportunities based on new knowledge and ideas, particularly when those ideas are generated externally.

These essential features of entrepreneurship can be extended and applied to a very different context, that of existing, incumbent organizations. The ability to recognize and/or create new opportunities within the context of an incumbent organization is generally characterized as intrapreneurship in the literature. The concept of absorptive capacity was introduced by Cohen and Levinthal (1990) and Teece et al. (1997). By contrast, the concept of 'corporate entrepreneurship' was introduced and made popular by Burgelman (1983, 1985) and generated considerable interest more recently in 'intrapreneurship' (Braunerhjelm et al., 2018).

Intrapreneurship is, compared to entrepreneurship, a phenomenon that did not garner much attention in the scholarly literature until recently. Introduced in a working paper by Gifford and Elizabeth Pinchot in 1978, while attending the Tarrytown School for Entrepreneurs in New York, the concept of intrapreneurship initially emerged within the field of 'corporate entrepreneurship', which can be characterized as the orientation of a corporation as an entity to behave like entrepreneurial firms (Pinchot, 1985). Thus, employees are motivated to behave, act and think like entrepreneurs and engage in innovative activities while working within the organizational context of a large organization. Thus, intrapreneurship is about the behavior of workers within the context of corporations and other firms. In particular, the core concept defining entrepreneurship also holds for intrapreneurship, which involves recognizing and/or

creating opportunities and then acting upon those opportunities to implement and commercialize them.

As Aldrich and Auster (1986) pointed out, the larger and older a firm, the less receptive to change the organization becomes. To circumvent this entrenchment, 'corporate entrepreneurship' was introduced as a management approach which encompasses all activities that are assumed to transform large and established corporations into entrepreneurial firms (Ireland et al., 2009). In particular, the goal was to overcome the costs and disadvantages of being 'large' and being rather inflexible and instead move towards a more flexible and dynamic company, emulating the behavior of new ventures, and consequently enhancing the financial performance (Zahra & Covin, 1995). Corporate entrepreneurship has thus become a broad encompassing concept, which includes activities like corporate venturing, corporate venture capitalists, spin-off activities, merger and acquisition activities and intrapreneurship.

The latter expresses itself as a consequent orientation of employees to act and behave like those in entrepreneurial companies and new ventures, and hence engage in innovative activities to create value. Therefore, intrapreneurship is perceived as the silver bullet to cope with the challenges and chances of an increased global competition (see Teece et al., 2016). A firm needs intrapreneurial capabilities that are the building blocks, enabling the engagement in innovative activities. The entrepreneurship literature has identified key elements that enable the creation of value, i.e. means to discover, evaluate and exploit opportunities (see Shane & Venkataraman, 2000). Maguire et al. (2004) propose that the following attributes can be associated with entrepreneurial behavior within an institutional context: (1) the ability to build legitimacy among diverse stakeholders, (2) the ability to bridge diverse stakeholders and to access resources, (3) the ability to translate interests of diverse stakeholders, (4) the ability to develop coalitions of diverse stakeholders, (5) the ability to institutionalize new practices and (6) the

ability to align new practices with values of diverse stakeholders. The underlying assumption thereof is the existence of absorptive capabilities to access knowledge.

These characteristics defining entrepreneurial behavior can be extended to the context of intrapreneurship. Intrapreneurial capabilities consist of the ability to absorb external and internal knowledge and transform that knowledge into innovation. In particular, absorptive capacities enable the understanding and exploitation of existing internal and external knowledge. Hence, it is about acquiring and leveraging new and existing resources to explore and exploit opportunities for value creation. Arthurs and Busenitz (2006, p. 199) describe respective capabilities as the "ability to identify a new opportunity and develop the resource base needed to pursue the opportunity". Intrapreneurship thus requires a multitude of components that range from the ability to drive change and create a context that encourages risk-taking, enable efficient knowledge flows and transfer processes, participate in networks and act on markets to address relevant customer segments to the ability to access sufficient resources that allow for experimentation. Employees need to be encouraged to focus on problem-solving and implementation-oriented thinking, act socially competent and with a high degree of self-initiative and sense of responsibility (Wunderer, 2001). Organizational structures need to be established that encourage interactions within and beyond organizational boundaries, allow for continuous learning, promote creativity and innovation through lean processes and quick decision-making and enable the access to networks and markets that fastens the determination of customer demands and facilitates interactions with relevant customer segments, yet also reduces transaction costs with regard to the introduction of new products or services (Christensen, 2005). Finally, sufficient resources are necessary to cope with the uncertainty associated with the intrapreneurial process and enable investments in new products or services that may or may not reach marketability (Urbano et al., 2013). Despite this multifacetedness, knowledge embodied in employees is the underlying force of value creation

also for intrapreneurs, which is why we take a human capital perspective with a special emphasis on absorptive capacities.

In this study, we focus on absorptive capacities as part of the firm's intrapreneurial capabilities that need to be managed and leveraged in order to access required knowledge. Individuals have to be aware of potential product and process innovations as well as new business fields. An intrapreneurship approach requires absorptive capacities to extend the firm's competences in creating new products, services, and developing and improving its practices on a tactical and strategic level (Teece, 2018). While the importance of absorptive capacities in shaping firm performance is undisputed (Cohen & Levinthal, 1990; Covin & Slevin, 1991) and the empirical evidence is overwhelming (Kostopoulos et al., 2011; Lane et al., 2001; Tsai, 2001; Wales et al., 2013), the drivers of absorptive capacities remain an open question. Absorptive capacities constitute a fundamental prerequisite to generate and implement new ideas to create business success and sustainable competitiveness, yet represent an important element in the management of intrapreneurship.

2.2 Hypotheses

In order to posit the main hypotheses in this paper, the key role played by human capital needs to be incorporated. We build on Griliches' knowledge production model of innovation as applied to the knowledge spillover theory of intrapreneurship developed by Braunerhjelm et al. (2018), which leads us to focus on how the stock and mobility of individuals affect a firm's absorptive capacity. Knowledge and R&D workers diffuse their knowledge by alternating between firms. A necessary prerequisite is the existence of well-educated individuals that are willing and able to locate to the firm with the best match with their human capital and talent, i.e. change their workplace. If this condition is met, new matches of individuals with heterogeneous knowledge lead to new ideas and create the potential for augmenting a firm's

absorptive capacity. Besides labor mobility, a firm's labor stock is essential for its absorptive capacity. In the digital economy, the mechanisms of diffusing and converting knowledge into marketable products are essential to the innovation process. To cope with these challenges, established corporations have to behave like entrepreneurial firms, in particular by stimulating their employees to behave like entrepreneurs, thus shaping their absorptive capacities and defending their market position. Vinding (2006) examines the importance of human capital and the labor stock on a firm's absorptive capacity. Görg and Strobl (2005) found that worker mobility has a positive influence on a firm's performance, especially if the mobile employee has work experience in the same industry in which the receiving firm is operating. Further empirical evidence indicates that labor mobility positively influences innovation and firm performance (Almeida & Kogut, 1999; Braunerhjelm et al., 2018; Kaiser et al., 2015; Oettl & Agrawal, 2008). By linking the inter-firm mobility of engineers in Silicon Valley to a firm's learning processes, Almeida and Kogut (1999) were the first to find a positive relationship between labor mobility and innovation processes. Oettl and Agrawal (2008) confirmed these results by demonstrating that both the host and sending firm take advantage of these knowledge flows.

H1a: Firm labor stock positively influences a firm's absorptive capacity.

H1b: Firm labor mobility positively influences a firm's absorptive capacity.

In contrast to Loebbecke and Picot (2015, p. 153), who posit that digitization hits "knowledge-based business models and cognitive workers as hard as – and perhaps even faster – than non-knowledge business models and manual workers", we have a more positive view on the consequences of digitization and assume that the firm's ecosystem and its influencing factors affect how firms are developing in the digital age. Digitization drastically reduces sunk

costs and thus fosters market entry by new firms. These new ventures typically are the result of exploiting opportunities originating from knowledge overlooked or neglected by incumbent firms (EFI, 2017; Haefliger et al., 2010; Weeds, 2012). Their founders and employees are a significant part of a region's labor stock. Ideally, these new ventures could scale up their business models, increasing market shares rapidly, and leaving no time for an adequate reaction by an established firm. New ventures are seldom, if at all, on the radar screen of the strategic management team as potentially relevant competitors or rival companies. Even if the new venture is not able to compete independently on a large scale, close competitors could do so by acquiring the entrepreneurial firms. We assume that even in this case these companies are important for a regions labor stock and consequently firms' labor stocks as well.

Particularly in terms of knowledge spillovers and human capital, the region and environment of a firm influence how changes and transitions concern a firm's performance. We assume that the impact of labor mobility, which from a firm's perspective can be seen positively as 'learning by hiring' or negatively be associated with losing knowledge workers, is strongly influenced by human capital in the region and its mobility. Romer (1986, 1990) and others (Glaeser, 2000; Glaeser et al., 2004) show that human and social capital shape the productive capacities of societies and economic growth. The concentration of skilled entrepreneurs in metropolitan areas can be explained by their tendency to innovate in a way that creates demand for other skilled workers (Berry & Glaeser, 2005). Lee et al. (2010) have shown that the ability of a region to attract human capital is essential for innovation. Braunerhjelm et al. (2018) consider firm size and ascertain that small firms benefit disproportionately from the intraregional mobility of knowledge workers.

H2a: Regional labor stock positively influences a firm's absorptive capacity.

H2b: Regional labor mobility positively influences a firm's absorptive capacity.

Stimulating employees to exploit firm capabilities and ideas has been portrayed in the extant literature. This involves increasing a firm's absorptive capacity to enhance the ability to exploit opportunities originating in knowledge overlooked and neglected by the incumbent firm.[1] Thus, we focus on labor mobility on a firm and a regional level. Stimulating the absorptive capacity in incumbent firms to evaluate promising ideas and new ventures, intrapreneurship could then serve as a means to detect potential new ventures as target firms and could serve as a mechanism to better integrate the new venture team after the acquisition process. Therefore, we direct our attention to the firm and regional labor stock. In this paper, we argue that the stock as well as the mobility of human capital on the firm as well as the regional levels are the driving forces shaping firms' absorptive capacities positively. Miguélez and Moreno (2015) assess the converse effect, which is to what extent absorptive capacities determine knowledge flows' impact on regional innovation. They show that a region's absorptive capacity increases the impact of mobility and networks on innovation. We hypothesize that the positive effect of labor mobility at the firm level can only be generated if the firm is located in a region where high levels of human capital and highly skilled workers are at its disposal. Otherwise, the missing opportunity to match new knowledge with the existing stock of human capital within the firm leads to negative impacts on a firm's absorptive capacity and thus intrapreneurial activities. This revolving door effect describes the dynamic implications of labor mobility and takes into account that the density of available human capital in the region is essential for a firm's intrapreneurial success, which is strongly influenced by individual absorptive capacities (Enkel et al., 2017).

[1] There are plenty of examples that employees founded their own company just to exploit the opportunities from neglected and overseen ideas. Prominent examples are the founders of SAP, former employees of IBM, or the 'traitorous eight', leaving Shockley Semiconductors Laboratory, to found Fairchild Semiconductors, the incubator for Silicon Valley.

H3a: The interaction of firm and regional labor stock positively influences a firm's absorptive capacity.

H3b: The interaction of firm and regional labor mobility positively influences a firm's absorptive capacity.

3. Dataset and Methodology

3.1 Dataset

The focus of our paper is to investigate the dependency of a firm's absorptive capacity on the labor stock and labor mobility as well as selected contextual factors. Because digitization is transforming the contemporary business environment (Freitag & Brettel, 2017), especially within high-tech industries, we rely on a dataset consisting of 450 knowledge intensive publicly listed and traded firms which have their core business activities in Germany. We measure firms' absorptive capacities by using annual R&D spending per sales, following the seminal work by Griffith et al. (2004), who empirically confirmed the link between research and development, technology transfer and absorptive capacities. Distinguishing between the regional as well as the firm labor stock and labor mobility requires two distinct measures, i.e. firms' employees as well as citizens living within the labor market region the respective firm is embedded in[2]. We thus proxy the firm labor stock by the logarithmized number of firms' employees and firm labor mobility by the percentage change/ variance in the number of firms' employees. Accordingly, we proxy the regional labor stock by the logarithmized number of regional citizens of the respective labor market region and regional labor mobility by the percentage change divided by

[2] We use labor market regions as the smallest spatial unit, utilizing the classification of Eckey et al. (2006) who divide Germany into in sum 150 labor market regions, taking into consideration economically integrated and rather homogenous areas with an adequate population size of at least 50,000 inhabitants.

the variance in the number of regional citizens of the respective labor market region. Because both firm and regional labor stocks are skewed, we have logarithmized the respective variables (see Manning & Mullahy, 2001).

Beyond the labor stock and labor mobility, we follow Castellacci and Natera (2013) as well as Autio et al. (2014) who stress the importance of context for entrepreneurial innovation and absorptive capacities. Intrapreneurship could stimulate employees to develop new ideas where the incumbent firm serves as an incubator and an internal market, which stimulates the exploitation of new opportunities. To pursue this effect, we include several other controls.

Prior research shows that regional density and industry agglomeration play an important role in fostering economic growth (Becker et al., 1999; Ellison et al., 2010). Especially in knowledge intensive industries where radical and incremental innovation play an important role, regional innovation systems can foster competitive advantages and enhance firms' absorptive capacities (Cooke et al., 1997). Caragliu and Nijkamp (2012) investigate how the cognitive capabilities of regions, which encompass social, relational and human capital, influence absorptive capacities. We follow this strand of prior research and control for a region's density as a measure of its potential resources. In order to follow a holistic approach and to take into account the diversity of regions, we additionally control for further regional specifics (innovativeness, employment, entrepreneurship). Moreover, the importance of universities as sources of knowledge spillovers and providers of human capital has been extensively studied (Acs et al., 2009, 2013; Anselin et al., 1997; Audretsch, 2014; Audretsch & Lehmann, 2005; Klofsten & Jones-Evans, 2000). We recognize the importance of this source of knowledge spillovers by considering universities as source of human capital within a region (university size, research intensity, funding intensity). We further control for firms' international business strategy. Firms' foreign subsidiaries may have a decisive impact on employee fluctuation, opening up new career prospects for existing employees on the one hand

and offering interesting vacancies for potential new employees (Reiche, 2007; Taneja et al., 2015). Policy approaches to foster the competitiveness of regions can shape priority setting and further development of knowledge and technologies (Audretsch et al., 2019b; Lehmann & Menter, 2018a; Leyden & Link, 2015). We contribute to this research by controlling for public cluster policies within the observed regions (promotion as a leading-edge cluster region). Overall, we derive our data from the German Federal Statistical Office, the German Patent and Trademark Office as well as the Thomson Datastream, encompassing a 15-year period from 1998 – 2012 (see table 1).

- Insert table 1 about here –

3.2 Descriptive statistics

Fritsch et al. (2018) investigate path dependencies within Germany and show that regional differences concerning entrepreneurial capabilities and activities are persistent and tend to have long-lasting effects on innovation and economic growth (Fritsch & Slavtchev, 2011; Fritsch & Wyrwich, 2014; Fritsch et al., 2018). This may partially explain the large spread of our variables of interest, especially the level of R&D spending per sales, our proxy for *absorptive capacities*, as our dataset includes firms investing large amounts of money in R&D as well as firms relying solely on outsourced R&D, making no direct investments in R&D (see table 2). Our dataset further captures both small and medium sized enterprises as well as large firms, as indicated by the large spread of firms' employees (*firm labor stock*). However, not only firms, but also respective regions differ significantly in size and population as shown by our variables *regional labor stock* as well as *regional density*. Both *firm labor mobility* and *regional labor mobility* are mainly driven by large incumbents like BMW, KUKA, or SAP and metropolitan areas like Munich, Berlin, or Frankfurt respectively. More than half of the included firms are co-located

within cluster regions (*cluster policy*), indicating the economic strengths and performance of respective firms and regions (see Lehmann & Menter, 2018b).

- Insert table 2 about here -

The correlation matrix provides further valuable insights into the relationship between regional and firm characteristics (see table 3). The bivariate correlations between the regional labor stock and the level of entrepreneurship ($r = 0.89$) as well as university size ($r = 0.78$) are rather high, yet can be explained by size effects. University size is further highly correlated with the level of entrepreneurship ($r = 0.83$), revealing the importance of the higher education sector on entrepreneurial mindsets, intentions and cognition (Liñán et al., 2011).

- Insert table 3 about here -

One drawback of empirical studies are unwished endogeneity effects. At a first glance, bivariate correlations across the variables as predicted, like in table 3, are in general on a rather low level (lower than 0.60) except for at least three correlations: the entrepreneurship variable seems to be highly correlated with regional labor stock ($r = 0.89$) and university size ($r = 0.83$), and also university size and regional labor stock seem to be correlated ($r = 0.78$). The interrelation of these three variables reflects the facts found in empirical studies in that university size shapes entrepreneurship (just by 'the size', the amount of graduates and staff) and that university size shapes the regional labor stock (also by the size effects). The interplay between these three variables thus reflects the empirical evidence of co-evolutionary effects of universities on regional labor stock and entrepreneurship. All other variables included show a rather low (bivariate) correlation. However, evaluating the size effect of the coefficients is not

an objective measure but rather an 'agreement', where coefficients above 0.8 are labelled as a 'good fit', coefficients with a size of 0.7 as a 'moderate fit', while values lower than 0.6 seem to reflect only a weak relationship (see Heumann & Schomaker, 2016; Rohatgi & Saleh, 2015). These measures, however, also vary across disciplines and fields.

3.3 Methodology and estimation techniques

We employ a random effects panel regression approach as suggested by the Hausman specification test (Hausman, 1978) in order to assess how the labor stock and labor mobility as well as further contextual factors affect firms' absorptive capacities. Our estimation approach thus contains three distinct vectors:

$$Y_{rt} = \gamma_0 + \gamma_1 Labor\ stock_{rt} + \gamma_2 Labor\ mobility_{rt} + \gamma_3 Contextual\ factors_{rt} + \varepsilon_{rt}$$

where Y_{rt} is the yearly R&D spending per sales of firm *r* at time *t*. We use this measure as a proxy for firms' absorptive capacities. The vector *Labor stock* contains both the firm labor stock as well as the regional labor stock; firm and regional labor mobility are covered in the vector *Labor mobility*. The vector *Contextual factors* includes firm internationalization, regional innovativeness, regional employment, regional density, entrepreneurship, university size, university research intensity, university funding intensity as well as a dummy variable, indicating political support in the form of public cluster policy within the respective labor market region. As usual, ε_{rt} represents the error term.

In order to analyze both isolated as well as comprehensive effects, we employ eight different estimation specifications within our approach. Whereas our first estimation (Model I) captures firm specifics, our second estimation (Model II) considers regional specifics. The subsequent estimations focus on the impact of entrepreneurship (Model III), university specifics (Model

IV) and the influence of cluster policy (Model V). Model VI represents our full model, which is further complemented by the interaction term between firm and regional labor mobility (Model VII) and the interaction term between the firm and regional labor stock (Model VIII). By incorporating the interaction term between firm and regional labor mobility within our model, we are able to investigate the 'combined effect' of labor mobility induced by both the firm and the region, i.e. the dynamic effect of labor mobility. 'Combined' thereby refers to the interdependent effect of both labor mobility on both a firm and regional level, i.e. only if both labor mobility on a firm and regional level exist, we will be able to see statistical significant effects as represented by the respective labor mobility interaction term. The same applies for the interaction term between the firm and regional labor stock respectively.

Our approach of employing eight different estimation specifications shall serve as a robustification of our empirical results. In addition to that, we change the dependent variable and employ the logarithmized firm R&D spending to proxy a firm's absorptive capacity as an alternative outcome measure and run the same estimation models as described above (see Appendix 1). Considering the findings of our alternative outcome measure reveals that our results are rather robust, especially with regard to the dynamic effect of labor mobility, i.e. the interaction effect of firm and regional labor mobility.

4. Results

The results of our random effect models are depicted in table 4. Model I examines the isolated effects of firm characteristics. The firm labor stock ($\beta = -12.09, p < 0.01$) as well as firm labor mobility ($\beta = -13.23, p < 0.01$) have a significantly negative effect on firms' absorptive capacities. All other model specifications reinforce the significant effects of these two firm characteristics. As hypotheses H1a and H1b posited a positive influence of the firm labor stock and mobility on a firm's absorptive capacity, we have to reject these hypotheses. Model II

focuses on the regional labor stock and regional labor mobility and contains additional regional characteristics. The labor stock ($\beta = 16.01, p > 0.10$) as well as labor mobility ($\beta = 9.874, p > 0.10$) within a region have a positive yet not significant effect on firms' absorptive capacities. As hypotheses H2a and H2b posited a positive influence of the regional labor stock and mobility on a firm's absorptive capacity, we do not find strong support for these hypotheses. All additional regional control variables for innovation activities, density and employment in the respective labor market region are not significantly different from zero. When regional and firm level labor characteristics, along with additional controls are simultaneously included into our estimations (see Model VI to VIII), the effects for firm labor characteristics and the regional labor stock remain unchanged.

- Insert table 4 about here -

When considering contextual factors, entrepreneurship is found to negatively affect firms' absorptive capacities ($\beta = -0.002, p < 0.05$), especially in our full model (Model VIII), which is not surprising given that intrapreneurship and entrepreneurship are substitutes in some respects. Model IV isolates the effect of universities as a source of knowledge spillovers within a region and shows that universities and associated university spillovers foster firms' absorptive capacities by size effects ($\beta = 0.0004, p < 0.10$). This interrelatedness between the public and the private sector also explains why cluster policy does not have a significant influence in our full models (see Model VI to VIII), since policy instruments potentially influence all other contextual dimensions, although our isolated view on cluster policy (see Model V) indicates a positive impact on our endogenous variable ($\beta = 16.80, p < 0.10$).

To test our revolving door hypothesis H3a and H3b, i.e. the dynamic effect of labor mobility, we include interaction terms for firm and regional labor mobility as well as firm and

regional labor stock. Model VII demonstrates that the simultaneous appearance of firm and regional labor mobility can positively shape firms' absorptive capacities ($\beta = 38.04, p < 0.01$). Only in the case that workers leaving a firm can be adequately replaced by other available employees in that the shift of workers terminates mismatches and generates the opportunity to achieve a "learning-by-hiring" effect, can labor turnover develop into a positive effect. The interaction between the regional labor stock and the firm labor stock (Model VIII) is also positive and statistically significant ($\beta = 6.857, p < 0.10$). Hence, we find strong support for hypotheses H3a and H3b.

In summary, we can neither confirm hypotheses H1a and H1b nor hypotheses H2a and H2b in that the firm/regional labor stock and firm/regional labor mobility have on their own a positive effect on a firm's absorptive capacity. However, our results confirm hypotheses H3a and H3b, i.e. the interaction of firm and regional labor stock as well as firm and regional labor mobility both positively influence a firm's absorptive capacity. Taking up the prior discussion that labor mobility could act as both an antecedent and as a consequence of intrapreneurial activities of organizations in the region, our findings support the latter. Labor mobility may only have positive effects on a firm's absorptive capacity if fluid labor markets, represented by regional labor mobility, facilitate adequate matches between employees and employers. Hence, the management of intrapreneurial capabilities needs to take account of both internal and external factors to effectively shape and leverage a firm's intrapreneurial orientation.

5. Discussion

In contrast to Kaiser et al. (2015) and Braunerhjelm et al. (2018), we cannot verify a significantly positive effect by firm labor mobility. In our models, firm labor stock as well as firm labor mobility have a significantly negative effect on firms' absorptive capacities. The labor stock as well as labor mobility within a region have a positive yet not significant effect

on firms' absorptive capacities. These results are in line with studies highlighting the importance of intra-regional labor flows (see Boschma et al., 2014; Eriksson & Lindgren, 2008). When considering contextual factors, we can confirm previous results in the main. Bosma et al. (2011) show that the higher the level of income in a country, the more prevalent is intrapreneurship. Thus, higher levels of economic development result in higher proportions of individuals working in organizations instead of becoming an entrepreneur. Our findings support these previous results as entrepreneurship is found to negatively affect firms' absorptive capacities. Universities and associated university spillovers within a region foster firms' absorptive capacities by size effects. This result confirms prior research emphasizing the interplay between universities and their regional environments (Rajalo & Vadi, 2017; Lehmann & Menter, 2016).

We especially contribute to the body of intrapreneurship literature with our revolving door hypothesis and the result that the simultaneous appearance of firm and regional labor mobility can positively shape firms' absorptive capacities. By addressing the regional as well as the firm level, we confirm the results by Almeida and Kogut (1999) that regional labor mobility positively influences innovation processes. In addition, we provide a first attempt to define intrapreneurial capabilities by describing the relevant building blocks. We further offer an operationalization of intrapreneurial capabilities by focusing on absorptive capacities as an essential part of firms' intrapreneurial capabilities.

As with all research, our study is subject to a number of limitations. Measuring absorptive capacities by firm R&D spending per sales follows the seminal work by Cohen and Levinthal (1990) as well as Lane and Lubatkin (1998), yet does not cover all aspects of intrapreneurial capabilities. Our small and rather unbalanced panel also does not include information about the mobility of major patent holder or star scientists working within firms. As those key employees may decisively influence the activities within firms, respective individuals should be taken into

account, too – especially in the era of the digital economy. Additionally, further contextual factors such as the homogeneity of an industry, the efficiency of cluster networks, the openness of competitors for collaboration as well as further firm specifics could be included within the analyses. An important aspect that should also be considered in future studies is the effects of exogenous shocks such as the financial crisis (see Bosch, 2011; Storm & Naastepad, 2015). From a methodological point of view, future studies might consider the utilization of instrumental variables to better address potential endogeneity issues that naturally arise in the context of firm-region interaction. Due to the multifacetedness of the concept of "intrapreneurial capabilities", scholars might use factor analyses to better grasp all dimensions relevant to this concept to confirm and extend our findings.

6. Conclusion

The movement of workers and its impact on knowledge flows and knowledge spillovers has been a focus of the extant research (Agrawal et al., 2006; Maliranta et al., 2009), but has more recently been conflated with the so-called knowledge spillover theory of intrapreneurship (Braunerhjelm et al., 2018), which takes into account knowledge enhancing effects through recruiting new employees ("learning-by-hiring" effect) as well as through employees leaving a firm ("learning-by-diaspora" effect). Our study has taken this strand of literature as a starting point, in that we provide a novel focus on the role of firm labor mobility in enhancing intrapreneurship. Considering labor mobility as well as the labor stock from both the firm and the regional levels, this paper provides a more holistic picture of the impact of knowledge flows and networks on absorptive capacities. Building on recent studies emphasizing the importance of context (Autio et al., 2014; Zahra et al., 2014), we have also included contextual influencing factors on the firm, regional, university and policy levels into our estimation approaches.

Our results suggest that firm labor mobility does not have a positive effect on the absorptive capacities of firms as postulated by Braunerhjelm et al. (2018). However, the interaction between firm labor mobility and regional labor mobility is found to stimulate absorptive capacities, indicating the dynamic effect of labor mobility, which we designate as a revolving door effect. Hence, firm labor mobility is a necessary, yet not sufficient prerequisite for enhanced intrapreneurship. It also requires efficient and fluid labor markets (represented by our variables *regional labor stock* and *regional labor mobility*) in order to facilitate the requisite matches between employees and employers. Our metaphor of the revolving door in the context of efficient labor markets thus describes the dynamism that whenever an employee decides to leave a firm, he or she might be adequately replaced by another worker, with an even better match with the respective position than before, enabling augmented intrapreneurial capabilities even in the course of employee fluctuation ("learning-by-diaspora" effect). The same holds for recruiting new employees: firms need to have access to sufficient labor market pools to enable good matches, which ultimately enhances firm intrapreneurship ("learning-by-hiring" effect).

Our findings offer several practical implications for both firm managers as well as policymakers. First, firm managers should not retain employees at all costs, since firm labor mobility might stimulate absorptive capacities and resolve existing mismatches within the firm. Our described revolving door effect hence implies that firm managers should rather look for an adequate replacement, which requires robust and well-functioning labor markets. Our second implication for firm managers addresses the latter point. Firm managers need to choose firm locations that offer a labor pool of high human capital workers. Our analysis shows that e.g. the co-location to universities with firms benefiting from highly educated graduates has a positive impact on firm absorptive capacities. Thus, the management of absorptive capacities to foster an intrapreneurial approach goes beyond a sole firm focus. The external environment, or firm context, also needs to be taken into consideration. Third, policymakers need to ensure efficient

and fluid labor markets. Policies might address this issue by labor regulations, e.g. dismissal protection, that allow and enhance the mobility of workers and help to resolve existing mismatches. Fourth, policymakers should pay attention to contextual factors such as universities that strengthen and fertilize the innovative environment of firms and educate highly skilled workers, ultimately enabling the mobility of a highly skilled workforce.

Future research should try to more fully capture the concept of intrapreneurial capabilities. Thinking of intrapreneurship as an innovation process, absorptive capacities explain the initial accumulation, exploration and processing of information, whereas at later stages, also the exploitation and creation of new ideas emerge as important. We have made a first attempt to depict the relevant building blocks of intrapreneurial capabilities by considering the process of discovery, evaluation and exploitation of opportunities to ultimately create value. Future studies need to substantiate and/ or complement this characterization of intrapreneurial capabilities and strive for a more generally accepted conceptualization of intrapreneurial capabilities. Scholars should thereby consider additional contextual parameters such as the homogeneity of industries, the efficiency of cluster networks, or the openness of competitors for collaboration. Moreover, a differentiation between low and high performing firms, small and medium sized firms and large incumbents as well as treated and untreated firms and regions in terms of financial support through policy initiatives is needed in order to derive meaningful policy recommendations, which would also need to consider potential exogenous shocks such as the financial crisis. Subsequent studies should further consider the influence of the mobility of major patent holders or star scientists, since efficient and fluid labor markets might not offer an adequate surrogate of such essential and exceptional individuals. Another open question that remains and could not be definitively answered through our research refers to the linkage between the absorptive capacities of firms in an intrapreneurial setting and the regional entrepreneurship potential: Is regional entrepreneurship a complement of or substitute for intrapreneurship within the firm?

We appeal to subsequent research to build on and extend our results in moving this research agenda forward. It is further important to better understand the antecedents and consequences of intrapreneurial capabilities, i.e. which organizational settings enable and facilitate the development of intrapreneurial capabilities and how those capabilities ultimately affect firm performance. Hence, more conceptual but also empirical studies are needed to fully capture intrapreneurial capabilities and the underlying mechanisms.

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Figures and Tables

Table 1 – Variables and Operationalization

Type	Variable	Measure	Source	Theory
Dependent Variable	Absorptive capacity	Yearly R&D spending per sales (EUR)	Thomson Datastream	Cohen & Levinthal, 1990; Qian & Acs, 2013
Independent Variable	Firm labor stock	Logarithmized number of firms' employees	Thomson Datastream	Kaiser et al., 2015; Braunerhjelm et al., 2018
	Firm labor mobility	Percentage change/ Variance in the number of firms' employees	Thomson Datastream	Kaiser et al., 2015; Braunerhjelm et al., 2018
	Regional labor stock	Logarithmized number of regional citizens	German Statistics Office	Oettl & Agrawal, 2008; Almeida & Kogut, 1999
	Regional labor mobility	Percentage change/ Variance in the number of regional citizens	German Statistics Office	Oettl & Agrawal, 2008; Almeida & Kogut, 1999
Control Variable	International focus	Yearly international assets (EUR)	Thomson Datastream	Tsai, 2001; Reiche, 2007; Taneja et al., 2015
	Regional innovation	Number of patent applications in relation to the workforce (in 10,000)	German Patent and Trademark Office, German Statistics Office	Cooke et al., 1997; Castellacci & Natera, 2013
	Regional employm.	Regional employment rate	German Statistics Office	Berry & Glaeser, 2005
	Regional density	Number of citizens per square kilometer of land area	German Statistics Office	Becker et al., 1999; Ellison et al., 2010
	Entrepreneurship	Number of business enterprises in relation to the workforce (in 10,000)	German Statistics Office	Acs et al., 2013, 2016
	University size	Number of university-students per region	German Statistics Office	Anselin et al., 1997; Audretsch, 2014;
	Research intensity	Publications per research fellow	German Statistics Office	Anselin et al., 1997, Audretsch, 2014
	Funding intensity	Total amount of third party funding (public + private)	German Statistics Office	Klofsten & Jones-Evans, 2000; Rajalo & Vadi, 2017
	Cluster policy	Regional promotion as a 'leading-edge cluster'	BMBF	Leyden & Link, 2015

Table 2 – Descriptive Statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Absorptive capacities	overall	147,404	603,524	0	6,900,000	N = 3,502
(abs.)	between		451,834	0	4,808,800	n = 418
	within		161,069	-1,783,396	3,326,368	T-bar = 8.4
Firm labor stock	overall	12,850	46,931	1	536,350	N = 5,730
(abs.)	between		42,906	3	426,720	n = 443
	within		10,194	-149,446	355,511	T-bar = 12.9
Firm labor mobility	overall	0.26	11.92	-1.00	976.00	N = 6,750
	between		3.07	-0.11	64.99	n = 450
	within		11.52	-65.60	911.27	T = 15
Regional labor stock	overall	1,860	1,212	119	4,570	N = 6,748
(abs.)	between		1,212	121	4,449	n = 450
	within		50	1,675	2,061	T-bar = 15
Regional labor mobility	overall	0.23	0.46	-1.55	1.58	N = 6,747
	between		0.37	-1.18	0.87	n = 450
	within		0.27	-0.93	1.06	T-bar = 15
International focus	overall	0.29	0.25	0.00	1.14	N = 2,306
	between		0.20	0.00	1.04	n = 329
	within		0.15	-0.41	1.03	T-bar = 7.0
Regional innovation	overall	18.64	16.50	0.00	188.99	N = 6,750
	between		15.65	1.47	64.06	n = 450
	within		5.27	-7.59	173.32	T-bar = 15
Regional employment	overall	0.92	0.08	0.00	0.98	N = 6,750
	between		0.04	0.70	0.97	n = 450
	within		0.06	0.12	1.09	T-bar = 15
Regional density	overall	461.6	336.93	49.28	1,716	N = 6,748
	between		337.18	52.83	1,665	n = 450
	within		8.95	411.05	512.67	T-bar = 15
Entrepreneurship	overall	22,271	16,090	802.00	60,620	N = 6,750
	between		15,861	988.33	52,255	n = 450
	within		2,799	11,093	30,636	T-bar = 15
University size	overall	35,785	28,908	0.00	108,585	N = 6,750
	between		28,594	0.00	96,990	n = 450
	within		4,445	19,930	50,783	T-bar = 15
Research intensity	overall	0.50	0.18	0.00	1.28	N = 5,815
	between		0.16	0.06	0.87	n = 389
	within		0.09	0.17	1.18	T-bar = 15
Funding intensity	overall	81,202	102,091	0	972,242	N = 6,750
	between		75,544	0	327,478	n = 450
	within		68,757	-245,992	966,511	T-bar = 15
Cluster Policy	overall	0.52	0.50	0.00	1.00	N = 6,750
	between		0.50	0.00	1.00	n = 450
	within		0.00	0.52	0.52	T-bar = 15

Table 3 – Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Absorptive capacities	1.00												
(2) Firm labor stock	-0.23	1.00											
(3) Firm labor mobility	-0.01	0.00	1.00										
(4) Regional labor stock	0.07	0.01	0.01	1.00									
(5) Regional labor mobility	0.07	-0.08	0.01	0.34	1.00								
(6) International focus	-0.08	0.26	-0.01	0.03	-0.10	1.00							
(7) Regional innovation	0.00	-0.01	0.00	0.20	0.48	-0.08	1.00						
(8) Regional employment	0.02	0.07	0.00	0.08	0.26	-0.03	0.30	1.00					
(9) Regional density	0.01	0.20	0.01	0.37	-0.18	0.13	-0.03	0.02	1.00				
(10) Entrepreneurship	0.07	-0.07	0.01	0.89	0.44	-0.03	0.27	0.07	0.15	1.00			
(11) University size	0.10	-0.05	0.03	0.78	0.38	-0.06	0.22	-0.01	0.15	0.83	1.00		
(12) Research intensity	0.07	0.00	0.00	0.42	0.17	0.08	0.02	0.08	0.14	0.46	0.42	1.00	
(13) Funding intensity	0.07	-0.05	0.00	0.35	0.37	-0.11	0.37	0.13	-0.07	0.47	0.49	0.18	1.00

Table 4 – Panel regression estimating absorptive capacities

	Model I	**Model II**	**Model III**	**Model IV**	**Model V**	**Model VI**	**Model VII**	**Model VIII**
Firm labor stock	**-12.09*** **					**-15.84*** **	**-15.70*** **	**-67.83** **
	(2.042)					**(2.461)**	**(2.414)**	**(26.85)**
Firm labor mobility	**-13.23*** **					**-13.85*** **	**-47.03*** **	**-46.93*** **
	(4.559)					**(4.839)**	**(9.682)**	**(9.660)**
Regional labor stock		16.01				21.29	19.70	-26.61
		(12.75)				(18.13)	(17.83)	(29.74)
Regional labor mobility		9.874				8.153	2.577	4.365
		(8.387)				(14.45)	(14.43)	(14.44)
Firm labor mob. x							**38.04*** **	**37.89*** **
Regional labor mob. *(Interact.)*							**(9.581)**	**(9.559)**
Firm labor stock x								**6.857***
Regional labor stock *(Interact.)*								**(3.521)**
International focus	7.803					13.04	14.74	15.04
	(12.18)					(14.12)	(14.02)	(14.01)
Regional innovation		-0.275				-0.296	-0.314	-0.299
		(0.292)				(0.394)	(0.388)	(0.389)
Regional employment		10.89				246.5	265.3	238.9
		(56.26)				(261.3)	(258.2)	(258.6)
Regional density		-0.006				0.011	0.009	0.006
		(0.017)				(0.019)	(0.018)	(0.018)
Entrepreneurship			-0.0004			**-0.002** **	**-0.002** **	**-0.002** **
			(0.0006)			**(0.001)**	**(0.001)**	**(0.001)**
University size				**0.0004***		**0.0008** **	**0.0008** **	**0.0007***
				(0.0002)		**(0.0004)**	**(0.0004)**	**(0.0004)**
Research intensity				4.899		8.320	9.192	7.274
				(22.78)		(25.96)	(25.61)	(25.64)
Funding intensity				0.00001		0.00001	0.00001	0.00001
				(0.00003)		(0.00003)	(0.00003)	(0.00003)
Cluster Policy					**16.80***	4.303	5.574	4.337
					(10.13)	(15.00)	(14.72)	(14.78)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total observations	1,264	2,064	2,064	1,820	2,064	1,121	1,121	1,121
R^2	0.06	0.01	0.01	0.01	0.01	0.07	0.10	0.11

The endogenous variable is R&D spending per sales. Standard errors are in brackets. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

Appendix 1 – Robustness test

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
Firm labor stock	**0.654*** **					**0.640*** **	**0.645*** **	**0.817** **
	(0.027)					**(0.028)**	**(0.028)**	**(0.347)**
Firm labor mobility	**-0.051*** **					**-0.051*** **	**-0.073*** **	**-0.074*** **
	(0.019)					**(0.019)**	**(0.021)**	**(0.021)**
Regional labor stock		0.156				0.087	0.067	0.230
		(0.172)				(0.226)	(0.225)	(0.398)
Regional labor mobility		**0.179*** **				-0.020	-0.039	-0.037
		(0.061)				(0.077)	(0.077)	(0.077)
Firm labor mob. x							**0.067*** **	**0.067*** **
Regional labor mob. *(Interact.)*							**(0.024)**	**(0.024)**
Firm labor stock x								-0.023
Regional labor stock *(Interact.)*								(0.046)
International focus	**-0.212*** **					-0.089	-0.091	-0.091
	(0.076)					(0.080)	(0.080)	(0.080)
Regional innovation		**0.007** **				**0.011*** **	**0.011*** **	**0.010*** **
		(0.003)				**(0.004)**	**(0.004)**	**(0.004)**
Regional employment		**0.477***				0.260	0.313	0.326
		(0.286)				(1.888)	(1.884)	(1.884)
Regional density		**0.001*** **				0.00001	0.00001	0.00002
		(0.0003)				(0.0003)	(0.0003)	(0.0003)
Entrepreneurship			**-0.00001***			-0.00001	-0.00001	-0.00001
			(0.00001)			(0.00001)	(0.00001)	(0.00001)
University size				0.00001		**0.00001** **	**0.00001** **	**0.00001** **
				(0.000003)		**(0.000003)**	**(0.000003)**	**(0.000003)**
Research intensity				0.311		**0.351***	**0.342***	**0.345***
				(0.196)		**(0.203)**	**(0.203)**	**(0.203)**
Funding intensity				0.00001		0.00001	0.00001	0.0000002
				(0.000002)		(0.000002)	(0.000002)	(0.000002)
Cluster Policy					**0.768*** **	0.050	0.060	0.068
					(0.216)	(0.256)	(0.256)	(0.256)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total observations	1,690	3,278	3,278	2,883	3,278	1,482	1,482	1,482
R^2	0.22	0.05	0.05	0.05	0.05	0.25	0.25	0.25

The endogenous variable is R&D spending (logarithmized). Standard errors are in brackets. The asterisks *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.