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The firm's evaluation of local research institutes and universities - an empirical analysis for Germany

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The firm's evaluation of local research institutes and universities – an empirical analysis for Germany

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Extended Abstract:

Spatial proximity facilitates transfer of knowledge and technology between research institutes or universities (RIU) and firms. Against this background the location of research institutions and universities is often seen as an instrument of regional policy to promote knowledge flows and R&D activity of firms. One major practical challenge is, however, to bring together both actors. The matching process is often hindered by prejudices and lacking information about the capabilities and requirements on both sides. This study contributes to the sparse empirical literature on this topic by analyzing the firms' attitudes towards proximate RIU. We make use of differentiated data on firm characteristics and their evaluation of certain location factors in the years 2006 and 2009 provided by the IAB establishment panel.

Several research questions are investigated by applying ordered probit regression models. How are non-innovating firms or firms with low R&D activities rating their local RIU? Are there important differences between urban and rural regions or between large firms and SMEs? Do objective information such as size and specialization of the local universities affect the firm's evaluation? How far is "local" (distinguishing data at the NUTS3 and NUTS2 level)? Does a successful participation of local universities in the German "Excellence Initiative" change the firms' attitude?

The results indicate that firms which are expected to be open to collaboration with RIU (in terms of R&D, human capital, knowledge-intensive industries) are rating their local RIU higher than other firms. We suppose that firms are already self-selected to places where they find their suitable collaboration partners. Objective information about the universities such as specialization on STEM fields positively affects the evaluation of proximate RIU. Especially the universities' focus on mathematics and natural sciences (slightly surprisingly rather than engineering) makes them better off from the perspective of the individual firm. Furthermore, information about universities in the remaining NUTS 2 region exhibit larger effects than information on the NUTS 3 region. This indicates that firms have a larger distance in mind when thinking of their "location" and "proximity to RIU". Another finding is that the announcement of the winning universities in the "Excellence Initiative" which additionally funds scientifically excellent concepts does not affect the firms' view on the local RIU.

Keywords: proximity, university-industry linkages, universities of excellence, location factor, ordered probit, difference-in-differences

JEL codes: I23, I28, O31

1 Introduction and theoretical background

Location factors affecting the innovative capability of the local firms are discussed controversially in the academic literature (see, e. g. Huggins et al. 2008). The empirical approaches to capture the endowment of a region with universities and (non-university) research institutions, their interactions with local firms, and the effects on innovation behavior and competitiveness are manifold. One question which is crucial for the firm's decision to make use of nearby universities and non-university research institutions is whether the latter are actually seen as valuable collaboration partners. To our knowledge, this question has not been addressed yet in the literature.

Our study focuses on the importance and the evaluation of research institutions and universities (RIU) from the firms' perspective. It is analyzed which types of firms require geographic proximity and which characteristics determine the grade they give to this location factor. The study aims at providing evidence for the relevance and perceived quality of RIU as a location factor. More importantly, firms are differentiated with regard to basic characteristics (industry, size, exports) and innovation behavior (innovations, R&D collaborations) in order to identify those being (potentially) involved in interactions with RIU. Spatial proximity between economic actors, the agglomeration of a larger number of them, as well as the structure of regional clusters are expected to promote interaction, learning, and in the consequence – innovation (e. g. Morgan 1997, Koschatzky 2001). Moreover, transfer of tacit knowledge being an auxiliary instrument for firms to utilize scientific results is facilitated by personal contacts (Gertler 2003). Especially universities and research institutions are potential sources of technological knowledge which firms would translate into innovations (Audretsch / Feldman 1996, Audretsch / Dohse 2007).

However, RIU do not exhibit positive effects on the local business per se. Several studies provide detailed results about the necessary conditions for knowledge transfer taking place effectively. First, Cohen and Levinthal (1989) suggested that firms that are already engaged in R&D have higher capacities to utilize external information. Later, Cohen (2002) specified that positive effects are visible for new R&D projects as well as the completion of ongoing projects. Beise and Stahl (1998) also found favorable effects of prior R&D activities in order to use scientific results for marketable innovations but no effects of geographical proximity to research institutions on technology transfer. Contrasting evidence is provided by Ponds et al. (2010) who not only show that academic research positively effects regional innovation due to geographical proximity but also due to existing networks from university-industry collaboration. Similar results are yield by Fritsch and Franke (2003).

The regionally different propensity for continuing collaborations calls for further research on the firms' characteristics in detail (e. g. Fritsch 2004). Corresponding results are found, e. g. in Cohen (2002), where only some industries, larger firms and start-ups are identified as frequent users of RIU collaborations. Furthermore, Abramovsky et al. (2007) and Abramovsky and Simpson (2011) show that the role of the quality of RIU for co-location of firms and forms of interaction varies dependently on the industry. Another approach to explain the propensity to collaborate is to understand proximity not only in a geographical sense but also in terms of cognitive, organizational, social and institutional proximity (Boschma 2005) or organizational and technological proximity (Knoben / Oerlemans 2006). Besides substantial firm characteristics affecting the propensity collaborate with RIU and utilize external knowledge, Howells et al. (2012) emphasize the importance ("major barrier") of attitudes towards R&D collaboration with RIU in general. To our knowledge, it is the sole study hypothesizing about subjective perceptions and judgments on RIU. Their key arguments are different scanning costs, absorptive capacity, and that often only a small number of (R&D intensive) firms had the opportunity to gain experiences.

Against this background it is an open question to what extent firms find the nearby RIU suitable for their purposes. There may be successful universities with international reputation and experienced researchers in technology fields corresponding to the firms' business but if the firms themselves do not set a high value on the (proximity to) these institutions or appreciate their quality, then there will not be any interaction or knowledge spillover between them.

Our research questions address some of the issues related to the firm's view on local RIU:

- How are non-innovating firms or firms with low R&D activities rating their local RIU?
- Are there important differences between urban and rural regions or between large firms and SMEs?
- Do objective information such as size and specialization of the local universities affect the firm's evaluation?
- How far is "local" (distinguishing data at the NUTS3 and NUTS2 level)?
- Does a successful participation of local universities in the German "Excellence Initiative" change the firms' attitude?

The paper is structured as follows. First, the data basis is described. Second, evaluation of RIU as location factor is analyzed by means of ordered probit regressions. Thereby, we also look at different subgroups of firms which are of special interest for innovation policy purposes. Third, some policy implications and conclusions for future research are derived.

2 Data

The IAB establishment panel comprises about 16,000 firms in Germany and allows for representative analysis of different topics concerning the company's performance, structure and development of employment, training and some further questions on investment and innovation. The questionnaire consists of annually repeated basic questions, every two or three years on specific details (e. g. concerning recruitment, training, innovation) as well as singular events (e. g. affection by the crisis). Remote data access is provided by the Research Data Centre (FDZ) of the Federal Employment Agency.

The waves 2006 and 2009 of the survey contain information about the firms' assessment of location factors, e. g. proximity to customers or suppliers, quality of the skilled labor supply, attractiveness for workers, proximity to research institutions, technology centers and higher education institutions, transport connection, regional wage level, or municipal taxes. Specifically, they were asked to rank the importance of each of the location factors on a scale from 1 (extremely important) to 5 (not important). Furthermore, these location factors were graded with marks from 1 to 6, whereby 1 means highest quality.

The location factor of interest is the "proximity to research and technology centers and universities" ("*Nähe zu Forschungs- und Technologiezentren bzw. Hochschulen*"). We neglect "technology centers" in our interpretation for two reasons. First, in most cases they are integral part of research institutes and universities. So there usually are rarely technology centers without a respective research institution. Second, from the firm's perspective the intermediary function is presumably less important than the institution to interact with. Therefore we assume that it is the actual research institution which is graded by the firms and not its intermediary.

An isolated interpretation of the question could suggest that the reference to "universities" would also address their education function and thus blur our understanding of this location factor as a source of scientific research and potential for R&D collaboration. We therefore have to make sure that firms understand this question in the sense of our analysis. In fact, there are two aspects suggesting our interpretation. One aspect is that – in the order of the questionnaire – the location factor "quality of skilled labor supply" (third place) precedes "proximity to RIU" (fifth place). Another aspect is the wording "*Hochschulen*". This term only includes universities and universities of applied sciences (so called "*Fachhochschulen*") which are the only higher education institutions that are regularly open to R&D collaboration and knowledge transfer while other academies and higher schools which educate at the tertiary education level are not comprised by "*Hochschulen*". For these reasons this location

factor should only be interpreted in the sense of R&D collaboration and knowledge spillover / technology transfer, leaving the education function of universities aside.

Besides the questions about importance and quality of the location factors there are a number of firm characteristics to include in our analysis. We aggregate the 41 different industries to four sectors of (non) knowledge intensive manufacturing and services so that the meanwhile break in the classification (from the national 2003 version which builds on NACE rev. 1.1 to the 2008 version and NACE rev. 2, respectively). Not regarded are non-commercial industries with more or less flexible location choices, i. e. public services etc. and agriculture, as well as non-knowledge intensive services (mostly personal services and retail).

The variables for the innovation behavior have a different timing than the location factor questions. While location factors are asked in 2006 and 2009, improved or new products are asked in 2007 regarding the two-year time span 2006 and 2005, and in 2010 and 2009 with regard to the preceding year, i. e. 2009 and 2008. The harmonization of this question thus consisted of consolidating the two separate questions in 2010 and 2009 in order to make it comparable with the question in 2006. We therefore relate the assessment of the location factor to innovations within the last two years. In contrast, no harmonization was possible for the question of conducting own R&D and collaboration. These were asked in 2007 and 2009, thus we relate the assessment of the location factor in 2006 to R&D activities in (the subsequent year) 2007, and the assessment in 2009 to activities in the same year.

3 Empirical analysis of the location factor “proximity to RIU”

3.1 Model

The determinants of the firms’ evaluation are analyzed by means of ordered probit regression analysis of the grade the firms are giving for the quality of the location factor “proximity to RIU”. The two years 2006 and 2009 are pooled and standard errors adjusted by clustering the firm ID. Marginal effects are not yet reported due to work in progress.

One major distinction is made between firms with different statements about the importance of the location factor. It is intuitive that one for whom the location factor is very important also has more and better information about its features than one for whom the location factor does not matter at all. Therefore, the evaluation of firms which attach great importance on proximate RIU is more valid than for firms stating that it is not important. The latter are, however, of special interest since this group may be subject to policy measures which aim to increase the participation in innovation processes, e. g. by supporting the establishment of

collaboration projects. For the distinction between this two groups of firms we pool the answers “not important” and “less important” on the one hand and on the other hand “important”, “very important” and “extremely important”. By dividing the firms into two groups instead of including the degree of importance in the model we also circumvent potential endogeneity problems since the determinants of the quality judgments are also possible determinants of the stated importance of the location factor.

Additional information about the scientific quality is provided by the results of the Excellence Initiative initiated by Federal Ministry of Education and Research (*Bundesministerium für Forschung und Innovation, BMBF*) in the form of a competition of concepts which have been evaluated by international experts in the corresponding research fields. The results of the competition have been announced on November, 13th 2006. Since the survey of the IAB establishment panel concludes in the mid of October the information about a successful participation of the local universities was known in the 2009 wave but not in the 2006 wave. It is therefore possible to investigate this information effect by means of a diff-in-diff approach.

Results for three main specifications are reported (I-III): First, only firm characteristics, second, extended specification by structural information on the universities in the NUTS 3 region and a diff-in-diff estimator for local participation in the Excellence Initiative, and third, an extension by corresponding NUTS 2 information. In the following, estimated coefficients are seen to be robust if significance is given in all three specifications.

The firm characteristics and the underlying suppositions are:

- *Number of employees* (+ squared term): capacities of the firm to establish and manage potential collaboration, size-related probability of innovation activities
- *Share of foreign revenue* on total revenue: engagement on global markets, experiences and information about market conditions and requirements of potential partners
- *Share of intermediate inputs* on total revenue: possible effects resulting from a firm’s part in the value chain
- *Technological state* of the machines etc., measured on a 5 point scale with 1 for the most recent technological state and 4/5 (reference category): general technology orientation of the firm and possibly degree of being informed about the state of the art in the required technological sciences
- *Share of investments for extension purposes* on total investments: firms planning to expand their activities
- *Firm age > 10 years* (Dummy): higher innovation orientation of younger firms

- Share of *work places requiring an academic degree*: human capital intensity, innovation orientation, absorptive capacity regarding potential collaborations
- Conducting *R&D* = (potentially) innovating firm
- *Industry* dummies for knowledge intensive manufacturing and services (reference category: non-knowledge intensive manufacturing): innovation orientation
- *Type of the firm*, dummy variables for headquarter, regional branch or single-firm company (reference category): functional responsibility for innovation within the structure of the whole company
- *NUTS 1 region* (German Länder) dummy variables

Non-firm characteristics are:

- *Number of students* in the NUTS 3 and in the NUTS 2 region (the latter excluding the numbers of the NUTS 3 region) where the firm is located: size of the local universities as a signal for organizational capacities
- Share of *students in mathematics / natural sciences and in engineering sciences* in the NUTS 3 / remaining NUTS 2 region: specialization of the local universities on technologically relevant fields (faculties)
- University in the NUTS 3 / remaining NUTS 2 region participating in the *Excellence Initiative (EI)*: scientific quality of the local universities
- *Year 2009* (Dummy): time trend
- *Difference-in-difference estimator* (interaction term) for EI university * year 2009: introduced signal for scientific quality

Many of the abovementioned characteristics are related to a potential self-selection of the firms to places where high-quality academic collaboration partners are located. This selectivity is, however, no substantial problem for the analysis or the interpretation of the results since the main interest is about those firms which are not yet involved in university-industry linkages or other forms of R&D collaborations.

3.2 General Results

The baseline specification (I) only comprises firm characteristics (and the year 2009 dummy variable). The number of observations in the two groups of firms with different statements about the importance of the location factor varies between about 1,500 (important) and 4,000 (not important) firms (table 1). This number is only slightly lower in model III. In terms of the Pseudo R² the model explains only a small share of the variation. Generally, i. e. also later in

the subgroup-specific regressions, the Pseudo R² is lower than 0.1, but always higher for the “important” group than for the “not important” group. This result supports our presumption that the firms in the former group are better informed regarding the location factor and thus give more systematically varying answers about the quality than the more arbitrarily evaluating group of firms negating any importance of proximity to RIU.

Table 1: Ordered probit regression of the grade of the location factor “proximity to RIU”

<i>dependent variable: grade of the location factor "proximity to RIU"</i>	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	-0.0001	(0.132)	-0.0001	(0.007)	-0.0001	(0.334)	-0.0001	(0.033)	-0.0001	(0.214)	-0.0001	(0.181)
empl. (sq)	0.0000	(0.392)	0.0000	(0.006)	0.0000	(0.273)	0.0000	(0.025)	0.0000	(0.237)	0.0000	(0.100)
foreign revenue (%)	-0.0009	(0.390)	-0.0019	(0.112)	-0.0009	(0.444)	-0.0019	(0.122)	-0.0005	(0.654)	-0.0025	(0.053)
intermediate inputs (%)	0.0013	(0.101)	0.0008	(0.552)	0.0009	(0.239)	0.0011	(0.427)	0.0009	(0.265)	0.0015	(0.324)
state technol. = 1 (D)	-0.2755	(0.011)	-0.3067	(0.124)	-0.3249	(0.003)	-0.3642	(0.076)	-0.3404	(0.003)	-0.4198	(0.056)
state technol. = 2 (D)	-0.2063	(0.047)	-0.1900	(0.326)	-0.2470	(0.019)	-0.2392	(0.230)	-0.2487	(0.021)	-0.2824	(0.187)
state technol. = 3 (D)	-0.0674	(0.525)	-0.1062	(0.596)	-0.1076	(0.315)	-0.1187	(0.565)	-0.1054	(0.339)	-0.1148	(0.604)
extension investments (%)	0.0007	(0.123)	-0.0007	(0.410)	0.0007	(0.138)	-0.0006	(0.441)	0.0006	(0.197)	-0.0007	(0.439)
firm age ≥ 10 yrs (D)	0.0787	(0.050)	0.0666	(0.408)	0.0863	(0.033)	0.0390	(0.629)	0.0889	(0.034)	0.0238	(0.781)
knowl.-int. manuf. (D)	-0.0809	(0.083)	0.0277	(0.694)	-0.0951	(0.042)	-0.0152	(0.831)	-0.0753	(0.121)	-0.0642	(0.383)
knowl.-int. services (D)	-0.0468	(0.246)	-0.1363	(0.149)	-0.0200	(0.620)	-0.0912	(0.337)	-0.0282	(0.504)	-0.1308	(0.184)
academic skills (%)	-0.0079	(0.000)	-0.0084	(0.000)	-0.0062	(0.000)	-0.0065	(0.000)	-0.0058	(0.000)	-0.0065	(0.000)
innovating firm (D)	-0.0270	(0.637)	-0.2056	(0.002)	-0.0585	(0.311)	-0.2049	(0.002)	-0.1054	(0.080)	-0.1922	(0.006)
students (NUTS3)					0.0000	(0.008)	0.0000	(0.118)	0.0000	(0.025)	0.0000	(0.020)
mathem./nat. sc. (NUTS3, %)					-1.2068	(0.000)	-1.2137	(0.000)	-1.2927	(0.000)	-1.2555	(0.000)
engineering (NUTS3, %)					-0.2975	(0.001)	-0.2759	(0.057)	-0.2596	(0.007)	-0.2750	(0.067)
students (NUTS2)									0.0000	(0.841)	0.0000	(0.001)
mathem./nat. sc. (other NUTS2, %)									-1.4779	(0.023)	-2.5545	(0.018)
engineering (other NUTS2, %)									0.1582	(0.600)	-0.0533	(0.909)
EI university (other NUTS3, D)					-0.1877	(0.611)	-0.0860	(0.816)	-0.4596	(0.000)	-0.3419	(0.046)
DiD (EI x year 2009)					0.0358	(0.921)	-0.2694	(0.431)				
EI university (other NUTS2, D)									-0.2737	(0.000)	0.2369	(0.012)
year 2009 (D)	0.0085	(0.950)	-0.2589	(0.359)	-0.0136	(0.923)	-0.1999	(0.500)	-0.0217	(0.868)	-0.1377	(0.654)
number of obs	4,117		1,513		4,117		1,513		3,763		1,382	
Pseudo R ²	0.0202		0.0412		0.0355		0.0622		0.0353		0.0624	

Displayed are coefficients and p-values obtained by ordered probit regression. Standard errors adjusted (clustered firm ID). (D) denotes dummy variables, (%) shares of revenue, investments, employment, and students in the corresponding region. p-values above 0.1 in light grey. Reference groups for dummy variables: state of technology = 4/5 (oldest state), non-knowledge intensive manufacturing (industry variables). Controls not reported: type of firm (single-firm company, headquarter or regional branch), German Länder (NUTS 1 region, dummy variables). Source: IAB establishment panel, waves 2006 and 2009, own calculations processed by remote data access.

For this latter group of firms the state of the technology employed, being established less than 10 years ago, and the human capital intensity are the most influential characteristics for positively evaluating the proximate RIUs (a negative sign indicates a lower and thus better grade). Firms stating that proximate RIU are an important location factor only show two significant characteristics: the number of employees, human capital and conducting R&D are positively correlated with quality judgments. Especially the size of the R&D coefficient is markedly higher (0.2056 compared to 0.0270) for the “important” group while all other coefficients are of similar size compared to the “not important” group. This difference is possibly the result of a self-selection of firms to places where the suitable collaboration partners are already located. The results tell, first, that if proximate RIU are not important to

firms then also conducting R&D plays no role for the further assessment of their quality. Second, if proximity is important, then firms which show no own R&D efforts are rating the proximate RIU worse and vice versa indicating that availability of academic collaboration partners complements own R&D.

Adding structural information on the local universities to the model moderately increases the Pseudo R^2 for both groups. Specialization of the universities on STEM fields (science, technology, engineering, and mathematics) significantly improves the quality judgments (model II). The coefficient of the students' share in mathematics and natural sciences is about four times higher than for the share of engineering sciences. The latter is therefore of minor importance from the perspective of the individual firm. Interestingly, the size of the coefficients is very similar between the two subgroups of firms. Since the coefficient for conducting R&D does only change marginally this indicates that the simple faculty structure of a university is no part of possible self-selection mechanisms. Moreover, the part of the judgments which is influenced by rough objective information about the universities (the share of students in certain fields) is independent of whether the location factor is important. Thus for the firms which are self-selected to suitable locations it is more than the fact that a university does *something* with STEM which shapes the decision about potential collaboration partners. The partners in the universities therefore have to exhibit more detailed features in order to meet the firm's needs.

The effect of a successful participation in the Excellence Initiative on the firms' quality judgment is investigated by interacting the year 2009 and the EI dummy variables (model II). The interaction term can be interpreted as a diff-in-diff estimator. However, there is no significant effect of the EI on any of the two groups of firms. Interestingly, the firms already had a good opinion about the universities (at each regional level, see also model III) before they have been labeled "excellent".

Besides the structural information of the local universities at the NUTS 3 level, in model III we also include information about the universities in the further NUTS 2 region (excluding the numbers for the corresponding NUTS 3 region). This aims to find out which regional level is understood by the firms when talking about their "location". In contrast to the NUTS 3 level only mathematics and natural sciences at the NUTS 2 level show a significant effect on the quality judgment. For the "not important" group the sign of the NUTS 2 coefficient in this field of study is slightly higher than for the corresponding NUTS 3 coefficient (1.4779 compared to 1.2927). For the "important" group the coefficient is even twice the size of the

NUTS 3 level. We therefore conclude that firms define larger distances to be “proximate” than only the NUTS 3 level, especially those firms for which the location factor is important.

3.3 Results for subgroups of firms

In the following certain subgroups of firms are distinguished which often are implicitly or explicitly addressed by innovation policy measures. These are

- 1) Firms of small and medium size (< 250 employees)
- 2) Firms without own R&D (“non-innovating firms”)
- 3) Younger firms (< 10 years)
- 4) Firms in the knowledge-intensive manufacturing sector
- 5) Firms in city districts (*kreisfreie Städte*) and non-city districts (*Landkreise*)

3.3.1 Firms of small and medium size

The results for smaller firms do not deviate markedly from the aforementioned general results. One reason is certainly the pure number of firms with less than 250 employees which dominate the first analysis being the vast majority of firms. Noteworthy differences are the lacking significance of engineering faculties for the “important” group of firms and the even larger coefficient for mathematics and natural sciences in the further NUTS 2 region (3.7081).

3.3.2 Non-innovating firms

Firms without own R&D show similar results as the smaller firms regarding engineering faculties at the NUTS 3 level (no significance for the “important” group) and the coefficient for mathematics and natural sciences at the NUTS 2 level (4.1888).

3.3.3 Young firms

For young firms belonging to the “important” group the model shows comparably high Pseudo R^2 values although there are rather less noticeable effects of certain firm characteristics. The faculty structures also show minor or even contradictory effects (such as the large positive and significant coefficient of engineering faculties at the NUTS 2 level). However, there is a unique effect of the announcement of the EI results. Both groups give EI locations a significantly better grade than before.

Table 2: Regression results for subgroups of firms

< 250 employees

<i>dependent variable: grade of the location factor "proximity to RIU"</i>	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	-0.0003	(0.755)	-0.0041	(0.021)	-0.0003	(0.768)	-0.0035	(0.050)	-0.0005	(0.633)	-0.0034	(0.069)
empl. (sq)	0.0000	(0.838)	0.0000	(0.034)	0.0000	(0.809)	0.0000	(0.124)	0.0000	(0.754)	0.0000	(0.127)
foreign revenue (%)	-0.0014	(0.267)	-0.0010	(0.533)	-0.0012	(0.335)	-0.0007	(0.662)	-0.0008	(0.563)	-0.0016	(0.331)
intermediate inputs (%)	0.0016	(0.043)	0.0002	(0.912)	0.0013	(0.102)	0.0004	(0.787)	0.0013	(0.126)	0.0009	(0.586)
state technol. = 1 (D)	-0.3061	(0.007)	-0.4203	(0.045)	-0.3402	(0.003)	-0.4827	(0.032)	-0.3499	(0.003)	-0.5336	(0.028)
state technol. = 2 (D)	-0.2380	(0.029)	-0.2893	(0.154)	-0.2671	(0.016)	-0.3389	(0.121)	-0.2585	(0.023)	-0.4073	(0.085)
state technol. = 3 (D)	-0.1012	(0.361)	-0.2077	(0.324)	-0.1218	(0.281)	-0.2254	(0.317)	-0.1054	(0.363)	-0.2099	(0.388)
extension investments (%)	0.0007	(0.132)	-0.0007	(0.411)	0.0007	(0.148)	-0.0006	(0.533)	0.0006	(0.206)	-0.0005	(0.597)
firm age ≥ 10 yrs (D)	0.0728	(0.077)	0.0466	(0.583)	0.0796	(0.054)	0.0312	(0.715)	0.0849	(0.047)	0.0143	(0.875)
knowl.-int. manuf. (D)	-0.0941	(0.054)	0.0427	(0.590)	-0.1054	(0.031)	-0.0004	(0.996)	-0.0898	(0.077)	-0.0811	(0.331)
knowl.-int. services (D)	-0.0507	(0.225)	-0.1812	(0.077)	-0.0295	(0.481)	-0.1310	(0.204)	-0.0436	(0.318)	-0.1810	(0.090)
academic skills (%)	-0.0072	(0.000)	-0.0084	(0.000)	-0.0055	(0.000)	-0.0070	(0.000)	-0.0053	(0.000)	-0.0071	(0.000)
innovating firm (D)	-0.0164	(0.792)	-0.2305	(0.003)	-0.0352	(0.577)	-0.2113	(0.007)	-0.0839	(0.201)	-0.1829	(0.024)
students (NUTS3)					0.0000	(0.049)	0.0000	(0.415)	0.0000	(0.084)	0.0000	(0.050)
mathem./nat. sc. (NUTS3, %)					-1.2139	(0.000)	-1.1896	(0.004)	-1.2914	(0.000)	-1.3065	(0.002)
engineering (NUTS3, %)					-0.2896	(0.002)	-0.2685	(0.111)	-0.2477	(0.014)	-0.2414	(0.171)
students (NUTS2)									0.0000	(0.995)	0.0000	(0.000)
mathem./nat. sc. (other NUTS2, %)									-1.8614	(0.009)	-3.7081	(0.003)
engineering (other NUTS2, %)									0.2023	(0.522)	0.1317	(0.808)
EI university (other NUTS3, D)					-0.2753	(0.490)	0.1718	(0.693)	-0.5195	(0.000)	-0.4191	(0.037)
DiD (EI x year 2009)					0.0831	(0.835)	-0.5896	(0.151)				
EI university (other NUTS2, D)									-0.2884	(0.000)	0.2756	(0.022)
year 2009 (D)	-0.0075	(0.959)	-0.1016	(0.762)	-0.0420	(0.777)	-0.0006	(0.999)	-0.0642	(0.645)	0.1521	(0.710)
number of obs	3,792		1,128		3,792		1,128		3,474		1,024	
Pseudo R ²	0.0203		0.0454		0.0342		0.0642		0.0343		0.0642	

Non-innovating firms

<i>dependent variable: grade of the location factor "proximity to RIU"</i>	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	-0.0002	(0.075)	-0.0004	(0.042)	-0.0001	(0.291)	-0.0004	(0.043)	-0.0001	(0.220)	-0.0003	(0.120)
empl. (sq)	0.0000	(0.370)	0.0000	(0.051)	0.0000	(0.308)	0.0000	(0.070)	0.0000	(0.273)	0.0000	(0.136)
foreign revenue (%)	-0.0001	(0.962)	-0.0034	(0.115)	-0.0004	(0.793)	-0.0041	(0.062)	-0.0001	(0.970)	-0.0040	(0.074)
intermediate inputs (%)	0.0011	(0.173)	0.0010	(0.599)	0.0007	(0.387)	0.0011	(0.543)	0.0006	(0.454)	0.0014	(0.472)
state technol. = 1 (D)	-0.2959	(0.015)	-0.4441	(0.112)	-0.3321	(0.008)	-0.4381	(0.111)	-0.3536	(0.005)	-0.4635	(0.133)
state technol. = 2 (D)	-0.2238	(0.058)	-0.3176	(0.239)	-0.2484	(0.039)	-0.3005	(0.256)	-0.2586	(0.035)	-0.2875	(0.337)
state technol. = 3 (D)	-0.0777	(0.517)	-0.1472	(0.594)	-0.1083	(0.377)	-0.1129	(0.678)	-0.1079	(0.388)	-0.0913	(0.767)
extension investments (%)	0.0006	(0.190)	0.0001	(0.928)	0.0006	(0.232)	0.0004	(0.726)	0.0006	(0.272)	0.0003	(0.783)
firm age ≥ 10 yrs (D)	0.0703	(0.094)	0.0888	(0.366)	0.0763	(0.070)	0.0777	(0.433)	0.0723	(0.100)	0.0661	(0.531)
knowl.-int. manuf. (D)	-0.0571	(0.265)	-0.0116	(0.907)	-0.0737	(0.151)	-0.0400	(0.694)	-0.0718	(0.177)	-0.0980	(0.345)
knowl.-int. services (D)	-0.0456	(0.267)	-0.1404	(0.175)	-0.0193	(0.638)	-0.0821	(0.428)	-0.0275	(0.521)	-0.1184	(0.274)
academic skills (%)	-0.0089	(0.000)	-0.0066	(0.002)	-0.0072	(0.000)	-0.0052	(0.011)	-0.0066	(0.000)	-0.0052	(0.011)
innovating firm (D)												
students (NUTS3)					0.0000	(0.020)	0.0000	(0.178)	0.0000	(0.041)	0.0000	(0.031)
mathem./nat. sc. (NUTS3, %)					-1.2593	(0.000)	-1.2787	(0.008)	-1.3417	(0.000)	-1.4168	(0.005)
engineering (NUTS3, %)					-0.2891	(0.003)	-0.3381	(0.126)	-0.2524	(0.014)	-0.2446	(0.289)
students (NUTS2)									0.0000	(0.568)	0.0000	(0.045)
mathem./nat. sc. (other NUTS2, %)									-1.5384	(0.027)	-4.1888	(0.017)
engineering (other NUTS2, %)									0.2284	(0.475)	0.2618	(0.682)
EI university (other NUTS3, D)					-0.1394	(0.717)	-0.3000	(0.090)	-0.4971	(0.000)	-0.4356	(0.066)
DiD (EI x year 2009)					-0.0492	(0.896)	0.0000					
EI university (other NUTS2, D)									-0.2663	(0.000)	0.0991	(0.466)
year 2009 (D)	-0.0318	(0.829)	0.1218	(0.743)	-0.0570	(0.707)	0.1875	(0.624)	-0.0753	(0.591)	0.3027	(0.470)
number of obs	3,657		808		3,657		808		3,344		734	
Pseudo R ²	0.0203		0.0373		0.0361		0.0574		0.0358		0.0575	

Table 2 (continued)

Firm age < 10 yrs

<i>dependent variable: grade of the location factor "proximity to RIU"</i>	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	-0.0005	(0.308)	0.0001	(0.814)	-0.0003	(0.509)	0.0000	(0.911)	-0.0001	(0.818)	0.0000	(0.997)
empl. (sq)	0.0000	(0.733)	0.0000	(0.299)	0.0000	(0.997)	0.0000	(0.611)	0.0000	(0.966)	0.0000	(0.701)
foreign revenue (%)	-0.0018	(0.439)	-0.0042	(0.189)	-0.0017	(0.471)	-0.0035	(0.276)	-0.0008	(0.761)	-0.0030	(0.356)
intermediate inputs (%)	0.0011	(0.493)	-0.0038	(0.307)	0.0004	(0.788)	-0.0022	(0.559)	0.0009	(0.609)	-0.0020	(0.626)
state technol. = 1 (D)	-0.2420	(0.272)	-0.2279	(0.588)	-0.2994	(0.146)	-0.2973	(0.503)	-0.4073	(0.039)	-0.0058	(0.990)
state technol. = 2 (D)	-0.2354	(0.269)	-0.1374	(0.737)	-0.2800	(0.157)	-0.2509	(0.559)	-0.3902	(0.038)	0.0262	(0.954)
state technol. = 3 (D)	0.0662	(0.758)	0.3088	(0.479)	0.0121	(0.952)	0.1627	(0.720)	-0.1003	(0.600)	0.4594	(0.352)
extension investments (%)	0.0004	(0.675)	-0.0037	(0.035)	0.0001	(0.932)	-0.0034	(0.066)	0.0005	(0.592)	-0.0032	(0.132)
firm age ≥ 10 yrs (D)												
knowl.-int. manuf. (D)	-0.0742	(0.503)	0.0343	(0.854)	-0.1321	(0.247)	-0.0436	(0.818)	-0.0565	(0.629)	-0.1098	(0.607)
knowl.-int. services (D)	0.0480	(0.553)	0.0751	(0.708)	0.0471	(0.562)	0.1422	(0.488)	0.0052	(0.951)	0.1558	(0.461)
academic skills (%)	-0.0077	(0.000)	-0.0096	(0.002)	-0.0070	(0.001)	-0.0082	(0.007)	-0.0058	(0.012)	-0.0086	(0.005)
innovating firm (D)	-0.0416	(0.760)	0.0412	(0.789)	-0.0513	(0.712)	0.0674	(0.667)	-0.2487	(0.087)	0.1187	(0.480)
students (NUTS3)					0.0000	(0.997)	0.0000	(0.099)	0.0000	(0.426)	0.0000	(0.008)
mathem./nat. sc. (NUTS3, %)					-1.3992	(0.010)	-1.1542	(0.187)	-1.3535	(0.018)	-1.3286	(0.149)
engineering (NUTS3, %)					-0.2646	(0.189)	-0.0872	(0.802)	-0.1307	(0.555)	-0.0004	(0.999)
students (NUTS2)									0.0000	(0.172)	0.0000	(0.307)
mathem./nat. sc. (other NUTS2, %)									-1.7718	(0.163)	-9.5177	(0.002)
engineering (other NUTS2, %)									1.8329	(0.005)	-0.0206	(0.986)
EI university (other NUTS3, D)					1.0045	(0.163)	1.6957	(0.004)	-0.6677	(0.027)	0.0580	(0.878)
DiD (EI x year 2009)					-1.4667	(0.036)	-1.8381	(0.001)				
EI university (other NUTS2, D)									-0.0747	(0.560)	0.3663	(0.158)
year 2009 (D)	0.1071	(0.744)	0.2157	(0.745)	0.3031	(0.359)	1.1108	(0.003)	0.0422	(0.896)	0.9768	(0.012)
number of obs	933		283		933		283		850		253	
Pseudo R ²	0.0262		0.0748		0.0404		0.1000		0.0443		0.1081	

Knowledge-intensive manufacturing

<i>dependent variable: grade of the location factor "proximity to RIU"</i>	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	0.0002	(0.168)	-0.0001	(0.001)	0.0002	(0.114)	-0.0001	(0.005)	0.0002	(0.288)	-0.0001	(0.009)
empl. (sq)	0.0000	(0.303)	0.0000	(0.001)	0.0000	(0.209)	0.0000	(0.005)	0.0000	(0.357)	0.0000	(0.009)
foreign revenue (%)	-0.0023	(0.159)	-0.0018	(0.301)	-0.0022	(0.190)	-0.0017	(0.327)	-0.0015	(0.378)	-0.0019	(0.309)
intermediate inputs (%)	0.0045	(0.034)	0.0027	(0.284)	0.0040	(0.059)	0.0030	(0.236)	0.0035	(0.116)	0.0043	(0.100)
state technol. = 1 (D)	-0.1022	(0.610)	-0.2653	(0.425)	-0.1848	(0.356)	-0.3348	(0.319)	-0.1825	(0.359)	-0.2458	(0.485)
state technol. = 2 (D)	-0.1132	(0.543)	-0.2441	(0.446)	-0.1630	(0.376)	-0.3033	(0.351)	-0.1552	(0.397)	-0.1829	(0.594)
state technol. = 3 (D)	-0.0259	(0.893)	-0.1686	(0.610)	-0.0533	(0.779)	-0.1918	(0.568)	-0.0879	(0.643)	-0.0456	(0.898)
extension investments (%)	-0.0005	(0.603)	-0.0009	(0.501)	-0.0008	(0.440)	-0.0010	(0.441)	-0.0010	(0.316)	-0.0008	(0.531)
firm age ≥ 10 yrs (D)	0.1068	(0.289)	0.1923	(0.235)	0.1383	(0.182)	0.1735	(0.288)	0.0680	(0.516)	0.1236	(0.473)
knowl.-int. manuf. (D)												
knowl.-int. services (D)												
academic skills (%)	-0.0091	(0.021)	-0.0118	(0.000)	-0.0086	(0.032)	-0.0107	(0.001)	-0.0083	(0.035)	-0.0113	(0.001)
innovating firm (D)	-0.1492	(0.081)	-0.2460	(0.025)	-0.1538	(0.076)	-0.2429	(0.027)	-0.1485	(0.096)	-0.2330	(0.039)
students (NUTS3)					0.0000	(0.084)	0.0000	(0.429)	0.0000	(0.053)	0.0000	(0.451)
mathem./nat. sc. (NUTS3, %)					-0.7996	(0.180)	-1.0558	(0.063)	-0.5257	(0.403)	-1.0337	(0.084)
engineering (NUTS3, %)					-0.5915	(0.001)	-0.2620	(0.252)	-0.6305	(0.001)	-0.3165	(0.185)
students (NUTS2)									0.0000	(0.984)	0.0000	(0.116)
mathem./nat. sc. (other NUTS2, %)									-3.9952	(0.023)	-1.3876	(0.391)
engineering (other NUTS2, %)									-0.8570	(0.177)	-0.3394	(0.632)
EI university (other NUTS3, D)					-0.8508	(0.058)	-0.4467	(0.435)	0.0519	(0.863)	0.0035	(0.991)
DiD (EI x year 2009)					0.9347	(0.010)	0.4580	(0.347)				
EI university (other NUTS2, D)									-0.1190	(0.352)	0.2973	(0.042)
year 2009 (D)	0.0679	(0.773)	-0.5658	(0.095)	0.0148	(0.949)	-0.6225	(0.106)	0.0562	(0.814)	-0.5578	(0.156)
number of obs	863		661		863		661		815		619	
Pseudo R ²	0.0302		0.0560		0.0438		0.0647		0.0373		0.0697	

Table 2 (continued)

City districts (kreisfreie Städte)

dependent variable: grade of the location factor "proximity to RIU"	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	-0.0001	(0.280)	0.0000	(0.516)	-0.0001	(0.519)	-0.0001	(0.274)	-0.0001	(0.316)	-0.0001	(0.121)
empl. (sq)	0.0000	(0.155)	0.0000	(0.932)	0.0000	(0.306)	0.0000	(0.362)	0.0000	(0.212)	0.0000	(0.148)
foreign revenue (%)	-0.0023	(0.093)	-0.0042	(0.009)	-0.0024	(0.088)	-0.0040	(0.013)	-0.0021	(0.133)	-0.0041	(0.011)
intermediate inputs (%)	0.0013	(0.160)	0.0039	(0.028)	0.0012	(0.216)	0.0040	(0.023)	0.0011	(0.256)	0.0036	(0.047)
state technol. = 1 (D)	-0.2955	(0.025)	-0.0292	(0.895)	-0.3221	(0.014)	-0.0907	(0.703)	-0.2844	(0.029)	-0.1345	(0.586)
state technol. = 2 (D)	-0.2639	(0.037)	-0.0131	(0.951)	-0.2844	(0.025)	-0.0544	(0.813)	-0.2468	(0.048)	-0.1036	(0.665)
state technol. = 3 (D)	-0.1204	(0.350)	0.1001	(0.652)	-0.1368	(0.288)	0.0756	(0.751)	-0.1034	(0.417)	0.0707	(0.776)
extension investments (%)	0.0008	(0.135)	-0.0009	(0.360)	0.0009	(0.124)	-0.0009	(0.372)	0.0008	(0.169)	-0.0007	(0.513)
firm age ≥ 10 yrs (D)	0.1364	(0.005)	0.0890	(0.422)	0.1495	(0.002)	0.0719	(0.518)	0.1285	(0.009)	0.0736	(0.516)
knowl.-int. manuf. (D)	-0.0735	(0.172)	-0.1242	(0.140)	-0.0773	(0.152)	-0.1359	(0.108)	-0.0802	(0.142)	-0.1501	(0.083)
knowl.-int. services (D)	-0.0475	(0.332)	-0.2164	(0.087)	-0.0414	(0.397)	-0.1807	(0.155)	-0.0491	(0.321)	-0.2025	(0.113)
academic skills (%)	-0.0088	(0.000)	-0.0093	(0.000)	-0.0082	(0.000)	-0.0092	(0.000)	-0.0081	(0.000)	-0.0086	(0.000)
innovating firm (D)	-0.1268	(0.053)	-0.2506	(0.003)	-0.1494	(0.023)	-0.2469	(0.003)	-0.1549	(0.020)	-0.2377	(0.005)
students (NUTS3)					0.0000	(0.004)	0.0000	(0.860)	0.0000	(0.006)	0.0000	(0.044)
mathem./nat. sc. (NUTS3, %)					0.2217	(0.499)	-0.4529	(0.325)	0.3865	(0.265)	0.0282	(0.955)
engineering (NUTS3, %)					-0.4678	(0.000)	-0.4078	(0.018)	-0.4615	(0.000)	-0.4023	(0.022)
students (NUTS2)									0.0000	(0.674)	0.0000	(0.000)
mathem./nat. sc. (other NUTS2, %)									-2.3802	(0.011)	-3.1853	(0.036)
engineering (other NUTS2, %)									0.2615	(0.537)	0.5415	(0.433)
EI university (other NUTS3, D)					0.5355	(0.053)	-0.4243	(0.148)	-0.2543	(0.358)	-0.0323	(0.935)
DiD (EI x year 2009)					-0.5042	(0.038)	0.0000					
EI university (other NUTS2, D)									-0.2990	(0.000)	0.2160	(0.083)
year 2009 (D)	0.0264	(0.863)	-0.5218	(0.078)	0.0468	(0.767)	-0.5109	(0.101)	0.0313	(0.838)	-0.4877	(0.110)
number of obs	2,924		964		2,924		964		2,854		946	
Pseudo R ²	0.0133		0.0462		0.0223		0.0535		0.0264		0.0611	

Non-city districts (Landkreise)

dependent variable: grade of the location factor "proximity to RIU"	I				II				III			
	not important		important		not important		important		not important		important	
	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value	coeff	p-value
employees	0.0000	(0.696)	-0.0001	(0.060)	0.0000	(0.742)	-0.0001	(0.110)	0.0000	(0.859)	0.0000	(0.712)
empl. (sq)	0.0000	(0.861)	0.0000	(0.031)	0.0000	(0.995)	0.0000	(0.078)	0.0000	(0.814)	0.0000	(0.642)
foreign revenue (%)	0.0016	(0.426)	0.0006	(0.760)	0.0016	(0.415)	0.0009	(0.644)	0.0025	(0.301)	-0.0003	(0.883)
intermediate inputs (%)	-0.0002	(0.861)	-0.0046	(0.047)	-0.0002	(0.866)	-0.0048	(0.039)	-0.0006	(0.705)	-0.0041	(0.110)
state technol. = 1 (D)	-0.1361	(0.469)	-0.7139	(0.037)	-0.2051	(0.275)	-0.7188	(0.033)	-0.2791	(0.199)	-0.7492	(0.043)
state technol. = 2 (D)	0.0225	(0.901)	-0.4827	(0.144)	-0.0556	(0.758)	-0.4801	(0.141)	-0.0955	(0.652)	-0.4783	(0.179)
state technol. = 3 (D)	0.1254	(0.497)	-0.4255	(0.219)	0.0454	(0.806)	-0.4311	(0.206)	0.0097	(0.964)	-0.3647	(0.331)
extension investments (%)	0.0001	(0.891)	-0.0007	(0.627)	-0.0002	(0.853)	-0.0007	(0.634)	-0.0007	(0.477)	-0.0008	(0.629)
firm age ≥ 10 yrs (D)	-0.0618	(0.404)	-0.0463	(0.708)	-0.0462	(0.535)	-0.0799	(0.521)	-0.0238	(0.777)	-0.1586	(0.252)
knowl.-int. manuf. (D)	-0.1904	(0.056)	0.2940	(0.027)	-0.1776	(0.075)	0.2732	(0.044)	-0.1130	(0.322)	0.2531	(0.108)
knowl.-int. services (D)	-0.0141	(0.847)	0.0495	(0.739)	0.0159	(0.827)	0.0808	(0.592)	0.0001	(0.999)	0.0667	(0.689)
academic skills (%)	-0.0049	(0.010)	-0.0049	(0.035)	-0.0043	(0.026)	-0.0040	(0.093)	-0.0030	(0.214)	-0.0035	(0.179)
innovating firm (D)	0.2056	(0.125)	-0.1728	(0.148)	0.2360	(0.080)	-0.1606	(0.179)	0.1274	(0.468)	-0.1236	(0.347)
students (NUTS3)					0.0000	(0.553)	0.0000	(0.591)	0.0000	(0.954)	0.0000	(0.962)
mathem./nat. sc. (NUTS3, %)					-1.5116	(0.010)	-2.1201	(0.006)	-2.0792	(0.002)	-2.1539	(0.009)
engineering (NUTS3, %)					0.3901	(0.147)	0.1996	(0.591)	0.5043	(0.109)	0.2136	(0.599)
students (NUTS2)									0.0000	(0.601)	0.0000	(0.647)
mathem./nat. sc. (other NUTS2, %)									-2.5932	(0.010)	-3.0661	(0.042)
engineering (other NUTS2, %)									-0.1880	(0.733)	0.3751	(0.569)
EI university (other NUTS3, D)					-0.6507	(0.167)	-0.2969	(0.579)	-0.2315	(0.216)	-0.3236	(0.207)
DiD (EI x year 2009)					0.4903	(0.283)	-0.1886	(0.702)				
EI university (other NUTS2, D)									-0.0821	(0.603)	0.4922	(0.025)
year 2009 (D)	0.0338	(0.898)	-0.1871	(0.651)	-0.2916	(0.145)	-0.0111	(0.980)	-0.0663	(0.804)	0.1259	(0.782)
number of obs	1,193		549		1,193		549		909		436	
Pseudo R ²	0.0262		0.0485		0.0352		0.0696		0.0431		0.0794	

Displayed are coefficients and p-values obtained by ordered probit regression. Standard errors adjusted (clustered firm ID). (D) denotes dummy variables, (%) shares of revenue, investments, employment, and students in the corresponding region. p-values above 0.1 in light grey. Variables dropped by Stata due to multicollinearity are indicated by red colored zero-coefficients. Reference groups for dummy variables: state of technology = 4/5 (oldest state), non-knowledge intensive manufacturing (industry variables). Controls not reported: type of firm (single-firm company, headquarter or regional branch), German Länder (NUTS 1 region, dummy variables). Source: IAB establishment panel, waves 2006 and 2009, own calculations processed by remote data access.

3.3.4 Knowledge-intensive manufacturing

In the knowledge-intensive manufacturing sector firms are expected to face higher international innovation competition and therefore rely more heavily on external knowledge and innovation inputs. The results for this subgroup of firms are mixed. Mathematics and natural science faculties affect the evaluation for the “important” group at the NUTS 3 level and for the “not important” group at the NUTS 2 level. The diff-in-diff estimator shows a positive sign indicating that the EI worsens the quality judgment. Generally, the conclusions for this group are limited.

3.3.5 District type

The results for the regionally differentiated subgroups are straightforward. In both types of NUTS 3 regions mathematics and natural sciences faculties in the further NUTS 2 region are improving the firms’ evaluation of the location factor. However, only in non-city districts these faculties are also effective at the NUTS 3 level while in city districts the engineering sciences are the more important location factor. City districts also show the rare result of a significant diff-in-diff estimator (also with the expected negative sign) for the “not important” group.

4 Conclusions

Geographical proximity facilitates knowledge spillover and especially R&D collaborations between research institutes and universities are expected to generate large benefits for the innovation activities of firms and region economy as a whole. The literature has already worked out that firms need to show specific characteristics to be open to knowledge and technology transfer. Particularly own R&D activities are an important absorptive capacity for firms. However, there are still invisible barriers between the two worlds. Thus, an enhanced understanding of proximity, as Boschma (2005) suggested, or the relevance of subjective perceptions and judgments about each other, as pointed out by Howells et al. (2012) are the more recent fields of study.

Against this background we employed a large representative German firm survey, the IAB establishment panel, to shed some light on the determinants of quality evaluations by the firms. The results may contribute to a more actor-centered view on knowledge spillover, R&D collaborations and the underlying matching processes. Our analysis deals with the question of how firms evaluate the proximate research institutions and universities (RIU). The key variable of interest are school grades the firms have given the location factor “proximity

to RIU. Thereby we distinguish firms by their stated importance of this special location factor. The idea behind this differentiation is that a firm first needs to be concerned with the location factor at all in order to make justified evaluations of its quality.

Several research questions are investigated by applying ordered probit regression models. How are non-innovating firms or firms with low R&D activities rating their local RIU? Are there important differences between urban and rural regions or between large firms and SMEs? Do objective information such as size and specialization of the local universities affect the firm's evaluation? How far is "local" (distinguishing data at the NUTS3 and NUTS2 level)? Does a successful participation of local universities in the German "Excellence Initiative" change the firms' attitude?

The results indicate that firms which are expected to be open to collaboration with RIU (in terms of R&D, human capital, knowledge-intensive industries) are rating their local RIU higher than other firms. We suppose that firms are already self-selected to places where they find their suitable collaboration partners. Objective information about the universities such as specialization on STEM fields positively affects the evaluation of proximate RIU. Especially the universities' focus on mathematics and natural sciences (slightly surprisingly rather than engineering) makes them better off from the perspective of the individual firm. Furthermore, information about universities in the remaining NUTS 2 region exhibit larger effects than information on the NUTS 3 region. This indicates that firms have a larger distance in mind when thinking of their "location" and "proximity to RIU". Another finding is that the announcement of the winning universities in the "Excellence Initiative" which additionally funds scientifically excellent concepts does not affect the firms' view on the local RIU.

We conclude that for firms which are self-selected to suitable locations it is more than the fact that a university does *something* with STEM which shapes the decision about potential collaboration partners. The partners in the universities therefore have to exhibit more detailed features in order to meet the firm's needs. This result underlines the known difficulties of matching processes between firms und RIU. The technological requirements of the firms are very particular and the fact that there is a proximate university with an emphasis on technologically relevant fields or even a scientifically "excellent" university is not compelling for collaboration to take place. This conclusion is also supported by the result that more distant RIUs in the further NUTS 2 region play a more important role than the very near RIU in the same NUTS 3 region. It is simply more likely to find a technological match within larger distances. Firms therefore have a geographically wide sense of the term "location factor" when potential R&D collaboration partners included.

The results do not differ substantially between selected subgroups of firms which often are of special interest to innovation policy makers such as SMEs, young firms, non-innovating firms, the knowledge-intensive manufacturing sector or city districts (*kreisfreie Städte*) compared to non-city districts (*Landkreise*). Together with the supposed high selectivity in the choice of potential collaboration partners we conclude that the geographical location of RIU should not be interfered by regional policy purposes. Following our results the requirement of technological proximity is more important than geographical proximity.

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