3 Agglomeration and FDI in East German Knowledge-Intensive Business Services

3.1 Introduction

The enlarged European Union (EU) is characterized by a heterogeneous economic structure across its countries and regions. Multinational enterprises (MNEs) and foreign direct investment (FDI) in science-based sectors can be considered as a driving force behind the spiky economic structure that puts capitals, large cities and metropolitan areas at the forefront of globalization. It seems that regional agglomerations of knowledge and capabilities attract FDI in knowledge-intensive services such as R&D and innovation. The extent and sectoral spread of these services FDI depends upon the position of the region in the geographical hierarchy within and across European countries (Cantwell and Iammarino 1998, 2000). So called ‘higher order’ regions that accumulate diverse technological competencies are more likely to attract foreign technology than other specialized regions (Cantwell and Iammarino 2000). This process has not only been confined to EU-15 countries; it became particularly visible during the economic transition process in the new EU members states (NMS) as well as in East Germany. In these economies, FDI has played a crucial role in economic restructuring and in the technological catching-up process. However, there is a heavy concentration of MNEs in urban areas. This particularly applies to the service sector (see Gauselmann and Marek 2012). Arguably the provision of knowledge-intensive business services (KIBS) plays a major role in this process.

In knowledge-based economies, knowledge-intensive services have become crucial for regional innovation performance. This development is reflected by the persistent growth of KIBS, which has shown to be among the most dynamic sectors in industrialized economies (see e.g. Murray, Kotabe, and Westjohn, 2009, or Doloreux, Freel, and Shearmur, 2010). In OCED countries, the absolute number of employees in business services has increased by around 40% between 1999 and 2007. In Germany, for example, this development was even more pronounced, growing by approximately 50% during the same period. As Simmie and Strambach (2006) note, the driving

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23 See OECD’s regional and sectoral employment figures. Business services: NACE Rev.1 Code 70 to 74.

24 See the Social Insurance Statistics of the German Federal Employment Office.
force behind the growth in KIBS has moved away from being cost-driven to being based on an increasing flexibility in the production system. Miles (2005) sees three major reasons why the KIBS sector has grown much faster than the rest of the economy: increasing outsourcing tendencies in specialized labor inputs, the internationalization of services, and a higher demand for new technologies (such as IT) and specific knowledge inputs (such as compliance with environmental regulations).

Due to their increasing impact on the technological capability of regions, KIBS are defined as facilitators, carriers or sources of innovation (see den Hertog 2000). The significant role played by KIBS in the regional innovation system and in competitiveness stems primarily from the indirect effect of providing intermediate inputs into the user sector, which implements the innovations (see e.g. Simmie and Strambach 2006).

In line with the literature, Shearmur and Doloreux (2008) observe that KIBS cluster spatially and highly depend on agglomeration economies. Despite improvements in communication technology, spatial proximity and the direct linkages with local clients are still necessary characteristics for the KIBS sector. This distance-sensitivity is mostly driven by the complexity and the high degree of customization of the knowledge-intensive services (see e.g. Muller and Zenker 2001). Despite their heterogeneous structures, Simmie and Strambach (2006) observe this phenomenon of spatial concentration and interregional disparities across European countries. The authors conclude that a specialization process is amplified by a cumulative learning process and knowledge-spillovers. Thus, it is apparently difficult for cities and regions to strengthen knowledge-intensive services and technologies which were not previously established. This is a relevant aspect especially in CEE transition economies, which were exposed to a distinct transition and industrial reconstruction process.

In the literature, only a few studies deal with the impact of location attributes on the development of KIBS in multi-regional studies (see e.g. Andersson and Hellerstedt, 2009, or Antonietti and Cainelli, 2008). This chapter aims to fill this gap by combining three research characteristics. Firstly, it focuses on the impact of agglomeration and the potential for the regional technology capability as determinants for the location decision of FDI in the dynamic KIBS sector. Furthermore, the focus on functional units, by choosing the regional level of the East German Raumordnungsregionen.

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25 East Germany consists of 22 RORs. The statistical unit of the RORs is constructed as functional units taking into account the commuting streams. In comparison with the NUTS classification, the size of RORs is between the NUTS-2-level and the NUTS-3-level. See e.g. Jindra (2011) p.38.
(ROR), provides insights into the self-reinforcing process of regional KIBS concentration. Secondly, Miles (2005) states that KIBS are spatially concentrated in few core metropolitan regions. This development is very pronounced in CEE transition economies. This distribution enables the analysis of the transition specific catching-up process, which depends on the exploitation of its knowledge potential rather than on acting as an extended workbench for West European economies (see Gauselmann and Marek 2012). Thirdly, the analysis combines enterprise data from the population of the IWH FDI Micro Database including 789 foreign and West German affiliates in the East German KIBS sector with a large dataset of the 22 East German RORs.

This chapter is organized as follows: Section 3.2 introduces the economic model behind the FDI location choice process. This is followed by the econometric theory that underlies the empirical analysis. Section 3.3 contains hypotheses from the economic theory and previous literature on KIBS and FDI location. The data used in the regressions and stylized facts are presented in Section 3.4. Section 3.5 provides a discussion on the empirical results, which are summarized in the concluding Section 3.6.

3.2 Theoretical Background

Following Basile, Castellani, and Zanfei (2008), an investor’s choice of location is a three-step decision. Firstly, the enterprise decides whether to serve a foreign market. In the second step, the investor decides how to serve the market. This investment can be implemented through exports, joint ventures, licensing or foreign direct investment. Finally, the investing company chooses a region for its foreign investment. In a firm-level framework, this chapter analyses the location choice of an investor, who has already decided to invest in East Germany. Thus, the investor faces the decision of choosing one of the \( j \in J \) regions as the location for its foreign investment.

3.2.1 Economic Theory

In the empirical literature, the location choice approach of Head and Mayer (2004) has been used in many studies. This approach is based on the Dixit-Stiglitz model of

\[26\] The figures of the IWH-FDI Micro Database show that 50% of East German foreign investments in the KIBS sector are located in Berlin, 60% of Polish KIBS FDI are located in the region of Warsaw and 75% of the Czech KIBS FDI are located in Praha. The data can be made available upon request.
monopolistic competition (see Dixit and Stiglitz 1977), which links the production cost function with a utility-maximizing demand function of a representative individual. The Dixit-Stiglitz model was advanced by Venables (1996) and Krugman’s (1991) New Economic Geography (NEG), who emphasize the importance of agglomeration economies on regional development and attracting investment from abroad. On the basis of the assumption that an investor chooses the region \( j \) for its investment in sector \( k \) that promises the highest profits over a finite time horizon, the model of Head and Mayer (2004) founds on the following profit function:

\[
\pi_{jk} = (1 - t_j) \sum_{m=1}^{M} [(p_{jkm} - c_{jkm})x_{jkm}]
\]

(3.1)

In this profit function, the firm’s profit depends on the demand for good \( x \) in market \( m \), its price \( p \), costs \( c \) and the imposed taxes \( t \). Through a two-step maximization based on a constant elasticity of substitution (CES) function, the optimal demand for good \( x \) and the optimal monopoly price can be replaced by the following term:

\[
x_i = \frac{a(P)Y \cdot P^{\sigma-1}}{p_i^\sigma}, \quad p_i = \frac{\sigma}{\sigma - 1}c.
\]

(3.2)

Thus, the optimal demand for \( x \) depends on the share \( a(P) \) of the total income \( Y \) spent on good \( x \), the price index \( P \) and the elasticity of substitution \( \sigma \), which is assumed to exceed unity. The insertion of (3.2) into (3.1) and the assumption that the investor can only serve the plant location \( j \) and its neighboring regions, which is indicated by a dummy variable \( \phi_{jm} \), leads to the following profit function:

\[
\pi_{jk} = (1 - t_j) \sum_{m=1}^{M} \left[ \frac{1}{\sigma - 1} c_{jk}\phi_{jm} \frac{a_m(P_m)Y_mP_m^{\sigma-1}}{(\sigma - 1)^{\frac{\sigma}{\sigma - 1}} c_{jk}\phi_{jm}^\sigma} \right]
\]

(3.3)

For the ongoing transformation, the factor of demand \( a_m(P_m)Y_m \) and the price index \( P_m^{\sigma-1} \) is defined as the market access \( MA_m \). The costs of production \( c_{jk} \) depend on the sectoral wage rate \( w_{jk} \), transaction costs between the investor and the subsidiary occurring from distance between the investor’s home country and the region of investment, \( d_j \), and a productivity factor \( A_{jk} \). This productivity factor depends on the regional education level \( E_j \), the skill-level of the work force \( O_j \), the economic

\[27\] See e.g. Gauselmann and Marek (2012) for a detailed description of the derivation the profit function.
diversity $H_j$, agglomeration variables such as the sectoral specification $S_{jk}$, and the technological performance of the regional economy $T_j$, in region $j$. Following Brülhart, Jametti, and Schmidheiny (2012), it is assumed that marginal costs are influenced by factorizing the independent variables, and weighting their influence on the production costs by means of variable-specific elasticities.

$$c_{jk} = w_{jk} d_j^2 A(S_{jk}, T_j, H_j, O_j, E_j)$$  \hspace{1cm} (3.4)

After inserting (3.4) and $MA_m$ into (3.3), the profit function can be transformed into the following log-linear empirical function with the coefficient vector $\beta$ and the error term, $e_{jk}$:

$$\pi_{jk} = \beta_0 + \beta_1 \ln t_j + \beta_2 \ln w_{jk} + \beta_3 \ln d_j + \beta_4 \ln E_j + \beta_5 \ln S_{jk} + \beta_6 \ln T_j + \beta_7 \ln O_j + \beta_8 \ln H_j + \beta_9 \ln \left( \sum_{m=1}^{M} \frac{MA_m}{\phi_{jm}} \right) + e_{jk}.$$  \hspace{1cm} (3.5)

### 3.2.2 Econometric Approach

The profit function (3.5) is the basis for the conditional logit estimation, analyzing the location choice of FDI in the East German KIBS sector. In this context, the location choice founds on a stochastic utility maximization process for an enterprise $i$, which results from the choice of region $j$ as a plant location selected from $J$ possible regions of the sample. In this analysis, the deterministic part of the profit function is made up of alternative-specific regressors $z_{ijk}$. The stochastic and unobservable part of the equation is represented by an error term $e_{ijk}$.

$$\pi_{ijk} = z'_{jk} \beta + e_{ijk}.$$  \hspace{1cm} (3.6)

As described above, the investor chooses the region $j$, which exceeds the expected profits of all the other regions $l \in J$, with $l \neq j$. For each investment decision, the sample’s set of regions is the dependent variable in this context. The chosen region equals one, the remaining regions take on a value of zero. This assumption leads
to the following estimation of the model’s choice probabilities $P_{ijk}$ (see e.g. Greene 2003):

$$P_{ijk} = \text{Prob}(\pi_{ijk} > \pi_{ilk}, \forall l \neq j) = \text{Prob}(e_{ijk} > x'_{ilk}\beta - x'_{ijk}\beta + e_{ilk}, \forall l \neq j). \quad (3.7)$$

By assuming a type I extreme value distribution, the probability function (3.7) can be transformed into the conditional logit equation:

$$P_{ijk} = \frac{\exp(x'_{ijk}\beta)}{\sum_{l=1}^{J} \exp(x'_{ilk}\beta)}. \quad (3.8)$$

3.3 Hypotheses

In the literature, a large number of studies have investigated the impact of agglomeration economics on regional FDI inflows. Among others, Bronzini (2007) stresses the distinction within agglomeration externalities between localization (sectoral specialization) and urbanization (diversification). On the one hand, the theoretical foundation of specialization effects bases on Marshall (1920), who stresses that agglomeration effects are essentially made up of labor market specialization, knowledge-spillovers and supplier linkages in a specific sector. On the other hand, Jacobs (1969) points out that in a diversified economy a large variety of goods can promote the transfer of knowledge and productivity growth. The majority of empirical studies analyzing the impact of agglomeration economies on the regional attractiveness for FDI, focuses on the manufacturing sector. These studies predominantly show that the attraction of foreign investors depends positively on localization (see e.g. Basile, Castellani, and Zanfei, 2008, or Crozet, Mayer, and Mucchielli, 2004). Compared to localization, the impact of urbanization was less frequently considered in FDI location choice studies. However, some studies show a positive impact of urbanization on the attractiveness for FDI (see e.g. Guimarães, Figueiredo, and Woodward, 2000, or Barrios, Görg, and Strobl, 2006).

For the KIBS sector, Antonietti and Cainelli (2008) sum up that agglomeration externalities in the KIBS sector are driven by knowledge-spillovers, labor-pooling,
and input sharing. Furthermore, Andersson and Hellerstedt (2009) point out a path-dependency for the development of KIBS when the relevant sector has already been established. Even within the KIBS sector there is evidence of labor market pooling in the area of investment. For the United Kingdom and Germany, this result is confirmed by Simmie and Strambach (2006). They show that each region is characterized by a relatively stable and specific employment structure across different KIBS branches. These KIBS specific results lead to the first hypothesis:

**Hypothesis 1:** Localization increases the regional attractiveness for FDI throughout the KIBS sector.

In addition to localization effects, Cantwell (1989) states that labor-pooling and supplier-linkages also result in an increasing potential for knowledge-spillovers. Following Cantwell and Iammarino (1998), this potential is fostered by tacit knowledge resulting from learning dynamics and knowledge exchange in a region. This interaction can establish a stable mechanism of knowledge accumulation which raises the region’s attractiveness for an investor.

For German regions that are home to at least one university, Audretsch and Lehmann (2005) show that entrepreneurial activities in high-tech sectors are positively influenced by the performance of the local university and other regional possibilities of accessing knowledge. The results of the detailed sectoral analysis are in line with Andersson and Hellerstedt (2009), who observed that R&D and a higher educational background of the labor force positively influence the development of KIBS. This leads to the second hypothesis:

**Hypothesis 2a:** The potential for knowledge-spillovers of a region (measured by R&D, human capital, education and patents) raises the attractiveness for FDI in the regional KIBS sector.

As Audretsch (1998) notes, R&D is the most important source for knowledge production followed by human capital, workforce skills and the presence of scientists and engineers. Furthermore, Audretsch (1998) notes that R&D is closely linked to the region’s performance in terms of patent applications.

**Hypothesis 2b:** In the analysis of location factors for KIBS FDI, R&D and patents are the most important factors controlling for the technological capability.
3.4 Data

In order to analyze the factors determining the decision of a foreign enterprise where to invest in East Germany, the analysis is based on micro data on foreign direct investment from the IWH FDI Micro Database. This database contains detailed firm-level data including information on the ownership structure. In this sample a company is considered as foreign owned, if at least one foreign investor owns a direct company share of at least 10% or a total share of at least 25%. Since West German investments were crucial for the East German transition process, the sample of FDI is supplemented by 142 investments from West Germany.\(^{29}\)

This definition of FDI leads to a sample size of 789 enterprises in the KIBS sector having either a foreign or a West German investor, which meet the relevant criteria. These enterprises are distributed across 22 Raumordnungsregionen (ROR) in East Germany as displayed in Figure 3.1a and Table A.5 of the Appendix. The concept of RORs accounts for commuter movements between peoples’ residence and work place. Thus, this framework can be considered as functional and appropriate in order to reflect agglomeration economies.\(^{30}\) Nearly the half of the 789 investments are located in Berlin, whereas the other spatial concentration of KIBS FDI can be found in the RORs of Oberes Elbtal/Osterzgebirge, Westsachsen, Magdeburg, Ostthüringen, and Havelland-Fläming.

In order to model the location decision of an investor to invest in the East German KIBS sector and to merge the company data with regional and sectoral characteristics, the sample contains the following firm-level information:

- **Location of investment \( j \):** Each enterprise is allocated to one of the 22 East German ROR using the postal code of the enterprise’s registered address.

- **Branch of sector \( k \):** The sectoral classification of the enterprise is in accordance with the European Union’s NACE Rev.1.1. 2-digit classification. In this chapter, the definition of the KIBS sector relies on Miles (2005). Thus, the sample includes enterprises belonging to the sectors classified by the NACE Rev.1.1. 2-digit codes 72 (computer and related activities), 73 (R&D) and the majority of 74 (other business activities).

\(^{29}\) See Günther, Gauselmann, et al. (2011) for more detailed information.

\(^{30}\) See e.g. Jindra (2011).
Figure 3.1: Spatial distribution of FDI, employment, and patent registrations in the KIBS sector per ROR

a) Frequency  b) Localization Quotient  c) Patents

- **Date of investment t**: The date of investment is proxied by the date the enterprise was entered in the local register of commerce. To avoid endogeneity of the investment, it is assumed that the investment decision was made the year before the enterprise was registered.\(^\text{31}\) Due to data availability issues for the regional variables, the analysis of investment decisions is restricted to a time period between 1996 and 2010.

- **Investor’s origin**: The country where the investor is registered.

An enterprise’s location decision is modelled by combining the enterprise data described above with regional data from the German Federal Statistics Office (StaBu), the Federal Employment Agency (BA), the European Patent Office (EPO), Eurostat, the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) and input-output tables of the World Input-Output Database (WIOD). In the model, each investor faces the decision to choose the region out of the sample’s 22 regions, which promises to maximise the enterprise’s profits.

The period of time of this analysis is restricted by the availability of regional data, which are predominantly not available before 1995. The regional variables are divided into three groups: agglomeration, endowment and other regional factors.

\(^{31}\) See e.g. Jindra (2011).
**Agglomeration:** In order to analyze the impact of regional agglomeration on an enterprise’s location choice, the following measures are included in the analysis. Firstly, the localization is measured by the Localization Quotient (LQ) of sector $k^{32}$ in region $j$: $^{33}$

$$LQ_{jk} = \frac{emp_{jk}/emp_j}{emp_k/EMP} \quad (3.9)$$

The denominator of (3.9) is the share of employees working in sector $k$, $emp_{jk}$, of the total employment figure in region $j$, $emp_j$, whereas the numerator is defined as the share of employees working in sector $k$ in all regions of the sample, $emp_k$, of the total employment figure in the sample, $EMP$.

Secondly, the variety of available inputs in region $j$ depends on the regional economic diversity, which is measured by the Herfindahl Index, $herf_j$:

$$herf_j = \sum_{k=1}^{K} \left( \frac{emp_{jk}}{\sum_{l=1}^{K} emp_{jl}} \right)^2 , \quad (3.10)$$

The Herfindahl-Index is constructed by the sum of squared employment shares over all NACE Rev.1.1. 2-digit codes in region $j$ and does not differ across sectors. As can be seen in (3.10), a diversified economy in region $j$ coincides with a low value in this index. The Herfindahl-Index as well as the Localization Quotient refer to the Social Insurance Statistics provided by the Federal Employment Agency (BA).

Thirdly, KIBS are considered as important input suppliers for the manufacturing industry. In order to control for the presence of the manufacturing in region $j$ and for supplier linkages between KIBS and the manufacturing industry, a manufacturing linkage index, $MLI_{jk}$, is included in the regression.

$$MLI_{jk} = \sum_{s=1}^{S} a_{ks}emp_{sj} \quad (3.11)$$

The regional $MLI_{jk}$ is the sum of the following factors across all manufacturing sectors $s \in S$ (NACE Rev.1.1. codes 10 to 37): the share of inputs in manufacturing

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32 Since the enterprises are classified by NACE Rev.1.1. 2-digit codes, the sample is split into 3 KIBS sectors. This implies that the localization coefficient of region differs across these sectors.

33 See e.g. Shearmur and Doloreux (2008).
### Table 3.1: Summary of regional variables and their sources

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>LQ</td>
<td>Localisation Quotient</td>
<td>BA/own calculation</td>
</tr>
<tr>
<td>herf</td>
<td>Herfindahl Index</td>
<td>BA/own calculation</td>
</tr>
<tr>
<td>MLI</td>
<td>Manufacturing Linkage Index</td>
<td>BA/WIOD/own calculation</td>
</tr>
<tr>
<td>patent</td>
<td>Patent registrations by inventors</td>
<td>EPO</td>
</tr>
<tr>
<td>rnd</td>
<td>Proportion of employees with an R&amp;D occupation</td>
<td>BA/own calculation</td>
</tr>
<tr>
<td>hrsto</td>
<td>Proportion of employees with a technical-scientific occupation</td>
<td>BA/own calculation</td>
</tr>
<tr>
<td>stud</td>
<td>University students per 1,000 inhabitants</td>
<td>BBSR</td>
</tr>
<tr>
<td>gdp</td>
<td>Regional GDP in Mio. €</td>
<td>BBSR</td>
</tr>
<tr>
<td>mp</td>
<td>Market Potential (aggregate GDP of neighboring RORs)</td>
<td>BBSR/own calculation</td>
</tr>
<tr>
<td>STunemp</td>
<td>Unemployment rate in % excluding long-term unemployed</td>
<td>Eurostat</td>
</tr>
<tr>
<td>wage</td>
<td>Average sectoral wage per full-time equivalent</td>
<td>Federal Statistics Office</td>
</tr>
<tr>
<td>tax</td>
<td>Average regional business tax rate (Gewerbesteuerhebesatz)</td>
<td>BBSR</td>
</tr>
<tr>
<td>dist</td>
<td>Euclidean distance between the major city of the region and the capital of the investing country</td>
<td>Own calculation</td>
</tr>
</tbody>
</table>

sector $s$ stemming from the KIBS sectors $k$ of all domestic inputs in sector $s$, $a_{ks}$, and the share of employees working in manufacturing sector $s$.\(^{34}\)

**Endowment:** The regional patent activity collected by the European Patent Office captures the technological performance and the extent of knowledge-spillovers in region $j$. The patent applications are the basis for the calculation of the patent measurement depending on the origin of the inventors of the registered patents.\(^{35}\)

Since the European Patent Office provides patent data for the technology classes and not for industrial sectors, the analysis refers to the aggregate patent activity in region $j$. In addition to the patent measurement, the regional proportion of employees with an R&D occupation ($\textit{rnd}_{j}$) and the share of employees with a scientific-technical occupation ($\textit{hrsto}_{j}$) serve as a control variables for the regional presence of human capital.\(^{36}\) The potential for human capital is reflected by the region’s proportion of

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\(^{34}\) The input share is derived on the basis of annual input-output tables provided by WIOD. Since the WIOD provides only aggregated input information for the sectors 71 to 74, the $\textit{MLI}_{jk}$ does not differ across the 3 KIBS sectors, but over regions and time. Furthermore, the input-output tables do not vary across regions implying that the differences over the regions at time $t$ stem from the employment shares.

\(^{35}\) A large fraction of patent applications has more than one inventor. In order to avoid an overweight of multi-inventor patents, the patent measurement refers to a fractional counting. See Frietsch, Schmoch, et al. (2011).

\(^{36}\) The classification for R&D employees refers to Bade et al. (2004), whereas HRSTO is defined according to the OECD (1995). Both measurements are based on the occupation terms used by the Germany’s Federal Statistical Office.
university students (including students at universities of applied science) per 1,000 inhabitants.

**Other regional variables:** In addition to the agglomeration and endowment variables described above, the following variables are included in the analysis. Since market access enables the fixed costs of the investment to be recovered, the market size is expected to raise the regional attractiveness for FDI. This is done by including the regional GDP as well as the accumulated GDP of the neighboring RORs. In terms of the potential costs of investment, the location decision also takes the sectoral wage rate, the unemployment rate (excluding long term unemployed), and the average regional business tax rate (Gewerbesteuerhebesatz) into consideration. The distance to the investor’s home country and the region of investment is included in order to capture transaction costs of distance between the investor and the affiliate. The distance is calculated by the Euclidean distance between the capital of the investor’s home country and the major city of the region. Finally, dummy variables for the Federal States (Bundesländer) are included in the regressions.

### 3.5 Empirical Results

The results of the regressions are reported in Table 3.2. The first four columns contain the regression results for the agglomeration and endowment variables. The last three columns contain the regression output for the complete set of explanatory variables; the whole sample in column (5) and two subsamples in column (6) (excluding West German investors) and (7) (excluding Berlin).

When only the agglomeration variables are taken into consideration, the Localization Quotient, and Herfindahl-Index are highly significant and in line with the literature that the regional attractiveness for FDI increases with localization and economic diversity. The effect of the linkage to the manufacturing sector is surprisingly negative. This picture partly changes when endowment variables are included in the regression. Localization remains positively significant, whereas manufacturing linkage loses its explanatory power when the human capital variables, $hr_{stoj}$ and $stud_{j}$, are included. The impact of the economic diversification, $her_{fj}$, turns insignificant across the columns (2) to (7).

These results confirm Hypothesis 1 that a region’s attractiveness in terms of KIBS FDI increases with potential intra-industry linkages. This finding is in line with the
theory and empirical results described above and provides additional support for the proclaimed path dependency in the East German KIBS sector. Furthermore, the results suggest that the potential for co-location to the manufacturing industry does not raise the attractiveness of a region to host KIBS FDI, if ROR are chosen as the regional level of analysis.\(^{37}\)

### Table 3.2: Conditional Logit Estimation Results

<table>
<thead>
<tr>
<th></th>
<th>Agglomeration</th>
<th>Agglomeration and Endowment</th>
<th>complete</th>
<th>FDI</th>
<th>exBerlin</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln LQ )</td>
<td>0.743***</td>
<td>0.363***</td>
<td>0.368***</td>
<td>0.308**</td>
<td>0.446***</td>
</tr>
<tr>
<td></td>
<td>(0.122)</td>
<td>(0.135)</td>
<td>(0.131)</td>
<td>(0.139)</td>
<td>(0.167)</td>
</tr>
<tr>
<td>( \ln \text{man}_\text{link} )</td>
<td>-1.407***</td>
<td>-0.410</td>
<td>0.075</td>
<td>-0.856**</td>
<td>-0.853**</td>
</tr>
<tr>
<td></td>
<td>(0.306)</td>
<td>(0.415)</td>
<td>(0.380)</td>
<td>(0.333)</td>
<td>(0.404)</td>
</tr>
<tr>
<td>( \ln h_f )</td>
<td>-2.591***</td>
<td>0.459</td>
<td>0.097</td>
<td>-0.064</td>
<td>0.378</td>
</tr>
<tr>
<td></td>
<td>(0.062)</td>
<td>(0.777)</td>
<td>(0.783)</td>
<td>(0.723)</td>
<td>(0.924)</td>
</tr>
<tr>
<td>( \ln \text{patent} )</td>
<td>0.392***</td>
<td>0.396***</td>
<td>0.276**</td>
<td>0.255**</td>
<td>0.251**</td>
</tr>
<tr>
<td></td>
<td>(0.077)</td>
<td>(0.073)</td>
<td>(0.109)</td>
<td>(0.127)</td>
<td>(0.112)</td>
</tr>
<tr>
<td>( \ln \text{rnd} )</td>
<td>0.160</td>
<td>0.963***</td>
<td>0.963***</td>
<td>0.909**</td>
<td>0.943***</td>
</tr>
<tr>
<td></td>
<td>(0.547)</td>
<td>(0.328)</td>
<td>(0.356)</td>
<td>(0.384)</td>
<td>(0.343)</td>
</tr>
<tr>
<td>( \ln \text{hrsto} )</td>
<td>3.130*</td>
<td>5.172***</td>
<td>0.097</td>
<td>-0.799</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.728)</td>
<td>(1.097)</td>
<td>(1.018)</td>
<td>(1.161)</td>
<td>(1.707)</td>
</tr>
<tr>
<td>( \ln \text{stud} )</td>
<td>0.018</td>
<td>0.097**</td>
<td>0.038</td>
<td>0.041</td>
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</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.041)</td>
<td>(0.292)</td>
<td>(0.419)</td>
<td>(0.310)</td>
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<tr>
<td>( \ln \text{gdp} )</td>
<td>-0.270</td>
<td>-0.220</td>
<td>0.387</td>
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<tr>
<td></td>
<td>(0.287)</td>
<td>(0.328)</td>
<td>(0.291)</td>
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</tr>
<tr>
<td>( \ln \text{mp} )</td>
<td>0.108</td>
<td>0.124</td>
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<tr>
<td></td>
<td>(0.180)</td>
<td>(0.203)</td>
<td>(0.181)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln \text{tax} )</td>
<td>-0.711</td>
<td>0.093</td>
<td>-0.799</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.018)</td>
<td>(1.161)</td>
<td>(1.707)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln \text{wage} )</td>
<td>2.176</td>
<td>5.459</td>
<td>5.813</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.287)</td>
<td>(4.831)</td>
<td>(4.934)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln \text{STunemp} )</td>
<td>-0.471</td>
<td>-0.633</td>
<td>-0.255</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.617)</td>
<td>(0.685)</td>
<td>(0.647)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \ln \text{dist} )</td>
<td>-1.342***</td>
<td>-1.342***</td>
<td>-0.384</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.292)</td>
<td>(0.419)</td>
<td>(0.310)</td>
<td></td>
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</tr>
</tbody>
</table>

Conditional Logit Estimation. Dependent variable: Enterprise’s location choice for region \( j \) among 22 Raumordnungsregionen. Standard errors in parentheses. Significance level: ***\( p < 0.01, **p < 0.05, *p < 0.1.\)

Dummy variables for Federal States are not shown in the table.

The impact of the endowment variables is analyzed in columns (2) to (4). In column (2), all endowment variables are included. In order to account for potential multicollinearity, column (3) and (4) contain only a pair of the endowment variables. When all endowment variables are included in the regression, the regional patent activity and the share of employees with a scientific-technical occupation have a highly significant impact, whereas the share of R&D occupation and the student-population ratio do not show any significance. In columns (3) and (4) the four variables are split into two groups: patent activity and R&D employment on the one hand, and

\(^{37}\) The results remain stable when the manufacturing linkage is replaced by the share of employees working in the manufacturing sectors. These results are available upon request.
scientific-technical occupation and student share on the other hand. The impact of each variable turns or remains positively significant. Thus, hypothesis 2a can be accepted.

As shown in Table A.6 of the appendix the endowment variables are positively correlated with each other, but no correlation coefficient exceeds the value 0.64. However, the variables can be exposed to multi-collinerativity. When controlling for the impact of the pairs of endowment factors in column (3) and (4) by means of likelihood-ratio tests (LR-Test), the test statistics clearly show that patent activity and R&D are the driving forces among the endowment variables. The LR-Test between the unrestricted (column 2) and the restricted model (column 3), which sets the coefficient of patents and R&D equal to zero, show a Chi-Square test statistic of 35.69 indicating a p-value of 0.000 with two degrees of freedom. This result rejects the LR-Test hypothesis that patent applications and R&D do not have any impact. When setting the coefficients of scientific-technical occupation and student share equal to zero, the LR-Test between the regressions of column (2) and (4) shows a Chi-Square test statistic of 3.37 and a p-value of 0.185 with two degrees of freedom. Hence, the hypothesis of the LR-Test, that both variables do not influence the regression, cannot be rejected. These results confirm hypothesis 2b, that the regional patent activity and the share of employees working in R&D professions are the most important knowledge spillover factors for the regional attractiveness for KIBS FDI in East Germany.

When including other regional control variables, the impact of agglomeration and endowment variables is not affected. The control variables’ impact is predominantly insignificant, except for the distance between the investor and the affiliate. An LR-Test between the complete sample and the regression in column (4) shows a Chi-Square test statistic of 11.90 and a p-value of 0.064 with six degrees of freedom. Thus, the hypothesis that the six control variables do not have a significant impact on the regression outcome cannot be rejected. This result is not in line with most of the other FDI location choice studies, which predominantly attest a dominant role of regional GDP on the attractiveness of a region for FDI.

The estimation results do not change substantially when West German investors or investments located in Berlin are excluded from the sample. With respect to the former subsample, a Hausman-Test, comparing the estimates between the whole sample and the subsample, shows a p-value of 0.021. Thus, the hypothesis of a non-systematic difference between both (sub)-samples can be rejected. A Hausman-Test,
checking for differences between the whole sample and the subsample excluding Berlin, reports a p-value of 0.241 and does not reject the hypothesis. Thus, the estimates of both sub-samples in column (5) and (7) do not differ systematically, although 48.9% of the KIBS FDI investments are located in the German capital. Hence, the estimates can be considered as robust.

3.6 Conclusions

Arguably the provision of knowledge-intensive business services through multinational firms mainly localized in urban areas played an important role the catching-up process of transition economies in Central and Eastern Europe as well as East Germany. This chapter analyses the impact of location determinants - agglomeration and endowment effects in particular - on the location choice of MNEs in the East German KIBS sector. In a conditional logit model, this chapter investigates the location factors of 789 enterprises, which have either a foreign or West German investor, over the period between 1996 and 2010. The regional disaggregation refers to the subdivision of 22 East German Raumordnungsregionen.

The results show that agglomeration advantages are among the driving forces for the location of multinational firms in the East German knowledge-intensive business service sector. Regional localization advantages, illustrating the potential for intra-industry linkages in the region of investment, prove to be one of the most important pull factors. Furthermore, the analysis does not find any evidence that neither a diversified economic structure nor co-location to the manufacturing industry raise the probability to attract a foreign investor in the KIBS sector. However, the impact for the manufacturing linkage is predominantly negative.

The impact of the region’s technological capability, captured by measurements of human capital, the educational background of the workforce, patent activity, and R&D, is significantly positive. A detailed analysis of these endowment factors shows that R&D and the regional patent activity, which is closely related to R&D, are the most important endowment variables for investments in the East German KIBS sector. This result is in line with Audretsch (1998), who stated that R&D is the most important source for knowledge production.

Compared to the majority of FDI location choice studies, which predominantly focus on manufacturing FDI, the market size measured as regional GDP does not have
an impact on the regional attractiveness for FDI. This result can be considered as
a sector-specific attribute for KIBS indicating that the location decision depends
on the availability of highly specialized inputs rather than on the market access
possibilities.

The findings provide an explanation for the spatial concentration in the knowledge-
intensive business services sector. As outlined by the KIBS theory (see e.g. Antonietti
and Cainelli 2008), the development of KIBS is contingent upon labor pooling and
R&D related activities. In recent literature, the impact of these externalities was
proven to be relevant for the start-ups of KIBS enterprises. This chapter confirms
this relationship also in the context of FDI into KIBS. Hence, it provides additional
evidence that KIBS develop faster in an environment with a potential for intra-
industry linkages and a high regional capability for technological interactions, and
serves to explain path dependency in the KIBS sector.

Although the East German economy is characterized by a heterogeneous composition
of regions, it is important to keep in mind that the analysis is restricted to a single
post-transition economy. Thus, the results do not necessarily allow implications
for other economies. Furthermore, the decomposition of East Germany into 22
Raumordnungsregionen also needs to be taken into consideration when interpreting
the results. Especially, the negative impact of co-location to the manufacturing
industry could change, if a lower of degree of regional disaggregation was chosen.

As shown above, CEE economies have taken differing transition paths. This especially
holds for the comparison between NMS of the EU and former Soviet CIS countries.
Therefore, the investigation of inward FDI in Russia provides a complementary
picture to the studies in chapter 2 and 3. On the one hand, in both regions (NMS
and CIS) large urban agglomerations are among the major recipients of FDI. On the
other hand, the distribution of FDI across Russian regions is highly concentrated
in comparison to the NMS. Furthermore, the access to core industries is highly
regulated in the Russian Federation. Among these sectors, the mining industry is
fundamental for the Russian economy. Despite the strict access for foreign investors,
a distinct share of FDI is located in Russian regions, which are dominated by the
mining sector and natural resources. Therefore, it is compelling to focus on the role
of natural resources, when investigating the determinants of FDI in Russian regions.