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The impact of regional and functional integration on the post-entry performance of knowledge intensive business service firms

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Abstract

Knowledge intensive business service firms (KIBS) are an important element of modern economies and thus attracting increasing interest in scientific research. In the existing literature it is argued that due to the important role of knowledge, innovation and user-producer interaction in the KIBS sector, functional and regional integration are particularly decisive for the firms' post-entry development. Nevertheless, few existing studies are dealing with questions of entrepreneurship in the KIBS sector using micro firm data. This contribution gives an empirical analysis of the determinants of post-entry performance of KIBS in three German metropolitan regions. Due to the lack of suitable firm micro data, telephone interviews with 547 firm founders have been conducted. By applying multivariate estimation methods it can be shown that functional linkages to knowledge providers, customers and co-operation partners indeed matter for the performance of young KIBS. Regarding regional integration, however, especially a high diversification of spatial reach is proved to be crucial.

JEL-Classification: D21, J23, L80, O30

Keywords: Employment growth; Entrepreneurship; Entry; Innovation; Knowledge-intensive business services; Post-entry performance

1 Introduction

This paper gives an empirical analysis of the determinants of post-entry performance of newly founded knowledge intensive business service firms (KIBS) using a newly created firm micro-level dataset. Special emphasis is met on the role of a KIBS functional and regional integration on its post-entry growth. In current research, notwithstanding the richness of studies about KIBS and about entrepreneurship, there is a lack of empirical studies linking these two fields of research as well as a lack of studies using firm micro data for an analysis of the determinants of post-entry growth in the KIBS sector.

First, studies about KIBS are predominantly concerned with the role of KIBS (and services in general) for economic development and change, with the nature and significance of innovation processes in the service sector, or with the inter-firm relationships of KIBS. Entrepreneurship in the KIBS sector is hardly ever discussed. This is all the more astonishing as the emergence of the KIBS sector is a very recent economic phenomenon and as foundations of new companies play a central role.

Second, entrepreneurship research has undergone a somewhat inflationary development within the last few years, at least in the European context. However, although it is well-known that the service sector accounts for a considerable part of economic development and change and thus for firm foundations (Almus et al. 2001), there is an overwhelming bias in existing entrepreneurship research towards the manufacturing sector (e.g. Wagner 1994, Honjo 2004, Strotmann 2002, 2003) which is primarily the result of a lack of suitable micro data for the service sector. Moreover, a lot of studies examining the post-entry performance of newly founded firms do this either by studying sets of highly aggregated factors or on the basis of very small samples using qualitative methods.[1] The only examples explicitly examining newly founded KIBS are – to the best of our knowledge – the publications presented by Almus et al. (2001) and by Santarelli/Piergiovanni (1995) which are based – in contrast to our study – on aggregate regional data. For a deeper understanding of the ongoing processes in the KIBS sector,

[1] There is a wide range of studies in the field of business administration examining the success factors of newly founded firms (e.g. Cooper 1985, Lechner/Dowling 2003). Most of these studies are based on small numbers of case studies. Although this is very insightful in certain respects, especially on the firm level in strategic research, it is very difficult to generalise the results of these studies. Furthermore, these studies use the term "competitiveness" synonymous for success.

and certainly with regard to its obvious importance, it seems reasonable to gain deeper insights into the determinants of a KIBS post-entry growth.

We therefore have conducted an empirical study examining the determinants of the development of newly founded KIBS. In autumn 2003, 547 firm founders in three German metropolitan regions were asked about the process of their firm's foundation, the development of their firm, as well as about co-operation, market, knowledge, and proximity.

This paper is organised as follows: In section 2, the conceptual framework will be presented in three paragraphs: the characteristics of KIBS, the determinants of the post-entry performance of newly founded firms, and the special role of functional and regional integration for the development of start-ups. Dataset and methodology will be outlined in section 3. The empirical results are the content of section 4. Section 5 concludes.

2 Conceptual framework: The post-entry performance of KIBS

As no genuine examination of the post-entry performance of start-ups in the KIBS sector exists, it seems useful for a comprehensive approach, to converge the problem analytically from existing research (1) into KIBS and (2) the post-entry performance of start-ups. The extensive literature describing and analysing the characteristics of KIBS like innovation and integration, user-producer interaction, etc. can be taken into consideration. As KIBS are by definition innovative and, at least to some extent, technology-based, literature on success factors of new technology-based firms (NTBFs) and innovative enterprises may apply. In linking these two rather well researched fields, hypotheses about the determinants of the post-entry performance of KIBS can be deduced. In the course of our theoretical argumentation we will emphasise the role of functional and regional integration as factors influencing the development of newly founded KIBS, as they are supposed to be of particular importance in this sector.

2.1 What is special about KIBS?

Especially in developed countries, there has been a large dissemination and growth of producer and business services during the past few decades. The causes for that phenomenon are manifold, but they are mostly believed to be an outcome of an

increasing division of labour, specialisation, and the growing flexibility of production processes (Santarelli/Piergiovanni 1995). These developments combine several sub trends like shifts in management philosophy (lean production, outsourcing, core competencies), changes in the structure of demand, as well as increasing unevenness in the application of new technologies to product and process innovation (Miles 2003). In the course of these processes the shortening of product life cycles and an increasing role of knowledge and innovation can be observed. With a remarkable increase in the number of firms, firm foundation rates, and employees, KIBS are believed to be a main driving force of technological change and economic progress (Czarnitzki/Spielkamp 2000, Koch/Stahlecker 2004, Wiig/Aslesen 2003).

KIBS are characterised by their knowledge intensity and their customer orientation. They provide knowledge-intensive services to other firms or organisations (and not to private households) (Almus et al. 2001). The knowledge intensity can be measured by input factors (mostly by the qualification structure of the employees or R&D expenditures) or by output factors like innovations (Audretsch 2002, Haas/Lindemann 2003).[2] However, in order to assess KIBS in quantitative studies, the Standard Industry Classification was mostly applied, and there is a certain consensus in the literature about the included sectors and branches (for an overview, see Koch/Stahlecker 2004) that should be included. Generally, it is differentiated between *Technical KIBS* (T-KIBS), for instance software providers, engineering consultants, and architects, and *Professional KIBS* (P-KIBS) like accountants, lawyers, and business consultants (Nählinder/Hommen 2002).

KIBS are innovative firms by definition.[3] One of the most important features of KIBS is the close interaction between the firms and their customers in innovation processes (Gallouj/Weinstein 1997). As KIBS mostly provide non-material, intangible, and highly customised services, their products are specialised expert knowledge, competencies in research and development in applied problem solving. The provision of such services requires cumulative learning processes, which can only be realised by in-depth interaction between service supplier and client (Strambach 2002). Another explanation

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[2] Especially the output factors are difficult to measure, as most innovative services are not patented. Furthermore, it has to be mentioned that "the definition of knowledge-intensive services is a relative affair" (Miles et al. 1995).

[3] Similar to the measurability of the knowledge intensity, the problem occurs when measuring innovativeness. This is more serious as services are usually not patent protected.

for this interaction is the nature of innovation processes in the modern economy. Since the emergence of evolutionary concepts explaining technological change (Nelson/Winter 1982), innovation is no longer seen as a linear sequence from invention to commercialisation, but rather as an interactive process involving interaction and feedback loops between various actors (Isaksen 2003).[4] Thereby, it is no longer the purely technical quality and the allocation of resources that matter for the successful development of an innovation, but rather the quality of communication, exchange, and interaction between various actors (Johannisson 1998). KIBS play an important role in these processes of assuming and optimising logistic, marketing, controlling, and management tasks for other organisations. KIBS act, on the one hand, as external knowledge sources for their client firms and, on the other hand, they are not only auxiliary actors in innovation processes but are becoming independent innovation creators (Gallouj/Weinstein 1997, Muller/Zenker 2001).

To summarise this section, we may outline four basic features of KIBS[5] :

1. KIBS are knowledge intensive and innovative firms
2. The services of KIBS are directed at private business firms
3. Innovation occurs in interactive learning processes
4. Interaction and learning matters for KIBS

As this contribution is about entrepreneurship and about the post-entry performance of newly founded firms, it is essential to assess also the wide strand of literature dealing with the growth of firm foundations. Thus, in the subsequent section, a survey of possible determinants of new-firm growth will be outlined. Special emphasis will be met on the role of knowledge, innovativeness, and interaction, as these are especially important for KIBS.

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[4] Theories of Regional Innovation Systems (Morgan 2004, Moulaert 2003) transfer this perception of innovation processes to a regional level by stating that the conditions influencing interaction may be varying in and are specific for different regional settings, i.e. regions.

[5] It has to be pointed out that the KIBS sector is certainly a more heterogeneous entity than it may seem in the simplifying model outlined above. We may, for example, expect differences between more technically oriented firms like engineering services and others like, for example, non-technical business consultants or advertisers. However, the outlined characteristics roughly apply. In our empirical study, we will account for intra-sectoral differences.

2.2 The determinants of growth of young firms

The factors influencing the performance of new firms are generally categorised as entrepreneur-specific, firm-specific, and environmental (Autio 2000, Brüderl et al. 1996, Honjo 2004). Despite the fact that it is not always easy to distinguish between the different factors, we will, at least for a rough structuring, draw back on this classification.

Especially in the so-called "trait models" the firm founder as an individual is considered to be the central element determining the chances of survival and success of the new firm. It is particularly emphasised that his general characteristics (age, character, human capital, social networks) and specific entrepreneurial qualifications (like entrepreneur specific experience and knowledge, motivation, risk disposition) matter for the development of the new firm (Brüderl et al. 1996). Almus and Nerlinger (1998) figure out that the growth rates of new firms tend to increase with the human capital of the founder, especially in innovative industries. The trait models are criticised by the so-called "contingency concepts", which emphasise that start-ups and the factors of their development cannot be regarded isolated from the factors of the direct and indirect environment of the start-ups (Littunen et al. 1998).

The second category of factors influencing the growth of new firms are the characteristics of the new firm. Of special importance in this context are the hypotheses of a liability of newness and a liability of smallness as well as the concept of organisational imprinting. Regarding the influence of a firm's size on its development, ambivalent research results exist. While, for example, Wagner (1994) detects no significant impact of size the majority of other studies (e.g. Strotmann 2002, 2003) points out that start-up size matters. Almus and Nerlinger (2000) state that the growth rates of new firms in the manufacturing sector tend to increase with the technology orientation of the sub-sector of the firm. Innovativeness is regarded as an important factor influencing the success of new firms: While the risk of failure increases, those firms that survive are more likely to grow because of the chance to generate competitiveness by product differentiation (Audretsch 1991).

The idea of organisational imprinting (Stinchcombe 1965) refers to the fact that structural characteristics of a firm that emerged at the time of its foundation, influence

the further development of the firm, because these characteristics are characterised by a certain persistence (Brüderl et al. 1996). It is assumed that, for example, the quality or the innovativeness of the business idea or the form of the foundation[6] and the organisational heritage, coming to the new firm via the founder, have a sustainable impact on its later development. Agarwal et al. (2002), for example, discovered significant impacts of the form and quality of knowledge transfer on the development of newly founded ventures. Klepper (2001), in his seminal review of the literature about employee start-ups states that the background and the networks of the founder have significant impacts on the development of the companies. For knowledge intensive industries, Isaksen (2003), in a study of 269 software firms in Norway, points out that internal know-how and resources of the firms have been identified as the most important stimuli for competitiveness[7].

Last but not least, environmental factors (or external characteristics) are believed to have an impact on new firm development. The basic idea behind the assessment of environmental factors is that new firms are founded under specific circumstances (location, sector, time) and thus are influenced by rather unique economic, social, political, cultural, and institutional factors. These circumstances do not only influence the probability and possibility of a new firm being born (opportunities and constraints), but also the conditions for its development (Brüderl et al. 1996).

Several lines of research are dealing with quite heterogeneous factors. Most of the existing studies are analysing the impact of aggregated environmental factors. For example, endogenous growth theories emphasise the impact of sectoral, regional, and structural characteristics on the existing industry, the available cumulated managerial know-how, the institutional endowment, or the qualification structure as success factors for new firms (Littunen et al 1998). Within the scope of agglomeration and urbanisation theories, seedbed and incubator concepts based, to a considerable extent, on Marshall's industrial district theory suppose that not only the regional endowment with classical location factors, but also soft factors like entrepreneurial climate, role models, etc.

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[6] E.g. independent vs. dependent foundations, original vs. derivative foundations. Recently, the institutional origin of the founder and his respective heritage is increasingly discussed (Klepper 2001, Koster/van Wissen 2004; Lindholm/ Dahlstrand 1997).

[7] Even if Isaksen (2003) did not analyse the growth of the surveyed firms but only the importance that the founders attributed to different factors for competitiveness.

matter. So far, empirical studies have generated ambiguous results regarding the impact of clustered structures on a new firm's development (Honjo 2004).

In most studies in entrepreneurship research, the outlined factors are examined isolated from each other. However, some concepts and studies try to overcome these shortcomings. Regarding entrepreneur-specific factors, the contingency models try to break up the isolated view of the entrepreneur and his institutional and economic surroundings (Littunen et al. 1998). Similarly, the environment of a new firm cannot be regarded as passive and receptive, as a pure container for the new firms development, even though this is the case in a huge strand of the literature dealing with highly aggregated data as determinants of firm foundation and growth (Autio 2000). In doing so, it remains mostly unanswered whether and how new firms use their relations into their environment for their development and whether those relations matter for their growth. Consequently, it seems necessary to assess the determinants of the growth of new firms from the point of view of a single firm.

Section 2.1 has outlined the importance of knowledge, innovation and, consequently, of interaction and integration for firms in the KIBS sector. In the following, we will thus approach the significance of regional and functional integration as determinants of growth of newly founded KIBS.[8] We suppose that functional and regional integration and interaction (in innovation processes) are crucial for the development of KIBS.

The background for this approach is the accentuation of interaction, of relational aspects regarding the firms and their founders as integral and active parts of their environment. Due to the role of innovation in the KIBS sector and due to the role of interaction for innovation processes it seems to be promising to put an emphasis upon those processes and linkages as determinants of growth of the analysed young firms (Johannisson 1998, Yli-Renko et al. 2001). The relevant research questions will be questions like "How does the single founder and his firm interact in the natural environment?", "How and on

[8] With Kevin Morgan (2004), we may also term these phenomena as 'organizational or relational proximity' on the one hand and 'physical or geographical proximity' on the other. However, as our empirical research is not so much about proximity but rather about intensity of interaction, we decided to term it as 'integration'. In the present paper, we will not adhere to any kind of spatial fetishism, we always regard relational proximity as underlying spatial proximity, or, as Morgan (2004, 3) terms it, we are aware of the problem of "conflating spatial reach with social depth".

which geographical scale does he use resources?", and "What are the implications of these interaction schemes for the firms' development?".

2.3 Functional integration

What does integration and interaction mean? How do they emerge? What are their consequences? What may be their role for the firm's performance? And how does integration influence the growth of newly founded KIBS? These are the questions addressed in the following section.

Since the work of Penrose (1959) it is known that the accumulation of knowledge is a driving force for the growth of firms, as it opens new productive opportunities and new abilities to exploit them. As knowledge creation, acquisition, and exploitation are primarily social processes, relations, interaction, and social capital are critical for the development of firms (Yli-Renko et al. 2001). Regarding integration and interaction, it is important to distinguish between two kinds of processes: (1) the origins and the patterns of interaction deriving from the foundation of the firm and (2) the current orientation of interaction, i.e. co-operation, market relations, and knowledge transfer among others.

Interaction does not evolve from a vacuum. It is based upon relations between different actors. These relations differ in origin, intensity, and direction. When a new firm evolves, the founder or the founding team brings in a set of routines and existing relations from their former activities (employment, formation, etc.). These must not be exactly apt to the needs of the new firm but, anyhow, they have an influence on its early development (Sorenson 2003). If the existing routines and relations are apt to the needs of the new firm, positive effects for the firm's development may be expected (Agarwal et al. 2002, Klepper 2001). In contrast, improper or atavistic routines can hamper innovation and newness and may thus be contra-productive for the firm's development.

It has been stated that especially knowledge and user-producer interaction matter for the development of KIBS. As most KIBS are highly specialised and provide services exactly adapted to the clients' needs, it is to be expected that implicit knowledge and personal networks of the founder are crucial. Entrepreneurs importing customer relationships in their new firms should have better growth prospects in the first years

after the foundation (Lechner/Dowling 2003)[9]. But it is also knowledge and innovation that matter for the development of most new firms in general. R&D inputs may have negative impacts on the growth of young firms as they require resources and as it takes time before they come into fruition (Bantel 1998). For young KIBS this effect might be somewhat weaker, as R$D is frequently executed in close co-operation with their clients. With regard to innovation, integration is a two-edged sword. On the one hand, close networking may guarantee the access to new ideas via communication and knowledge exchange; on the other hand, close interaction may lead to routines and thus hamper innovation processes (Koch 2003, Koster/van Wissen 2004). These thoughts may be summarised in a first proposition:

Proposition 1 Relations of the founder deriving from the pre-entry stage influence the growth of newly founded KIBS. As they may bring about access to knowledge and to the market, they may have positive impacts on growth.

Yet, functional integration also matters in the further course of development, in the ongoing relations of the new firm. In this respect, according to the characteristics of innovation processes in modern economy, a wide variety of relationships can be helpful for the successful development of a new firm. For KIBS, however, especially the quantity and the intensity of co-operation with customers and partners may be of relevance for their development. Also informal contacts with other persons in the same industry and contacts with suppliers can be regarded as important factors for competitiveness (Isaksen 2003). A large strand of management literature is examining the role of network integration for entrepreneurship formation, and the success of new businesses (Birley 1985, Johannisson 1998, Lechner/Dowling 2003, Yli-Renko et al. 2001. For an overview see Autio 2001). Most of these empirical studies are based upon qualitative case studies or upon quantitative studies with a small number of cases resulting in a lack of comparability. But network integration also seems to have its limits. Yli-Renko et al. (2001) showed that – due to decreasing flexibility and openness – an increasing intensity (quality) of relations has negative impacts on firms' competitiveness. Regarding KIBS, the following may be concluded:

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[9] Lechner/Dowling (2003) attribute this to the fact that newly founded firms have to overcome the liability of newness.

Proposition 2 Close interaction with and diversification of customers in innovation processes/projects is conducive to a young KIBS' growth in the first years.

Interaction and functional integration can be accomplished in different ways and by different manners because communication and co-operation are manifold processes. Within the last few decades, the rapidly evolving information and communication technologies led to new and much faster ways of information-exchange and also changed the nature of innovation and interaction processes in many respects. However, it seems questionable whether there is a "death of distance" (Cairncross 1997) by which spatial proximity between individuals or organisations is getting irrelevant for the quantity or quality of their interactions. Especially by economic geographers, it has been frequently stated (and empirically proved) that geographical proximity matters: "Because information diffuses rapidly across organisational and territorial borders, it is wrongly assumed that *understanding* does, too" (Morgan 2004, 3, emphasis in original). Then, how might spatial proximity and respectively regional integration affect the post-entry performance of KIBS?

2.4 Regional integration

Especially in the so-called territorial innovation models (for recent reviews of the literature see Morgan 2004 or Moulaert/Sekia 2003) it is claimed that spatial proximity between different actors matters in innovation processes and for regional development.[10] Mostly, it is argued that knowledge – especially uncodified, tacit knowledge – and its organisation is tied to personal capabilities and information (know-how, know-who) and thus has a spatial component (Foray/Lundvall 1996, Morgan 2004). Localised knowledge spillovers as the basis for innovation are more likely to be realised in spatial proximity (Audretsch et al. 2002). Since innovation is increasingly seen as an interactive, evolutionary process involving various actors, especially the relationships between the actors as well as the institutional pre-conditions of these relations are regarded to be crucial for innovation processes. Spatial proximity can play a key role for communication and interaction, as trust, common understanding, and a common culture are often favoured by spatial proximity. Through learning-by-

[10] Contrarily, the effects of spatial proximity on the performance of firm foundation have only sporadically been examined.

interacting, information and knowledge for innovations develop and can be transmitted and implemented (Hausmann 1996). As KIBS are innovative, knowledge- intensive firms with a high degree of interaction, it can be supposed that spatial proximity may have an effect on their development.

Like functional integration, regional integration also has two aspects: first, the origin of the founder always has a regional component[11] and, second, the ongoing relations of the firm have a geographical orientation, may they be far-reaching or locally bounded. Founders starting their firm in the region they had been working and living before can be expected to be closer integrated into local networks. Audretsch et al. (2002) point out that localised knowledge spillovers may be more important for young firms because they rely more on external knowledge produced by other firms or universities. And, as Vaessen/Wever (1993, 127) put it: "Easy access to customers is crucial to generating rapid growth".

If the founder stems from the region in which he founds the firm, we may expect a close integration into the local networks, which can be crucial for the access to knowledge and for early customer relationships that are particularly important for KIBS. Although this regional integration might be of importance for the early growth of KIBS firms, it seems questionable whether those local relations are sufficient in later stages of development. In the course of the development of a new firm, it might be important to be able to create and draw back upon spatially diversified linkages to knowledge sources, co-operation partners and customers. To summarise, the following hypothesis may be proposed:

Proposition 3 Local linkages of the founder in early stages of his firm's development may have positive impacts on the post-entry-performance of the firm. However, in the course of the development of the firm spatial diversification of linkages to knowledge-providers, co-operation partners and customers may be advantageous for their development.

[11] In a range of studies it has turned out that around 80% of the firm foundations occur in close spatial proximity to the living and/or working place of their founder (e.g. Cooper 1985).

In the following, the outlined propositions will be tested and analysed on the basis of empirical data deriving from standardised interviews with KIBS founders in Germany.

3 Data, economic model and measurement issues

3.1 Data

As suitable firm micro data for an analysis of the impact of regional and functional integration on the post-entry performance of KIBS is missing, this paper is based upon a newly created dataset. In three German agglomeration regions (Bremen, Munich, Stuttgart) a telephone survey with founders of start-ups in the KIBS sector was conducted.

The KIBS sector is defined according to the mainstream of relevant publications (for an overview and discussion of different definitions see Koch/Stahlecker 2004) and includes firms classified under the NACE-Codes 72, 73 and 741-744[12]. Furthermore, the population was restricted to firms founded between 1996 and 2003. Additionally, we only considered foundations registered in the trade register, which are original foundations. This means we excluded subsidiaries, branch offices, new firms arising from mergers & acquisitions and firm reformations from the survey.

Based on these definitions the population size was 7,714 firms A random sample, stratified by the 3-digit sectoral attribution, of 2,108 firms was drawn[13]. Based upon that sample, 547 successful interviews could finally be conducted resulting in a quite satisfactory rate of return of almost 26%. The survey was carried out in October and November 2003. In principle, the founder of the firm was interviewed. In case of firms founded by more than one person, one of these founders was interviewed.

For the interviews, a standardised questionnaire covering a total of 29 questions was developed. The first part of the interview concerned individual attributes of the founder (e.g. context of business idea, former occupation and location of workplace, skills, etc.),

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[12] Some sub-sectors of 744 have been excluded. For example, a significant proportion (up to nearly 40%) of firms was classified as "Management activities of Holding Companies" (7415) which we did not consider as KIBS.

[13] The sectoral distribution of the firms included in our dataset corresponds by and large with the data provided by the foundation panel of the Centre for European Economic Research (ZEW) which can be regarded as the most reliable and detailed data source for firm foundations in Germany.

the second part dealt with start-up characteristics of the firm and its development over time.

Thereby, we are able to "measure" the role of functional and regional integration for a new KIBS post-entry growth in a more profound manner than existing studies which rely upon aggregated regional data. Before presenting the results of the empirical estimation, the following section will describe the economic model and the methodology.

3.2 Economic model and measurement issues

Following the majority of existing studies, a firm's growth is measured by the average annual growth rate of employment from period one to period t.

$$w_i^t = \frac{\ln E_i^t - \ln E_i^1}{t}$$

To be able to analyse the growth of firms we retrospectively asked the founders about the development of their firms from the foundation till the day of interrogation with respect to turnover, number of employees and the number of free-lancers (which constitute an important element in service firms). In this paper, we focus on the analysis of employment growth. We will extend our analyses to turnover growth and other growth indicators in future research.[14]

Using OLS estimation, a firm's employment growth is explained by a vector of explaining covariates x_i', β is the vector of coefficients to be estimated. ε_i is a random error, which captures all determinants not explicitly modelled, and which is assumed to be i.i.d. (see e.g. Greene 2003 or Wooldridge 2002) To account for heteroscedasticity of unknown form, standard errors will be estimated heteroscedasticity consistent using White's (1980) method.

$$w_i^t = \frac{\ln E_i^t - \ln E_i^1}{t} = x_i'\beta + \varepsilon_i, \qquad \varepsilon_i \sim N(0, \sigma^2)$$

[14] This is not trouble-free(rather short period and the not reliably recalled number of employees in the year of firm foundation), but usual in empirical research (see also Brüderl et al. 1996 for example). To be more precise one would have to create a suitable panel dataset tracking the development of single firms over time.

As it is well known that the results of OLS estimation might be influenced by outliers, we also applied robust regression methods to test the stability of the results in this respect. The basic idea of robust regression methods is to reduce the influence of outliers by a suitable weighting scheme (see e.g. Rousseeuw and Leroy 1987 for a general description of the issues and methods. A description of the method of robust regression we applied is given in Hamilton 2002).

Based on the theoretical considerations in section 2 individual specific-, firm specific- and environment-specific determinants of the KIBS employment growth will be included in our economic model. In contrast to existing studies based on firm data a special emphasis is met on the impact of functional and regional integration on a firm's post entry-performance.

We measure **functional integration** of a newly founded KIBS by a set of different variables. The *professional background of a founder* is an important aspect of functional integration (Klepper 2001). A set of dummy variables controls for the fact whether the founder worked at a university or a similar scientific institution, in the private economy or whether the founder was self-employed or a free-lance worker before the new-firm foundation. To account for routines and knowledge transfer, an additional dummy variable measures whether the *concrete idea of foundation* has its origin in the former occupation.

The *firm's share of turnover generated by customers from the manufacturing sector* gives hints about the importance of demand from the manufacturing sector on the growth performance of KIBS. A further variable measures how close the KIBS' services are integrated into their customers' processes of innovation. One might expect that a closer *integration in the R&D-process* might strengthen the growth possibilities in early years. Furthermore, the *form and intensity of cooperation* (cooperation contracts, joint projects, mission oriented research or informal contacts) might also stimulate the post-entry growth.

To account for a possible impact of **regional integration** on post-entry growth, the following variables are included into the model. The role of regional demand for a firm's growth and its embeddedness in regional networks is at first measured by the

share of turnover earned within the region[15]. In contrast to the hypothesis of a positive impact of local regional demand on a firm's growth one might instead expect that a strategy of *regional diversification* might be more promising. We therefore alternatively include an index of regional diversification of turnover into the model which has its maximum value one if a firm earns equal shares of turnover on each regional level (region, rest of the Federal State, rest of Germany, foreign country). Its minimum value is zero if total turnover is earned within one single regional level.

Moreover, we control for a possible impact of the *existence of a regional lead customer* who played – according to the founder – a decisive role for the foundation. To consider whether a firm receives *access to new knowledge and new technologies* by cooperation partners we tested several variables. In case of partners we can distinguish whether the partners primarily stem from the region of the firm itself or from outside the region and – which is a more functional aspect – whether the cooperation *partners are from the public sector or from the private economy*.

The *development of the spatial range* of a firm's market is also used as an explaining variable. The founders were asked whether they expanded their relevant market geographically since the foundation or whether they had a shrinking spatial reach. One could expect that a strategy of regional expansion coincides with a higher employment growth.

In addition to the variables controlling for a possible impact of functional and regional integration, further variables are added to control for entrepreneur-specific, firm-specific and industry-specific effects.

As general *entrepreneur-specific determinants* the sex of the founder and his/her age are considered. Whether the KIBS was founded by a single founder or by a team of founders is also included in the model by a binary dummy variable. Concerning *firm-specific determinants* of firm growth, there is quite a lot of evidence in empirical research in particular for the manufacturing sector – that there is a higher risk of death for smaller firms ("liability of smallness") while surviving small firms grow faster than their larger counterparts (see section 2). To allow for a possible impact of firm size on

[15] By the term "region" the questionary referred to the planning region in which the respective firm was located.

the growth of KIBS, the logarithm of start-up employment is included into the model. To account for non-linearities its square is also used. Following the basic idea of Jovanovic's (1982) selection theory there might also exist a "liability of newness" or of adolescence. This means that the risk of death is higher for young firms, which enter the market and have to learn that they are not viable[16]. With respect to both hypotheses one could expect that young surviving firms might grow faster than older firms. The firm's age is either approximated by a set of year dummies or a variable measuring the firm's age in years. As the results do not depend on the concrete specification only the results including the firm's age in years are considered.[17] The qualification structure of a firm's employees is represented by a dummy variable which is one if all employees are academics.

Industry-specific effects are measured either by a single binary variable (T-KIBS versus P-KIBS) or in a more detailed way by including a set of sectoral dummy variables (software, other activities related to data processing, technical services, consultancy services, advertisement). As the results do not depend on the concrete specification only the results for the five dummy variables are presented in this paper.

A problem we cannot address in our analyses is the problem of a possible survivor bias (see for an early discussion of the problem e.g. Mansfield 1962). As we can only rely upon the answers of those firms that survived until the day of interrogation, information about those KIBS, which had to exit the market in the meantime could not be obtained. This might lead to an inconsistent estimation of the 'real' growth equation when only referring to surviving firms. However, as we do not have panel data or information about existing firms we cannot control for a potential selection bias by applying bivariate tobit estimation or the Heckman two-step estimation (see e.g. Greene 2003).

Therefore, our estimation results can only explain the growth of surviving KIBS. But as the vast majority of existing studies (see e.g. Evans 1987, Hall 1987 or Strotmann 2002) show that though there often exists a statistically significant attrition bias it does rarely

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[16] While the liability of newness hypothesis forecasts the highest risk of market exit immediately after start-up, the thesis of a liability of adolescence claims that the risk of death increases after start-up and decreases if the firm survived a certain period.

[17] We additionally included the knowledge intensity of a firm approximated by its *qualification structure* (share of employees with university degree) and the amount of its *R&D expenditures* (relation of R&D expenditures to turnover) as explaining variables. As they did not help explaining the growth of employment we abstained from their inclusion in our preferred model versions.

influence the estimation results of the growth equation, this might be a minor problem. Geroski (1998) for example named in his analyses of Gibrat's law the missing empirical relevance of the selection bias a 'stylized fact'.[18] Anyhow, we cannot state for sure that selection problems do not influence our results.

4 Empirical results

4.1 Descriptive statistics

After excluding all firms with missing values in any of the relevant variables, a set of 446 firms remains for our further multivariate analyses. With respect to the firm's employment the average annual rate of growth is – according to our definition – 11.9 per cent per year.[19]

The majority of the surviving start-ups managed to grow since their foundation. Almost 60 per cent of the 446 firms dispose of a larger number of employees at the time of interrogation than at the end of the start-up year. 135 firms or about 30 per cent of the firms did not change their employment, while 45 firms or 10 per cent had to shrink since their start-up. Table 4-1 gives the descriptive statistics of all variables included in our model estimation.

With respect to the 446 newly founded KIBS are distributed rather equally over the five sectors software (16,4%), technical services (23,5%), consultancy services (21,7%), advertisement (17%) and other activities related to data processing (21,3%). In more than 50% of the KIBS start-ups, the founder(s) have their professional background in the private economy, 13,5 per cent of all founders stem from academic institutions and 35,2 per cent were self-employed or did free-lance work before the foundation.

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[18] "Attrition bias does not seem to be a major problem, and inferences made about firm performance using data on survivors is often robust to the inclusion of data on non-survivors" (Geroski 1998, 17).

[19] As for the total sample the corresponding rate of employment growth is rather similar, we do not have selection effects with respect to the dependent variable.

Table 4-1: Descriptive statistics

	N	Mean	Std. dev.	Min	Max
Growth rate of employment	446	0,119	0,184	-0,536	1,221
Entrepreneur-specific effects					
Age of the founder (in years)	446	37,726	8,626	16	64
Sex of the founder (1=female)	446	0,123	0,329	0	1
Team foundation (1=yes)	446	0,630	0,483	0	1
Firm-specific effects					
Age of the firm in years	446	4,865	1,854	2	8
Start-up employment (log.)	446	1,008	0,750	0	3,219
Start-up employment² (log.)	446	1,577	1,964	0	10,361
Firm employs 100% academics (1=yes, 0 = no)	446	0,289	0,454	0	1
Industry-specific effects[20]					
Software (72.2)	446	0,164	0,370	0	1
Other activities related to data processing (72.1, 72.3-72.6)	446	0,213	0,410	0	1
Technical Services (73.1, 74.2 & 74.3)	446	0,235	0,425	0	1
Consultancy Services (73.2 & 74.1)	446	0,217	0,413	0	1
Advertisement (74.4)	446	0,170	0,376	0	1
Functional integration					
Professional background: private economy (reference)	446	0,513	0,500	0	1
Professional background: scientific research	446	0,135	0,342	0	1
Professional background: self-employed	446	0,352	0,478	0	1
Concrete idea from an earlier occupation led to foundation (1=yes, 0=no)	446	0,854	0,353	0	1
Share of turnover with clients from manufacturing sector	446	0,515	0,363	0	1
Close integration into the customers' innovation processes (1=yes, 0=no)	446	0,735	0,442	0	1
Intensity of cooperation with partners (0=none or informal, 1=formal cooperation)	446	0,493	0,501	0	1
Regional integration					
Founder stems from the region (1=yes, 0=no)	446	0,783	0,413	0	1
Lead-customer with crucial influence on foundation (1=yes, 0=no)	446	0,321	0,467	0	1
Share of regional turnover (%)	446	0,460	0,393	0	1
Regional dispersion of turnover (1=max. of dispersion, 0=min. of dispersion)	446	0,395	0,310	0	1
Broader regional expansion of market (1=yes)	446	0,383	0,487	0	1
No change in expansion of market (1=yes)	446	0,531	0,500	0	1
Smaller regional expansion of market (1=yes)	446	0,085	0,279	0	1
Access to new knowledge/technologies primarily by partners from outside the region (1=yes)	446	0,460	0,499	0	1
Access to new knowledge/technologies primarily by partners from inside the region (1=yes)	446	0,386	0,483	0	1
No partners (1=yes)	446	0,155	0,362	0	1

[20] Numbers in parentheses represent the respective NACE-codes of the included branches (see annex).

4.2 Results of multivariate analyses

Different models have been estimated to gain an impression of the validity and the sensitivity of the results. It can be summarised in general that the results remain rather stable and do not strongly depend on the type of model. The presentation of our estimation results is therefore limited to our preferred models. OLS estimation and robust regression reducing the impact of outliers lead without a single exception to the same results regarding the signs of the estimated coefficients, but differ in some cases with respect to their statistical significance.

Generally speaking, the estimation results underline that functional and regional integration of new KIBS indeed play a key role in explaining post-entry growth. To be precise, however, we find that in spite of large interdependencies between functional and regional integration, the former seems to be particularly important for a KIBS post-entry growth.

At first, we may conclude that most of the control variables testing entrepreneur- and firm-specific effects on the growth of the new firm agree with the theoretical considerations. Newly founded KIBS do not seem to be different from most other firm foundations in this respect. When surviving, small KIBS and young KIBS grow faster than their larger and older counterparts. A statistical significance of the impact of firm age, however, is only given in OLS estimation. Team foundations seem to have higher rates of employment growth than foundations of single founders, but not statistically significant.

However, our central aim in this paper is to address the impact of functional and regional integration on the post-entry performance of the newly founded KIBS. In the following, we will therefore focus our analyses on those aspects.

Regarding **functional integration**, it is particularly the professional/institutional background of the founder that proves to be highly significant for a new KIBS post-entry performance: firms whose founders come from scientific institutions (university, professional formation) grow significantly faster than those of founders who were employed in private firms before. Although this result is in line with other studies, the effect has not expected to be so articulated in the KIBS sector. One could instead expect that service firms depend more upon relations to customers than upon formal

knowledge. Founders who were self-employed or had an own firm before the new firm foundation grew, in contrast, significantly slower than those founders who were employed in private firms before. It might be supposed that formerly self-employed persons already dispose of some day-by-day business and therefore have no need to grow in the early stages of their firm's development.

Similarly, the existence of a (regional) lead client has a negative impact on the post-entry performance, though statistical significance is only given in OLS estimation. The "import" of business ideas, services, or technologies from a former occupation has a positive, but insignificant impact on the firm's post-entry growth. Therefore, regarding **proposition 1**, it seems to be especially the access to knowledge causing success and not a closer integration into the market (which might be expected for founders from firms and more from those who were self-employed).

On the other hand, close interactions with customers in innovation processes have a positive impact on the employment growth of young KIBS. The more deeply the KIBS are involved into the innovation processes of their customers, the more likely they are to grow. And, secondly, also the intensity of co-operation has an at least weakly significant positive impact on the KIBS development: the more formalised the co-operation process was, the more likely was the firm to grow. If the services new KIBS deliver to their clients are closely integrated in their clients' innovation processes (e.g. in the R&D process, in the process of production or in the process of (re-) organisation), these KIBS can expect a higher employment growth. Regarding a possible impact of the diversification of customers, we found no significant effects on the KIBS' development.[21] In contrast, the highly significant positive impact of the share of turnover earned with customers from the manufacturing sector rather seems to point to the primordial importance of traditional manufacturing as clients in the KIBS sector. To summarise, **proposition 2** can only partially be confirmed, as close interaction of customers has significant effects on the post-entry performance of the KIBS, while diversification of customers has not. This supports the assumption of the outstanding importance of user-producer interaction in the KIBS sector.

[21] We did not include the variable in the presented models as it proved to be insignificant throughout all models.

Table 4-2: Determinants of employment growth of newly-founded KIBS, Results from OLS estimation and robust regression, P-values in parentheses

	Model 1		Model 2	
	OLS estimation	Robust regression	OLS estimation	Robust regression
Entrepreneur-specific effects				
Age of the founder (in years)	-0.002	-0.002	-0.001	-0.002
	(0.165)	(0.015)**	(0.165)	(0.016)**
Sex of the founder (1=female)	-0.052	-0.035	-0.052	-0.035
	(0.011)**	(0.100)	(0.011)**	(0.102)
Team foundation (1=Yes)	0.020	0.016	0.019	0.015
	(0.282)	(0.325)	(0.288)	(0.333)
Firm-specific effects				
Age of the firm (in years)	-0.012	-0.004	-0.012	-0.004
	(0.019)**	(0.301)	(0.019)**	(0.299)
Start-up employment (log.)	-0.095	-0.069	-0.095	-0.069
	(0.000)***	(0.007)***	(0.000)***	(0.007)***
Start-up employment² (log.)	0.006	0.002	0.006	0.002
	(0.511)	(0.866)	(0.511)	(0.864)
Firm employs 100% academics (1=yes, 0=no)	-0.095	-0.095	-0.095	-0.095
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Industry-specific effects[22]				
Other activities related to data processing (ref.: software)	0.031	0.036	0.031	0.035
72.1, 72.3-72.6	(0.169)	(0.109)	(0.185)	(0.119)
Technical Services (ref.: software)	0.031	0.033	0.030	0.033
73.1, 74.2 & 74.3	(0.158)	(0.146)	(0.160)	(0.151)
Consultancy (ref.: software)	0.075	0.053	0.074	0.053
73.2 & 74.1	(0.003)***	(0.019)**	(0.003)***	(0.020)**
Advertisement (ref.: software)	0.018	-0.007	0.018	-0.008
74.4	(0.504)	(0.767)	(0.511)	(0.759)
Functional integration				
Professional background: scientific research (ref.: priv. econ.)	0.067	0.040	0.067	0.040
	(0.041)**	(0.077)*	(0.042)**	(0.078)*
Professional background: self-employed (ref.: priv. econ.)	-0.044	-0.037	-0.044	-0.037
	(0.008)***	(0.015)**	(0.008)***	(0.015)**
Concrete idea from an earlier occupation led to foundation	0.031	0.024	0.031	0.025
(1=yes, 0=no)	(0.142)	(0.219)	(0.142)	(0.217)
Share of turnover with clients from manufacturing (%)	0.000	0.000	0.000	0.000
	(0.072)*	(0.094)*	(0.068)*	(0.092)*
Close integration in the customers' innovation processes	0.031	0.020	0.030	0.020
(1=yes, 0=no)	(0.093)*	(0.207)	(0.096)*	(0.215)
Intensity of cooperation with partners	0.019	0.025	0.019	0.025
(0=none or informal, 1=formal cooperation)	(0.221)	(0.090)*	(0.220)	(0.089)*
Regional integration				
Founder stems from the region (1=yes, 0=no)	-0.006	-0.002	-0.007	-0.003
	(0.726)	(0.900)	(0.713)	(0.874)
Lead-customer with crucial influence on foundation (1=yes)	-0.030	-0.021	-0.030	-0.022
	(0.076)*	(0.171)	(0.096)*	(0.165)
Share of regional turnover (%)			0.000	0.000
			(0.930)	(0.819)
Regional dispersion of turnover	0.038	0.050	0.038	0.052
(1=max. of dispersion, 0=min. of dispersion)	(0.114)	(0.033)**	(0.147)	(0.035)**
Broader regional expansion of the market (ref.: no change)	0.051	0.037	0.051	0.037
	(0.003)***	(0.013)**	(0.003)***	(0.013)**
Smaller regional expansion of the market (ref.: no change)	-0.084	-0.073	-0.084	-0.073
	(0.001)***	(0.004)***	(0.001)***	(0.004)***
Access to new knowledge/technologies primarily by partners from	0.043	0.036	0.043	0.036
outside the region (ref.: no partners)	(0.019)**	(0.024)**	(0.022)**	(0.024)**
Access to new knowledge/technologies primarily by partners from	0.009	0.009	0.010	0.010
inside the region (ref.: no partners)	(0.640)	(0.663)	(0.631)	(0.653)
Constant	0.201	0.179	0.200	0.176
	(0.002)***	(0.001)***	(0.002)***	(0.002)***
Observations	446	446	446	446
R-squared	0.316	0.296	0.317	0.296
Wald, F-statistic	7.94	7.36	7.61	7.06
	(0.000)***	(0.000)***	(0.000)***	(0.000)

[22] Numbers in parentheses represent the respective NACE-codes of the included branches (see annex).

Regarding **regional integration**, several observations can be made: Whether a founder stems from the region or not does not have a statistically significant impact on the post-entry growth of newly founded KIBS. The existence of a regional lead client who plays a crucial role for the foundation and early development of the firm (in the eyes of the founder) can be shown to have a weakly significant negative influence on the post-entry growth of the new firm. It may be deduced that the existence of such a lead client hampers the growth of the new company due to a strong dependency of the new firm from this client. This orientation towards the lead client may lock up the access to other clients in the early stages of the firm's development and may thus hamper growth.

With respect to regional demand a strategy of **regional diversification** seems to be more promising than focusing on a single regional area: the higher the dispersion index of regional turnover is, i.e. the more a firm is present on different regional levels at the same time, the better are its growth prospects. At the same time, the share of turnover earned within the firm's region has no significant impact on the employment growth.

The results for the development of the spatial range of the market are highly significant: Firms which managed to expand their market geographically are significantly more likely to grow than those who had no changes in their spatial market orientation. Those with a shrinking reach grow slower in a statistically significant manner.

Last but not least, we regarded the spatial characteristics of knowledge access. It turned out in our empirical model that start-up KIBS who have more partners from outside the region than from within the region are significantly more successful in post-entry growth than new KIBS whose cooperation partners are mainly from within the region. Whether the partners can be found in the private or in the public sector, however, does not play a crucial role for new-firm growth. We therefore did not include those variables in our preferred models.

To summarise the results with respect to **proposition 3,** it can be stated that the local linkages of the KIBS founders, deriving from his provenance have no significant impact on a firm's development. Contrarily, the second part of the proposition - that spatial diversification has positive impacts on the firms' performance - can be supported by our findings.

5 Conclusions

The present contribution uses newly created firm micro-level data to analyse the determinants of post-entry growth of firms in the sector of knowledge intensive business services. A special focus is met on the importance of functional and regional integration on the KIBS performance. Both factors are appraised to be of particular interest in the KIBS sector, here co-operation and information exchange play a crucial role for the successful accomplishment of innovative activities in this sector.

Our empirical analyses show that functional and regional integration of young KIBS can be conducive to their post-entry growth in various ways. Concerning the provenance of the founder, his/her institutional background matters, while purely regional linkages, i.e. starting a firm in the region one has been living or working before, does not lead to statistically significant benefits with respect to the early growth of the firms. Even in the KIBS sector, which is believed to be quite oriented to application and which is based to a considerable extent upon tacit knowledge, founders who have been working in universities or scientific research institutions have eminent advantages in post-entry growth compared to founders with a more applied background.

In the day-to-day business of the KIBS – in generating and processing knowledge and innovations for and with their clients, functional *and* regional integration matter. But our results give some hints that, while it is *close functional* integration which is conducive to post-entry growth, it is rather *loose regional* integration fostering a positive development. Those firms succeeding to extend their market spatially, those having partners outside their location are most likely to increase their employment.

Though our study helps reducing the lack of empirical micro data studies dealing with the growth performance of KIBS, there is of course still considerable need for further research. Intra-sectoral differences seem to have some relevance, especially the sub-sector of consulting activities is outstanding in this regard. This fact asserts that the KIBS sector is a highly heterogeneous entity (Koch/Stahlecker 2004). It would be desirable for future research to account for these intra-sectoral differences in a more profound manner. It is conceivable that firms with a more technical profile might rely more upon regional linkages than others due to closer co-operation and a higher importance of face-to-face contacts (codified knowledge). Furthermore, it could be an

interesting task to also account for regional differences, which was not possible in the present study. From existing research (Almus et al. 2001, Santarelli/Piergiovanni 1995) it is known that the sectoral structure of firm foundations in the KIBS sector partly depends upon regional industry structure. However, it remains unknown whether in different regions these regional characteristics are really assessed by the young firms. And, last but not least, growth in the post-entry stages recently after firm foundation may differ from later development and growth of the firms (Lindholm/ Dahlstrand 1997) and the problem of accounting for the possible survivor bias should be addressed.

This study made a first step in reducing the lack of detailed micro information concerning KIBS when analysing the determinants of a KIBS growth using a newly created cross-sectional firm-level data base. To be able to really follow up the development of single KIBS firms over time and to analyse growth and in particular survival in a more profound manner, suitable panel data should be created in the future.

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Annex

KIBS and sub-sectors in the NACE-classification

NACE-Code	3-digit sector (name)
72.1	Hardware consultancy
72.2	Software consultancy and supply
72.3	Data processing
72.4	Data base activities
72.5	Maintenance and repair of office, accounting and computing machinery
72.6	Other computer related activities
73.1	Research and experimental development on natural sciences and engineering
73.2	Research and experimental development on social sciences and humanities
74.1	Legal, accounting, book-keeping and auditing activities / tax consultancy / market research etc.
74.2	Architectural and engineering activities and related technical consultancy
74.3	Technical testing and analysis
74.4	Advertising