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Working Paper

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DIW Discussion Papers, No. 886

Provided in Cooperation with:
German Institute for Economic Research (DIW Berlin)

Suggested Citation: Lejpras, Anna (2009) : Determinants of internationalization: differences between service and manufacturing SMEs, DIW Discussion Papers, No. 886, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

This Version is available at:
https://hdl.handle.net/10419/29800

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Discussion Papers

886

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Berlin, April 2009

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IMPRESSUM

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Fax +49 (30) 897 89-200
http://www.diw.de

ISSN print edition 1433-0210
ISSN electronic edition 1619-4535

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Determinants of Internationalization:

Differences between Service and Manufacturing SMEs[§]

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21.04.2009

Abstract

This paper empirically investigates the antecedents of internationalization of SMEs, focusing on differences between the manufacturing and service sectors. Specifically, employing a bivariate probit model based on survey data of approximately 3,900 East German firms, I analyze which firm-related and external factors affect a firm's decision to export and/or relocate production or other operations abroad. Generally, I find that SMEs from the manufacturing sector do more exporting than service firms. The results reveal that size, having main competitors located abroad, and introducing a novel product all are significantly positively related to the internationalization of SMEs regardless of industry affiliation. However, manufacturing firms in the high-tech sector are far more likely to be engaged in internationalization activity than are service firms, regardless of whether the latter are high-tech. Locational conditions and cooperation activities are generally less important for internationalization of service firms, too, compared to their manufacturing counterparts.

Keywords: *Internationalization, Service, Manufacturing, Bivariate Probit Model*

JEL classification: M16, M20, L25, R30, O30

[§] I thank Martin Anderson, Heike Belitz and Andreas Stephan for their helpful comments and suggestions. Furthermore, I gratefully acknowledge the suggestions and comments by seminar participants at Jönköping International Business School. The usual disclaimer applies.

1 Introduction

Globalization and rapid progress in information and communication technologies, as well as international services trade agreements (such as the General Agreement on Trade in Services and the European Union Service Directive), have improved the position of service industries in the world economy. Consequently, an ever-increasing number of service firms are engaging in foreign markets (e.g., Daniels 1993; OECD 2008; Roberts 1999). The literature on internationalization, however, does not pay much attention to this sector, tending to focus more on the manufacturing sector and multinational enterprises (MNEs). Moreover, the sparse literature that does exist on the topic concentrates on particular branches of the service industry, without much generalization of concepts or findings (Bryson 2001; Contractor, Kundu and Hsu 2003).

Scholars highlight four features that distinguish services from manufactured goods: (1) intangibility (services are not transportable or storable), (2) inseparability (production and consumption occur simultaneously), (3) perishability (services cannot be saved but must be consumed as they are produced), and (4) heterogeneity (services are unique and difficult to standardize) (e.g., Zeithaml, Parasuraman and Berry 1985). Of course, different services are characterized by varying degrees of these attributes. Researchers argue that it is the intensity of the respective characteristics that influences tradability and performance of particular service industries in foreign market operations and this also inevitably makes their internationalization pattern different from that of the manufacturing sector (Clark and Rajaratnam 1999; Clark, Rajaratnam and Smith 1996; Ekeledo and Sivakumar 1998; Erramilli 1990; Knight 1999).

The main objective of this study is to empirically investigate the driving forces behind internationalization of small and medium-sized enterprises (SMEs), focusing on differences between the service and manufacturing sectors. Specifically, I examine the factors determining firm choice (or not) of an internationalization strategy—exporting or relocating production or other operations abroad—and whether the particular antecedents are substantively different between service and manufacturing SMEs. To this end, I estimate a bivariate probit model that can account for the correlation between the two internationalization strategies. The analysis uses survey data of about 3,900 East German SMEs engaged in various types service and manufacturing activity.

This paper is novel in that the analysis includes a wide range of exogenous variables that can be generally classified into two groups: firm-specific or external factors. The firm-related variables, such as size, age, sector, or innovation capabilities, incorporate the attributes and

strategic orientation of a firm. The external factors, such as quality of firm location, competition situation, and collaboration and networking activity, are designed to discover the impact of a firm environment's on its foreign activity. Extant empirical studies, with their primary focus on the characteristics of host and/or home-country markets neglect explicitly modeling the effect of firm location on its internationalization (e.g., Dunning 1998; O'Farrell, Wood and Zheng 1998; Porter 2000), an oversight this paper intends to remedy.

One potential concern of this study refers to the general classification and definitional problems of service and manufacturing industries (e.g., Clark et al. 1996; Daniels 1993; OECD 2008, Pilat and Wölfl 2005), seeing as the distinction between the two sectors is increasingly blurred in today's world. Still and all, however, the two sectors do play different roles in the economy. For example, the manufacturing sector is much more strongly linked to other industries (e.g., suppliers, transport, etc.). Thus, it is expected that there is enough variation in the internationalization process of these two sectors to make a study of the differences worthwhile.

2 Theoretical Background

2.1 Theories of Internationalization

The literature reveals four main approaches to firm internationalization: (1) the internalization approach and the eclectic paradigm, (2) stage models, (3) the network perspective, and (4) a business-strategy approach. The first approach is based in the economic school of foreign direct investment (FDI) theory; the latter three are more behavioral approaches (Coviello and McAuley 1999; O'Farrell et al. 1998). Each of the four approaches is discussed below.

2.1.1 Internalization approach and the eclectic paradigm

Based on transaction cost analysis (TCA), the internalization theory aims to explain factors influencing the modality choice of organizing cross-border activities by MNEs (Anderson and Gatignon 1986; Buckley and Casson 1976; Buckley 1988; Dunning 1981, 1988; Rugman 1981; Hennart 1988, 1991; Williamson 1975, 1979). The general axiom of the internalization approach is that firms choose a foreign market location, as well as the mode of market servicing, for which overall transaction costs are minimized. Markets are assumed to be competitive but characterized by various imperfections, including, for example, cost of knowledge, government regulations and tariffs, and quality control problems. Indeed, imperfections in goods and factor markets are seen as one of the chief reasons for internalization, especially of knowledge-intensive intermediate products. To reduce the risk of losing its knowledge advan-

tage, a firm will favor high-control modes of foreign market entry—through the establishment of a hierarchically structured organization, that is, FDI. Conversely, standardized and unsophisticated products can be distributed more efficiently in lower-control modes—through nonequity or contractual agreements, for example, licensing or exporting.

In his eclectic (OLI) paradigm of international production, Dunning (1981, 1988, 1992) proposes a more general and comprehensive theory of FDI and MNE activity. In addition to internalizing (I) advantages elaborated within the scope of the transaction cost approach, the OLI paradigm highlights two other advantages that influence the international engagement of a firm, namely, ownership-specific (O) and location-specific (L) advantages. O-advantages are comprised of unique firm-related characteristics and capabilities that make a firm superior to local competitors, regardless of its location. O-advantages encompass not only tangible assets, such as workforce, capital, and property rights, but also intangible ones, such as managerial and entrepreneurial skills, organizational and marketing systems, noncodifiable knowledge embodied in human capital experience, and the technology or ability to reduce costs of intra and/or inter-firm transactions. L-advantages involve the competitive advantages of countries and the potential benefits of firm activity in a particular location. L-specific variables include country-related resource endowments and markets (availability, prices, and quality), transport and communication costs, infrastructure, barriers to trade, business and cultural environment, political and institutional framework, and so forth.

2.1.2 Stage models

Another approach to firm internationalization examines foreign market expansion in terms of hypothetical development stages. This can take one of two paths: (1) the establishment chain (stage) model (also known as the Uppsala model or the U-model) introduced by Johanson and Wiedersheim-Paul (1975) and developed further by Johanson and Vahlne (1977, 1990), or (2) the diffusion of innovation theory (innovation-related models or I-models) derived from Rogers's (1962) stages of the adoption process (Young 1995). Both the U-model and the I-models are viewed as more dynamic than the internalization paradigm and focus firm exporting activities rather than FDI (Andersen 1993; Turnbull 1987; Young 1987).

The U-model[1] suggests that firm internationalization occurs incrementally and gradually due to lack of knowledge, especially experiential knowledge, and uncertainty. The model ar-

[1] Johanson and Wiedersheim-Paul (1975) distinguish between four subsequent modes of foreign market entry, which reflect increasing levels of international involvement: (1) no regular export activities, (2) export via independent representative (agents), (3) establishment of an overseas sales subsidiary, and (4) overseas production/manufacturing units.

gues that firms initially engage in psychically close foreign markets (i.e., those that are not so very different from the home market) through low-risk, indirect exporting approaches. Over time and on the basis of experience gained in this way, the firm will expand into more distant markets through higher control modalities. Thus, a basic proposition of the U-model is that market knowledge and market affect both market commitment decisions and the way current decisions are made—and these, in turn, influence market knowledge and commitment (Johanson and Vahlne 1977, 1990; Johanson and Wiedersheim-Paul 1975).

The innovation-based approach sees the internationalization process as a learning sequence that occurs within the innovation adoption process. Various I-model adaptations, developed by Bilkey and Tesar (1977),[2] Cavusgil (1980, 1982),[3] Czinkota (1982),[4] and Reid (1981),[5] generally posit that export development depends on external stimuli (e.g., unsolicited orders or inquires) and/or internal factors such as attitudinal and behavioral commitment of managers. The particular I-models vary with respect to the number and definitions of the development stages; however, Andersen (1993) suggests that these differences are more semantic than anything else.

2.1.3 Network perspective

A third and more recent school of internationalization research, referred to as the network perspective, recognizes that foreign market development does not solely depend on firm-related advantage, but also relies on networking activities and strategic alliances (Blankenburg and Johanson 1992; Cunningham and Culligan 1991; Johanson and Mattsson 1988, 1992). Therefore, externalization rather than internalization of foreign markets and/or functions occurs. The portfolio of exchange relationships includes the firm's direct relationships (e.g., individuals, business units, public agencies, and noncommercial organizations) and its indirect connections to those individuals or entities with which firm personnel are directly linked (e.g., Firm X cooperates with Firms Y, which is linked also with Firm Z, thus Firm X and Z have an indirect relationship through Firm Y). Hence, networks can be limitless in ex-

[2] Bilkey and Tesar (1977) consider a six-stage process: (1) management is not interested in exporting, (2) management is willing to fill unsolicited orders, but makes no effort to explore the feasibility of active exporting, (3) management actively explores the feasibility of active exporting, (4) the firm exports on an experimental basis to some psychologically close country, (5) the firm becomes an experienced exporter to this country, and (6) management explores the feasibility of exporting to other more psychologically distant countries.

[3] Cavusgil (1980) suggests five stages: (1) domestic marketing, (2) pre-export stage, (3) experimental involvement, (4) active involvement, and (5) committed involvement.

[4] Czinkota (1982) introduces a six-stage model: (1) the completely uninterested firm, (2) the partially uninterested firm, (3) the exploring firm, (4) the experimental firm, (5) the experienced small exporter, and (6) the experienced large exporter.

[5] Reid (1981) defines the following five stages of internationalization: (1) export awareness, (2) export intention, (3) export trial, (4) export evaluation, and (5) export acceptance.

tent and are viewed as unbounded and nontransparent (Blankenburg and Johanson 1992; Johanson and Vahlne 1990, 1992).

By exploiting the complementary and synergistic potential of their members' capabilities and competencies, networks facilitate joint accomplishment of mutually beneficial although not necessarily identical goals. A basic assumption of the network approach is that the individual firm is dependent on resources controlled by other firms and secures access to those resources via its network position. It follows logically from this idea that firm internationalization is also influenced by the network (Bell 1995; Cunningham and Culligan 1991; Johanson and Mattsson 1988, 1992; Johanson and Vahlne 1990, 1992; O'Farrel and Wood 1999).

2.1.4 Business strategy

The business strategy framework is a pragmatic approach to firm internationalization. Under this approach, it is understood that firms take a wide range of variables into consideration when looking at the benefits and costs of various internationalization strategies, but at times do not have an entirely objectively rational way of choosing between the alternatives. However, by calculating the profit potential of each alternative, the options can be assessed more rationally to find the optimal solution and, thus, to find an appropriate mode of foreign market entry and/or to change the market servicing mode over time (Clark and Mallory 1997; Reid 1983; Welford and Prescott 1994). The business strategy approach emphasizes achieving success of the firm as a whole, not simply the efficiency maximization of individual subsidiary units. Accomplishing this goal requires actively managing interdependencies across firm divisions (Kim and Hwang 1992).

Generally, scholars distinguish between two groups of variables relevant to the internationalization decision: external and internal factors (Kim and Hwang 1992; Porter 1985; Reid 1983; Root 1987; Turnbull and Ellwood 1986). The external factors involve market characteristics and supply conditions of both the host country and home regions (e.g., workforce, market accessibility and attractiveness, cultural distance, ease of transportation, and degree of competition). The internal variables are comprised of firm-related factors, specifically the firm resources (such as size, branch, capital resources, managerial knowledge, export orientation and international trade experience) and firm product factors (particularly technology level and product differentiation).

2.2 Internationalization Theories and Diversity of Service and Manufacturing Firms

The research discussed above deals with various strands of the complex phenomenon of firm internationalization and they complement each other more than they compete (Coviello and McAuley 1999; Daniels 1991). However, each has its own specifics and/or drawbacks that disqualify it from being completely appropriate for this study (O'Farrell et al. 1998).

The main criticism of the FDI theory is that it attempts to explain the extent, form, and location of foreign investment of MNEs by focusing primarily on transaction-cost advantages (TCA), rather than on the pattern of firm internationalization (Johansson and Mattsson 1988). In fact, many service companies have lower capital needs than manufacturing firms and thus benefit from lower entry barriers into foreign markets in terms of financial constraints—establishing an office, for example, is much cheaper than setting up a manufacturing plant. Indeed, the internalization approach neglects a variety of non-TCA stimuli (e.g., following client's foreign market entry, securing product quality, enhancing firm prestige) that are important determinants of firm internationalization (Bell 1995; Erramilli and Rao 1993; Roberts 1999). Furthermore, though Dunning claims that firm internationalization should be investigated in a wider strategic context, he does not consider it a managerial decision-making process (Coviello and McAuley 1999). Neither does Dunning make any distinction between beginners and advanced firms in foreign markets or between various forms of foreign investment (Forsgren 1989), all of which make the FDI approach inappropriate for this paper.

Reid (1983) argues that the stage model approach is too deterministic and that the internationalization process of individual firms is highly situational. Firms, regardless of industry sector, do not necessarily implement consistent and incremental steps toward internationalization (e.g., Bell 1995; Clark and Mallory 1997; Crick, Chaudhry and Batstone 2001; Lautanen 2000). Moreover, stage models appear to be too inflexible to account for firm strategic (re-)orientation (such as combining various modes of foreign market servicing in one country or withdrawing from a foreign market altogether) or foreign market specifics and requirements with respect to entry modes (McKiernan 1992; Turnbull and Valla 1986; Young, Hammill, Wheeler and Davies 1986). Further critique of the stage model involves that it neglects the conditions under which a firm might begin international engagement or shift from one stage to another (Cavusgil 1980). Thus, this research strand does not appear to be an effective theoretical framework for investigating strategic firm internationalization.

As to the network perspective, scholars emphasize the collaborative nature of the internationalization of knowledge-based services (e.g., Bell 1995; Knight 1999; O'Farrell et al. 1998; O'Farrell and Wood 1999). And, indeed, due to their very nature, services generally do re-

quire a more intense client-producer interaction than does manufacturing, where standardization of the product across countries is easier to achieve. On the other hand, by focusing solely on the interdependencies between actors, the network approach does not provide any explanation for certain foreign market development that is only partially the result of collaboration and even less for that which occurs without any cooperation. Thus, the network perspective provides only a partial explanation for internationalization and needs to be complemented by broader aspects of firm strategy.

Compared to the frameworks discussed above, the business strategy approach is more multilateral and appears flexible enough to handle the development, characteristics, and goals of individual firms, on the one hand, and to capture the influence of firm environment (e.g., competition situation or locational conditions) on the other (Clark and Mallory 1997; Kim and Hwan 1992; O'Farrell et al. 1998). Therefore, this study is primarily based on the business strategy approach, with some attention to the network perspective.

I expect that both internal and external factors play an important role in the internationalization of SMEs. Internal factors, such as firm size, age, and innovation capability, should incorporate the influence of the firm's characteristics, capacities, and strategic orientation. External factors, such as attractiveness of firm location or collaboration and networking, should capture the impact of the firm environment on its international activities. Due to the great diversity between the manufacturing and service sectors (discussed above), as well as large differences between specific industries, predictions about differences in the effects of the particular factors of firm internationalization between the two sectors have been, to date, highly ambiguous. This study intends to shed some light on this issue.

3 Data and Econometric Model

3.1 Data

I use firm-level data collected by the German Institute for Economic Research (DIW Berlin) in the course of a large survey entitled "Current Situation and Outlook of East German Firms."[6] This survey was sent to 30,000 firms in East Germany in 2004; the response rate was approximately 20 percent. To avoid the potential bias of affiliation with a firm group, firms that were related to a firm group in 2002 and did not relocate their production or another unit abroad in 2003/2004 are excluded from the analysis. Observations with missing values are removed, too, leaving a final sample of 3,939 firms (3,063 manufacturing firms and 876 engaged in services).

[6] The survey was carried out on behalf of the German Ministry of Education and Science.

The questionnaire consisted of 49 questions eliciting general information about a firm, its business operations, the economic and competition situation, and R&D activities, as well as cooperation and networking. Firms also provided information about their production capacity and the importance and quality of several different locational factors, including proximity to universities, regional availability of skilled labor, and different types of support provided by regional authorities and institutions. Because locational conditions have improved significantly in many East German regions over the last 15 years and yet there is still strong heterogeneity between regions (Fritsch, Hennig, Slavtchev and Steigenberger 2007), these data are highly appropriate for testing locational effects (Eickelpasch, Lejpras and Stephan 2007; Lejpras and Stephan 2008).

The use of qualitative firm assessments of business situation and locational conditions arguably raises the concern that the data will be biased as it is possible that a firm's assessment of locational conditions may not reflect the objective reality of same. For instance, a firm's perception of proximity to a university or an airport may vary somewhat from the actual distance. However, perceptions, regardless of their objective truth, still have an impact on decision making and thus can be crucial to economic activity.

3.2 Model and Hypotheses

3.2.1 Methodology and dependent variables

Each firm has two choices with respect to internationalization in 2003/2004: (1) to engage in exporting, and/or (2) to relocate production and/or other business operations abroad. Since it is possible that a firm employs both foreign strategies simultaneously, the empirical analysis uses a bivariate probit model approach that allows for two binary choice equations with correlated disturbances (e.g., Greene 2003). Let EX represent the exporting strategy choice, where $EX = 1$ if a firm sells on the foreign markets and $EX = 0$ if the firm has domestic sales only. Another binary choice dependent variable R takes the value 1 if the firm relocates abroad and 0 if the firm does not relocate abroad. The developed econometric model is given as follows:

$EX^* = x'\beta_{EX} + \varepsilon_{EX}$, where $EX = 1$ if $EX^* > 0$, 0 otherwise,

$R^* = x'\beta_R + \varepsilon_R$, where $R = 1$ if $R^* > 0$, 0 otherwise,

$E\left[\varepsilon_{EX} \mid x\right] = E\left[\varepsilon_R \mid x\right] = 0$,

$Var\left[\varepsilon_{EX} \mid x\right] = Var\left[\varepsilon_R \mid x\right] = 1$,

$Cov\left[\varepsilon_{EX}, \varepsilon_R \mid x\right] = \rho$.

Hence, the error terms ε_{EX} and ε_R are assumed to be jointly normally distributed with zero means, unit variances, and a correlation coefficient ρ. The vector x denotes a set of explanatory variables (described below) that are identical for the two equations in this model. Moreover, the empirical specification of the model entails four categories of observations, with their unconditional probabilities:

$$\Pr(EX=1, R=1) = \Phi(x'\beta_{EX}, x'\beta_R, \rho),$$

$$\Pr(EX=1, R=0) = \Phi(x'\beta_{EX}) - \Phi(x'\beta_{EX}, x'\beta_R, \rho),$$

$$\Pr(EX=0, R=1) = \Phi(x'\beta_R) - \Phi(x'\beta_{EX}, x'\beta_R, \rho),$$

$$\Pr(EX=0, R=0) = 1 - \Phi(x'\beta_{EX}) - \Phi(x'\beta_R) + \Phi(x'\beta_{EX}, x'\beta_R, \rho),$$

where Φ refers to the bivariate standard normal cumulative distribution function. The corresponding log-likelihood function is:

$$\ln L = \sum_k \ln \Pr(EX_k, R_k), \text{ where } k = 0,1.$$

3.2.2 Independent variables

Table 1 sets out the specification and measurement of the explanatory variables included in the model. Accordingly to the business strategy approach, the independent variables represent the firm-related characteristics and capabilities (firm size, age, innovativeness, industry), as well as attributes specific to the firm environment (locational conditions, competition situation, collaboration activities). A detailed description of the exogenous variables follows.

Size. Even though SMEs are more frequently internationalizing (Knight 2001; Lo, Hauser, Stiebale, Engel and Kohlberger 2007; OECD 2008), the literature generally finds that these firms are less likely to engage in foreign activity than are larger companies, chiefly due, it is argued, to their lower resource capacities in terms of finance, knowledge, or managerial experience. They are also more sensitive to external barriers, for example, market and/or product standard regulations, compared to larger companies (e.g., Acs, Morck, Shaver and Yeung 1997; Brunninge, Nordqvist and Winklund 2007; Hollenstein 2005; Kuo and Li 2003). Hence, I expect that firm size, measured by number of employees, positively relates to internationalization. To account for the possible nonlinear effects of firm size, the model includes four dummy variables for the following size categories: (1) size < 10, (2) size ≥ 10 but < 50, (3) size ≥ 50 but < 100, and (4) size ≥ 100.

Age. The business strategy approach views a firm's international behavior as dependent on its resources and capabilities, as well as external conditions. As a firm ages, it develops

managerial and entrepreneurial competencies and accumulates knowledge and experience about the competitive environment. Thus, firm age should positively affect its involvement in foreign markets. Firm age is captured in the model through three dummy variables: (1) age < 3 years, (2) age ≥ 3 but < 15, and (3) age ≥ 15.

Innovativeness. Firm innovativeness is assessed by way of four variables: (1) deployment share in R&D in 2003 (as a percentage), (2) a dummy for introducing a novel product on the domestic and/or foreign market in 2003/2004, (3) a dummy for applying for a patent in 2003/2004, and (4) a dummy for issuing a license in 2003/2004. The internationalization literature emphasizes that superior innovation capabilities play a decisive role in a firm's foreign engagement (e.g., Buckley and Casson 1976; Dunning 1988; Miesenbock 1988; Mutinelli and Piscitello 1998). Accordingly, I expect that firm innovativeness spurs its internationalization.

Industry. The last group of firm-specific explanatory variables includes a dummy for affiliation with the manufacturing sector, as well as dummies for affiliation with high-tech manufacturing and/or high-tech services.[7] Generally, the literature suggests that manufacturing firms, as well as firms servicing knowledge-intensive products, have a higher degree of internationalization than their counterparts from the service sector and/or low-tech firms.

Locational conditions. The existence of clusters and the spatial concentration of economic activity illustrate the crucial role of firm location (e.g., Dunning 1998; O'Farrell, Wood and Zheng 1998; Porter 2000). Indeed, a firm located in a region with good-quality factor endowment should enhance its internationalization. In the model, the influence of firm location is separated into the effects of four groups of locational conditions: availability of skilled labor, transportation infrastructure, proximity to research facilities, and various types of support from public authorities and other bodies. The particular locational factors are assessed by firms on a six-point Likert scale, ranging from unimportant (0), important and very bad quality (1), to important and very good quality (5). The variable "skilled labor" refers to the mean value of the firm's assessment of the regional availability of skilled workers and additional education supply. The variable "transportation" has to do with interregional transportation links. The variable "research facilities" is the mean value of the assessments of proximity to universities and research institutes. Finally, the variable "support" encompasses assessments

[7] Here, I use the industries classification according to Götzfried (2004). High-tech manufacturing industries include chemicals and chemical products (NACE 24), machinery and equipment (NACE 29), office machinery and computers (NACE 30), electrical machinery and apparatus (NACE 31), radio, television, and communication equipment and apparatus (NACE 32), medical, precision, and optical instruments, watches, and clocks (NACE 33), motor vehicles, trailers, and semi-trailers (NACE 34), and other transport equipment (NACE 35). High-tech services are computer and related activities (NACE 72) and research and development (NACE 73).

of support from local financial institutions, job centers, local government, business development corporations, state government, and chambers.

Competitors. The competition situation is included via two dummy variables: (1) one for having main competitors located abroad, and (2) one for having main rivals in proximity to the firm (i.e., within 30-km radius from the company's headquarters). Porter (1990) argues that strong local competition exerts constant pressure on a firm to innovate, improve product and quality standards, increase efficiency, and reduce prices. Indeed, co-location with strong rivals facilitates discovering and developing sources of competitive advantage and, thus, achieving success internationally. Furthermore, the literature suggests that organizations tend to exhibit mimetic isomorphism and/or "follow-the-leader behavior" (DiMaggio and Powell 1983; Ito and Rose 2002; Levitt and March 1988). Accordingly, to reduce uncertainty, a firm is likely to imitate its foreign rival's successful international practices. Hence, I expect the two variables to relate positively to firm internationalization.

Cooperation. The model includes three dummy variables for frequent cooperation with a variety of partners (e.g., universities, research institutes, or other firms) in three fields: product development, process development, and sales. Accordingly to the network approach, collaboration activities should facilitate internationalization by enabling firms to gain access to the complementary resources, competencies, and capabilities of their cooperation partners.

First, I estimate the econometric model for all firms so as to identify the determinants of choosing different modes of foreign market entry by SMEs. I also estimate the model separately for the manufacturing firms and the service firms and thus am able to discover whether the significance and the magnitude of each explanatory variable differs between the two groups.

Table 1 about here.

4 Results

4.1 Descriptive Analysis

The sample includes data for 3,939 firms—3,063 manufacturing firms and 876 from the service sector. About 70 percent of all firms neither exported nor relocated abroad; about 30 percent engaged in international activities in 2003/2004 (see Figure 1). Thus, 28.1 and 0.6 percent engaged in exporting only and relocated production and/or other operations abroad only in 2003/2004, respectively. Moreover, 1.6 percent adopted both internationalization strategies simultaneously. On average, firms from high-tech manufacturing operate more frequently on

foreign markets than other firms. Though high-tech services are more frequently engaged in international activity than are other types of services, the extent of this engagement is still only at about the level of that of low-tech manufacturing.

Figure 1 about here.

Table 2 presents the distribution of firms in industries (at the two-digit level of NACE) and internationalization strategies. Not surprisingly, manufacturing firms selling on domestic markets only are more often affiliated with lower technology manufacturing, such as food products and beverages, wood products, nonmetallic mineral products, and fabricated metal products. However, firms that choose to internationalize, in whatever form, are from both high-tech and low-tech industries. Regarding the service sector, the vast majority of those firms engaged in real estate activities and education (100 percent of firms from the two branches), as well as the renting of machinery and equipment (about 90 percent of these firms), are chiefly oriented to domestic markets. Only those firms engaged in research and development appear to show on average a considerably higher internationalization degree than other services.

Table 2 about here.

Table 3 sets out the distribution of firms in five size categories. Approximately 90 percent of all firms have fewer than 50 employees and only about 3 percent have more than 100 employees. Manufacturing firms are significantly larger than service firms.

Table 3 about here.

Table 4 presents the means and standard deviations of the explanatory variables included in the econometric model, as well as the results of t-tests on mean differences for manufacturing and service firms compared to all firms. The two types are considerably different. First, the service firms engage in significantly less exporting (assessed in terms of share in total turnover in the year 2002 and in 2003/2004) compared to the all-firms group. Second, manufacturing firms are significantly older than all firms; service firms are younger: 77 and 94 percent of manufacturing and service firms are less than 15 years old, respectively. Regarding innovation activity, service firms have significantly higher deployment share in R&D and

issue licenses more frequently than all firms; manufacturing firms employ on average fewer personnel in R&D and issue licenses less frequently. Furthermore, manufacturing firms gave significantly better assessments of support from regional authorities and other organizations, and worse assessments of the proximity to research facilities, than all firms. Service firms gave consistently higher ratings to the regional supply of skilled labor and proximity to research facilities than did the all-firms group. Nevertheless, service firms, on average, provide worse assessments of the "support" locational condition.[8] Finally, the share of firms having main competitors located abroad is higher for the manufacturing sector and lower for services compared to the all-firms group. However, service firms have main rivals co-located more frequently than all firms; the manufacturing firms encounter this situation less frequently.

Table 4 about here.

4.2 Model Estimation Results

The next subsection presents the results of the model estimation using the data from all SMEs in the sample. In the Section 4.2.2, I discuss those findings that relate to differences between the manufacturing and service firms with respect to the determinants of their internationalization.

4.2.1 Antecedents of SMEs' Internationalization

Table 5 sets out the estimates of the bivariate probit model for all firms. The correlation coefficient ρ is 0.288 and highly significant, suggesting that the bivariate choice approach is more appropriate than a two univariate probit one. A positive ρ value indicates that unobservable factors, such as managerial experience or motivation, that increase the probability of exporting are also associated with a higher likelihood to relocate abroad (after accounting for the impact of the included factors). In addition to estimated coefficients, I also present the corresponding marginal effect at means of the independent variables to simplify interpretation of results.[9]

Three variables are especially important determinants of SME internationalization. First, firm size—assessed in terms of number of employees—relates significantly positively both to

[8] Figure 2 in the Appendix presents the importance and assessment of specific locational conditions as rated by the firms.

[9] The marginal effects shown in Table 5 refer to the marginal probabilities of engaging in exports and relocating abroad, respectively, which are given by: $\Pr(EX=1)=\Pr(EX=1,R=1)+\Pr(EX=1,R=0)$ and $\Pr(R=1)=\Pr(EX=1,R=1)+\Pr(EX=0,R=1)$.

exports and relocation abroad. The second crucial factor is the competition situation. The findings show that having main rivals abroad is conducive to internationalization, as expected. Thus, this result seems to confirm the mimetic behavior of firms. Contrary to expectations, however, is that having main competitors in proximity significantly impairs a firm's probability of international activity. Interestingly, the negative impact of co-location with main rivals is much stronger on exporting activity than it is on relocation abroad. Third, firm innovativeness enhances internationalization. Introducing novel products and applying for patents are driving forces behind exporting. Internationalization via relocation abroad is significantly facilitated by introducing novel products only.

I find that being a manufacturer significantly increases the probability of exporting. However, the strategy of relocation of production or other operations appears to be independent of industry sector. Surprisingly, I find a negative influence of firm age on exporting: firms older than 15 appear more likely to sell on domestic markets only than to export.[10]

Several explanatory variables specific to the firm environment significantly influence SME internationalization. I find that proximity to research facilities (universities and/or research institutes) fosters exporting. Surprisingly, the regional availability of skilled labor appears to diminish the probability of exporting. Nevertheless, SMEs selling on the foreign market have a significantly higher share of employees with a university degree than their nonexporting counterparts.[11] This could imply that the nonlocal, or extra-regional, labor markets are more important sources of acquiring skilled workers for SMEs that export.

Good-quality interregional transportation infrastructure is conducive to a decision to relocate abroad. Firms that give good assessments to the support provided by various regional bodies are less likely to relocate abroad, as are firms who engage in frequent collaborating in sales. Contrary to expectations, cooperation activities appear to have an insignificant effect on an SME's decision to sell on the foreign market.

Table 5 about here.

[10] Empirical studies present inconsistent results on the relationship between firm age and internationalization. Some scholars find no correlation, while others detect a positive sign or even a negative relation, emphasizing the growing role of born-globals—firms that engage in foreign activity soon after founding—in the business world (e.g., Autio, Sapienza and Almeida 2000; Keeble, Lawson, Smith, Moore and Wilkinson 1998; Kundu and Katz 2003; Lo et al. 2007; Miesenbock 1988).

[11] For the exporting and nonexporting firms, the share of employees with a university degree amounts on average to 24.4 and 19.7 percent, respectively. The difference of these mean values is significant at the 1 percent level (the calculated t-value is –4.73).

4.2.2 Differences Between Service and Manufacturing SMEs

The model estimation results for the separate samples of manufacturing and service SMEs reveal that there are substantial differences between the two sectors as to internationalization (see Table 6). For manufacturing SMEs, being from a high-tech industries strengthens the probability of engaging in exporting, but has an insignificant impact on relocating abroad. For service firms, however, being high-tech has no significant impact on any type of internationalization, but having main competitors located abroad is quite important to the exporting decision. For manufacturing firms, having foreign and local competitors has about the same impact on the propensity to export, but in opposite directions.

Regarding firm innovation capabilities, I find that only one variable—introduction of a novel product on either the domestic or foreign market—significantly favors exporting by service SMEs. For the manufacturing sector, however, two innovation output variables—applying for a patent and introducing a novel product—significantly enhance exports. Introducing a novel product also has a significantly positive impact on the decision to relocate abroad. Interestingly, looking at the innovation input side, the results for manufacturing SMEs show that the higher the deployment share in R&D, the lower the probability of relocating abroad. In other words, manufacturing SMEs with a high degree of R&D appear less likely to separate production from other operating areas and relocate, than do their counterparts with low R&D intensity.

The findings show that certain locational conditions influence SME internationalization differently, depending on whether the SME is in manufacturing or in services. Only good-quality supra-regional transportation links are significantly positively related to engaging in exporting by service firms; however, several locational factors appear to affect the foreign activity of manufacturing firms. The presence of research facilities and various types of support from regional authorities and other bodies are conducive to exporting by manufacturing firms. However, firms that assess these locational factors as good are also less likely to relocate production or other operations abroad. Furthermore, good-quality transportation infrastructure slightly increases the probability of a manufacturer to relocate abroad.

Finally, the influence of cooperation activities on choice of internationalization strategy by manufacturing SMEs appears to differ from that it has on service sector SMEs. Frequent cooperation in process development favors relocating abroad for manufacturing firms, but this relationship is negative for service firms. Additionally, manufacturing firms that collaborate frequently in sales are less likely to relocate abroad.

Table 6 about here.

5 Conclusions and Implications

Based on two approaches to firm internationalization—the business strategy approach and the network perspective—this paper investigates the driving forces behind international activity of SMEs, focusing on differences between the manufacturing and service sectors. Specifically, I analyze which factors influence firm choice between two alternative foreign strategies: engaging in exporting and/or relocating production or other operations abroad. To this end, I employ a bivariate probit model approach that can account for possible correlation between the two binary dependent variables. The model is based on survey data from approximately 3,900 SMEs from East Germany and includes various firm-related and external factors.

The results from both the descriptive and econometric analysis reveal that manufacturing SMEs, particularly in high-tech industries, engage in more exporting than do their service counterparts. Furthermore, findings from the model estimating for the manufacturing and service sectors separately show that there are considerable differences between the two with respect to the specific antecedents of internationalization. Regarding firm innovativeness, only introducing a novel product on the domestic and/or foreign market facilitates the decision to export for service firms. For the manufacturing sector, two innovation output variables—patent applications and novel products—foster engaging in exports. Interestingly, however, manufacturing firms with a high deployment share in R&D and/or that assess proximity to research facilities as an important and good locational condition, are less likely to relocate.

Having main competitors located abroad, as well as firm size, significantly enhance the internationalization of all SMEs, regardless of industry affiliation. However, having main rivals in proximity to the firm has a significant negative impact on engaging in foreign market activity. This surprising finding deserves attention in future research.

Overall, it is more difficult to discern the significant determinants of firm internationalization for service SMEs than it is for manufacturing firms. One possible explanation for this outcome might involve the lower degree of standardization in service products compared to manufacturing goods, which also makes foreign activity by service firms more unique and highly situation-specific (e.g., Bell 1995; Clark and Mallory 1997). Moreover, scholars argue that the internationalization of service SMEs varies substantially between particular industries (e.g., Samiee 1999; Nachum 1999; OECD 2008). Thus, future investigation of SME internationalization patterns and processes, especially that focused on the service sector, should take intra-industry differences into consideration.

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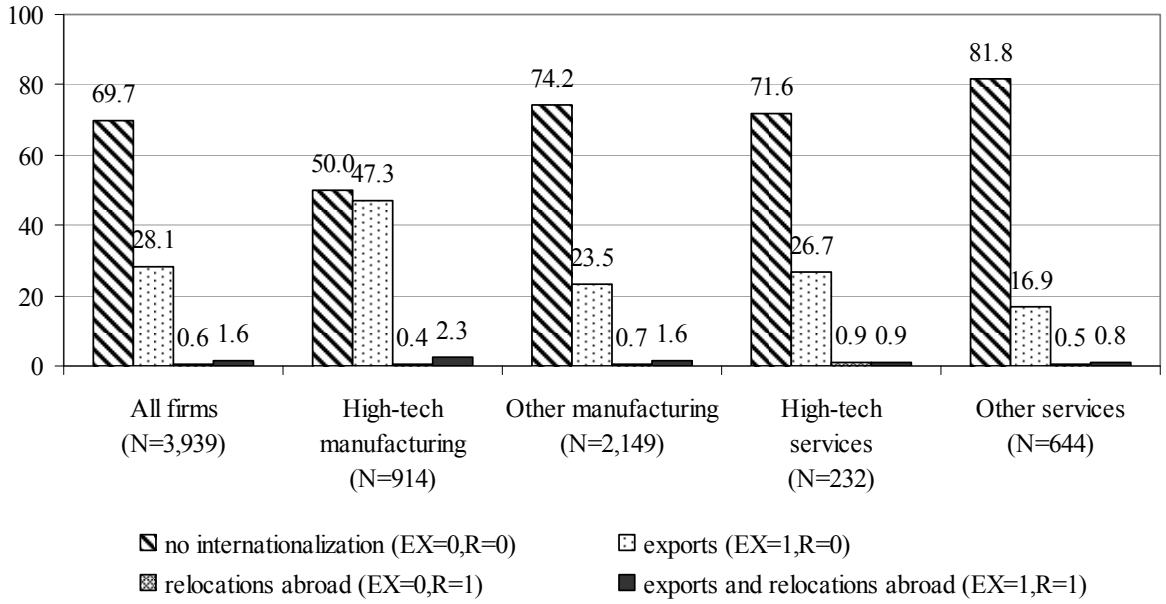
Figures

Figure 1 Firm distribution in internationalization strategies—relative frequencies (in percentages)



Note: High-tech manufacturing industries include chemicals and chemical products (NACE 24), machinery and equipment (NACE 29), office machinery and computers (NACE 30), electrical machinery and apparatus (NACE 31), radio, television, and communication equipment and apparatus (NACE 32), medical, precision, and optical instruments, watches, and clocks (NACE 33), motor vehicles, trailers, and semi-trailers (NACE 34), and other transport equipment (NACE 35). High-tech services are computer and related activities (NACE 72) and research and development (NACE 73).

Tables

Table 1 Specification of the exogenous variables

Variable	Description
FIRM-SPECIFIC FACTORS	
Size	dummies for (1) size < 10 employees, (2) size ≥ 10 but < 50, (3) size ≥ 50 but < 100, (4) size ≥ 100
Age	dummies for (1) age < 3 years, (2) age ≥ 3 but < 15, (3) age ≥ 15
Innovativeness	
R&D deployment	deployment share in R&D in 2003 as percentage
Novel products	a dummy for introducing novel products in 2003/2004
Patent applications	a dummy for applying for patents in 2003/2004
License issues	a dummy for issuing licenses in 2003/2004
Industry affiliation	
Manufacturing	a dummy for affiliation with the manufacturing sector
High-tech manufacturing	a dummy for affiliation with high-tech manufacturing
High-tech services	a dummy for affiliation with high-tech services
EXTERNAL FACTORS	
Locational conditions	
Skilled labor	firm assessment of the regional availability of skilled labor and additional education supply
Research facilities	firm assessment of proximity to research facilities
Transportation	firm assessment of interregional transportation links
Support	firm assessment of support from regional authorities and other organizations
Competitors	
Foreign competitors	a dummy for having main competitors located abroad
Local competitors	a dummy for having main competitors co-located (within 30-km radius from firm headquarters)
Cooperation	
Product development	a dummy for frequent cooperation in product development
Process development	a dummy for frequent cooperation in process development
Sales	a dummy for frequent cooperation in sales

Table 2 Firm distribution in internationalization strategies and industries

	Internationalization strategy								
	EX=0,R=0		EX=1,R=0		EX=0,R=1		EX=1,R=1		
	N	*RRF*	N	*RRF*	N	*RRF*	N	*RRF*	Total
Food products and beverages	241	*88.9*	26	*9.6*	1	*0.4*	3	*1.1*	271
Textiles	44	*54.3*	34	*42.0*	0	*0.0*	3	*3.7*	81
Wearing apparel	28	*66.7*	11	*26.2*	2	*4.8*	1	*2.4*	42
Tanning and dressing of leather	18	*69.2*	6	*23.1*	0	*0.0*	2	*7.7*	26
Wood and products of wood and cork, except furniture	130	*82.8*	25	*15.9*	1	*0.6*	1	*0.6*	157
Pulp, paper, and paper products	12	*44.4*	15	*55.6*	0	*0.0*	0	*0.0*	27
Publishing, printing, and reproduction of recorded media	184	*79.0*	45	*19.3*	3	*1.3*	1	*0.4*	233
Chemicals and chemical products	24	*37.5*	37	*57.8*	1	*1.6*	2	*3.1*	64
Rubber and plastic products	82	*48.8*	81	*48.2*	0	*0.0*	5	*3.0*	168
Other nonmetallic mineral products	130	*81.3*	28	*17.5*	0	*0.0*	2	*1.3*	160
Basic metals	20	*50.0*	18	*45.0*	2	*5.0*	0	*0.0*	40
Fabricated metal products, except machinery and equipment	563	*77.1*	153	*21.0*	4	*0.5*	10	*1.4*	730
Machinery and equipment n.e.c.	185	*51.4*	168	*46.7*	0	*0.0*	7	*1.9*	360
Office machinery and computers	4	*33.3*	8	*66.7*	0	*0.0*	0	*0.0*	12
Electrical machinery and apparatus n.e.c.	80	*54.8*	60	*41.1*	1	*0.7*	5	*3.4*	146
Radio, television, and communication equipment and apparatus	19	*38.8*	27	*55.1*	0	*0.0*	3	*6.1*	49
Medical, precision, and optical instruments, watches, and clocks	107	*48.6*	111	*50.5*	0	*0.0*	2	*0.9*	220
Motor vehicles, trailers, and semi-trailers	15	*48.4*	14	*45.2*	1	*3.2*	1	*3.2*	31
Other transport equipment	23	*71.9*	7	*21.9*	1	*3.1*	1	*3.1*	32
Furniture; manufacturing n.e.c.	85	*59.9*	48	*33.8*	2	*1.4*	7	*4.9*	142
Recycling	57	*79.2*	15	*20.8*	0	*0.0*	0	*0.0*	72
Total manufacturing	*2,051*	*67.0*	*937*	*30.6*	*19*	*0.6*	*56*	*1.8*	*3,063*
Wholesale and retail sales	32	*80.0*	8	*20.0*	0	*0.0*	0	*0.0*	40
Transporting and storage	10	*83.3*	2	*16.7*	0	*0.0*	0	*0.0*	12
Real estate activities	5	*100.0*	0	*0.0*	0	*0.0*	0	*0.0*	5
Renting of machinery and equipment without operator and of personal and household goods	50	*94.3*	3	*5.7*	0	*0.0*	0	*0.0*	53
Computer and related activities	149	*77.2*	42	*21.8*	1	*0.5*	1	*0.5*	193
Research and development	17	*43.6*	20	*51.3*	1	*2.6*	1	*2.6*	39
Other business activities	425	*80.3*	96	*18.1*	3	*0.6*	5	*0.9*	529
Education	5	*100.0*	0	*0.0*	0	*0.0*	0	*0.0*	5
Total services	*4,032*	*460.3*	*1,765*	*201.5*	*35*	*4.0*	*101*	*11.5*	*876*
Total	2,744	*69.7*	1,108	*28.1*	24	*0.6*	63	*1.6*	3,939

NOTE: RRF refers to the relative row frequency (in percentages). Bold descriptions show high-tech manufacturing and service industries.

Table 3 Firm distribution in size (in number of employees) categories

	Manufacturing firms		Service firms		All firms	
	N	*RCF*	N	*RCF*	N	*RCF*
size < 10	1,422	*46.4*	587	*67.0*	2,009	*51.0*
10 ≤ size < 50	1,353	*44.2*	256	*29.2*	1,609	*40.8*
50 ≤ size < 100	188	*6.1*	21	*2.4*	209	*5.3*
100 ≤ size < 250	85	*2.8*	11	*1.3*	96	*2.4*
size ≥ 250	15	*0.5*	1	*0.1*	16	*0.4*
Total	3,063	*100.0*	876	*100.0*	3,939	*100.0*

NOTE: RCF refers to relative column frequency (in percentages).

Table 4 Descriptive statistics

	Manufacturing firms		Service firms		All firms	
Variable	Mean	SD	Mean	SD	Mean	SD
Export intensity in 2002	6.30	15.72	3.51 -	13.13	5.68	15.23
Export intensity in 2003/2004	6.92	16.05	4.22 -	14.02	6.32	15.66
Age (in years)						
age < 3	0.11	0.31	0.10	0.30	0.11	0.31
3 ≤ age < 15	0.67 -	0.47	0.84 +	0.37	0.71	0.45
age ≥ 15	0.22 +	0.41	0.06	0.24	0.18	0.39
Innovativeness						
R&D deployment	4.65 -	12.32	10.00 +	22.48	5.84	15.34
Novel products	0.14	0.34	0.14	0.35	0.14	0.34
Patent applications	0.08	0.27	0.08	0.27	0.08	0.27
License issues	0.01 -	0.11	0.05 +	0.22	0.02	0.15
Locational conditions						
Skilled labor	1.56	1.33	1.79 +	1.43	1.61	1.35
Research facilities	0.39 -	1.10	0.89 +	1.56	0.50	1.23
Transportation	1.40	1.77	1.42	1.83	1.40	1.78
Support	1.08 +	0.99	0.83 -	0.87	1.02	0.97
Competitors						
Foreign competitors	0.22 +	0.42	0.07 -	0.25	0.19	0.39
Local competitors	0.46 -	0.50	0.58 +	0.49	0.49	0.50
Cooperation						
Product development	0.25	0.43	0.24	0.43	0.25	0.43
Process development	0.21	0.41	0.21	0.41	0.21	0.41
Sales	0.26	0.44	0.24	0.43	0.25	0.43
N	3,063		876		3,939	

Note: t-tests on differences of means: + significantly larger, - significantly smaller than comparison group (all firms) at 5 percent level.

Table 5 Bivariate probit model for all firms—Beta coefficients, marginal effects, and corresponding robust standard errors in parentheses

	Exports (EX=1)		Relocations abroad (R=1)	
	coeff./s.e.	marg. eff./s.e.	coeff./s.e.	marg. eff./s.e.
Constant	-0.884***		-2.149***	
	(0.104)		(0.214)	
FIRM-SPECIFIC FACTORS				
Size (size < 10 is the reference group)				
10 ≤ size < 50 [a]	0.335***	0.1101***	0.002	0.0001
	(0.051)	(0.017)	(0.117)	(0.004)
50 ≤ size < 100 [a]	0.742***	0.2757***	0.722***	0.0484***
	(0.101)	(0.040)	(0.159)	(0.018)
size ≥ 100 [a]	1.041***	0.3927***	0.970***	0.0854***
	(0.143)	(0.053)	(0.176)	(0.029)
Age (age < 3 is the reference group)				
3 ≤ age < 15 [a]	-0.005	-0.0016	0.046	0.0015
	(0.079)	(0.026)	(0.175)	(0.005)
age ≥ 15 [a]	-0.221**	-0.0679**	0.095	0.0033
	(0.094)	(0.028)	(0.196)	(0.007)
Innovativeness				
R&D deployment	0.002	0.0005	-0.006	-0.0002
	(0.002)	(0.001)	(0.005)	(0.000)
Novel products [a]	0.442***	0.1555***	0.291**	0.012*
	(0.072)	(0.027)	(0.135)	(0.007)
Patent applications [a]	0.416***	0.1474***	0.102	0.0036
	(0.090)	(0.034)	(0.158)	(0.006)
License issues [a]	0.218	0.0749	0.337	0.0157
	(0.160)	(0.058)	(0.268)	(0.017)
Industry affiliation				
Manufacturing [a]	0.209***	0.0647***	0.011	0.0004
	(0.065)	(0.019)	(0.132)	(0.004)
EXTERNAL FACTORS				
Locational conditions				
Skilled labor	-0.035*	-0.0113*	-0.017	-0.0005
	(0.020)	(0.006)	(0.039)	(0.001)
Research facilities	0.075***	0.0241***	-0.054	-0.0017
	(0.021)	(0.007)	(0.047)	(0.002)
Transportation	0.008	0.0027	0.050*	0.0016*
	(0.014)	(0.004)	(0.028)	(0.001)
Support	0.032	0.0104	-0.141**	-0.0046**
	(0.026)	(0.008)	(0.060)	(0.002)
Competitors				
Foreign competitors [a]	0.690***	0.2462***	0.393***	0.017***
	(0.059)	(0.022)	(0.108)	(0.006)
Local competitors [a]	-0.696***	-0.2211***	-0.268**	-0.0087**
	(0.051)	(0.016)	(0.114)	(0.004)
Cooperation				
Product development [a]	-0.019	-0.0061	-0.033	-0.0011
	(0.090)	(0.029)	(0.160)	(0.005)
Process development [a]	-0.137	-0.0429	0.294*	0.0117
	(0.093)	(0.028)	(0.172)	(0.008)
Sales [a]	0.073	0.024	-0.425**	-0.0112***
	(0.072)	(0.024)	(0.175)	(0.004)
N	3,939			
Log likelihood	-2,200.39			
Rho (ρ)	0.288***			

Note: * p < 0.10, ** p < 0.05, *** p < 0.01. ([a]) dy/dx is for discrete change of dummy variable from 0 to 1.

Table 6 Bivariate probit model for manufacturing and service firms—Marginal effects from joint distributions

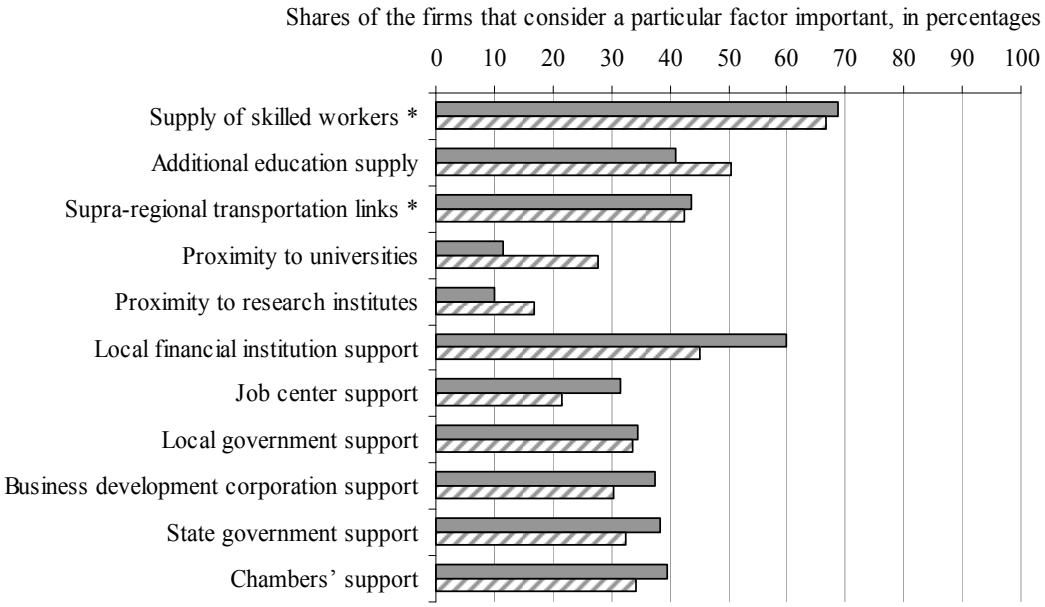
	Manufacturing			Services		
	EX=1,R=1	EX=1,R=0	EX=0,R=1	EX=1,R=1	EX=1,R=0	EX=0,R=1
FIRM-SPECIFIC FACTORS						
Size (size < 10 is the reference group)						
10 ≤ size < 50 [a]	0.0016	0.1087***	-0.0015	-0.0002	0.1070***	-0.0014
	(0.002)	(0.019)	(0.002)	(0.002)	(0.032)	(0.002)
50 ≤ size < 100 [a]	0.0345**	0.2698***	0.0050	0.0374	0.1064	0.0326
	(0.014)	(0.041)	(0.004)	(0.029)	(0.095)	(0.027)
size ≥ 100 [a]	0.0795***	0.3086***	0.0110	-0.0020**	0.3351**	-0.0023
	(0.026)	(0.062)	(0.008)	(0.001)	(0.162)	(0.002)
Age (age < 3 is the reference group)						
3 ≤ age < 15 [a]	0.0010	0.0038	0.0007	0.0006	0.0088	0.0007
	(0.003)	(0.029)	(0.003)	(0.001)	(0.048)	(0.002)
age ≥ 15 [a]	0.0010	-0.0510	0.0024	0.0000	-0.0544	0.0010
	(0.004)	(0.033)	(0.004)	(0.002)	(0.057)	(0.004)
Innovativeness						
R&D deployment	-0.0003**	0.0011	-0.0003***	0.0000	0.0000	0.0000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Novel products [a]	0.0102*	0.1367***	0.0022	0.0063	0.1137**	0.0042
	(0.006)	(0.032)	(0.003)	(0.005)	(0.049)	(0.005)
Patent applications [a]	0.0049	0.1608***	-0.0009	0.0038	0.0783	0.0027
	(0.005)	(0.040)	(0.002)	(0.005)	(0.063)	(0.004)
License issues [a]	0.0226	0.1237	0.0080	0.0004	0.0696	-0.0004
	(0.023)	(0.079)	(0.011)	(0.002)	(0.074)	(0.002)
Industry affiliation						
High-tech industries [a]	0.0010	0.1336***	-0.0023	-0.0003	-0.0035	-0.0003
EXTERNAL FACTORS						
Locational conditions						
Skilled labor	-0.0007	-0.0143*	-0.0002	0.0003	-0.0068	0.0004
	(0.001)	(0.008)	(0.001)	(0.000)	(0.010)	(0.001)
Research facilities	-0.0018	0.0266***	-0.0020**	0.0005	0.0072	0.0005
	(0.001)	(0.009)	(0.001)	(0.001)	(0.009)	(0.000)
Transportation	0.0010*	-0.0030	0.0008*	0.0002	0.0205***	-0.0001
	(0.001)	(0.005)	(0.000)	(0.002)	(0.007)	(0.000)
Support	-0.0017	0.0206**	-0.0018**	-0.0016	-0.0025	-0.0020
	(0.001)	(0.010)	(0.001)	(0.001)	(0.016)	(0.001)
Competitors						
Foreign competitors [a]	0.0149***	0.2077***	0.0025	0.0118	0.4460***	0.0004
	(0.005)	(0.023)	(0.002)	(0.008)	(0.074)	(0.002)
Local competitors [a]	-0.0107***	-0.2337***	-0.0017	0.0006	-0.1169***	0.0022
	(0.003)	(0.018)	(0.002)	(0.001)	(0.030)	(0.002)
Cooperation						
Product development [a]	-0.0032	0.0038	-0.0024	0.0016	-0.0495	0.0035
	(0.003)	(0.036)	(0.002)	(0.001)	(0.040)	(0.003)
Process development [a]	0.0121*	-0.0540	0.0132**	-0.0028**	-0.0129	-0.0033
	(0.006)	(0.035)	(0.007)	(0.001)	(0.045)	(0.002)
Sales [a]	-0.0063**	0.0285	-0.0050**	-0.0013	0.0163	-0.0017
	(0.003)	(0.028)	(0.002)	(0.001)	(0.043)	(0.002)
N	3,063			876		
Log likelihood	-1,739.12			-407.8		
Rho (ρ)	0.321***			0.303*		

Note: ([a]) dy/dx is for discrete change of dummy variable from 0 to 1. Bold values indicate significant marginal effects at 10 percent level.

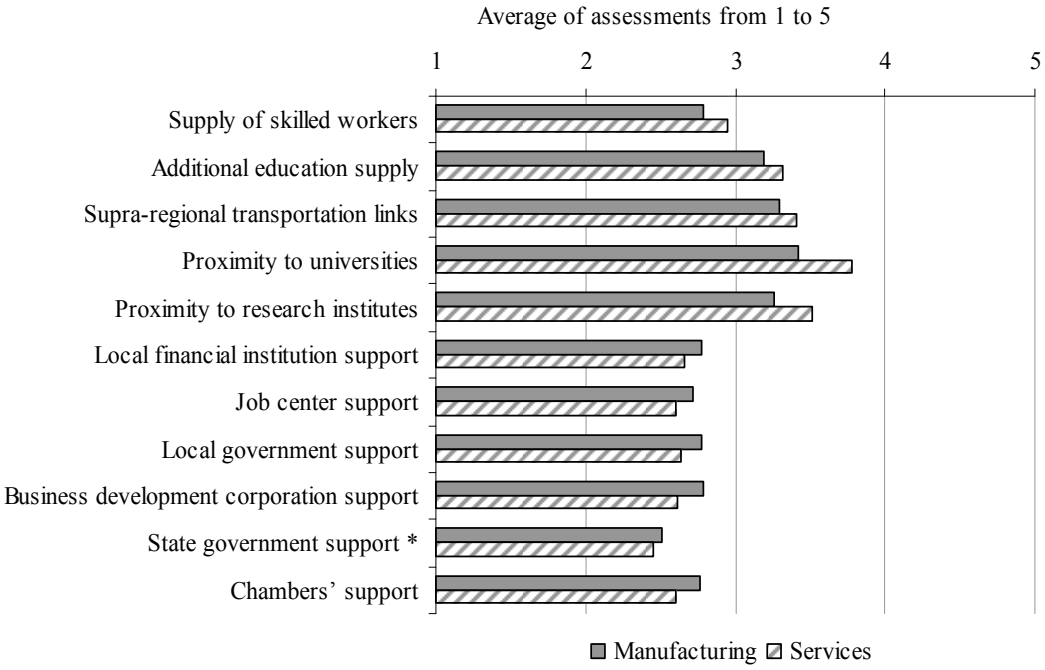
Appendix

Figure 2 Importance and assessment of locational conditions by firms

(a) Importance of the locational conditions by firms



(b) Assessment of the locational conditions by firms



NOTE: * denotes insignificant mean differences at 5 percent level.