Internationalisation Strategy and Innovation Performance in SMEs – A comparative study of Japan and Germany

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Abstract

We investigate the role of internationalisation strategies of small and medium-sized enterprises (SMEs) in Japan and Germany on the firms' product innovation performance. While both countries are a mong the leading innovation nations, innovation performance of SMEs differs substantially. The paper aims to explore the role of SME internationalisation as a driver for diverging performance in innovation. We find evidence for an association between exploitation-based internationalisation strategy and firms' new-to-market (novel) product innovation performance. Furthermore, while the link between firm cooperation and innovation is evidenced in Germany, this association is not supported by Japanese SMEs. Perhaps the most consistent phenomenon is that firms combining exploitation and exploration strategies can achieve the best innovation performance. We also evidence the influential power grounded on the aspects of distance constraints, company size and product type. These results lead to important implications to the strategies of internationalization and innovation for SMEs' managers and policy makers.

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Key words: Internationalisation, cooperation, innovation performance, SMEs, Japan and Germany

Introduction

The growing globalisation of markets, international competition, and increasingly dispersed knowledge have led many SMEs to tap into foreign knowledge and stay proximate to key markets, no more so in the area of product innovation. Prior work (Love and Roper, 2015; Amoako and Lyon, 2014) suggests innovation fostered by international activities plays an important role for the prosperity of SMEs through partnership and spillovers. The practices of working with external actors for innovation success have been around for decades. And yet, the effect of this externalization strategy on innovation performance remains opaque. Some (e.g. Pullen et al., 2012) highlight that external alliances help firms to shorten new product development time, reduce cost and increase operation flexibility; whereas others (e.g. Dickson, Weaver and Hoy, 2006) caution such approach lead to new risks, threats and additional transaction cost that diminish innovation result. This opacity offers the point of departure of this paper.

This paper addresses this opacity by focusing upon two internationalization strategies that most used by SMEs – exporting and inter-firm cooperation. In so doing, this paper makes three contributions. First, it addressed the role of an SME's internationalization strategy upon its innovation performance – an important topic recently emerged in the internationalization literature. Prior research on internationalization and global strategies has been focused primarily on large Western MNCs (see e.g. Venaik, Midgley and Devinney, 2005; Birkinshaw, 1996). The strong focus in prior research on large companies implies that investigating the global integration strategies of internationalizing SMEs might greatly enrich the understanding of the competitive drivers in a pan-national scale, as SMEs representing 90%+ of all businesses in many economies. And yet, our understanding in this regard remains insufficient. We attend this issue by providing a unique comparative study into two highly innovative countries and yet with very different idiosyncratic (physical and psychic) distance when engaging in internationalization activities – Japan and Germany.

Second, while exporting and cooperation are studied in separate track of literature, previous work (e.g. Grossman and Helpman, 1991; Barge-Gil, 2010) has noticed that engaging in foreign markets might concurrently open access in inter-firm cooperation. Along with this line, Alcacer and Oxley (2014) point to that the access to overseas knowledge via firm cooperation in the foreign markets is an important reason why exporters tend to be more innovative. In contrast, previous research (e.g. Khanna and Palepu, 2010; Xie and Li, 2018) also has reminded us such an advantage can be offset if firms can get similar access. For

example, a home market that is open to the cross-border transfer of capital, goods, and knowledge may leads to such offsetting. As a result, knowledge spillovers may be taking place within the home country through cooperating with foreign investors (importers or even inward foreign direct investor). So much so, while cooperation strategy improves the innovation ability of local firms in general, it may weakens the innovation advantages grained through exporting. Taken together, the integration of a firm's exporting and cooperation (either with cooperative partners in home or foreign country) is highly possible in practice, the relevant literature up to date however has not yet fully addressed this interplay approach, nor does it give sufficient attention to the undertaken cooperation (at home or abroad). This paper is among the early (if not the first) study addressing such a hybrid strategy.

Third, it is appealing that exporting behaviour, firm cooperation or a hybrid strategy should empower a SME to achieve better innovation performance. Several barriers however may limit a firm's engagement and the success of such a strategy. For example, the influence of demographic characteristics (Whittaker et al., 2016) and psychic distance in culture and language (Nordman and Tolstoy, 2014) can be an important contingency for the innovation performance of SMEs. From a different perspective, Leiponen (2012) argues sector differences may benefit some and impede others by using external knowledge. Damijan, Kostevc and Polanec (2010) point to very small firms find exporting difficult because of very limited resources and manpower. It suggests these contingencies may reflect an imperfect understanding of the empirical practice upon inter-firm cooperation and exporting behaviour of SMEs. To address this issues, this paper considers the influence embedded in the differences of distance (physical and psychic) constraints, company size and sectorial factor, contributing a more systematic study to small business research.

We make these contributions by asking three questions: How do exporting and firm cooperation relate to a purported objective of SMEs – the commercial success of product innovation? Whether an integrated strategy improves the impact on innovation performance? And finally, how do the differences of distance constraint, company size, and sectorial factor impact on these relationships? To address the questions, we used large scale survey data collected from SMEs in Germany and in Japan during 2012 - 2015. Two countries were selected for a subtle comparative study not only because both have SMEs representing 95%+ of all businesses with higher exporting- and innovation-orientation, but more importantly, their distinct culture differences (West and East), and contrast geographic divergence (one in mainland, another an island).

This paper is structured as follows. Next section provides a brief literature background and the development of hypotheses. It then presents the research methods and findings, followed by their implications to theory and practice. This paper is concluded by its limitations and how these can be addressed by future research.

Theoretical background and hypotheses

In its fundamental definition, internationalization concerns with the process of a firm's involvement in international markets (Susman, 2007). Compared with FDI and other forms of internationalization, exporting and foreign cooperation (i.e. inter-firm cooperation in foreign market) are among the strategies mostly used by SMEs. The essential reason lies in both approaches involve less commitment or risk, and require less complicated management resources (Cassiman and Golovko, 2011). In the extant literature, exporting and cooperation are generally addressed in separate track of studies. Exporting has been studied in theories such as 'learning-by-exporting' (e.g. Love and Ganotakis, 2013) and observed by a resource-based or a knowledge-based view (e.g. Golovko and Valentini, 2011). While a positive link runs from innovation to exporting is well established in the literature, the notion that international business provides considerable opportunities for knowledge transfer through exports to improve innovation has just drawn some research attention in recent years (Combes et al., 2009; Love and Ganotakis, 2013; Xie and Li 2018). An enticing explanation is exporters have the access to diverse knowledge which is not available in the domestic market and this knowledge can spill back to the focal firm. Such movement therefore fosters innovation. In this sense, embarking on the advantage of exporting behaviour to benefit innovation can be potentially valuable to SMEs that are inherited with the liability of smallness. Following this line of reasoning, we pose:

H1: Exporting strategy significantly associates with SMEs' innovation performance.

In a different strand of research, various theories contribute to firm cooperation research, such as transaction cost theory (Weaver and Dickson, 1998), network theory (Baker, Grinstein and Harmancioglu, 2016), open innovation (Chesbrough, 2003) and resource-based view (Dickson, Weaver and Hoy, 2006). The conventional wisdom is inter-firm cooperation benefits innovation through interdependence of technology, resources and the access

complement, enabling firms to reduce uncertainty and resource constrains so that speed up innovation process (Whittaker, Fath and Fiedler, 2016).

While exporting and cooperation have been well studied in the different stream of studies, cooperation has been considered important for exporting firms (Johnson, Webber and Thomas, 2007; Barge-Gil, 2010). Grossman and Helpman (1991) and Hagedoorn (1993) suggest that cooperation can be seen as a way to access new markets for many exporting firms on one hand and the benefits of inter-firm cooperation can be better realised through the exporting behaviour of firms on the other. Similarly, Tether and Tajar (2008) propose inter-firm cooperation makes exporting firms more attractive to innovation partners. This line of literature implies a SME may spur higher product innovation success in both competence and financial terms when exercise exporting strategy together with cooperation with allied partners. Nevertheless, while exporting provides firms with opportunities for foreign cooperation (i.e. cooperation in foreign markets) to access knowledge from elsewhere, a group of scholars (e.g. Khanna and Palepu, 2010; Chang and Xu, 2008) have noticed that such an advantage can be weakened if firms may benefit from knowledge spillovers taking place in the home country by seeking foreign knowledge by cooperating with multinational investors, by importing technology and capital goods or even reaching out through inward foreign direct investors. Along with this strand of literature, we propose:

H2a: Cooperation with partners in foreign country (foreign cooperation hereafter) significantly associates with SMEs' innovation performance.

H2b: Cooperation with partners in home country (home cooperation hereafter) significantly associates with SMEs' innovation performance.

H3a: The integration of exporting and foreign cooperation significantly associates with SMEs' innovation performance.

H3b: The integration of exporting and home cooperation significantly associates with SMEs' innovation performance.

Whilst one group of scholars advocate the possibility running from the internationalization strategy (as discussed above) towards innovation activities and performance, another group (see below) show that such a strategy constitutes new risks,

threats and additional transaction cost that hamper innovation outcome. In this paper, we focus on three possible impediments to firms' exporting and cooperation behaviour – distance barriers, resource constraints and sectorial factor, and are summarized below.

Resource constraints – size matters

In the SME literation, the issue of resource constrains has been viewed as a paradoxical factor in promoting as well as demoting inter-firm cooperation and exporting behaviour. For example, while the traditional wisdom highlights the benefits of externalization to compensate the lack of resources in SMEs (as discussed), Wakelin (1998) have found that larger innovative firms are more likely to export, and smaller firms, owing to 'resource poverty', are more likely to stay in the domestic market. O'Cass and Weerawardena (2005) tested the Schumpeterian hypothesis of a positive relationship between firm size and innovation, and provided evidence to support Wakelin's argument. Park, Chen and Gallagher (2002) also pointed to larger SMEs engage more in allied cooperation than smaller SMEs. In contrast, Dickson, Weaver and Hoy (2006) empirically showed that smaller firms plays a significant role in R&D alliances and are benefited from the resource acquisition in the innovation process. As this line of debates continue, question is then raised whether firm size influences the effect of a SME's internationalisation strategy on its innovation performance. To address this issue, we assume medium-sized firms have more resources than the smaller ones, therefore:

H4a: The influence of exporting, cooperation or their hybrid forms on innovation performance of medium-sized SMEs is stronger than for small-sized firms.

Sectorial factor – manufacturing and services

Another important issue is embedded in the sectorial differences. In the extant literature, much research has addressed the internationalisation issues in the manufacturing sector (see e.g. Masurel, 2001). In contrast, the relevant study with respect to sectorial difference has received little research attention with only a handful of exceptions, and yet with inconsistent conclusion. For example, Erramilli (1991) proposes that services companies have an advantage over manufacturing companies in the internationalisation process, because services firms have lower overhead costs and fewer risks. In contrast, Leiponen (2012), through an

observation in Finnish services and manufacturing firms, suggests that external knowledge sourcing strategies benefit more to manufacturing than services firms as a result of the inferior R&D management capabilities in services firms. Miles (2007) also noticed that many service innovations involves in reshaping processes in a way to better respond to new market needs, resulting in high transactional costs when involving international markets. Grounded on these inconclusive arguments, we assume services firms are facing more difficulties than their manufacturing peers in managing exporting and cooperation. We question whether exporting and cooperation strategies would better benefit those services firms that overcome the hurdles in applying such strategies. Thus:

H4b: The influence of exporting, cooperation or their hybrid forms on innovation performance of manufacturing sector firms is stronger than for service sector firms.

Distance barriers – physical and psychic

An important constraint to internationalisation activities, cooperation in particular, relates to the distance constraints. This barrier includes *physical distance* where geographical gap incurs cost of transport and communication, and *psychic distance* where the differences in culture, language and customers acquire extra resources and manpower in cooperation and internationalisation process. Delerue and Lejeune (2011) study mimetic behaviours (i.e. a market position adoption is likely to be imitated in a geographically proximate market) and have evidenced a positive relationship between mimetic behaviour and international alliance formation. With a similar token, Bell (2005) also showed that a mimetic process within proximate markets plays an important role in fostering firms' innovation activity. In comparison, Murray et al. (2011), through a study of exporters in China, showed that psychic distance has significant effects on new product development and marketing communication capabilities. Manolova and Yan (2002) studied the institutional environment in Bulgaria and have concluded that the institutional environment has significant influence on firms' strategic decisions. This stream of literature reflects that the differences of cultural and language between a firm's domestic market and the export market represents a profound institutional factor that is likely to have an impact on innovation performance in SMEs. Prior studies all point to that 'distance' constrains play a vital role in studying firm internationalisation and cooperation. To test this effect, we assume:

H4c: The more the distance constraints are, the less the effect of exporting, cooperation or their hybrid forms on SMEs' innovation performance.

Research Method

The Study

In this empirical study, we use an innovation output model frequently used in the literature that relies on CIS-type data (Laursen and Salter, 2006; Leiponen and Helfat, 2010; Klingebiel and Rammer, 2014; Crépon, Duguet and Mairesse, 1998; Czarnitzki and Lopes-Bento, 2015). The model relates product innovation performance to innovation inputs, a firm's internationalisation strategy, and other firm characteristics that may affect product innovation success.

The dependent model variable is the share of sales generated by product innovation (*inn_out*). Innovation input is measured by R&D expenditure over sales (*inn_inp*). With respect to the internationalisation strategy, we distinguish five types: (1) firms which are present on foreign markets and cooperate with foreign organisations for innovation (*fma_fco*), (2) firms present on foreign markets but cooperating only domestically (*fma_dco*), (3) firms present on foreign markets but not cooperating at all (*fma_nco*), (4) firms only serving their domestic market but cooperating with partners abroad (*dma_fco*), and (5) firms only serving the domestic market and cooperating with domestic partners (*dma_dco*). The sixth group, firms only serving their domestic market and not cooperating, is the reference group. In general terms we write the innovation production function as:

$$inn\_out_i = \alpha + \beta_1\, fma\_fco_i + \beta_2\, fma\_dco_i + \beta_3\, fma\_nco_i + \beta_4\, dma\_fco_i + \beta_5\, dma\_dco_i + \chi\, inn\_inp_i + \delta\, \mathbf{X} + \varepsilon_i$$

α is a constant, β, χ and δ, are the parameters to be estimated, **X** is a vector of control variables and e is a firm-specific error term.

Sample

We utilize data from the German and Japanese official innovation surveys. Both surveys follow the methodology of the Community Innovation Survey (CIS). The CIS is a data collection activity initiated by the European Commission in 1992 which has since become an international standard in collecting firm-level innovation data and which is applied beyond Europe, including a number of Asian countries. The CIS applies the definitions of innovation in the business enterprise sector as laid down in the Oslo Manual (OECD and Eurostat, 2005). Although the surveys are conducted for each country independently, they build upon the same harmonized questionnaire and comparable procedures with respect to sampling, survey instrument and data processing. We use the most recent two waves which is 2012 and 2015 for Japan and 2013 and 2015 for Germany.

In line with the literature, we focus on firms with product innovations and ignore non-innovative firms as well as firms with innovations in other areas (e.g. process innovation). This allows us to better observe innovation performance from product innovators. The firm sample is restricted to SMEs, using the size threshold of 250 employees to separate large firms from SMEs. Upon which, we recognise firms with <50 employees as small firms and with 50 to 249 employees as medium-sized firms.

Variables

All model variables are measured using information from the innovation surveys:

- *inn_out*: share of sales generated in year t by product innovations that have been introduced in the years t-2 to t
- *inn_inp*: R&D expenditure in year t per employee
- Foreign market presence (*fma*): selling products to customers outside the domestic market (i.e. Japan or Germany) in years t-2 to t
- Only domestic market presence (*dma*): selling products only to customers in the domestic market in years t-2 to t
- Foreign cooperation (*fco*): Cooperating with other firms or institutions on innovation activities during the years t-2 to t that are located outside the SMEs' own country; cooperation partners may include customers, suppliers, competitors, universities, public and private research institutes, and consultants
- Domestic cooperation (*dco*): Cooperating with other firms or institutions on innovation activities during the years t-2 to t that are located in the SMEs' own country

- Control variables (**X**): size (logarithm of number of employees), age (logarithm of years since firm foundation), sector dummies (2-digit ISIC industries), year dummy; for size and age, likely non-linear effects are captured by included also the squared term of the variables

In order to identify the role of internationalisation on product innovation performance for different degrees of product novelty, we split the dependent variable into two sub-measures: the sales share of new-to-market innovations refers to an SME's new products for which no similar products have been available in the SME's market at the time of introduction, while only new-to-firm innovations are products introduced by an SME for which similar offers have been available on the SME's market at the time of introduction. We hence estimate three model variants: one for total new product sales, one for new-to-market sales, and one for only new-to-firm sales.

In order to investigate the role of internationalisation strategies on innovation output of SMEs for different resource constraints and different product characteristics, we apply a split-model approach. First, we split the models by firm size and separate small firms and medium-sized firms. Secondly, we split by product category and separate manufacturing firms from service firms.

As the dependent variable includes a large share of zero observations, i.e. SMEs that either did not introduce a single new-to-market product innovation, or they did not generate any sales with such innovations in the reference year, we apply Tobit models that explicitly take into account the censored nature of our data. Table 1 and 2 provide a summary of statistics and variable description and their correlation coefficients.

Results

Estimating the effect of exporting, cooperation and their hybrid forms

Table 3-5 show the Tobit model results between two countries based on the full sample of firms, small-sized firms, medium-sized firms, manufacturing and service sector firms for new to market (novel) and new-to-firm (incremental) innovations. Turning now to the link between exporting and innovation outcomes. The results suggest a rather consistent pattern that exporting significantly associates with novel product innovation, but not with incremental innovation. This pattern is evidenced both in Japan and in Germany. H1 is therefore supported when (once again) considering novel innovation but on no account of

incremental innovation. Significant results are also found in cooperation and their subjected integrated forms, when considering novel innovation, but not incremental innovation. Therefore, we find evidence to support H2a, H2b, H3a and H3b in the case of novel innovation. One exception however is detected the link between home cooperation (cooperation with partners in home country) and the novel innovation performance in Japan. Notably, we do find when home cooperation integrated with exporting, it turns to a significance association with innovation.

Three influential aspects

The next step is to consider the contingent aspects of company size, sectorial difference or distance constraint. We focus on the observations upon the novel (not the incremental) innovation where we find most of the significant results. Surprisingly, the results suggests size does matter but in the opposite direction. We first observe the contingency influenced by company size. Interestingly, we find support towards the links of exporting and/or cooperation with innovation in small-sized firms in both countries; and yet we cannot make the same conclusion from our do not find these links in our medium-sized firms (especially in Germany). Therefore, H4a is not supported. With regard to the sectorial difference, we find a rather consistent pattern between manufacturing and service sectors. As such, we are not able to claim there is significant differences caused by sectorial difference. Therefore, H4b is rejected. Finally, we find evidence that supports the contingent aspect caused by physical and psychic distance. Our analysis results indicate there is no association between firm cooperation and innovation performance in the country with higher distance barriers (such as Japan) than the one with lower distance barriers (such as Germany). We however cannot make the same conclusion from exporting. H4c is thus partially supported.

Discussion and Conclusion

In recent years the international trade literature has focused on the effects of exporting and its benefits in an open economy, it is well acknowledged that engaging in trade and cooperation enhances knowledge spillovers and inter organisational learning. And yet, there has been relatively little research examining the effect of exporting and cooperation on *ex post* firm performance, especially in SMEs. This study is set out to explore the association between

internationalisation and innovation performance in SMEs. We examine any differences existed in considering physical and psychic distance, company size and industrial factor. We provide evidence upon a strong link of exporting and/or cooperation with novel innovation, but not incremental innovation. While many prior internationalization research (e.g. Salomon and Shaver, 2005; Xie and Li, 2018) mainly focuses on product innovation as a whole, this study advances the understanding of the effects of internationalisation strategy in the context of different types of innovation.

The study into three contingent aspects is an important one, contributing a more systematic investigation into SMEs' internationalization strategy upon innovation performance. Following a similar research tread (e.g. Manolova et al., 2014; Dickson et al., 2006), this study shows that company size plays an important role when an SME seeks to reap benefits from its internationalization process. And yet, our finding is somewhat different from previous work (e.g. Weerawardena, 2005; Wakelin, 1998). Two (at least) implications lie in our findings. First, today, smaller firms (at least in Germany and Japan) may not be necessarily always short of resources in stepping into global markets (if they intend to), nor are they always lack of capabilities in engaging in allied cooperation. This may be (at least partly) attributed to government's subsidiary support or the sound economic and development in the countries such as Germany or Japan. Second, the results from German medium-sized firms were not expected. This result may imply considerations that go beyond the issues of resources or capabilities shortages. One possible explanation may be embedded in the concerns of trust and appropriation. When it comes to knowledge spillovers and learning for innovation, firms face uncertainties. In such circumstances, trust and relationship building in internationalisation process may be more complex and time-consuming in medium-size firms than in their small-size peers. The topic of trust and relationship building has brought some research attention in recently years (see e.g. Amoako and Lyon, 2014). There is a need for further research upon this aspect in SMEs.

The results in comparing manufacturing and service sector firms are not what we were expecting either. Our study show a rather consistent pattern between these two very different sectors. This results is different from the extant literature (see e.g. Masurel, 2001, Leiponen, 2012). It may imply the internationalisation strategy in the developed economies (such as Japan and Germany) is important for both manufacturing and service sector SMEs. It may also suggest that, in terms of the concerns of resource and capabilities for exporting and cooperation, the gap between manufacturing and service SMEs is getting smaller.

Perhaps the most intriguing finding is the contingent phenomenon based on distance differences. Our study seems to imply that in a country (such as Germany) with lower distance (both physical and psychic) barriers, adopting an international cooperation strategy may work well for innovation performance. In comparison, a country (such as Japan) with higher distance barriers, such a strategy may not work that well. All in all, it points to that distance constraint is an important factor to consider in SMEs' internationalisation and innovation strategies. This result has its implications to governments and policy makers who are responsible for or interested in supporting SMEs' growth and survival through innovation and globalization activities.

This study is not without limitations. First, while our time-series study contributes to knowledge in several issues in considering the association of exporting and cooperation with innovation, we understand it involves an accumulation effect that grows incrementally through time. A longitudinal study may better reflect this effect. Our data source at this point however are not panel data and do not allow us to run a longitudinal study. This leads to an area for research in the future. The second limitation relates to the countries we selected in this study. Two selected countries (Japan and Germany) provide us with excellent premises to study the topics into SMEs, internationalization strategies and innovation performance with a rather harmonized survey research design. Both countries are well developed and both are the top performers in innovation and internationalization. These similarities may confine us in terms of a broader comparison. To address this issue, to provide a comparative study that involves developed and developing countries or between more innovative and less innovative countries should be considered.

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Table 1: Descriptive statistics of model variables

Variable	No. Obs.		Mean		Std.dev.		Minimum		Maximum	
	JPN	GER	JPN	GER	JPN	GER	JPN	GER	JPN	GER
inn_out (tot)	2,033	3,657	0.188	0.265	0.264	0.253	0	0	1	1
inn_out (ntm)	2,033	3,486	0.069	0.064	0.165	0.152	0	0	1	1
inn_out (ntf)	2,033	3,486	0.119	0.197	0.211	0.221	0	0	1	1
fma_fco	2,033	3,657	0.073	0.089	0.261	0.285	0	0	1	1
fma_dco	2,033	3,657	0.124	0.182	0.330	0.386	0	0	1	1
fma_nco	2,033	3,657	0.104	0.340	0.305	0.474	0	0	1	1
dma_fco	2,033	3,657	0.039	0.012	0.194	0.108	0	0	1	1
dma_dco	2,033	3,657	0.383	0.077	0.486	0.267	0	0	1	1
inn_inp	2,033	3,657	0.456	0.006	2.099	0.027	0	0	37.873	1.500
lnage	2,033	3,657	3.105	2.939	0.701	0.893	0.000	-0.693	4.078	6.264
$lnage^2$	2,033	3,657	10.134	9.436	3.868	5.250	0.000	0.164	16.626	39.242
lnsize	2,033	3,657	3.578	3.186	0.885	1.189	2.303	0.000	5.517	5.517
$lnsize^2$	2,033	3,657	13.583	11.564	6.646	7.699	5.302	0.000	30.442	30.442
year_2015	2,033	3,657	0.673	0.499	0.469	0.500	0.	0	1	1

Table 2: Correlation coefficients of model variables

a. Japan

	inn_out (tot)	inn_out (ntm)	inn_out (ntf)	e1_f1	e1_d1	e1_c0	e0_f1	e0_d1	inn_inp	lnage	lnage2	lnsize	lnsize2
inn_out (tot)	1.000												
inn_out (ntm)	0.601	1.000											
inn_out (ntf)	0.780	-0.032	1.000										
fma_fco	0.031	0.085	-0.028	1.000									
fma_dco	-0.013	0.014	-0.027	-0.106	1.000								
fma_nco	0.015	0.046	-0.018	-0.096	-0.128	1.000							
dma_fco	0.033	0.022	0.024	-0.057	-0.076	-0.069	1.000						
dma_dco	-0.010	-0.038	0.017	-0.222	-0.297	-0.268	-0.160	1.000					
inn_inp	0.068	0.076	0.026	0.124	0.023	0.058	0.013	-0.072	1.000				
lnage	-0.025	-0.049	0.008	-0.025	0.042	0.019	-0.034	0.048	-0.057	1.000			
$lnage^2$	-0.021	-0.051	0.013	-0.024	0.045	0.031	-0.035	0.050	-0.060	0.981	1.000		
lnsize	-0.115	-0.091	-0.072	0.033	0.076	0.057	0.027	-0.069	-0.018	0.129	0.127	1.000	
$lnsize^2$	-0.111	-0.085	-0.072	0.034	0.080	0.059	0.031	-0.071	-0.012	0.126	0.125	0.994	1.000
y_2015	0.059	0.031	0.049	-0.013	-0.008	-0.100	0.012	0.196	0.027	0.273	0.302	-0.179	-0.182

b. Germany

	inn_out (tot)	inn_out (ntm)	inn_out (ntf)	e1_f1	e1_d1	e1_c0	e0_f1	e0_d1	inn_inp	lnage	lnage2	lnsize	lnsize2
inn_out (tot)	1.000												
inn_out (ntm)	0.474	1.000											
inn_out (ntf)	0.796	-0.157	1.000										
fma_fco	0.098	0.120	0.027	1.000									
fma_dco	0.048	0.066	0.008	-0.148	1.000								
fma_nco	-0.063	-0.031	-0.055	-0.224	-0.338	1.000							
dma_fco	0.020	0.020	0.003	-0.034	-0.051	-0.078	1.000						
dma_dco	0.043	0.051	0.014	-0.090	-0.136	-0.207	-0.032	1.000					
inn_inp	0.091	0.098	0.036	0.081	0.070	-0.047	0.011	0.055	1.000				
lnage	-0.197	-0.182	-0.095	-0.050	-0.004	0.095	-0.046	-0.053	-0.079	1.000			
$lnage^2$	-0.190	-0.161	-0.103	-0.063	-0.016	0.108	-0.043	-0.047	-0.078	0.965	1.000		
lnsize	-0.158	-0.073	-0.128	0.085	0.115	0.142	-0.035	-0.088	-0.034	0.255	0.257	1.000	
$lnsize^2$	-0.147	-0.074	-0.116	0.088	0.107	0.134	-0.031	-0.085	-0.034	0.256	0.261	0.977	1.000
y_2015	0.015	0.029	0.003	-0.009	-0.047	0.063	-0.013	-0.026	0.008	0.069	0.066	-0.005	-0.005

Table 3: Estimation results of Tobit models: base models

	new product total		**new-to-market**		**only new-to-firm**	
	JPN	GER	JPN	GER	JPN	GER
fma_fco	0.033	0.100***	0.164***	0.244***	-0.040	-0.000
	[0.027]	[0.017]	[0.032]	[0.023]	[0.027]	[0.018]
fma_dco	0.000	0.045***	0.085***	0.173***	-0.038	-0.009
	[0.022]	[0.014]	[0.028]	[0.019]	[0.023]	[0.014]
fma_nco	0.021	0.014	0.111***	0.110***	-0.031	-0.020*
	[0.024]	[0.011]	[0.029]	[0.017]	[0.024]	[0.012]
dma_fco	0.058*	0.048	0.075*	0.148***	0.029	-0.022
	[0.034]	[0.038]	[0.042]	[0.052]	[0.035]	[0.040]
dma_dco	0.004	0.036**	0.021	0.153***	-0.002	-0.016
	[0.016]	[0.017]	[0.021]	[0.024]	[0.016]	[0.018]
inn_inp	0.008**	0.413***	0.008**	0.561***	0.003	0.104
	[0.003]	[0.149]	[0.004]	[0.182]	[0.003]	[0.153]
lnage	-0.002	-0.071***	0.044	-0.119***	-0.030	0.014
	[0.047]	[0.017]	[0.060]	[0.023]	[0.048]	[0.018]
lnage2	-0.001	0.006**	-0.011	0.013***	0.007	-0.004
	[0.009]	[0.003]	[0.011]	[0.004]	[0.009]	[0.003]
lnsize	-0.092	-0.075***	-0.194**	-0.015	0.019	-0.068***
	[0.064]	[0.016]	[0.080]	[0.023]	[0.066]	[0.017]
lnsize2	0.008	0.007***	0.022**	0.002	-0.005	0.007***
	[0.009]	[0.002]	[0.011]	[0.004]	[0.009]	[0.003]
Constant	0.374***	0.454***	0.197	-0.096	0.107	0.261***
	[0.141]	[0.048]	[0.175]	[0.073]	[0.144]	[0.051]
Sigma	0.279***	0.242***	0.299***	0.283***	0.272***	0.246***
	[0.003]	[0.003]	[0.008]	[0.006]	[0.005]	[0.003]
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	2,033	3,657	2,033	3,626	2,033	3,486

Standard errors in brackets

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 4: Estimation results of Tobit models for new-to-market products: split models by size and product category

	new-to-market small firms		**new-to-market** medium-sized firms		**new-to-market** manufacturing		**new-to-market** services	
	JPN	GER	JPN	GER	JPN	GER	JPN	GER
fma_fco	0.172***	0.262***	0.140***	0.155***	0.155***	0.204***	0.175***	0.288***
	[0.043]	[0.032]	[0.046]	[0.029]	[0.035]	[0.028]	[0.064]	[0.043]
fma_dco	0.105***	0.213***	0.058	0.074***	0.052*	0.152***	0.225***	0.196***
	[0.037]	[0.026]	[0.040]	[0.026]	[0.029]	[0.024]	[0.069]	[0.038]
fma_nco	0.092**	0.123***	0.114***	0.059**	0.087***	0.107***	0.188***	0.118***
	[0.040]	[0.022]	[0.039]	[0.024]	[0.030]	[0.022]	[0.068]	[0.029]
dma_fco	0.060	0.184***	0.091	-0.060	0.060	0.214**	0.106	0.143**
	[0.058]	[0.064]	[0.057]	[0.103]	[0.049]	[0.096]	[0.077]	[0.071]
dma_dco	0.025	0.192***	0.003	0.022	0.040	0.165***	-0.001	0.156***
	[0.027]	[0.030]	[0.032]	[0.039]	[0.025]	[0.034]	[0.037]	[0.036]
inn_inp	0.009*	0.460**	0.010**	2.290***	0.007	4.063***	0.008	0.258
	[0.005]	[0.213]	[0.005]	[0.722]	[0.005]	[0.566]	[0.006]	[0.245]
lnage	0.031	-0.122***	0.024	-0.020	0.007	-0.092***	0.120	-0.166***
	[0.075]	[0.032]	[0.095]	[0.033]	[0.067]	[0.026]	[0.120]	[0.044]
lnage2	-0.007	0.010*	-0.012	0.001	-0.003	0.009**	-0.026	0.022***
	[0.014]	[0.006]	[0.018]	[0.005]	[0.012]	[0.004]	[0.023]	[0.008]
lnsize	0.231	0.047	-0.005	0.455	-0.146	-0.044	-0.258*	0.008

	[0.324]	[0.045]	[0.558]	[0.332]	[0.091]	[0.032]	[0.155]	[0.038]
lnsize2	-0.047	-0.012	0.005	-0.049	0.016	0.006	0.029	-0.003
	[0.053]	[0.009]	[0.060]	[0.036]	[0.012]	[0.005]	[0.021]	[0.006]
Constant	-0.476	-0.108	-0.163	-1.174	0.212	-0.026	0.163	-0.141
	[0.496]	[0.100]	[1.296]	[0.779]	[0.189]	[0.091]	[0.323]	[0.105]
Sigma	0.314***	0.321***	0.255***	0.187***	0.265***	0.245***	0.360***	0.340***
	[0.011]	[0.008]	[0.012]	[0.007]	[0.009]	[0.006]	[0.017]	[0.012]
Year. dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind. dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,259	2,555	774	1,071	1,172	2,050	861	1,576

Standard errors in brackets

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 5: Estimation results of Tobit models for only new-to-firm products: split models by size and product category

	only new-to-firm small firms		**only new-to-firm** medium-sized firms		**only new-to-firm** manufacturing		**only new-to-firm** services	
	JPN	GER	JPN	GER	JPN	GER	JPN	GER
fma_fco	-0.033	0.018	-0.044	-0.039	-0.012	-0.050**	-0.088*	0.061**
	[0.037]	[0.023]	[0.040]	[0.029]	[0.035]	[0.023]	[0.046]	[0.030]
fma_dco	-0.028	-0.011	-0.061*	-0.014	-0.026	-0.038**	-0.032	0.016
	[0.032]	[0.018]	[0.034]	[0.025]	[0.027]	[0.019]	[0.050]	[0.026]
fma_nco	-0.053	-0.020	-0.013	-0.027	-0.013	-0.037**	-0.055	-0.025
	[0.035]	[0.014]	[0.033]	[0.022]	[0.028]	[0.017]	[0.048]	[0.018]
dma_fco	0.019	-0.011	0.032	-0.044	0.075*	-0.109	-0.036	-0.001
	[0.049]	[0.046]	[0.048]	[0.088]	[0.046]	[0.091]	[0.054]	[0.047]
dma_dco	0.006	-0.004	-0.014	-0.046	0.029	-0.017	-0.037	-0.016
	[0.021]	[0.021]	[0.025]	[0.037]	[0.023]	[0.029]	[0.024]	[0.023]
inn_inp	0.006	0.062	-0.002	1.434*	0.002	0.242	0.004	0.066
	[0.004]	[0.163]	[0.004]	[0.785]	[0.005]	[0.572]	[0.004]	[0.169]
lnage	-0.042	0.030	0.007	-0.045	-0.031	-0.008	-0.032	0.049
	[0.062]	[0.023]	[0.076]	[0.032]	[0.062]	[0.023]	[0.075]	[0.031]
lnage2	0.011	-0.006	-0.004	0.005	0.009	-0.000	0.005	-0.011*
	[0.011]	[0.004]	[0.014]	[0.005]	[0.012]	[0.004]	[0.014]	[0.006]
lnsize	-0.100	-0.098***	0.068	-0.070	-0.126	-0.046*	0.230**	-0.064***
	[0.270]	[0.030]	[0.466]	[0.338]	[0.086]	[0.027]	[0.103]	[0.024]
lnsize2	0.012	0.014**	-0.011	0.005	0.014	0.006	-0.033**	0.005
	[0.044]	[0.006]	[0.050]	[0.036]	[0.011]	[0.004]	[0.014]	[0.004]
Constant	0.269	0.276***	0.015	0.384	0.297*	0.197***	-0.249	0.237***
	[0.415]	[0.064]	[1.079]	[0.791]	[0.180]	[0.075]	[0.212]	[0.075]
Sigma	0.286***	0.258***	0.240***	0.213***	0.268***	0.233***	0.277***	0.262***
	[0.007]	[0.004]	[0.008]	[0.005]	[0.007]	[0.004]	[0.008]	[0.005]
Year. dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind. dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,259	2,447	774	1,039	1,172	1,981	861	1,505

Standard errors in brackets

* $p < .1$, ** $p < .05$, *** $p < .01$