Interorganizational Knowledge Transfer and Performance. Knowledge Transferability and Internal Knowledge Transfers as Moderator Variables

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Abstract

In this article, we study the relation between knowledge transfers from the outside to the firm and performance. We propose a relation in the form of an inverted U, due to the relation between the value and the cost of the knowledge acquired. We also incorporate the idea that the transferability of knowledge and the degree to which knowledge is transferred within the organization have influence as moderating variables. Basing our study on a sample of 167 firms, we find no evidence that supports a relation of inverted U between transfers of external knowledge and performance. In contrast, the results confirm that firms do not see improvement in performance when knowledge is hard to transfer but do see improvement when it is transferred easily. Likewise, internal knowledge transfers affect transfers from customers as moderators, but they do not affect transfers from suppliers.

Introduction

In recent years, the importance of management of knowledge and knowledge transfers in studies of business management has continued to increase (Grant, 1997, Szulanski, 1996). Therefore, Conner and Prahalad (1996), working from the theory of resources and capacities, have considered knowledge one of the most important resources for achieving competitive advantage. For the same reason, others have studied the capacities for creating (Nonaka, 1994), transferring (Kogut and Zander, 1993), and integrating or using (Grant, 1996) knowledge.

Within this framework, knowledge transfers and the capacity of the firm to transfer knowledge have been considered fundamental for explaining some of the basic questions of firm leadership (Kogut and Zander, 1995). Many studies in this line of research have focused on both studying the transfer process and identifying factors that facilitate or inhibit transfers (Hansen, 1999; Simonin, 1999a; Szulanski, 1996). These studies are grounded in large part in communication theory (Gupta and Govindarajan, 2000) or in network theory (Hansen, 2002), depending on the kind of analysis. Thus studies based on communications theory have focused on the levels of nodal analysis, that is, factors related to the source, the receiver, or the pair or relation established between both. In contrast, studies based on networks have performed analysis on the systemic level, analyzing how the factors that determine the relation between one element and the others in the network affect the process and ease of accessing knowledge (Powell, Koput and Smith-Doerr, 1996; Hansen, 1999). All these cases have considered the kind of knowledge fundamental to the process (Simonin, 1999b). Regarding this last point, the most common distinction has been between explicit and tacit knowledge, as in most of the studies of knowledge management (Winter, 1987).

The research effort to determine the factors that influence knowledge transfers can be explained by their importance to the firm's performance. The relation between the capacity to transfer knowledge and the firm's performance has strong theoretical foundations (Zander and Kogut, 1995), although there is less empirical evidence. In this article, we study the relation between transfers of external knowledge and the firm's business performance, confirming the hypothesis that the relation is not linear but rather that there is a maximum limit at which the firm's capacity to absorb knowledge is exceeded, such that the firm pays the cost of the transfer without being able to benefit from it.

Likewise, studies of knowledge transfers usually focus on analyzing the factors mentioned above either for internal knowledge transfers (Szulanski, 1996) or for transfers between the firm and its environment (Inkpen, 2000; Lane, Salk and Lyles, 2001). In contrast, the relation between internal and external transfers has not been studied systematically. In fact, to make the potential of the knowledge acquired effective, this knowledge should be transferred internally to the unit that will assimilate,

transform, and exploit it. In this article, we analyze the importance of having internal knowledge transfers in the relation between internal and external knowledge transfers.

Transfers of external knowledge and performance

Access to knowledge produced outside the firm has been found to be one of the fundamental variables for explaining differences in firms' performance (Lane, Salk and Lyles, 2001). Yet transfers from the outside have not been related directly to business performance, but to organizational performances, principally in the firm's capacity for innovation (Powell, Koput and Smith-Doerr, 1996) and flexibility, since this means that a larger group of possible future behaviours is available (Huber, 1991). Moreover, the mere existence of transfers is not a sufficient condition for improving performance, since performance does not necessarily imply a change in the behaviour of the firm's members toward behaviour better adapted to its needs. It is thus necessary to move from the mere acquisition of knowledge to its exploitation so that knowledge transfers are related to performance (Cohen and Levinthal, 1990; Zahra and George, 2002).

Cohen and Levinthal (1990, p. 131) call the capacity for the absorption of knowledge: "not only the acquisition or assimilation of the information on the part of the organization, but also the organization's ability to exploit it." This three-level model— acquisition, learning or transfer from the exterior; assimilation; and exploitation—has found wide acceptance in the literature (Lane and Lubaktin, 1998; Lane, Salk and Lyles, 2001). However, Zahra and George (2002) have conceptualized the capacity to absorb knowledge as a dynamic capacity based on four fundamental capacities: acquisition, assimilation, transformation and exploitation. They have thus included Schumperian recombination (Galunic and Rodan, 1998) as an additional step.

What is significant about this way of understanding the relation between knowledge transfers and performance is that the existence of transfers is a necessary but not a sufficient condition to cause the behaviour of the firm's members to be influenced by the transfers and thus to have an effect on performance. Therefore, however much knowledge is acquired, benefit cannot be gained from its value if the knowledge cannot be assimilated, transformed or exploited. On the contrary, the possession of capacities

for the assimilation, transformation and exploitation of knowledge do not assume improvement in performance if transfers are not produced. Thus for some specific capacities of assimilation, transformation and exploitation, the relation between business performance and knowledge transfers is shown in Figure 1. The figure also confirms the hypothesis that the relation between performance and knowledge transfers grows to a certain level, T*, in which the relation then becomes inverse.

Figure 1 shows the first part of the curve, in which the relation between knowledge transfers and performance is positive. This hypothesis is based on the idea that, when the firm acquires knowledge from the outside, it should use its capacity for assimilating knowledge. This capacity allows it to understand the value of the knowledge, its significance, and its importance in an individual way. This apprehension of the knowledge will lead, without the concurrence of the other capacities in the cascade of processes of the capacity of absorption, to that fact that at a given moment those who have been in contact with the knowledge have a greater stock of knowledge and thus that the group of possible behaviours is greater (Huber, 1991), increasing flexibility (Zahra and George, 2002).

INCLUDE FIGURE 1 ABOUT HERE

This whole cascade of positive effects of the transfer of knowledge has a limit: the point at which the knowledge transfers are so significant that they exceed the firm's capacity to assimilate, transform or use the knowledge. That is, the firm's capacity to assimilate knowledge is not a dichotomous variable; rather, the firm has the capacity to assimilate a quantity of knowledge with a specific complexity per unit of time. Thus if we exceed the capacity of assimilation, the firm will have to bear the costs associated with the dedication of resources to the transfer without being able to benefit from the advantages of this greater stock of knowledge. Thus,

H1: The relation between the transfers of external knowledge and performance have the form of an inverted U. Up to the level at which the capacity for assimilation, transformation, and exploitation is exceeded (T*), the relation is positive; from this point on, it is negative.

Internal knowledge transfers as moderating variable

Cohen and Levinthal (1990) advise us that the mere existence of transfers from outside the firm is not enough; for these to really be useful, the firm must be able to exploit the knowledge. They thus write that: "*An organization's absorptive capacity does not simply depend on the organization's direct interface with the external environment. It also depends on transfers of knowledge across and within subunits that may be quite removed from the original point of entry*" (p. 131-132).

In this way, the knowledge acquired and assimilated by the group in contact with the external source of knowledge can be transferred internally within the organization, such that there is vicarious learning among different groups within the organization. Following Huber (1991), this can be assimilated under the rubric of organizational learning, since the group of possible behaviours of the firm's members is much greater. Further, the fact that the knowledge is assimilated and transformed by a larger group of the firm's units increases the probability of its being useful. That is, not all knowledge is useful in the unit that has received the knowledge from the outside. Thus contact between the knowledge acquired from the outside and the unit where it can be transformed and integrated increases the probability that the knowledge can be exploited. We can thus confirm the following hypothesis:

H2: The greater the internal transfers of knowledge, the greater the relation between external transfers of knowledge and performance.

Transferability of knowledge as moderating variable

From the first studies of management of knowledge, the characteristics of knowledge itself have been considered fundamental. The work of Winter (1987) and subsequently that of Kogut and Zander (1992) established the foundations for the characteristics of knowledge that they considered in their studies. These characteristics have also been considered when studying knowledge transfers (e.g., Simonin, 1999a; Szulanski, 1996). Logically, in the literature on knowledge transfer, interest centres on determining the ease or difficulty with which the knowledge can be transferred. This idea, with slight variations, has been mentioned in the literature under very different names. Simonin

(1999a) calls it *knowledge ambiguity*, which in his words "refers to the same underlying notion of transferability" (p. 597). In contrast, Szulanski (1996) prefers to speak of *internal stickiness*, part of which is caused by the characteristics of the knowledge transferred, among which we find causal ambiguity and unprovenness. Subramaniam and Venkatraman (2001; p. 361) speak of degree of tacitness and observe that "difficulty in *codification and transfer* is a central attribute of tacit knowledge [1]". In this study, we prefer to call the characteristic of the knowledge that makes it easier or harder to transfer *transferability of knowledge*, a definition upheld previously by Grant (1996).

Tautologically, if the knowledge is harder to transfer, one must dedicate more resources to realizing the process, decreasing the distance between the value and the cost of the transfer. Barney (1991) and Grant (1996) note that this characteristic of the resources is fundamental to the outline of the theory of resources and capacities, since when it comes time to acquire knowledge from the outside by imitation, the cost of the transfer causes the firm not to achieve any extra benefit.

Moreover, the lower the transferability of the knowledge, the greater the ease with which the firm's capacity for assimilation will be saturated. Following Zahra and George (2002), if the firm lacks sufficient capacity for assimilation, not only will it not be able subsequently to transform and exploit the knowledge, but it will also not be able to take advantage of the knowledge transferred to realize the improvements in performance to be gained from using the potential capacity to absorb knowledge. We therefore propose the following hypothesis:

H3: The greater the degree of transferability of the knowledge, the more positive the influence of external transfers of knowledge on the organization's performance.

Methods

Sample and data collection

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[1] Emphasis in the original.

To test the different hypotheses, we carried out an empirical study among large Spanish firms. The Duns & Bradstreet and *Actualidad Económica* databases were cross-referenced to ensure the reliability of the population list. The request for information was addressed to the CEO of each company. A sample of 975 firms was chosen at random, and each was asked to take part in the research. Due to the typical problems regarding the low response rate to questions on aspects of firms' strategy, extra care was taken to maximize the response rate. To this end, we began by pre-testing the questionnaire, carrying out a series of in-depth interviews with CEOs from firms that formed part of the population. Secondly, non-respondents were sent a new questionnaire about 1 month after the initial mailing. 215 valid responses were collected, for a response rate of 22.05%. The control variables are secondary data. We could only identify the sector and the size without any doubt for a total of 167 firms, these forming the sample used. The sample consists of both industrial and service organizations, with a workforce ranging from below 50 to over 40,000. The sample also includes firms with turnovers that range from less than 30 million euros to over 5 billion euros. The sample is, therefore, representative of a wide spectrum of companies.

The possible bias due to non-respondent firms has been analyzed. The aforementioned databases also provide secondary information on number of workers and turnover, both for firms in the sample and for non-respondents. The Kolmogorov-Smirnov test was used, and neither the number of employees ($p=0.496$) nor the turnover ($p=0.633$) was significantly different, meaning that we can be sure they come from the same population and that there is no bias in the respondent firms.

Knowledge Transfer Measures

Knowledge transfers take a central role in our study. Therefore, adequately measuring the transfers that occur within an organization, as well as from outside the firm, is of vital importance to the development of our work. We thus needed to measure the degree to which knowledge transfers exist among the firm's units and the importance of the external knowledge transfers.

Knowledge Transfer from customers and suppliers. We developed a Likert-type 7-point scale (1="totally disagree" to 7="totally agree"), which takes into account the two basic characteristics of the most commonly-used scales in studies of knowledge transfers with external agents (Kale, et al., 2000; Lyles & Salk, 1996; Simonin, 1999a; 1999b): a) the different types of knowledge that flow among organizations, and b) the fact that merely acquiring the knowledge does not suffice, but, rather, it must help the firm in improving its current capacities and abilities (thus reducing its dependence on external knowledge). Our basis, therefore, was the scale developed by Kale et al. (2000), which we applied to marketing-related knowledge, technological knowledge and knowledge of management.

The scale established can be applied to the firm's relations with any of the organizations it has links with, from its customers and suppliers to its strategic allies, research centers or business associations, to mention just a few relevant examples. In our case, we have concentrated on the knowledge transfers from the main customer and supplier with which co-operation links are kept.

The scale's validity and reliability were studied. We made an average for each of the three indicators for each knowledge type. Factorial analysis showed that items loaded on a single factor. The Cronbach's alpha values for internal consistency were 0.9699 (transfers from suppliers) and 0.9767 (transfers from customers), indicating an acceptable level of internal consistency.

Knowledge transfers between groups. For our study, we have adapted a scale developed by Gupta and Govindarajan (2000). We asked the directors of the firms to indicate the degree to which different groups in the firm transferred knowledge related to marketing and knowledge concerning technology and leadership, according to a 7-point Likert-type scale (1="never", 7="very much"). For each of these categories, we used three indicators due to the breadth of the concepts. The final result is the measure of the different indicators.

The validity and reliability of the scale have been studied. We made sure that the scale is unidimensional (only one factor with an eigenvalue greater than the unit) and that it is internally consistent ($\alpha= 0,8861$).

Knowledge Transferability

The ease with which knowledge can be transferred is a characteristic of that knowledge, which depends on its nature. Thus, although many studies have concentrated on the distinction between explicit and tacit knowledge to explain the higher or lower degree of transferability (Zack, 1999), this quality depends on a wide range of knowledge characteristics. In this paper, we have used the work of Winter (1987) and of Zander and Kogut (1995) to draw up a scale measuring the degree to which the knowledge is transferable. This scale consists of 4 indicators corresponding to: a) the possibility of recording the information and actual existence of records for carrying out the firm's main processes in written manuals and procedure lists; b) the ease with which new workers learn most of the knowledge without needing a long adaptation period; c) the lack of causal ambiguity; and d) the ability of people from outside the organization to understand the product and service creation processes. Thus, although it is clear that transferability is a multifactor concept, we have made a summary using a scale that helps us make comparisons. Previously, Molina et al. (2004) and Subramaniam and Venkatraman (2001) also used a single scale to this same end.

In order to ensure that transferability can be considered as a single factor, we studied the scale's unidimensionality by carrying out a factorial analysis. The items loaded on a single factor that explained 62.19% of the variance. This factor could then be used as a single construct for the sake of the study. When we studied the internal consistency by means of Cronbach's alpha, the statistic's value turned out to be higher than the 0.7 limit generally considered acceptable ($\alpha= 0.7952$).

Business performance

To study business performance, we use the scale developed by Murray and Kotabe (1999). We asked the firm directors what, on a 7-point Likert-type scale (1="never", 7="very much"), determined the firm's performance with respect to direct competitors

in the last three years. The use of scales in which performance is evaluated according to the main competitors is one of the most common practices in recent studies (e.g., Capron, 1999; Perera, Harrison and Poole, 1997; Steensma and Corley, 2000), especially in multisectorial studies (Brews and Hunt, 1999), while in the opposite case, it is normal to have to adjust the data (Zahra, Ireland and Hitt, 2000).

Control Variables

Two variables were introduced to control whether their effect on knowledge transfers among groups distorted the results. First, firm size was taken into account. Large firms are more likely to have different groups possessing knowledge that is relevant for the unit, which increases the possibility of internal transfers among groups (Huber, 1991). Likewise, size increases complexity, thus stimulating knowledge flows (Schulz, 2001). Therefore, the logarithm of the number of employees was introduced as a control variable.

Secondly, a series of dummy variables was introduced to control the effect of the sector of activity on the knowledge transfers. A higher or lower level of transfers depends on the institutional context (King and Zeithaml, 2003). Therefore, industrial firms were used as the base variable, and a dummy variable was included for firms in the services, construction, transport, banking and insurance sectors.

Results

The descriptive analysis and the correlation coefficients for the dependent variables can be seen in Table 1. As Venkatraman (1989) suggests, the interactions between variables have been computed by multiplication of the independent variables after subtracting their average, such that we minimize the possibility that there are problems of multicolinearity. In any case, the index of inflation of the variance and the condition index have been calculated for each regression. In all the cases, they maintained levels well below those recommended, indicating that the results are not affected by a possible multicolinearlity.

NOTE: INCLUDE TABLE 1 ABOUT HERE

Table 2 shows the estimated parameters. Model 1 includes only the control variables and the knowledge transfers from customers and suppliers. The estimations indicate that the transfers from suppliers affect the firm's performance positively ($p < 0,05$), as do the transfers from customers, with a quadratic rather than a linear relation ($p < 0,01$) in the case of the latter. These results do not agree with Hypothesis 1, such that the model of the relation between the knowledge transfers from outside and performance in the form of an inverted U has not been supported empirically.

NOTE: INCLUDE TABLE 2 ABOUT HERE

Model 2 incorporates the interactions between external and internal knowledge transfers. When we include these interactions, the transfers from customers squared lose a large part of their significance ($p < 0,10$), while the interaction between the transfers from customers and internal transfers is very significant ($p < 0,001$). This does not occur, however, in the case of the transfers from suppliers, since these have the same significance and magnitude ($p < 0,05$), and the variable of interaction is not significant. These results partly confirm Hypothesis 2.

In Models 3 and 4, the sample has been divided in two as a function of the transferability of knowledge. Model 3 thus shows the results for firms whose basic knowledge is not very transferable. In this model, we found only the interaction between knowledge from the suppliers and the internal transfers to be significant ($p < 0,05$). The capacity of the model to explain the differences in performance between the firms is hardly significant ($F = 1,710$; $p < 0,10$; R^2 adjusted $= 0,099$). In contrast, Model 4 shows the results of the regression for firms with knowledge that is easier to transfer. In this case, the model's explanatory capacity is significantly greater (R^2 adjusted $= 0,160$), and the relation between performance and the transfers from suppliers, the customers, and the interaction variable between knowledge transfers from customers and internal transfers is significant. These results support Hypothesis 3, since they confirm that when knowledge is hard to transfer, the greater cost associated with its transfer causes its influence on performance to be less that in cases where knowledge is easily transferred.

Discussion of the Results

First, the results show that knowledge transfers affect the performance of the organization positively. Thus firms with greater knowledge transfers have greater business performance. This result confirms the importance of a vision based on knowledge and the management of knowledge (Conner and Prahalad, 1996; Zander and Kogut, 1995).

On the other hand, the results are surprising with respect to the behaviour of the relation between knowledge transfers from the outside and performance. When we developed the hypotheses, we proposed a model of relation between interorganizational transfers and performance based on the relation between the value of the knowledge transferred and the cost of making the transfer. We considered the hypothesis that the relation is established in the form of an inverted U to be confirmed. In contrast, the results confirm a positive linear relation between the knowledge transfers from suppliers and the firm's performance. Further, in the case of transfers from the customers, the relation is positive and quadratic, indicating that an increase in the knowledge transfers from customers increases performance more than linearly

In interpreting these results, we can draw several conclusions. First, the model in the form of an inverted U proposed for the relation between knowledge transfers and performance has not been supported by the empirical evidence. Still, it is not reasonable to think that the relation between the knowledge transfers and performance is growing continually. We can thus consider that the sample of firms is only representative of the growing part of the curve. That is, it may be that the firms in the sample have a lower number of knowledge transfers at the optimal level and that therefore the estimates of the parameters are only valid for the growing part of the curve. This explanation is also related to a limitation of the current work, that of measuring knowledge transfers by using a 7-point scale.

On the other hand, the results partially confirm the need for the knowledge acquired from outside to be transferred within the firm to those places where it is going to be used. The hypothesis is fulfilled in the case of knowledge from customers, but not in the

knowledge transferred from suppliers. This result could be due to the fact that each kind of knowledge has a very different kind of user within the firm. Likewise, it makes sense to attribute these differences to the different nature of the relations with customers and suppliers and the different nature of the knowledge acquired, basically to its composition.

Finally, the results show the importance of the capacity for assimilating the knowledge in the relation between knowledge transfers and business performance. The capacity to absorb knowledge is a dynamic capacity formed by the interaction between the basic capacities of acquiring, assimilating, transforming and using the knowledge. In this respect, our study confirms the importance of harmonious growth in the capacities of the firm. It is therefore necessary to develop the different complementary capacities implicated in the process of absorption of knowledge in a coordinated way. As to the vision based on resources, the results confirm the need to study the relation between the different capacities, since their relation to performance will be moderated by the possibility of being able to use them in conjunction with the other resources and capacities needed. Thus the relation between capacities and performance is much more complex that has usually been considered in earlier studies.

Conclusions

The results of this study contribute a series of conclusions and recommendations both for firms and for the scientific community. In the case of firms, the results show a clear relation between the increase in knowledge transfers and the organization's performance. Therefore, organizations should pay attention to the aspects that we have seen to be important when they access knowledge from outside. They should also not forget the importance of spreading knowledge throughout the firm, above all knowledge provided by customers, and of making knowledge accessible in such a way that it can be used wherever it is going to be used. Nevertheless, we should not forget that knowledge transfers imply a cost, and that when this cost is excessive, as in the case where the knowledge is not very transferable, the possible benefits derived from greater knowledge are diluted by the greater costs.

The conclusions from the theoretical perspective strengthen the growing importance of knowledge in studies of firm management and strategic management. They also strengthen the importance for studies of firm management to consider the relation between the capacities, whether of complementarity or of substitution, since the relations between these are more complex than usually considered in previous studies.

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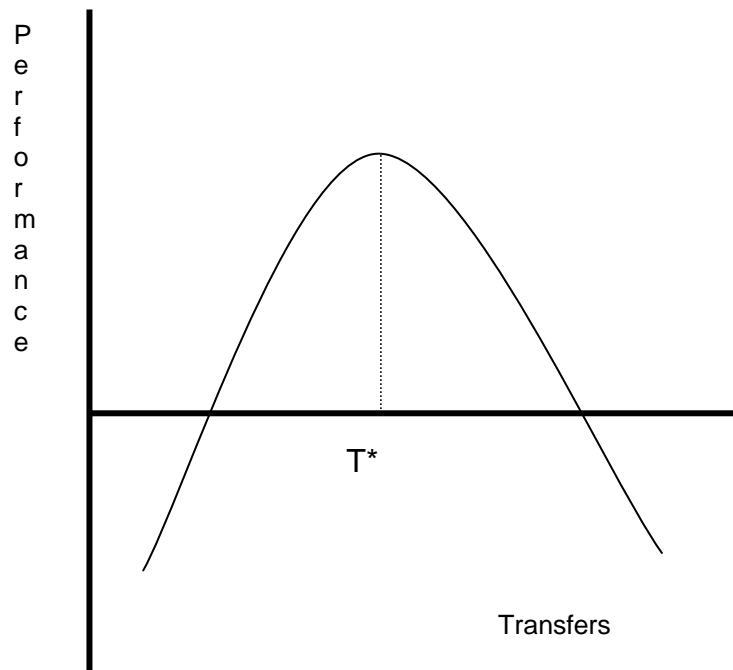Figure 1. Relation between external knowledge transfers and performance

TABLE 1
Mean, standard deviation and correlation [a]

Variable	Average	d.s.	1	2	3	4	5	6	7	8	9
1. Transfers from suppliers	3,496	1,352									
2.Transfers from customers	4,062	1,341	,570								
3. Transfers between groups	4,578	1,018	,254	,339							
4. Transferability of knowledge	4,822	1,113	,293	,295	,332						
5. Size	2,941	,584	,132	,128	,234	,012					
6. Services	,216	,412	,012	,064	,084	,019	,171				
7. Construction	,090	,287	-,067	-,032	-,163	-,039	-,048	-,165			
8. Transport	,084	,278	-,065	,006	,019	,156	-,002	-,159	-0,95		
9. Banking	,072	,259	,249	,176	,063	,217	,249	-,146	-0,87	-0,84	
10. Insurance	,012	,109	,105	-,033	,076	-,020	-,011	-0,58	-0,35	-0,33	-0,31

[a] n=167

[e] logarithm

Note: The correlations greater than 0,127 in absolute value are significant at $p<0,05$.

Variable	Model 1	Model 2	Model 3 Low transferability (n=79)	Model 4 High transferability (n=88)
A) Transfers from suppliers	0.132*	0.131*	0.086	0.188*
	(0.065)	(1.063)	(0.127)	(0.084)
B) Transfers from customers	0.050	-0.019	0.080	-0.138
	(0.064)	(0.064)	(0.108)	(0.083)
Sqr (A)	0.013	0.004	0.030	-0.032
	(0.038)	(0.037)	(0.064)	(0.050)
Sqr (B)	0.098**	0.070†	0.071	0.118*
	(0.37)	(0.038)	(0.064)	(0.048)
A* (Internal transfers)		-0.070	-0.098	-0.101
		(0.045)	(0.081)	(0.066)
B * (Internal transfers)		0.067***	0.074*	0.057*
		(0.018)	(0.032)	(0.025)
Control variables				
Constant	3.941***	4.609***	4.613***	4.721***
Size	0.081	-0.033	-0.140	0.045
	(0.130)	(0.129)	(0.237)	(0.145)
Services	-0.040	-0.030	-0.269	0.124
	(0.253)	(0.181)	(0.295)	(0.231)
Construction	0.023	0.138	0.407	-0.006
	(0.253)	(0.245)	(0.410)	(0.305)
Transport	0.130	0.070	0.598	-0.221
	(0.261)	(0.251)	(0.437)	(0.311)
Banking	0.272	0.316	0.368	0.282
	(0.299)	(0.289)	(0.947)	(0.306)
Insurance	0.024	-0.123	-1.456	1.689*
	(0.654)	(0.634)	(0.943)	(0.864)
R^2	0.119	0.195	0.237	0.275
Adjusted R^2	0.063	0.133	0.099	0.160
F	2.129**	3.130***	1.710†	2.376*

[a] logarithm
† $p<0.1$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$