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## **Asymmetries between ‘traditional’ and reverse knowledge flows in multinational firms: A study of acquisitions in transition economies**

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### **Abstract**

Leveraging knowledge from geographically disparate subsidiaries is a crucial source of competitive advantage for multinational enterprises. This study investigates the determinants of knowledge transfers to and from newly acquired subsidiaries in transition economies. We hypothesize that the determinants of ‘traditional’ parent-to-subsidiary knowledge transfers and ‘reverse’ subsidiary-to-parent knowledge transfers are based on different transfer logics. Organizational characteristics are important in ‘traditional’ knowledge flows, while knowledge characteristics are important in ‘reverse’ flows.

Based on a survey of 105 acquired subsidiaries in three Central and Eastern European countries, we find empirical support for our hypotheses. Host country locations have significant moderating effects.

**Key words:** knowledge management; acquisitions; multinational subsidiaries; transition economies

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Knowledge is a fundamental resource for firms to develop and retain competitive advantages (Grant, 1996; Inkpen, 1998). Multinational corporations (MNCs) leverage knowledge-based resources and capabilities across borders (Bartlett & Ghoshal, 1989; Gupta & Govindarajan, 1991, 2000; Hedlund, 1986; McCann & Mudambi, 2005), and thus engage in different types of knowledge flows to absorb and utilize knowledge from various sources at various locations within the multinational networks. This ability to transfer knowledge is thus essential for creating and transferring capabilities within MNCs (Kostova, 1999).

The effectiveness of knowledge transfer depends on the characteristics of the knowledge (Cantwell & Santangelo, 1999; Johanson & Vahlne, 1977; Zander & Kogut, 1995), as well as the organizational context, (Foss & Pedersen, 2002; Gupta & Govindarajan, 1991) and the organization's willingness and capabilities to transfer knowledge (Gupta & Govindarajan, 2000; Tsang, 2001; Wang, Tong & Koh, 2004). Moreover, external environmental factors moderate knowledge transfer across borders (Contractor & Sagafi-Nejad, 1981; Cui, Griffith, Cavusgil & Dabic, 2006; Meyer, 2007). Although the general characteristics are known, "very little systematic empirical investigation into the determinants of intra-MNC knowledge transfers has so far been attempted" (Gupta & Govindarajan, 2000: 474).

Most prior studies focus on traditional knowledge transfer from parent to subsidiary, while few investigate knowledge transfer from subsidiary to parent (Frost, 1998; Frost & Zhou, 2005; Håkanson & Nobel, 2000, 2001) and even less evidence exists concerning the differences between the two directions of knowledge flows. Therefore the

main contribution of this paper to study traditional and reverse knowledge flows within the same set of acquired MNC subsidiaries.

Reverse knowledge transfers are expected to play a pivotal role in generating global capabilities on the basis of dispersed pockets of knowledge with the network of a multinational firm. Yet, internal knowledge transfers are complex processes that are not always smooth and successful (Kostova, 1999). Therefore, we need a better understanding of the transfer logics underpinning reverse and traditional knowledge flows.

In the study of traditional and reverse knowledge flows, the two main determinants have been identified in the literature: knowledge characteristics and organizational characteristics (Frost & Zhou, 2005; Gupta & Govindarajan, 2000). A crucial knowledge characteristic is its relevance, that is, the similarity or overlap of the knowledge between parent and acquired subsidiaries (Schulz, 2003). This characteristic affects the receiving unit's 'absorptive capacity' that is essential for adapting and utilizing received knowledge (Lyles & Salk 1996; Mahnke, Pedersen & Verzin, 2005; Minbaeva, Pedersen, Björkman, Fey, & Park, 2003). Knowledge relevance allows us to analyze the characteristics of knowledge from the perspective of a specific receiver.

We investigate these knowledge flows for the case of subsidiaries established in pursuit of different motives. Some subsidiaries are mandated to generate and transfer new knowledge, while others may just exploit headquarters' existing knowledge in a new local environment (Cantwell & Mudambi, 2005; Kuemmerle, 1999). Subsidiary contexts and their relationship with headquarters vary with their strategic roles (Gupta & Govindarajan, 1991), which moderates the transfer success of organizational practices

(Kostova, 1999). Finally, although previous research indicates that location factors such as host market competition, market dynamism, culture distance and other institutional factors affect technology transfer (Contractor & Sagafi-Nejad, 1981; Cui et al., 2006), not many studies test their influence empirically.

Our empirical analysis focuses on hierarchical knowledge flows in recently acquired subsidiaries. Mergers and acquisitions provide a good opportunity for firms to access an existing and value-proven knowledge base (Empson, 2001). They are an important means for firms to complement and renew their knowledge bases (Bresman, Birkinshaw & Nobel, 1999; Castro & Neira, 2005; Vermeulen, 2005) and to obtain useful knowledge for developing new products and reducing the time to commercialize these products (Ganesan, Malter & Rindfleisch, 2005). Thus, acquired subsidiaries are a fruitful field within which to investigate our research questions

Prior empirical research on knowledge transfer has primarily been conducted on subsidiaries in established markets, with a few exceptions (e.g., Cui et al., 2006; Luo & Park, 2001; Lyles & Salk 1996). Knowledge transfer is very important for MNCs operating in transition economies (Cui et al., 2006; Lyles & Baird, 1994; Lyles & Salk 1996). In recent years, Central and Eastern Europe (CEE) has attracted increasing inflows of foreign direct investment (FDI) (e.g., Brouthers, Brouthers & Werner, 2001; UNCTAD, 2005). Moreover, some investments in this region are made for research and development purposes (Brouthers, Brouthers & Nakos, 1998). Subsidiaries in this region provide a good opportunity to investigate the evolution of knowledge transfer in MNCs since they enable us to observe the very first entries by foreign firms and the genesis of

knowledge transfers. Our unique survey-based sample is composed of 105 newly acquired subsidiaries in three CEE countries: Hungary, Poland and Lithuania.

Transition economies vary considerably in terms of their institutional environment and market attractiveness. These contextual factors are likely to affect MNC knowledge transfer (Meyer, 2007). We thus overcome a major limitation of many prior studies in the literature that use single context datasets (e.g., Cantwell & Mudambi, 2005; Frost & Zhou, 2005; Lyles & Salk, 1996).

The next section reviews recent research on internal knowledge flows in MNCs. Then knowledge relevance, the motives of acquisitions, and their influence on knowledge transfers are discussed to develop testable hypotheses. Empirical results are presented and analyzed for 105 acquired subsidiaries in three CEE countries. Finally conclusions and some managerial implications are provided.

## **THEORETICAL FOUNDATIONS**

Knowledge and innovation are becoming more important in generating productivity growth and competitiveness (e.g., Aghion & Howitt, 1998; Barro & Sala I-Martin, 1995; Battisti & Stoneman, 2003; Grossman & Helpman, 1991; Verspagen, 1991). Therefore, the competence of MNCs in leveraging their knowledge across dispersed foreign subsidiaries has become essential for achieving and sustaining competitive performance (Doz, Santos & Williamson, 2001). MNCs are complex cross-border organizations that manage knowledge flows in multiple directions, including exchanges within local clusters, hierarchical transfers between parent and subsidiary, and lateral transfers between subsidiaries (Mudambi & Navarra, 2004). In this study, we

focus on the hierarchical knowledge transfer between parent and acquired subsidiary because of the importance of such internal knowledge transfer.

MNCs are diverse, differentiated networks with complex internal and external relationships (Andersson & Forsgren, 2000; Ghoshal & Bartlett, 1990; Gupta & Govindarajan, 1991; Nohria & Ghoshal, 1997; O'Donnell, 2000). Knowledge transfers within MNCs occur within and between differentiated organizational subunits. On the one hand, headquarters is an important source of new knowledge for subsidiaries (Johanson & Vahlne, 1977; Porter, 1990; Sölvell & Zander, 1995, 1998). Headquarters possesses intangible assets and capabilities that motivate FDI (Buckley & Casson, 1976; Caves, 1996). In addition, subsidiaries can exploit such knowledge to prosper in local markets (Kuemmerle, 1999).

On the other hand, subsidiaries contribute to the resource base of the parent MNC's global operations, and thus, potentially, can have a major impact on the competitive advantage of the whole firm. Such contributions often originate from local R&D efforts and access to external resources in the local environment (Birkinshaw & Hood, 1998; Malnight, 1996). Since the early 1980s MNCs have been undertaking R&D in different subsidiaries (Cantwell, 1989), and such R&D in foreign subsidiaries has continued to expand (Håkanson, 1995).

Thus, the hierarchical knowledge flows within MNCs fall into two directional categories: parent-to-subsidiary (traditional flows) and subsidiary-to-parent (reverse flows). In this study, we have chosen to examine knowledge flows at the 'nodal' level (Gupta & Govindarajan, 2000). In particular, we focus on the role of acquired

subsidiaries in knowledge flows, either as a knowledge provider to the MNC parent or as a knowledge receiver from the parent.

Knowledge transfer is a process in which an organization re-creates and maintains a complex, causally ambiguous set of routines in new settings. Stickiness connotes difficulty experienced in this process (Szulanski 1996). Know-how, R&D capabilities and managerial techniques are transferred between MNCs units. But knowledge, especially tacit knowledge, does not necessarily flow easily within the MNCs. The stickiness of knowledge transfer also exists within organizations (Szulanski, 1996). Recent studies suggest that such factors as knowledge characteristics, source and target units' characteristics, the organizational contexts of transfer and environmental factors are likely to affect knowledge transfer (Burgelman, 1983; Cantwell & Santangelo, 1999; Cui et al., 2006; Foss & Pedersen, 2002; Ghoshal & Bartlett, 1994; Gupta & Govindarajan, 2000; Szulanski, 1996; Zander & Kogut, 1995). In sum, knowledge related barriers and the interaction of knowledge transfer participants are the important determinants of effective knowledge transfer. Therefore, we focus on the knowledge relevance of parent and acquired subsidiary as a determinant of knowledge transfers.

Relevance is a term used to describe how pertinent, connected, or applicable some information is to a given matter. According to relevance theory, a piece of information is characterized as relevant to an individual when its processing yields cognitive effects, i.e., when it permits new inferences or the revision of previously held assumptions (Sperber & Wilson, 1986). The greater these cognitive effects, the greater the relevance. Conversely, the greater the processing effort used to achieve these effects, the lesser the relevance.

Knowledge relevance is defined as “the degree to which external knowledge has the potential to connect to local knowledge” (Schulz, 2003: 442). Following relevance theory, the more the provider’s knowledge has implications for the receiver, and the easier it is for the knowledge receiver to derive these implications, the more the knowledge is relevant. In this study it specifically refers to the extent that the knowledge in the parent MNC and the knowledge in subsidiary are connected. With the increase of knowledge overlap between the knowledge providers and receivers, the likelihood of connection or relatedness also increases. The more the knowledge is connected, the more effective the transfer. In addition, firms can manage international business units more efficiently with the high degree of relatedness (Palich & Gomez-Mejia, 1999). So it is natural that many decision makers are likely to consider that relevant knowledge is of high value (Feldman & March, 1981) and make investments accordingly.

Secondly, if the knowledge to be learned is related to the firm’s current knowledge, the firm could quickly recognize the potential benefits of the new knowledge and thus motivate the firm to take measures to assimilate and utilize new knowledge for its benefits. For example, firms with more available relevant knowledge would like to invest more in R&D to absorb external knowledge (Cohen & Levinthal, 1990).

Thirdly, the connection enables learning firms to absorb and institutionalize the new knowledge. Absorptive capacity is “largely a function of their preexisting stock of knowledge” (Szulanski, 1996: 31). The more the new knowledge is connected with the current knowledge, the higher the capacity to assimilate, apply and integrate the knowledge within the organization. Gupta and Govindarajan (2000) suggest that a target unit’s capacity to absorb knowledge is a prime factor in determining its knowledge



receipts. So, knowledge relevance improves both the firm's willingness and capacity of learning, which are two critical factors that affect the extent and success of knowledge transfer (e.g., Gupta & Govindarajan, 2000; Tsang, 2001; Wang et al., 2004). Fourthly, Schulz reported that "knowledge can change other knowledge the more it is related to it or can be related to it" (2003: 442). Such knowledge relevance increases the ability of the knowledge receiver to change and develop the obtained knowledge.

In summary, knowledge relevance is positively related to absorptive capacity (Sabini, 1992). However, the two concepts are theoretically distinct. For example, in cases where knowledge relevance is low, but the transfer is considered a strategic priority, the firm may invest resources to create sufficient absorptive capacity.

## **HYPOTHESES**

### **Knowledge Characteristics**

Our core argument is that knowledge relevance has different influence on traditional and reverse knowledge transfers, because of the existence of principal-agent relationships within the MNCs. In traditional knowledge transfer, the parent firm transfers knowledge to subsidiary in order to exploit a home-based knowledge advantage in local environments. It has the authority to require its subsidiaries to adopt knowledge developed in home countries and could use control mechanisms to achieve it. Such traditional transfer is likely to be 'transplantation' or 'supplantation' (Mudambi, 2002). If MNCs acquire a local firm as a subsidiary, especially when its objective is to exploit local markets, they may infuse knowledge from home to supersede its existing knowledge. This is particularly relevant in transition economies where local firms

typically had weak management and marketing capabilities (Meyer & Estrin, 2001) and thus are eager to learn from new foreign owners. The subsidiary either replicates knowledge from parent or upgrades its current knowledge to integrate the new knowledge. Therefore, knowledge relevance between parent and subsidiary will not play a key role in knowledge transfer because of the parent firm's authority.

*Hypothesis 1a:* Knowledge relevance between parent and subsidiary has no significant relationship with the extent of traditional knowledge transfer from parent to subsidiary.

Reverse knowledge transfers from a subsidiary to its parent firm are much more difficult than traditional transfer. Subsidiaries may be motivated to transfer knowledge to their parent firm because such transfers could strengthen their strategic position in the whole organization (Gupta & Govindarajan, 2000). Yet, a parent firm would only be interested in such transfers that it deems to be beneficial from the receiver's point of view (Gupta & Govindarajan, 2000; Kogut & Zander, 1993; Tsai, 2001). Reverse knowledge transfer may be beneficial to the parent firm from the following ways: accessing local knowledge, coordinating a global strategy, improving processes in the MNCs network and providing new products (Ambos, Ambos & Schlegelmilch, 2006).

However, not every knowledge flow will equally benefit the receiver (Ambos et al., 2006). Some knowledge may benefit the parent firm greatly, while others may be more costly to integrate the improvements of operations that it generates. Moreover, parent firms may not recognize potential benefits, and thus not take appropriate initiatives to adopt knowledge available from subsidiaries (Meyer & Lieb-Dóczy, 2003). Because of

the principal-agent relationship, the parent firms' commitment to learning from subsidiaries is less than the subsidiaries' commitment to learning from the parent firms. In other words, it is a 'teaching' process in traditional transfer but a 'persuading' process in reverse transfer. The subsidiary has to persuade the parent firm that its knowledge can fit the parent's needs.

Knowledge relevance could help parent firms pay attention to the new knowledge of subsidiaries and recognize the potential benefits. The more their knowledge overlaps, the more likely the parent takes interest in the subsidiary's knowledge and understands its benefits. Therefore, reverse knowledge transfer is more sensitive to knowledge relevance than traditional knowledge transfer.

*Hypothesis 1b:* Knowledge relevance between parent and subsidiary has significant positive relationship with the extent of reverse knowledge transfer from subsidiary to parent.

The impact of knowledge relevance varies not only across internal contexts (i.e. traditional versus reverse) but also across external contexts (Meyer, 2007). The institutional distance between parent and subsidiary varies across subsidiary locations (Kostova, 1999). Further, with differences in culture, government regulations, customer preferences and labor availability, a subsidiary's location-specific competencies can vary dramatically (Cantwell & Mudambi, 2005; Gupta & Govindarajan, 2001) because organizations' practices are embedded in the environment they are developed (Kogut, 1993). Hence, it has been argued that bodies of knowledge are conditioned by location

characteristics that can affect how well the knowledge will ‘fit’ within different units of the firm. This implies that the same level of knowledge relevance can have a higher or lower impact on knowledge transfers in subsidiaries in different geographical locations (Jensen & Szulanski, 2004).

This is particularly relevant in the context of transition economies where variations in the pre-existing national innovation systems (Inzelt, 2004; Lundvall, 2007; Radosevic, 1998) and the diverse paths of institutional and organizational change moderate the patterns of knowledge flows within MNC subsidiaries (Meyer, 2007; Newman, 2000). Therefore, we expect that country specific effects moderate the effect of knowledge relevance on the amount of knowledge transferred.

*Hypothesis 1c:* The location of the subsidiary has a moderating effect on the relationship between knowledge relevance and traditional knowledge transfer.

*Hypothesis 1d:* The location of the subsidiary has a moderating effect on the relationship between knowledge relevance and reverse knowledge transfers.

### **Organizational Characteristics**

Organizational characteristics also play roles in knowledge transfer. Internal knowledge flows could be a function of the motivational disposition of units engaged in the transfer (Gupta & Govindarajan, 2000). Further, formal structure, systems and other attributes of organizational contexts affect the effectiveness of knowledge transfer (Burgelman, 1983; Foss & Pedersen, 2002; Ghoshal & Bartlett, 1994; Gupta & Govindarajan, 1991).

Whether the evolution of a subsidiary's strategic role is mainly driven by the parent or by itself, headquarters assignment is a powerful force in determining it (Birkinshaw & Hood, 1998). The acquisition motives of parent firm not only make an assignment for the acquired subsidiary, but also determine the relationship between parent and this subsidiary. In this paper, we adopt the subsidiary mandates proposed by Cantwell and Mudambi (2005): competence-creating and competence-exploiting. Parent firms expect competence-creating subsidiaries to introduce new knowledge to be used by other corporate units or become 'centers of excellence' (Birkinshaw, 1998; Frost, Birkinshaw & Ensign, 2002). On the other hand, they expect competence-exploiting subsidiaries to use home-based knowledge in local markets. These two subsidiary types help the parent MNC advance its 'exploration' and 'exploitation' strategic objectives (March, 1991). The motives of acquisitions are categorized accordingly.

Competence-exploiting subsidiaries tend to transfer and adapt knowledge from their parent to local markets. Usually they are not major centers of excellence or key hubs, and would not contribute much to the organizational heterarchy (Cantwell & Mudambi, 2005). In particular, in the years immediately following acquisition, these subsidiaries are engaged in implementing established home-based knowledge effectively in local environments, which often does not require much continual knowledge transfer from parent firms.

On the other hand, competence-creating subsidiaries are assumed to be more likely to introduce knowledge that is new to its parent firm. They are expected to be centers of excellence and diffuse knowledge to other units of the MNC network. However, in early period of integration into the parent MNC, these acquired subsidiaries

need knowledge infusion from parent to help to build and develop their capabilities of creating usable new knowledge. Further, they need to transplant the knowledge obtained from parent and integrate it with their locally existing knowledge (Mudambi, 2002). These processes of transplantation and integration require continuous knowledge transfer from the parent. The more the subsidiary's strategic importance is, the more investment of both knowledge and other resources from parent to the acquired unit. From the distinction of the two subsidiary mandates, we expect that acquisition motives play different roles in the hierarchical knowledge transfers at the early stage of acquisitions.

While headquarters assignment is a major factor in the nature of the subsidiary's mandate (Birkinshaw & Hood, 1998), competence-creating mandates are usually the outcome of a process of subsidiary evolution (Cantwell & Mudambi, 2005). Acquired competence-creating subsidiaries need to develop absorptive capacity relative to their new MNC parents (Lane & Lubatkin, 1998). Thus, we expect competence-creating subsidiaries to require greater knowledge infusions in the early years after acquisition, particularly in emerging market economies.

*Hypothesis 2:* A subsidiary acquired with a competence-creating motive has significantly higher 'traditional' knowledge transfer from parent to subsidiary than a subsidiary acquired with a competence-exploiting motive.

The resource-based view suggests that larger firms have greater resource stocks and are less dependent on external sources (Barney, 1991). It has been argued that this argument to apply to the case of knowledge resources in intra-firm relationships as well

(Mudambi & Navarra, 2004). Further, it has been shown that larger subsidiaries have more local linkages that can be used to access knowledge, reducing their need for parental knowledge (Chen, Chen & Ku, 2004). Therefore, we expect the relationship in hypothesis 2 to be moderated by the size of the subsidiary. Larger competence creating subsidiaries will be less likely to be heavily dependent on knowledge from their parent firms.

*Hypothesis 2a:* Amongst subsidiaries acquired with a competence-creating motive, the ‘traditional’ knowledge transfer from parent to subsidiary is negatively related to subsidiary size.

## **METHODS**

### **Data**

The empirical analysis is based on a questionnaire survey administered by local research teams in three countries in CEE in 2003. These countries have attracted increasing flows of FDI since they opened to international business in the early 1990s. Many joined the European Union in 2004 and thus accessed free market and experienced a further surge of FDI. These countries thus provide a suitable context for us to investigate knowledge transfers in MNCs, especially transfers between units in developed countries and units in emerging economies. In addition, the evolution of knowledge transfer over time could also be well studied in this context.

The base population of our study included all FDI projects established from 1990 to 2002, which have at least 10 employees and foreign equity participation of at least 10 percent. The research questions and instruments were designed and developed after three

meetings of the research teams. Then the questionnaire was translated into local languages and sent to the respondents in both languages.

The survey's base population was constructed from multiple locally available databases to get as full coverage of FDI as possible (complete databases of FDI projects in these countries do not exist). The questionnaire was sent to the chief executives of each firm for which contact information was available in the database. In most cases, this was followed up with telephone calls and personal interviews. We have obtained responses from about 535 foreign investment firms including 200 in Poland, 111 in Lithuania and 224 in Hungary. This represents 10 percent, 11 percent and 22 percent of the firms contacted respectively. The databases often reported very imprecise firm information, such that some contacted firms were not actually in operation (especially in Poland) or not actually foreign-owned (in Hungary), and thus should theoretically not have been in the base list of firms. Thus the aforementioned response rates are low estimates.

Of these foreign investors, 105 firms (44 in Poland, 21 in Lithuania and 40 in Hungary) became MNC affiliates through international acquisitions. This is the dataset used in the current study. The headquarters of the acquiring MNCs were located in different countries or regions (Table 1.1). Sixty-two percent of the acquisitions were undertaken by MNCs from Western Europe. This is consistent with the early research on the importance of proximity for FDI in Eastern European enterprises (Jensen, 2007). The Nordic region and North America are two other main origins of parent companies, and they account for 21 percent and 13 percent of the acquisitions respectively. The remainder of the parent companies originate from CEE, East Asia and Australia.



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The acquisitions in our sample cover a broad range of industries. Table 1.2 shows the distribution of sample firms by industry. Most of the acquisitions took place in manufacturing, with foreign investment a little bit higher in light manufacturing (28.6 percent) as compared to heavy manufacturing (21.9 percent). More than fifteen percent of the acquisitions occurred in business and financial services and twelve percent in trade. Other industries such as utilities, construction, hotel and restaurants, transport and communication also appear in the sample.

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The questionnaire covered different aspects of the characteristics, activities and knowledge of both parent and subsidiary units. We used the focal acquired subsidiary as our unit of observation. The next sub-section introduces the variables; detailed definitions of all variables used in this study are provided in the Appendix.

### **Variables**

**Dependent variable.** The dependent variable is the extent of knowledge transfer between parent and subsidiary. It consists of two directions of transfer: one is the traditional direction from parent to subsidiary; the other is the reverse direction from subsidiary to parent. Two questions were asked: to what extent are knowledge and technology from the parent's existing business transferred to assist the acquired business?

To what extent are knowledge and technology from the acquired business used to assist the parent's existing business?

Knowledge is a set of know-how and capabilities that “refer to a firm's capacity to deploy resources to affect a desired end. They are information based, tangible or intangible processes that are firm specific and are developed over time through complex interactions among the firm's resources” (Amit & Schoemaker, 1993: 35). There are different types of knowledge that could be transferred between parent and subsidiary. Gupta and Govindarajan (1994) distinguish six types of knowledge: market data on customers, market data on competitors, marketing know-how, distribution know-how, technology know-how and purchasing know-how. Schulz (2003) identifies three types of organizational knowledge: knowledge about technologies, knowledge related to sales and marketing, and knowledge pertaining to government agencies, competitors and suppliers. In this study, we measured the following types of transferred knowledge: knowledge about technology know-how, knowledge about sales and marketing, knowledge about financial resources and knowledge about management. The measures ranged from ‘not at all’ to ‘a very large extent’ on a five-point Likert-type scale. The Cronbach's alpha for the scales of traditional knowledge transfer and reverse knowledge transfer were 0.851 and 0.866 respectively.

**Independent variables.** The independent variables are related to knowledge characteristics and organizational characteristics. Knowledge characteristics mainly relate to knowledge relevance between parent and subsidiary, while organizational characteristics relate to the MNC parent's motives for acquisition.

We defined knowledge relevance as the extent to which the knowledge in the parent and the knowledge in the acquired subsidiary overlapped or were similar. From a relevance theory perspective, Schulz argued that “extra-unit knowledge is relevant to a subunit the more it has implications for the subunit, and the easier it is to derive these implications” (2003: 444). He measured these following factors that determine knowledge relevance: local knowledge base, codification of knowledge, extra-unit knowledge base, and the dyadic relationship. On the basis of these factors, we measured this construct directly by asking the respondents how similar the parent firm and the acquired firm were before acquisition with respect to five items: technology, product range, markets, customers and competition. Responses were reported on a five-point Likert scale, the Cronbach’s alpha for the aggregate index is 0.772.

The motives for the acquisitions are differentiated into two categories: competence-creation and competence-exploitation. We used the subsidiary mandate types from Cantwell and Mudambi (2005) to differentiate the firm’s motives. A competence-creating mandate implies that the subsidiary is expected to buttress and extend the parent MNC’s competencies well beyond the immediate environs of the host country. A competence-exploiting mandate implies that the subsidiary is expected to adapt and focus the parent’s existing competencies primarily for use in the host country. This variable is operationalized in terms of the foreign parent’s strategic objectives in the acquisition. If the subsidiary’s responsibilities are to deliver access to local researchers and skilled employees, to improve efficiency of the parent MNC’s global production network, or to control specific strategic assets in the host country, the subsidiaries are considered to be competence-creating. If the subsidiary’s responsibilities are to provide access to local

markets, to obtain local natural resources, or to utilize local low-cost labour force, the subsidiaries are considered to be competence-exploiting. In other words, competence-creating subsidiaries are strategically outward-oriented, while competence-exploiting subsidiaries are inward-oriented.

Further, we expect subsidiary size to negatively moderate the effect of acquisition motives on knowledge transfer. This is because larger subsidiaries are likely to have a better developed local knowledge network. They are therefore less in need of knowledge infusions from the parent MNC. We measure by the subsidiary's size by its number of employees (in logs).

**Control variables.** A number of firm, industry and location variables were included as controls. These include: host country, home country, acquisition industry, the size of acquired firm, the age of the acquired subsidiary, and the acquisition experience of the acquiring MNC.

To capture differences in host country contexts, the location of the subsidiary was represented by dummy variables in three categories: Poland, Lithuania, and Hungary. In addition, the home country/region contexts were controlled using dummy variables to represent three home country contexts: European countries, North American countries and other.

The industry context is also likely to have an influence on knowledge transfer within an organization. Manufacturing industries have different patterns of knowledge flows as compared to industries that are service-based (Grosse, 1996; Lathi & Beyerlein, 2000). Following Gupta and Govindarajan (2000), Kuemmerle (1999) and others, a

dummy variable was used to indicate whether the subsidiary was in manufacturing or services, with services serving as the base case.

At the firm level, we included the direct effect of the acquired firm's size as measured by the number of employees. Further, since it has been argued that firms with prior acquisition experience do better than those without such experience (Lubatkin, 1983) and that firms can develop their dynamic capabilities by learning from repeated practices (Eisenhardt & Martin, 2000), we controlled for the parent's acquisition experience, which is measured with the number of acquisitions the acquiring firm has made worldwide before the focal acquisition took place. Finally, we also controlled for subsidiary age, measured as the duration from the year that the subsidiary was acquired to the year that this survey is conducted.

## **RESULTS**

The correlation matrix of all variables is shown in Table 2.1. The mean number of prior foreign acquisitions is about 18. This indicates that many MNCs had considerable international acquisition experience before they acquired the current subsidiaries. Subsidiary age is 6 years on average, which shows that most of these acquired subsidiaries are in the early stage of their development. The average age and size of acquired subsidiaries in the three host countries is displayed in Table 2.2. Traditional as well as reverse knowledge transfers are significantly correlated with knowledge relevance, the competence-creating motive and host country dummies. In addition, the data reveal that the acquired subsidiaries in Poland are relatively larger than those in Lithuania and Hungary.

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Focusing on the core issue of this article, we examine the differences between traditional and reverse knowledge transfers. Our research hypotheses were tested using a hierarchical regression analysis on internal knowledge transfers. For each analysis we entered control variables in the first specification. In the second specification, we entered the main effects for knowledge characteristics (knowledge relevance) and organizational characteristics (the motives for the acquisition). In the third specification, we entered interaction terms. The parameter estimates of the regression models of both directions of knowledge transfers are provided in Table 3. Model 3 (reverse knowledge flows) and model 4 (traditional knowledge flows) present the overall results, controlling for location, industry and firm effects. The adjusted  $R^2$  values for models 3 and 4 are 0.08 and 0.08 respectively. In model 5 (reverse knowledge flows) and model 6 (traditional knowledge flows), we include the interactions between knowledge relevance and the host environments and the interaction between the motives for the acquisition and subsidiary size. We observe that the insertion of these interaction effects improves the explanatory power, with the adjusted  $R^2$  increasing to 0.10 and 0.11 in models 5 and 6 respectively. In all cases, the F statistics are significant, supporting the chosen model specifications. Further, the variance inflation factors in all models are not significant.

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In both models 3 and 5 relating to reverse knowledge transfers, knowledge relevance is highly statistically significant. In other words, increased similarity and/or overlap between the subsidiary's knowledge and that of the parent is associated a higher level of reverse knowledge. However, in models 4 and 6, knowledge relevance is not significant in explaining the extent of traditional knowledge transfer. Thus, hypotheses 1a and 1b are strongly supported by the results, suggesting that the knowledge relevance between source and target is important in determining the extent of reverse knowledge transfer but not in the level of traditional knowledge transfer. These results clearly confirm our argument that there is an asymmetry between traditional and reverse knowledge flows in terms of the effects of knowledge relevance.

Moreover, we found that the host country has a significant moderating effect on the relationship between knowledge relevance and knowledge transfers, as predicted in hypotheses 1c and 1d. A Polish location negatively moderates the effect of knowledge relevance on reverse knowledge transfer in acquired subsidiaries. In the case of traditional knowledge transfers, the moderating effect of a Polish location is positive. Hence, the effects of knowledge relevance on reverse as well as traditional knowledge transfers are significantly different in Polish subsidiaries, as compared subsidiaries in the other two host locations.

A more subtle examination of the moderating effect of location on the knowledge relevance – knowledge transfer relationship is provided in Figures 1.1 and 1.2. Here we

depict the relationship between knowledge relevance on knowledge transfer separately for the different host locations. The estimated values are computed at the average values of all other regressors in Table 3. In Figure 1.1, we see that the positive effect of knowledge relevance on reverse knowledge transfers is concentrated in subsidiaries located in Hungary and Lithuania. In Figure 1.2, we see that the relationship for traditional knowledge transfers is different in the three host locations, though the variation is not as stark as in the case of reverse transfers.

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The motive for acquisition is significant in determining the extent of traditional knowledge transfers. Subsidiaries established with competence-creating motives have significantly higher levels of traditional knowledge transfer from their parent firms. However, the motive for acquisition is not significant in reverse knowledge transfer. Thus hypothesis 2 is also supported. Further, subsidiary size negatively moderates the relationship between acquisition motive and traditional knowledge transfer, which supports hypothesis 2a. Small subsidiaries established with competence-creating motives receive more knowledge from their parents than large subsidiaries established with the same motives (Figure 2).



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Insert Figure 2 about here  
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## **DISCUSSION AND CONCLUSIONS**

The objective of this study is to understand how knowledge, organizational and location characteristics affect hierarchical knowledge transfers between an MNC parent and its acquired subsidiary. Specifically, we studied the influence of knowledge relevance and the motive of acquiring a subsidiary on internal knowledge transfers after controlling for location factors. Our findings indicate that these factors have an asymmetrical influence on knowledge transfers. Thus, traditional and reverse knowledge transfers are different processes, and our empirical results provide insights into the determinants of these differences.

**Knowledge relevance.** Our approach of using knowledge relevance links the knowledge to the organization, i.e., we focus on the levels of knowledge relatedness between the source and target. This is in contrast to the approach adopted in much of the literature where knowledge characteristics such as tacitness, causal ambiguity and complexity are not linked to the organization. However, our approach is consistent with the notion of absorptive capacity (Cohen & Levinthal, 1990) and more specifically to the notion of relative absorptive capacity (Lane & Lubatkin, 1998). This is because we expect knowledge relevance increase relative absorptive capacity in the dyad and thus to be positively related to the ability of a unit to understand and adopt knowledge inflows. We find that relevance is an important factor influencing knowledge flows within

multinational organizations, which is consistent with ideas in the literature (e.g., Hansen & Løvas, 2004; Markides & Williamson, 1994; Schulz, 2003). However, we find it to be important in reverse knowledge transfer rather than traditional knowledge transfer. The importance of the directional context in knowledge transfers is an important new finding.

This asymmetry could result from the different nature of learning processes in traditional and reverse knowledge transfers. The transfer of knowledge from parent to subsidiary is a process of either knowledge supplantation *or* knowledge transplantation (Mudambi, 2002). That is, the parent company transplants its home-based knowledge or uses it to supplant an existing knowledge base in the acquired subsidiary. In addition, the parent company has the authority and power to require the acquired subsidiary to adopt the knowledge inflow. In contrast, the transfer of knowledge from subsidiaries to parents is a process of searching for recognition and acceptance. To transfer knowledge, the subsidiary first needs to make the parent interested in it. An effective way for a subsidiary to attract its parent's attention is to show how its knowledge can support the parent's products or processes. When the subsidiary's knowledge is highly related to the parent's knowledge base, it is easier for the subsidiary to gain recognition.

**Acquisition motives.** We investigated subsidiary characteristics from their strategic context rather than their structure, control or the relationship with parent firm. Parents transfer more knowledge to acquired subsidiaries if they have a competence-creating motive, rather than a competence-exploiting motive. Further, the smaller the subsidiary, the more it is dependent on its parent for knowledge inflows. Our finding may be based on the fact that our sample consists of subsidiaries in emerging market economies, so that we are observing early investments in subsidiaries. In the early years,

the parent firm needs to infuse the necessary knowledge resources to help a subsidiary become a center of excellence. The smaller the acquired subsidiary is, the more dependent it is on knowledge inflows from its parent.

**Location context.** The host country context influences both traditional and reverse knowledge transfers, through direct effects and by moderating the relationship between knowledge relevance and transfer (Figures 1.1 and 1.2). Thus, the location of the subsidiary has very important effects on the implementation of knowledge transfers.

Specifically, our results suggest that location has a moderating effect on the knowledge relevance – knowledge transfer relationship. Relevance is less important for reverse knowledge and more important for traditional knowledge transfers in Poland relative to Hungary and Lithuania. For reverse knowledge transfers, the slope effect for Polish subsidiaries is small compared to subsidiaries in Hungary and Lithuania (figure 1.1). However, for traditional knowledge transfer the slope effect for Polish subsidiaries is greater than for the other two host locations (Figure 1.2).

Poland has by far the largest domestic market of the three host locations and also had a faster rate of transition in the study period (Jensen, 2007). This is supported in our data where the Polish subsidiaries are considerably larger in terms of employment than those in Hungary or Lithuania. This would suggest Polish subsidiaries are relatively more important to their parent groups and therefore have less of a problem in convincing their parent MNCs that their knowledge is valuable. This would account for the fact that a Polish location negatively moderates the effect of knowledge relevance.

Hungary has had the largest flow rate of FDI during the study period (UNCTAD, 2005). This is reflected in our data where the Hungarian subsidiaries were acquired

earlier, on average. These subsidiaries also had the smallest average employment in our sample, suggesting a higher level of capital intensity. It is likely that these subsidiaries are more highly specialized. Both small size and greater specialization would account for the greater importance of knowledge relevance in reverse knowledge transfers.

Host country institutional factors are likely to be crucial in determining the broad characteristics of the subsidiaries in each location. These broad characteristics are important determinants of the nature of intra-MNC knowledge transfers. Our results therefore underline the importance of validating results from any single country study by replication in other country contexts (Meyer, 2007).

Surprisingly home country and industry factors did not have significant effects on hierarchical knowledge transfer. Regarding home country factors, a possible explanation is that most of the acquirers originate from other European countries (84.8%), such that their geographic and cultural distance to the acquired firms is not very high. With regard to industry factors, an explanation could be that the acquired subsidiaries are in an early stage of development, so that the different knowledge trajectories between manufacturing and services have not yet emerged.

Taken together, these results demonstrate that knowledge, organizational and location factors have asymmetric effects on internal knowledge transfers. This study goes beyond prior research in that it examines traditional and reverse knowledge transfers within the same sample of firms. Earlier research suggests that there are many determinants of the success of knowledge transfer. We show that that the determinants vary with the direction of knowledge flows.

Schulz measures knowledge relevance as an abstract intervening concept. He recommended that “this line of research could be significantly strengthened if future studies develop empirical measures of knowledge relevance and explore the direct effects on knowledge flows” (2003: 455). This study implements this recommendation by measuring knowledge relevance directly.

Finally, we explore the relationship between subsidiary roles and knowledge transfers. The process of knowledge transfer in acquired subsidiaries that are expected to evolve to competence-creating status differs systematically from that in subsidiaries that are not expected to do so. Our results here are reflective of the nature of our sample. In developed economies with older subsidiaries, we would expect competence-creating subsidiaries to transfer more knowledge back to their parents, i.e., to exhibit higher reverse knowledge transfers. However, competence-creating status is the result of a process of subsidiary evolution (Birkinshaw & Hood, 1998; Cantwell & Mudambi, 2005). Our sample is made up of subsidiaries with low levels of knowledge resources and in an early stage of evolution, where the parent is still making knowledge ‘investments’. Thus we observe significantly higher traditional knowledge inflows in subsidiaries acquired with a competence-creating motive.

Knowledge transfer is complex and costly. We have demonstrated that the process of knowledge transfer is different for traditional and reverse knowledge flows as well as for different subsidiary strategic types. Hence, it is necessary for both parent and subsidiary to focus on those factors that are most important to the knowledge transfers being implemented.

## **Limitations and Directions for Future Research**

As with all empirical research, this study has its limitations. First, all measures are derived from questionnaires, which may result in bias because of the use of a single data-gathering method.<sup>1</sup> Therefore, telephone calls and personal interviews were also used in the data collection. The responses from these supplementary data methods corroborated our questionnaire responses, providing support for the veracity of the survey data.

Second, we used the only the MNC parent's motives in acquiring the subsidiary to examine its strategic mandate. This is because in the early stage of the acquired subsidiary's life, parental assignments are crucial determinants of its strategic context. However, subsidiary mandates evolve over time with the interaction of parent assignment, subsidiary choice and the local environment (Birkinshaw & Hood, 1998; Cantwell & Mudambi, 2005). These influences could be further explored in a future study. Third, the data for this study came from acquired subsidiaries in three Central and Eastern European countries and most of the acquirer firms are from nearby west European countries. This may reduce the influence of geographical distance and cultural heterogeneity. Thus, the results might not generalize to other contexts such as the emerging market economies in East Asia.

Fourth, our study is based on cross-sectional data. We are therefore not able to observe the process of subsidiary evolution. Time will play a role in both traditional knowledge transfer and reverse knowledge transfer between parent and acquired subsidiaries. Thus, it would be interesting to examine the evolution of the asymmetries we have uncovered in a longitudinal study. Fifth, our research focused on knowledge transfers in international acquisitions. Other foreign investment modes such as greenfield

entries and joint ventures are not discussed. Entry mode would affect the extent of knowledge transfers since the objectives of the investment and the roles of the subsidiary vary with it. Finally, data obtained simultaneously from both sides of the dyad: parent and subsidiary would be very helpful in exploring asymmetries in hierarchical knowledge transfers.

In sum, our results confirm the importance of knowledge characteristics and organizational characteristics in the study of knowledge flows. The key finding of our study is that the determinants of hierarchical knowledge transfers are not necessarily symmetric. Differences exist and managers should focus on the appropriate determinants depending on whether they are implementing traditional or reverse transfers.

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## **FOOTNOTES**

1(Page28) Common method bias occurs when the instruments enter into or affect the scores or measures that are being gathered. Since the questions we asked about independent and dependent variables are not highly correlated, the responses to each variable will probably not influence each other and this bias is unlikely to arise.

**TABLE 1.1**

## Home Country/Region Distributions of the Subsidiaries

Home country/region	Frequency	Percent
Asia	2	1.9
Europe		
Central and Eastern		
European countries	6	5.7
Germany	24	22.9
Nordic	21	20.0
Other W. Europe	38	36.2
North America	13	12.4
Other	1	1.0
Total	105	100.0

**TABLE 1.2**

## Industry Distributions of the Subsidiaries

Industry	Frequency	Percent
Mining	1	1.0
Manufacturing	53	50.5
Utilities	2	1.9
Financial services	16	15.5
Trade	12	11.7
Other services	21	20.4
Total	105	100.0

**TABLE 2.1**

## Correlation Matrix and Descriptive Statistics

Variables	Mean	S.D.	1	2	3	4	5
1 Reverse knowledge transfer	2.32	1.07	1				
2 Traditional knowledge transfer	3.49	1.03	0.14	1			
3 Knowledge relevance	2.83	0.98	0.29 *	0.16	1		
4 Competence-creating motive	0.30	0.46	0.06	0.30 *	0.08	1	
5 Poland	0.42	0.50	-0.16	-0.12	-0.15	-0.05	1
6 Lithuania	0.20	0.40	0.31 **	0.07	0.16	0.07	-0.43 **
7 Hungary	0.38	0.49	-0.11	0.08	0.02	-0.01	-0.67 **
8 Industry	0.50	0.50	-0.02	0.16	-0.02	0.00	0.07
9 North America	0.12	0.33	0.06	-0.21	-0.10	-0.19	0.33 **
10 European countries	0.85	0.36	-0.04	0.14	0.12	0.21 *	-0.34 **
11 Asia/other	0.03	0.17	-0.05	0.16	-0.05	-0.10	0.09
12 Acquisition experience (Log)	0.76	0.59	0.24	0.06	0.14	0.23	-0.09
13 Subsidiary age	6.05	3.48	-0.14	0.18	-0.06	0.05	-0.06
14 Subsidiary size (Log)	2.26	0.69	-0.06	0.13	-0.14	0.06	0.30 **

**TABLE 2.1**

## Correlation Matrix and Descriptive Statistics (Cont.)

Variables	6	7	8	9	10	11	12	13	14
6 Lithuania	1								
7 Hungary	-0.39 **	1							
8 Industry	-0.17	0.07	1						
9 North America	-0.19	-0.18	-0.03	1					
10 European countries	0.21 *	0.17	-0.05	-0.89 **	1				
11 Asia/other	-0.09	-0.02	0.17	-0.06	-0.40 **	1			
12 Acquisition experience (Log)	0.08	0.02	0.05	-0.02	-0.11	0.06	1		
13 Subsidiary age	-0.20	0.27 *	0.30 **	-0.13	0.10	0.07	-0.19	1	
14 Subsidiary size (Log)	-0.03	-0.28 **	-0.02	0.09	-0.20	0.24 *	-0.13	0.01	1

Note: N=105.

\* < 0.05 (2-tailed)

\*\* < 0.01 (2-tailed)

**Table 2.2**

The Average Age and Size of Acquired Subsidiaries in Host Countries

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Host locations	The average age of acquired subsidiaries (years)	The average size of acquired subsidiaries (number of employees)
Poland	5.84	1311
Hungary	7.67	254
Lithuania	4.86	781

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**Table 3**

Results of Hierarchical Regression Analysis of Hierarchical Knowledge Flows

Variables	Knowledge flows (Control effects)		Knowledge flows (Main effects)		Knowledge flows (Interactions)	
	Reverse (Model 1)	Traditional (Model 2)	Reverse (Model 3)	Traditional (Model 4)	Reverse (Model 5)	Traditional (Model 6)
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
(Constant)	2.11 (4.68) **	2.81 (6.28) **	1.39 (2.58) *	2.37 (4.49) **	0.86 (1.31)	2.62 (4.07) **
<b>Location effects</b>						
Host - Lithuania	0.59 (2.34) *	0.11 (0.43)	0.53 (2.14) *	0.07 (0.28)	0.81 (1.01)	-0.07 (0.09)
Host - Poland	-0.11 (0.50)	-0.13 (0.60)	-0.09 (0.41)	-0.12 (0.59)	1.05 (1.89) †	-1.05 (1.92) †
Home – N. America	0.33 (1.15)	-0.43 (1.51)	0.38 (1.34)	-0.28 (1.00)	0.31 (1.07)	-0.25 (0.88)
Home - Asia / other	-0.07 (0.12)	0.42 (0.77)	-0.03 (0.05)	0.59 (1.10)	-0.02 (0.04)	0.52 (0.98)
<b>Firm and industry effects</b>						
Industry	0.10 (0.54)	0.18 (0.96)	0.09 (0.50)	0.16 (0.92)	0.07 (0.38)	0.17 (0.98)
Parent acquisition experience (Log)	0.29 (1.26)	0.11 (0.47)	0.25 (1.06)	0.00 (0.02)	0.21 (0.88)	0.07 (0.31)
Subsidiary age	-0.02 (0.65)	0.04 (1.24)	-0.02 (0.54)	0.04 (1.43)	-0.01 (0.41)	0.04 (1.35)
Acquired subsidiary size (Log)	-0.02 (0.15)	0.16 (1.05)	0.00 (0.01)	0.14 (0.92)	-0.02 (0.15)	0.23 (1.49)
<b>Knowledge variable</b>						
Knowledge relevance			0.24 (2.36) *	0.14 (1.39)	0.45 (2.84) **	-0.03 (0.22)
<b>Organization variable</b>						
Competence-creating motive			0.06 (0.28)	0.48 (2.33) *	-0.27 (0.67)	1.17 (3.01) **
<b>Interaction effects</b>						
Competence-creating motive * Acquired subsidiary size					0.12 (0.75)	-0.36 (1.94) *
Relevance * Lithuania					-0.11 (0.43)	0.06 (0.25)
Relevance * Poland					-0.42 (2.19) *	0.33 (1.75) †
Adjusted R <sup>2</sup>	0.04	0.03	0.08	0.08	0.10	0.11
F statistics (p value)	1.53 (0.15)	1.34 (0.23)	1.85 (0.06)	1.90 (0.05)	1.87 (0.04)	1.99 (0.03)
N	105					

† = significant at the 0.1 level.

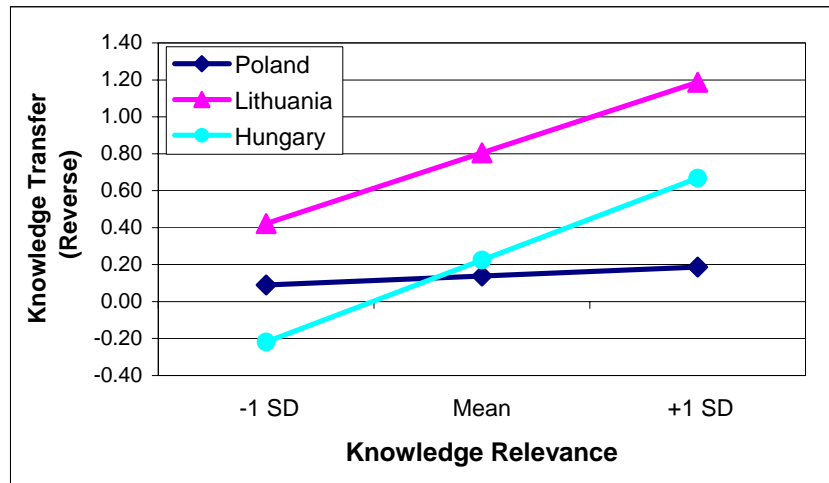
\* = significant at the 0.05 level

\*\* = significant at the 0.01 level



**FIGURE 1.1**

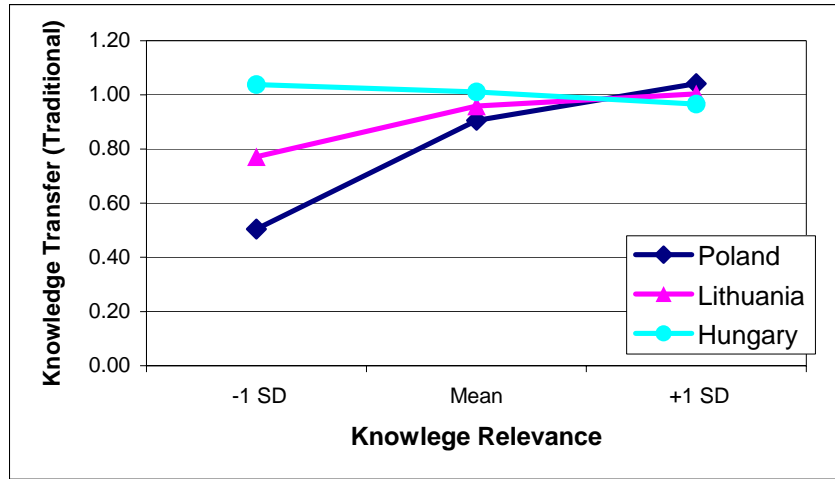
Reverse Knowledge Transfer across Host Countries<sup>◇</sup>



<sup>◇</sup> Computed at the average values of all other regressors in Table 3.

**FIGURE 1.2**

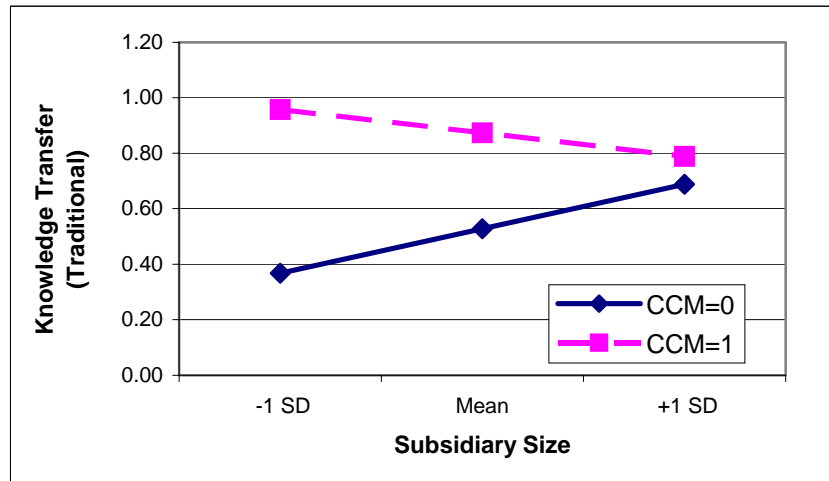
Traditional Knowledge Transfer across Host Countries<sup>◇</sup>



<sup>◇</sup> Computed at the average values of all other regressors in Table 3.

**FIGURE 2**

Traditional Knowledge Transfer over Subsidiary Size and Acquisition Motive of Subsidiary<sup>◇</sup>



Note: CCM = competence-creating motive.

<sup>◇</sup> Computed at the average values of all other regressors in Table 3.

## APPENDIX

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Variable	Definition
<b>Dependent variables</b>	
Reverse knowledge transfer	The extent of knowledge transfer from acquired subsidiary to parent, based on 4 items with 5-point Likert scales; $\alpha=0.866$ .
Traditional knowledge transfer	The extent of knowledge transfer from parent to acquired subsidiary, based on 4 items with 5-point Likert scales; $\alpha=0.851$ .
<b>Independent variable</b>	
Knowledge relevance	The extent of knowledge in subsidiary and parent is similar or overlapped, based on 5 items with 5-point Likert scales; $\alpha=0.772$ .
Competence-creating motive	1, if parent firm made the acquisition investment with the expectation of creating new competence; 0, if parent made the acquisition investment with the expectation of exploiting existing competences.
<b>Control variables</b>	
Host country variables	
Poland	1, if the acquired subsidiary is in Poland; 0, otherwise.
Lithuania	1, if the acquired subsidiary is in Lithuania; 0, otherwise.
Hungary	1, if the acquired subsidiary is in Hungary; 0, otherwise.
Home country/region variables	
North America	1, if parent firm HQ is in North America; 0, otherwise.

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European Countries	1, if parent firm HQ is in Europe; 0, otherwise.
Asia/other	1, if parent firm HQ is in Asia or other region; 0, otherwise.
Industry	
Manufacturing	1, if acquired subsidiary is in a manufacturing industry; 0, otherwise.
Firm variables	
Acquisition experience	The logarithm value of the number of acquisitions that the parent firm has made worldwide previously.
Subsidiary size	The logarithm value of the number of employees in the acquired subsidiary.
Subsidiary age	The length from the year that the subsidiary was acquired to the year that the survey was conducted (2003).

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\* Detailed questionnaire is available from the authors.