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A STRATEGY VIEW ON KNOWLEDGE IN THE MNE – Integrating Subsidiary Roles and Knowledge Flows

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Abstract

We assume knowledge inflows endogenous to subsidiary roles. Integrating organisational and knowledge-based views we propose a new subsidiary typology based on MNE integration-subsidiary capability. We hypothesise that both dimensions are positively associated with knowledge inflows into the focal subsidiary. This prediction is tested with data for 425 subsidiaries. The key findings were: (a) the extent for knowledge inflows differs significantly across all subsidiary roles; (c) it diminishes in a anti-clockwise direction starting in the high integration-high capability quadrant of the IC taxonomy; thus (b) both MNE integration and subsidiary capability drive knowledge inflows, although, the balance shifts more towards integration.

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Introduction

Multinational Enterprises (MNEs) possess some form of firm specific advantage such as a product, a production process, technology, reputation or other intangible assets, which allows firms to exploit foreign markets (Coase 1937, Dunning 1993). Furthermore, the notion has been widely accepted that MNEs comes predominantly into existence because of its desire to internalise knowledge transfer. Knowledge can be transferred more effectively and efficiently through internal organisation rather than external market mechanisms due to market imperfections including recognition and disclosure problems as well as negative externalities (Buckley/Casson 1976, Caves 1982, Hymer 1976, Teece 1976). Thus foreign investors transfer knowledge with respect to new specific techniques and for systemic knowledge embracing new procedures requiring integrative learning and coordination (Meyer 2003). Another major element of knowledge transfer is the training of local employees at all levels of the organisation (Blomström/Kokko 2002).

The notion that MNEs exist primarily because of their superior ability vis-à-vis markets to engage in knowledge transfer does not in any way imply that such knowledge transfers actually takes place effectively and efficiently on a routine base (Gupta/Govindarajan 2000). The knowledge-based theory identified a number of barriers including tacitness and causal ambiguity of knowledge (Lippmann/Rumelt 1982, Polanyi 1966, Zander/Kogut 1995) as well as motivational dispositions and insufficient absorptive capacity (Cohen/Levinthal 1989, Levinthal/March 1993, Simon 1991, Szulanski 1996). On the other hand, little systematic empirical evidence exists on the determinants of intra-MNC knowledge transfer from a strategic perspective. A notable exception is the work of Gupta/Govindarajan (1991, 1994, 2000) linking knowledge flows to organisational and process variables. However, they view the MNC in terms of knowledge flows, which in turn requires certain organisation. However, we hold that a subsidiary receives knowledge from its parent company in order to fulfill its objectives (Meyer 2003). Therefore, knowledge flows are endogenous to MNC strategy with regard to its subsidiary. During the 1980 and 1990s global strategy research developed a rich stream of literature emphasising the multinational subsidiary as a unit of analysis and created a good understanding of the various roles that subsidiaries assume (Bartlett/Goshal 1986, Jarillo/Martinze 1989, Jarillo/Martinez 1990, Birkinshaw/Morisson 1995, Taggart 1998). Most of

these studies base their analysis in the integration-responsiveness (IR) paradigm (Prahald/Doz 1987, Barlett/Goshal 1989). Here, the subsidiaries' role is conceptualised in terms of strategic responses to global integration and local responsiveness pressures on the MNE. Foss and Pedersen (2004) note that in the international business strategy field, knowledge-based theories are only insufficiently integrated with organisational issues.

We are particularly interested in the determinants of intra-MNC knowledge flows to foreign affiliates based in the transition economies of Central and East (CEE). The internationalisation process of MNEs into the region is fairly recent, and host country approaches to foreign investors differed substantially. The latter reflects the discussion about the potential gains and losses from foreign entry. With regard to MNE knowledge flow determinants there is a considerable number of empirical studies for CEE taking a knowledge-based perspective (Lyles/Salk 1996, Steensma/Lyles 2000 etc). However, linkages between organisational variables and knowledge transfer are rare (Manea/Pearce 2006).

Therefore, the objective of this study is twofold (i) to develop a typology of subsidiaries based on organisational as well as knowledge-based theory, and (ii) to establish an empirical link between these subsidiary roles and the extent of knowledge inflows. We adopt the IR framework for subsidiary roles as developed by Jarillo/Martinez 1989 and Taggart 1998) in a way to accommodate the concept of absorptive capacity i.e. firms' ability to identify external knowledge, to assimilate it, and use it efficiently in the production process. We conceptualise subsidiary's role in terms of two dimensions MNE integration and subsidiary capability. MNE integration captures subsidiaries' organisational (coordination of business function, autonomy, initiative etc) and trade links with its MNE. Subsidiary capability refers to the extent to which technological business functions (coordination of product/process development, initiative for change to product/market scope) as well as R&D capabilities exist in the foreign affiliate. From the MNE integration- subsidiary capability (IC) framework we can identify four different strategic subsidiary roles. Assuming that MNE integration and subsidiary capability are equally positively associated with knowledge inflows from the MNE group to the focal subsidiary, we would expect subsidiaries in the high MNE integration-high subsidiary capability quadrant have the highest knowledge inflows.

To verify our research hypothesis, we used firm-level data from 425 foreign subsidiaries based in five emerging economies based in Central East Europe (Poland, Hungary, Estonia, Slovakia and Slovenia) collected in 2002-2003. Company presidents and CEOs of foreign-invested firms provided information on measurable company characteristics and managers' assessment of a subsidiary's role. We conducted a cluster-centre analysis in order to allocate each

subsidiary to one particular role within the IC framework. Subsequently we used an ordered pobit technique to test for the link between subsidiary roles and knowledge inflows.

Empirical Evidence on Knowledge Transfer in MNEs

Gupta/Govindarajan (1991, 1994, 2000) link the knowledge-based to the organisational perspective. They classify subsidiary roles in terms of knowledge outflows and inflows, and subsequently test for the relation between these roles and organisational variables. They find a positive association between subsidiary integration as well as subsidiary dependence in decision-making and knowledge inflows from the parent (1994, 2000). This evidence is in line with the argument that strategic sensitiveness of knowledge-related activities can lead to tighter control of the subsidiary (Bartlett/Goshal 1989, Martinez/Jarillo 1991). On the other hand, if a subsidiary has a `high contributory role' (Birkinshaw et al 1998) it is likely to have greater R&D capabilities, is less technologically dependent on the parent, and hence has more autonomy to develop, manufacture, and market a product (Birkinshaw/Morrisson 1995, Pearce 1999, Taggart/Hood 1999). Therefore, the relation between knowledge flows, autonomy, and R&D capabilities does not appear clear-cut.

With regard to empirical evidence from CEE there is a considerable number of studies is analysing knowledge transfer from a knowledge-based perspective. These studies suggest that knowledge inflows from foreign parent depend on the provision of training, technology, and managerial assistance (Lyles/Salk 1996, Steensma/Lyles 2000). Informal institutions such as trust and shared values support the transfer of tacit knowledge (Lane et al 2001, Dhanaraj et al 2004). Other authors find that expatriates working in foreign subsidiaries (Minabeva/Michailova 2004) and specific human resource practices support knowledge transfer into the region (Cyr/Schneider 1996, Minbaeva 2005). On the other hand, there is a large body of research papers applying an organisational economics approach, which is however mainly focused on entry modes, governance, restructuring, and subsidiary performance, and not on knowledge transfer issues (see Meyer/Peng 2005 for a review).

A recent paper by Manea/Pearce (2006) differentiates a sample of CEE subsidiaries according to market, efficiency, and knowledge seeking motives and link these motives conceptionally to subsidiary roles: truncated miniature replica, rationalised product subsidiary, and world/regional product mandate (based on White/Poynter 1984, Pearce 1989 and 1992, Papanastassiou/Pearce 1999). Their data confirms the dominance of market seeking (truncated miniature replica) over efficiency seeking (rationalised product subsidiary), which in turn outweighs knowledge seeking (world/regional product mandate).

Majority subsidiaries use technology already existent in the MNE group rather than established host country specific technology, or their own R&D. This study hints at a link between subsidiary roles and knowledge flows in CEE. However, the study has two drawbacks. First subsidiary roles are defined by taking account of only one variable (investment motive). Second, the linkbetween strategic motives/subsidiary roles and knowledge flows has not been tested statistically. Thus, the contribution regarding the link between subsidiary roles and knowledge flows is rather limited.

Therefore, the objective of this study is to (i) differentiate subsidiaries roles existing in CEE, and (ii) to establish an empirical link between subsidiary roles and the extent of knowledge inflows. We frame subsidiary roles in respect in terms of MNE integration and subsidiary capabilities. This approach is in line with Foss and Pedersen (2004) arguing that in economics, as well as in the strategy field, knowledge-based theories are only insufficiently integrated with organisational issues.

Deriving the MNE integration-subsidiary capability framework

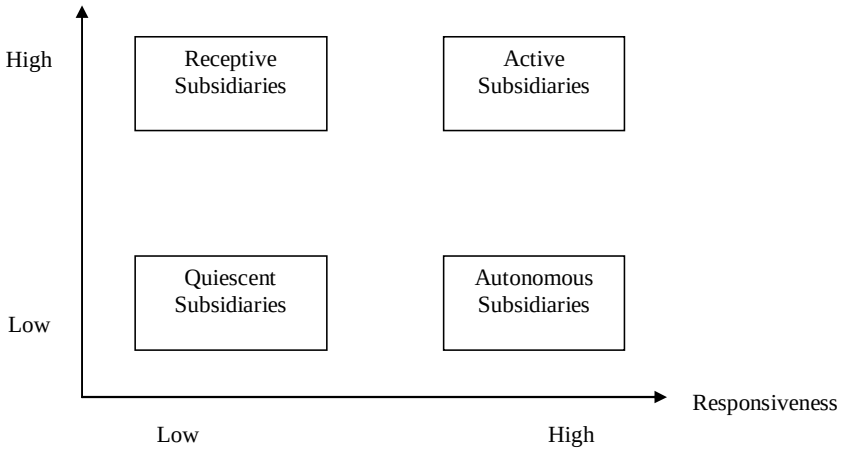
The international business literature assumes that there are different types of multinational enterprises. Prahalad and Doz (1987) identified a range of economic, political, customer, and competitive factors that create global integration and local responsiveness pressures on internationalising firms. Bartlett (1986) and Bartlett/Goshal (1989) differentiate the global, multinational, transnational, and international type of MNE within the integration-responsiveness framework. Most of global strategy literature applied a headquarter perspective, however, other literature started to identify particular subsidiary roles. Most of these studies can be related to the integration-responsiveness paradigm. Subsidiary roles are differentiated according to coordination demands for implementing a global strategy, and demands for value chain configuration (White/Poynter 1984, D'Cruz 1986, Jarillo/Martinez 1990, Roth/Morrison 1992, Birkinshaw/Morisson 1995, Taggart 1998). Bartlett/Goshal (1986) take a different angle by modelling subsidiary strategy as a function of the local environment and the subsidiary's unique capabilities, whereas Gupta/Govindarajan (1991, 1994) differentiate roles according to knowledge flow patterns.

Similar to Gupta/Govindarajan (1991, 1994) our aim is to scrutinise the link between knowledge flows and organisational/process variables. However, we assume that organisational/process variables are exogenous to knowledge flows because a subsidiary fulfils a particular role within the MNE. This in turn determines the knowledge flow pattern (Meyer 2003). Whereas, Gupta/Govindarajan (1991, 1994) define subsidiary roles in terms of knowledge

outflows and inflows, our study differentiates subsidiary roles in terms of MNE integration and subsidiary capability. This approach is more rooted in the traditional integration-responsiveness paradigm. The MNE integration dimension is slightly narrower than global integration as we focus on the relationship between foreign parent and subsidiary in terms of product flows and coordination of business functions in particular marketing. The subsidiary capability dimension measures the localisation of product/process development, subsidiary initiative for changes to product/market scope, as well as R&D capabilities. This dimension clearly reflects technological functions and capabilities latent in subsidiaries but also local market responsiveness. Therefore, we are able to derive our typology from Jarillo/Martinez (1990) and Taggart (1998) who differentiated subsidiary roles according to the integration-responsiveness paradigm. Furthermore, we can set our results into a comparative perspective having in mind differences in conception and measurement.

Jarillo/Martinez (1990) (hereafter J&M) built their typology around the geographical localisation of value adding activities, and the degree of integration of those activities across the MNE network. They suggest that a subsidiary follows an 'autonomous' strategy if it carries out most of the functions on the value chain in a manner that is relatively independent of its parent organisation or other subsidiaries; it follows a 'receptive' strategy if few of these functions are performed in the country and they are highly integrated with the rest of the company; the foreign affiliate pursues an 'active' strategy if many activities are located in the country, and they are carried out in close cooperation with the rest of the firm.

Chart 1: Subsidiary Roles within the IR-framework (J&M 1990/ Taggart 1998)



In a field study of 50 foreign affiliates located in Spain 1988 J&M identified three subsidiary groups of which one corresponded to the autonomous strategic type, and the other two were relatively highly integrated but showed a wide spread of localisation of activities. Hence, it was difficult to identify a purely receptive or active group of subsidiaries. From our point of view there is some inconsistency between J&M's dimension of geographical localisation of value adding activities and proxies used to measure it (local supplies, local sales, local content) that actually reflect better responsiveness.

Taggart (1998) mainly criticises J&M for not typifying a subsidiary role in the low integration-low responsiveness variant. Therefore, he extends the J&M typology by including the "quiescent" strategy in the low integration-low responsiveness quadrant. He uses various proxies related to MNE network linkages as well as the importance of worldwide markets to measure global integration. Local responsiveness is captured by decision-making autonomy regarding product/market scope, production capacity, advertising, and technology. This concept is applied to a sample of 171 manufacturing subsidiaries from the UK. The empirical analysis supports the existence of a quiescent role. It is close to the autonomous role in terms of integration, however, distinctly less responsive. Despite the fact that Taggart (1998) accepts that there are some considerable differences in the measurement of the integration/responsiveness dimensions, it appears to him from the comparison with the J&M study that levels of integration are generally somewhat higher among the Spanish subsidiaries particular in regard to active and receptive subsidiaries types.

To our knowledge until the present day there has been no empirical study that statistically discerns subsidiary roles with reference to the IR framework for subsidiaries based in CEE. Therefore, we adopted the IR framework as developed by J&M and Taggart (1998) in order to assess subsidiary roles along the two dimensions of MNE integration and subsidiary capability. Given the theoretical development of the IR framework from a subsidiary strategy perspective and corresponding empirical evidence as outlined above, there seems to be no reason why not each quadrant of our MNE integration-subsidiary capability space should not by theoretically occupied by MNE subsidiaries. Therefore, we expect to discern four different subsidiary roles in line with IC-framework adopted from Taggart (1998).

Data Description

To verify our research hypotheses, firm-level data was collected simultaneously in Poland, Hungary, Estonia, Slovakia and Slovenia in 2002-2003 using the same structured instrument. The largest FIEs in terms of employment were targeted to trace the most important technology transfer effects in each of the countries. Company presidents and CEOs of foreign-invested firms provided information on measurable company characteristics and managers' assessment of subsidiary strategy. In terms of methodology, we hence intentionally introduced a selection-bias: rather than being able to deduct from our results a general picture that applies to any technology transfer via FDI, our results pertain to the most important objects involved in this process and hence remain country-specific. Out of the 2203 subsidiaries we approached with our concise two-page questionnaire via standard mail, supported by an online-questionnaire for firms in our address database, some 458 provided us with a completed questionnaire. The response rate was the highest in Slovenia with 34.4 per cent, followed by Slovakia (30.2 per cent) and Estonia (30.0 per cent), while in Poland and Hungary only 18.8 per cent and 11 per cent respectively answered. For analysis we are able to use a substantial sample with data for 425 subsidiaries.

The highest proportion of the foreign-invested firms in our sample is from Poland (35.3%), followed by subsidiaries from Hungary (19,6%), Slovakia (18%), Slovenia (15.7%) and Estonia (11.5%). In terms of the industry breakdown, the biggest share in the total sample is in electrical and optical equipment industry (17%), followed by metals and metal products (14%), food, beverages and tobacco (10.%), non-metal mineral products (9%), chemicals and man-made fibers (8%), rubber and plastic products (7%), clothing and textiles (7%). The distribution of the firms by size is well balanced. However, Slovenian firms are significantly smaller and Hungarian firms significantly larger than the sample average. A comparison of manufacturing sectors shows a significantly higher than average number of employees per company only in food, beverages and tobacco and transport equipment industries. In all other manufacturing sectors there are no statistically significant differences in the number of employees. Poland is the most strongly represented both in terms of the number of firms and average employment, which is in line with high share of FDI in Poland in the total stock of FDI in manufacturing. The Slovenian sample is moderately overrepresented and Hungary slightly underrepresented. In addition, representativeness could also be evaluated comparing the number of firms included into the sample with the total number of firms with foreign investors in individual countries. From that point of view, sample firms represent about 4.9% of all foreign-invested firms in the analyzed countries.

The highest share is highest in Slovenia with 23.5%, followed by Estonia with 12.4%, Poland with 3.5% and Hungary with 2.1%. A standard test of non-response bias indicated no significant differences between respondents and non-respondents on variables such as country and industry distributions, number of employees, etc.

Empirical Assessment of Subsidiary Roles according to the IC-Framework

Prior studies used resource flows (knowledge), product flows (sales, supplies), product/ market scope, functional scope (value added activities), and decision-making authority (centralisation, autonomy, initiative) as indicators to determine subsidiary roles. Our choice covers product flows, functional scope, and decision-making authority as knowledge flows are taken endogenously to these variables in the next step of our study. From the survey data we derived three different proxies for each of the two dimensions, MNE integration and subsidiary capability (see Table 1).

Table 1: Proxies for MNE integration and subsidiary capability

MNE integration	Subsidiary Capability
Foreign parent initiative for changes in the organisation of business functions	Subsidiary initiative with regard to changes in the product scope and market scope
Extent to which marketing activities are undertaken at the HQ level	Extent of product development and process engineering are undertaken at subsidiary level
Intensity of trade integration of the subsidiary with the foreign parent	Importance of subsidiary as source for patents, licences, and research & development

Subsidiaries indicated "Who has taken initiative for changes in the following areas: organisation of (i) business functions,[2] (ii) product scope, as well as (iii) market scope. The answers were given on a 4-point Likert scale (a) only your company, (b) mainly your company, (c) mainly your foreign owner, or (d) only your foreign owner. If the foreign owner exercises most/all initiative regarding changes in the organisation of business functions there is a need for coordination at the HQ level indicating pressures for MNE integration. A high degree of subsidiary initiative regarding product and market scope signals on the one hand that the foreign parent is responsive to information regarding the local market

[2] *Including procurement, sales, marketing, production, R&D, engineering, maintenance, after sales services, finance, accounting strategic planning etc.*

(in line with Taggart 1998) and on the other hand these activities strengthen subsidiary capability. Subsidiaries were also asked to provide information on "Which business functions are being undertaken (a) on your own only, (b) mainly on your own, (c) mainly by your foreign owner, or (d) by your foreign owner only. We choose the extent to which marketing activities[3] are coordinated at the HQ level as an indicator for MNE integration (following J&M and Taggart 1998). Furthermore, we take an average over the extent to which product development[4] and process engineering[5] are undertaken by the subsidiary. This indicator shows the degree to which higher value-added business functions have been assigned to the subsidiary which signals subsidiary capability. Managers also evaluated "How important the subsidiary itself is as sources for patents, licenses, and R&D". The answers are given on a 5-point Likert scale: 1 = not important, 2 = little important, 3 = important, 4 = very important, 5 = extremely important. This proxy hints at subsidiary capabilities in terms of own technological knowledge or absorptive capacity. Finally, we use data on subsidiaries' trade integration with the foreign parent (calculated as share of sales to and supplies from parent in total trade). This proxies the intensity of linkages to foreign owner production network, indicates the importance of global markets, and therefore, signals MNE integration (in line with J&M and Taggart 1998).

Most researchers use a latent indicator based on a scale development technique – factor analysis in particular – to identify only one measure for reflecting one particular dimension. However, Venaik et al (2004) point to a number of drawbacks of a reflective index such as under-extraction or the unsecured assumption of high correlation of proxies along one dimension across different industries. We follow their suggestions and rely on a formative index i.e. we include all of the above 6 variables to classify subsidiary roles in the integration-capability (IC) framework.

Following J&M and Taggart (1998) we perform cluster analysis to identify distinct groups of subsidiaries. Taggart (1998) uses a hierarchical form to assess the efficiency of a four-group-cluster solution. However, we opt for cluster-centre analysis technique as a non-hierarchical multivariate statistical procedure often used for larger samples. This procedure does not aim at generating the most efficient cluster solution, however, it allows us to set the number of

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[3] Marketing has been defined as all activities aimed at increasing the demand for the product e.g., search for markets, changes in product according to customer preferences, etc.

[4] Product development referred to technical development in terms of functions the product provides as well as technical solutions to be solved to allow the product to offer those functions.

[5] Process engineering was defined as embracing all activities towards finding an efficient way to organise the process of production.

clusters in advance at four according to our IC framework. As cluster-centre analysis in itself is a descriptive rather than analytical tool, we subsequently conduct a discrimination analysis in order to assess how well the six variables predict the four-cluster-solution, and to what extent there are statistically significant differences between clusters.

Table 2 shows the results of the cluster-centre analysis. With regard to MNE integration we achieve a clear ranking of cluster IV, II, I and III, where, cluster IV is most integrated and cluster III the least across all three variables. With regard to the subsidiary capability the picture is somewhat more mixed. Taking subsidiary initiative for product/market scope and product/process development at subsidiary level cluster III is has the highest subsidiary capabilities followed by cluster I, II, and IV. However, R&D capability is highest in Cluster II followed by cluster III, IV, and I. Taking the average across all three variables subsidiary capability is strongest in cluster III, followed by cluster II, I, and IV. Thus, the least integrated subsidiary has the highest subsidiary capability (Cluster III). The opposite is the case for the most integrated subsidiary group (cluster IV). Cluster II comes second in terms of integration and capability. Cluster I is ranked third in terms of integration and capabilities.

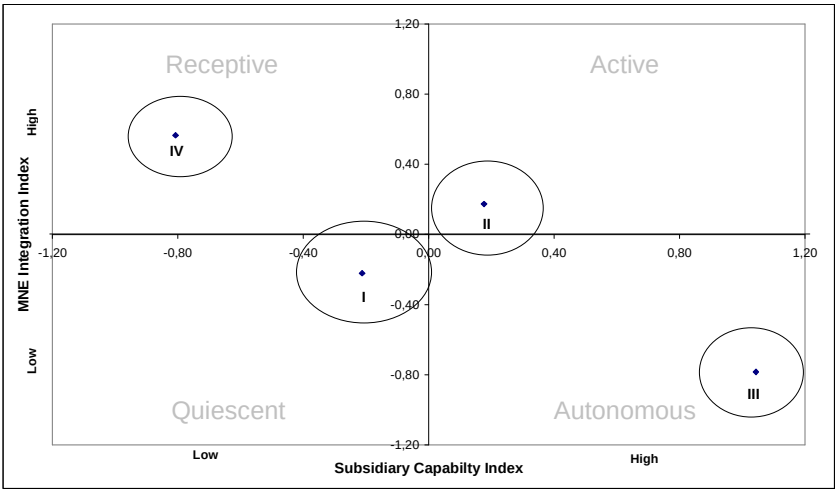
Table 2: Cluster centres of the four-cluster solution

	Cluster			
	I	II	III	IV
MNE Integration (MI)				
Parent initiative for organisation of business functions	-0,22	0,59	-0,82	0,62
Marketing undertaken at HQ level	-0,17	-0,09	-0,85	1,36
Trade integration with foreign parent	-0,25	0,036	-0,75	1,15
MI index (average over MI variables)	(-0,21)	(0,18)	(-0,81)	(1,04)
Subsidiary Capability (SC)				
Subsidiary initiative for product/market scope	0,11	-0,20	1,02	-1,15
Product/process development at subsidiary level	0,09	-0,04	0,10	-0,84
Subsidiary as source of patents, licences, and R&D	-0,86	0,76	0,58	-0,37
SC index (average over SC variables)	(-0,22)	(0,17)	(0,57)	(-0,78)
N	126	101	106	92

In order to visualise the clustering result in the IC framework we plotted the averages of the respective variables for MNE integration (MI index) and subsidiary capability (SC index) as coordinates for each cluster centre (see Chart 2). There seems to be a fairly good spread across the all four quadrants. It seems that we identified relatively clearly a receptive (cluster IV) as well as an

autonomous subsidiary role (cluster III). There is also a cluster centre in the high integration-high capability quadrant (cluster II) as well as a centre in the low integration-low capability quadrant (cluster I). Cluster II could be close to the characteristics of the active subsidiary strategy and cluster I of the quiescent type. However, cluster-centres I and II are quite close to each other in terms of Euklid distances (lower heterogeneity) and high standard deviations (lower homogeneity) compared to both the receptive and autonomous group (see Appendix Table A1).

Chart 2: Cluster centres in the IC framework



However, the results of the discrimination analysis indicate that 95,8% of the subsidiaries are correctly classified. The uni-variate ANOVA shows for each variable that the similarity of group means is significant. The statistical differences in respect of group means/standard deviations are robust (see Appendix Table A2). Therefore, all four clusters are significantly different from each other. The variable marketing at HQ level as well as trade integration with the MNE have contributed strongest to the clustering outcome. This indicates the importance of global markets and market orientation (global vs. domestic) as determinants of subsidiary roles. Interpreting the standardised coefficients in combination with the functions for cluster centroids (see Appendix Tables A3 and A4), we see that quiescent subsidiaries I can be significantly discerned from active subsidiaries in terms of lower trade integration, marketing coordination at HQ level, as well as R&D capabilities. To the best of our knowledge we would

conclude that the four-cluster solution presented above is statistically robust. From this follows, that we were able to identify four distinct subsidiary roles for a sample of CEE foreign affiliates in accordance with the IC framework as derived above.

Discussion of Subsidiary Roles

Having in mind the considerable differences in measurement and methodology between J&M, Taggart (1998) and our study, the level of integration tends to be comparatively high for our receptive and quiescent subsidiaries. We identified a quiescent type in line with Taggart (1998). However, based on our results we would object to Taggart's claim that truly quiescent and autonomous subsidiaries may be a feature of the UK, and truly receptive and active affiliates a feature of emerging markets such as Spain at the time. A descriptive analysis shows that active, quiescent, and in particular autonomous subsidiaries are domestic market oriented. Only receptive subsidiaries are clearly export oriented (see Appendix Table A5). This could be linked to a predominantly market-seeking constellation that is broadly in line with prior evidence (McGowan et al 2004, Manea/Pearce 2006).

There seems to be a mixture of market and knowledge seeking motives for the active subsidiary group, which is characterised by very high R&D capabilities (in line with Taggart 1998). Somehow in contrast to Manea/Pearce (2006) we seem to witness the emergence of a group of subsidiaries that manages to integrate its subsidiary capabilities into the global operations of its MNE. Some of these affiliates might have a regional or global product mandate and are part of a global or transnational corporation (Bartlett/Goshal 1989). However, as our active group has a bias towards medium-high tech industries and is dominated by Polish firms, we should be cautious in the generalisation of this result (see Appendix Tables A6 and A7).

Receptive subsidiaries are highly integrated with their MNE but have very low functional scope, and R&D capability (in line with Taggart's findings). This could indicate the characteristics of a specialised contributor being part of a global enterprise (Bartlett/Goshal 1989) mainly seeking efficiency. They are by far the youngest group (opposite to Taggart 1998) and have been mostly established as wholly foreign owned Greenfield sites (see Appendix Table A7). Therefore, we might see for some of these foreign affiliates an upgrading (in terms functional, product, or market scope) in the future. However, others might exit the market in case the focus was on competitive advantages through labour costs rather than more dynamic subsidiary capabilities.

The group of autonomous subsidiaries are most pronounced domestic market

oriented, and carry out most of the business function under their own responsibility including product/process development. They also initiate changes to product/market scope probably due to their local market expertise. In contrast to Taggart (1998) this group tends to be the oldest foreign affiliates. The early entry of foreign investors could be linked to first mover advantages in terms of capturing local market share. Investors tend to hold minority equity stakes and engage in restructuring towards creating a Brownfield investment. This subsidiary role is likely to be present in multinational companies (Bartlett/Goshal 1989). One possible future scenario could be that foreign owners follow a staged acquisition or a multiple entry strategy both leading to concentration of market share (Meyer/Lieb-Dóczy 2003, McGowan et al 2004). As a consequence some foreign investors might increase their commitment and integrate operation more globally other would exit the market. In the first case foreign affiliates might move into the active group.

Compared to the autonomous group quiescent subsidiaries have higher foreign equity commitment, and a larger share of Greenfield operations. According to Taggart (1998) this group is likely to be part of an international type of organisation. However, the trade structure in our case is more similar to active subsidiaries apart from the fact that quiescent subsidiaries source more locally. Thus, we some of these subsidiaries might also by part of a global/transnational organisation. In the future, some might move into the active subsidiary role, however, for this to happen subsidiary capabilities in need to be strengthened. An alternative scenario could be that affiliates are increasingly less integrated with the MNE, however, at the same time denied the resources to develop adequate subsidiary capabilities. This could by rapidly followed by a closure of operations.

Building the Hypotheses Linking Subsidiary Roles and Knowledge Flows

A priori it is not possible to know whether MNE integration or subsidiaries capabilities have a higher impact on the extent of knowledge inflows to the subsidiary. Under the assumption that MNE integration clearly dominates, we would hypothesize:

> *(H1) Knowledge flows are highest in the receptive group, followed by the active, quiescent, and finally the autonomous group.*
>
> Under the assumption that subsidiary capabilities clearly dominate the extent of knowledge inflows, we would hypothesise:
>
> *(H2) Knowledge flows are highest autonomous group, followed by the active, quiescent, and receptive subsidiary groups.*

Under the assumption that both dimensions carry equal weight, and if we keep the parameter high MNE integration constant for active and receptive subsidiaries, we can hypothesise:

(H3.1) Knowledge flows are higher for active subsidiaries compared to receptive subsidiaries due to lower own technological functions/capabilities for the latter.

Keeping the parameter of low MNE integration constant for quiescent and autonomous subsidiaries, we can hypothesise:

(H3.2) Knowledge flows are higher for autonomous subsidiaries compared to quiescent subsidiaries due to lower own technological functions/capabilities for the latter.

Keeping the parameter high subsidiary capability constant for active and autonomous subsidiaries, we can hypothesise:

(H3.3) Knowledge flows are higher for active compared to autonomous subsidiaries due to lower organisational integration for the latter.

Keeping the parameter low subsidiary capability constant for receptive and quiescent subsidiaries, we can hypothesise:

(H3.4) Knowledge flows are higher for receptive compared to quiescent subsidiaries due lower organisational integration for the latter.

From hypotheses *(3.1)* to *(3.4)* the extent of knowledge inflows would be highest for actives subsidiaries, followed by receptive, autonomous and quiescent subsidiaries

Econometric Approach and Estimation Results

We assess knowledge flows from the foreign owner company (not restricted to the HQ) to the local affiliate. In order to proxy knowledge inflow on a comprehensive basis we employ three different dependent variables. Foreign invested firms indicated the importance of the foreign owner as a source for (i) patents, licences, and R&D activities, and (ii) people and training. The answers were given on 5-point Likert scale ranging from 0 to 5 (with 0 = not important, 1 = little important, 3 = important, 4 = very important, and 5 = extremely important). The variable on patents, licences, and R&D proxies knowledge transfer in respect to intangible assets and codified knowledge. R&D related indicators are widely accepted, however, the importance of such knowledge is likely to vary across the technology intensity of industries. Therefore, the importance of the foreign investor for people and training provides a useful

alternative less susceptible to industry differences. It proxies the MNE contribution with respect the human capital formation in the foreign affiliate. This indicator carries more of the tacit dimension of knowledge. Finally, subsidiaries indicated the magnitude of changes with regard to the level of productivity in production since the entry of the foreign owner. Answers are provided on a 4-point Likert scale ranging from –2 to 2 (-2 = considerable reduction, -1= reduction, 0 = no change, 1 = increase, 2= considerable increase). Productivity growth is usually taken as an indicator of firm performance. However, there is a large bulk of studies looking at technology spillover effects via multinationals in CEE (see Jindra 2005 for an overview). It assumes that the change in productivity indicates to what extent knowledge has been integrated effectively and efficiently into the production process.

We use an ordered probit model is an estimation technique. Following Wooldridge (2002) and Greene (2003) ordered probit models should be applied if the dependent variables are categorically scaled. Ordinary least square regression analysis assumes distances between two responses as being identical for all responses. However, ordinal data give information about a ranking of different outcomes, where distances are not necessarily identical or unknown. If we would employ binary probit or multinomial logit/probit models, we would only account for nominal scale and would therefore ignore the information given by the ranking. As with binary probit regression models, the real dependent variable is unobserved. That is because the answers given are only given in some discrete value that best fits to the situation of the person interviewed. Therefore, we only observe whether an answer falls into a particular category or not. Following Greene (2003) it is sufficient to assume that the distribution is known and continuous as for all Maximum Likelihood Estimations. However, in probit models it s also assumed that the error term is normally distributed with its mean equal to zero and variance equal to unity.

For better interpretation of results we calculate the marginal effects for the different exogenous variables. Dealing with a restriction within the marginal effects that one of the possible outcomes will occur, the probabilities have to add up to unity and marginal effects add up to zero. For convenience we present and interpret in our study only the marginal effects of the two extreme outcomes (not important and extremely important; or considerable reduction and considerable increase). If the exogenous variable increases by one unit or a dummy variable from zero to unity, this implies that the probability of the endogenous observation falling into a certain category rises by this marginal influence (measured in percentages). To evaluate the whether the model as such is significant, we perform a Wald-Test under the assumptions of consistency and asymptotic normality (White 1982). We also present the Pseudo-R^2, but as we are

dealing with a non-linear model it is not bounded by zero and unity, therefore, the value of the Pseudo-R^2 can be interpreted as absolute value only, and not as ratio of explained variance over total variance. Above outlined estimations of marginal effects and test statistics rely on the assumption that the residuals are homoscedastic and normally distributed. Unfortunately, heteroscedasticity consistent estimation models do not exist for ordered probit models (Greene 2003). However, prior descriptive analysis and an examination of biases of the covariance matrix by using a bootstrap technique indicated no heteroscedasticity problem in our model specifications.

We test our hypotheses (2) to (4) by estimating the marginal effects for the below model specification (1) for each of our three dependent variables (R&D flows, human capital formation, productivity growth):

$$(1) \quad Pr\,(y) = CountryDum_i + IndDum_i + Size_i + Age_i + RoleDum_i$$

where *CountryDum* denotes the respective country dummies for Estonia, Hungary, Slovenia, and Slovakia to capture unobserved country effects. We use Poland as control group which constitutes the largest group in our sample. In order to captures industry-specific effects we introduce the dummy variable *IndDum* indicating the technology intensity of the firm's sector according to the OECD classification[6]. We estimate the effect for medium-low, medium-high and high technology industries in comparison to the low-tech industries as control group. We control for firm specific effects by introducing the variable *Size* that measure frims' size in term o employees (log values) as well as the variable *Age* measuring the years since entry of the foreign investor. Our main exogenous variable is *RoleDum* as a dummy the type of subsidiary role each affiliate has been allocated to. We use autonomous subsidiaries as control group, hence, estimate the effect of belonging to other subsidiary roles (quiescent, active, receptive) in comparison to the autonomous group.

The estimation for the importance of the foreign parent as source for patents, licenses, as well as research and development activities shows that in comparison to autonomous subsidiaries, the probability for this type of knowledge transfer increases most strongly for active subsidiaries, followed by foreign affiliates with a receptive, and quiescent role. For the latter group the marginal effect is only significant at a low level of significance.

[6] *We use the following OECD classification according to NACE 3-digit codes: High tech 242; 244, 30, 32, 333, 3530; Medium-high tech: 24 excl. 242; 29, 34, 352, 354, 359; Medium-low tech: 23, 25-28, 351; Low tech: 15-22, 36-37.*

Table 3: Overview Estimation results (see Appendix Table A 8 for full results)

	Patents, licenses, and R&D		Human capital formation		Productivity growth	
	not important	extremely important	not important	extremely important	considerable reduction	considerable increase
Dummy for FDI host economy (Poland as control group)						
Estonia	0,055	-0,059	0,002	-0,002	-0,011	0,018
Hungary	0,019	-0,023	0,140 **	-0,068 ***	-0,052	0,089
Slovakia	-0,037	0,052	-0,005	0,004	-0,041	0,071
Slovenia	-0,066 **	0,099 *	0,044	-0,027	-0,068 **	0,120 **
Dummy for technological class of industry (Lowtech as control group)						
MediumLowTech Industry	-0,097 ***	0,179 **	-0,043	0,036	0,151 **	-0,189 ***
MediumHighTech Industry	-0,082 ***	0,117 **	-0,020	0,014	0,058	-0,087
HighTech Industry	-0,080 ***	0,113 **	-0,047	0,035	-0,036	0,059
Firm-specific effects						
Size	0,005	-0,006	-0,003	0,002	-0,036 ***	0,057 ***
Age	-0,009	0,012	-0,016	0,011	-0,012	0,019
Main exogenous variables (autonomous subsdiaries as control group)						
Quiescent subsidiaries	-0,067 **	0,094 *	-0,125 ***	0,114 ***	-0,058 *	0,097
Active subsidiaries	-0,180 ***	0,344 ***	-0,184 ***	0,218 ***	-0,098 ***	0,177 ***
Receptive subsidiaries	-0,149 ***	0,279 ***	-0,159 ***	0,189 ***	-0,091 ***	0,163 **

In comparison to the low-tech group all subsidiaries operating in industries with higher technology intensity have a higher probability of high R&D intensive knowledge inflows. This result is in accordance with general intuition. The marginal effects are strongest for the medium-low tech group of industries. In terms of country-specific effects the probability of R&D knowledge inflows is only significantly higher in Slovenia compared to the Polish control group. We controlled for industry and country specific factors and the impact of active subsidiaries roles.

Taking now MNE knowledge flows with respect to human capital training in the foreign affiliate we get a very similar picture concerning the impact of subsidiary roles. Again, the marginal effect is strongest for actives subsidiaries, followed by receptive, and quiescent peers. However, now the effect is also very significant in regard to the latter, and the gap narrows between active and receptive subsidiaries. In contrast to R&D flows training seems to be provided by foreign parents independent of the technology intensity of the respective industry. Foreign affiliates in Hungary are less likely to benefit from human capital related knowledge flows, which could be potentially linked to generally earlier foreign entry to his particular CEE market and thus relatively higher stocks of human capital.

How do knowledge inflows translate into performance? The final model

specification is concerned with productivity growth since the entry of the foreign parent. The active and receptive roles increase similarly the probability of considerable improvements. Differences between the quiescent and autonomous group are not statistically significant. As would be expected firm size increases the likelihood of productivity growth due to higher economies of scale. Foreign affiliates based in have a higher probability of performance growth, whereas, firms in medium-low-tech show a negative effect on performance indicators.

Test statistics indicate robust estimations (see Appendix Table A 8). Therefore, to the best of our knowledge we can reject hypotheses (1) that the extent of knowledge is fully determined by the degree of MNE integration as well as hypothesis (2) that it is fully determined by the subsidiary capability. We cannot confirm hypothesis (3.1) that active subsidiaries compared to receptive affiliates have a higher knowledge inflows due to lower own subsidiary capability for the latter. Although, this applies in particular to R&D related knowledge and less so to human capital formation, and performance. We have to reject hypothesis (3.2) that knowledge inflow to autonomous subsidiaries exceeds those to quiescent peers due to lower degree of subsidiary capability for the latter. The opposite seems to be the case i.e. knowledge inflows to quiescent subsidiaries exceed the flow to autonomous peers due to lower organisational integration of the latter. However, the evidence is not very robust for R&D related knowledge, and for productivity growth there seem to be no significant differences. Hypothesis (3.3) can be confirmed i.e. active affiliates receive more knowledge inflows compared to autonomous affiliates due to lower MNE integration for the latter. Similarly, hypothesis (3.4) can be confirmed implying that receptive subsidiaries receive higher knowledge inflows compared to quiescent affiliates due to lower organisational integration in case of the latter.

In sum knowledge inflows are highest in for foreign affiliates with active roles, followed by receptive, quiescent, and autonomous types. We are able to infer that the extent of knowledge inflows is equally positive dependent on both MNE integration as well as subsidiary capability. However, this does not apply when we want to discern the quiescent from the autonomous role on the grounds of subsidiary capability. Hence, in this case the balance shifts more towards MNE integration as dominating determinant for knowledge inflows.

Summary and Discussion

Pursuing a subsidiary level analysis, this study investigates empirically the determinants of intra-MNC knowledge flows. In particular we focus on flows from the foreign parent company to the focal subsidiary. While previous studies applied either a knowledge-based perspective (for example Teece 1977, Gupta/Govindarajan 1991 and 1994, Levinthal/March 1993, Zander/Kogut 1995)

or an organisational/communication theoretical perspective (Goshal and Barlett 1988, Gupat/Govindarajan 2000), we aim at integrating both.

Similar to Gupta/Govindarajan (1991, 1994) we scrutinise the link between knowledge flows and organisational/process variables. However, we assume that knowledge flows are endogenous to organisational arrangements because subsidiaries fulfil a particular role within the MNE, and this in turn determines the extent knowledge flows. Whereas, Gupta/Govindarajan (1991, 1994) define subsidiary roles in terms of knowledge outflows and inflows, our study typifies subsidiary roles in terms of MNE integration and subsidiary capability. This subsidiary typology is closely related to the integration-responsiveness framework as developed by J&M (1990) and Taggart (1998). Therefore, we derive our integration-capability approach from the IR framework. However, we focus more narrowly on business functions and indicators relevant to the knowledge transfer process. MNE integration is measured by the trade links to the foreign parent, the extent of HQ coordination in respect to business functions in particular marketing. Whereas, subsidiary capability is measured by subsidiaries' initiative in respect to changes in product/market scope, control over product/process development, and own R&D capabilities. Thus, our study contributes in terms of theory development as the IC framework reflects the integration of organisational and knowledge-based perspectives.

Subsequently we discern statistically four robust different roles of subsidiaries within the IC-space: receptive, active, autonomous, and quiescent. From a broad comparative analysis and discussion of subsidiary groups identified, we arrive at a set of testable hypotheses regarding the link between particular subsidiary roles and the extent of knowledge inflows. All hypotheses were tested applying an ordered Probit estimation technique controlling for unobserved country, as well as industry, and firm-specific effects.

From the results we can infer that the probability of knowledge inflows from the parent company decreases an anti-clockwise direction starting in the high integration-high capability quadrant of our taxonomy. In other words knowledge inflows are most likely for subsidiaries having an active role within the MNE. This group is characterised by a relatively close integration with the rest of the corporation combined with limited technological functions, but high own R&D capabilities. The receptive type showing the highest MNE integration, however, combined with the lowest technological functions and capabilities follows the active group in terms of knowledge inflow probability. Quiescent subsidiaries come third. They blend modest MNE integration, modest own technological functions, but low R&D capabilities. The autonomous group has the lowest probability to receive knowledge flows from its MNE. It is hardly integrated with its MNE in terms of trade and business functions, therefore, exercises also

technological functions, and has relatively high own R&D capabilities. We can conclude that the extent of knowledge inflows is by and large positively dependent on both MNE integration as well as subsidiary capability. However, the balance shifts slightly towards MNE integration as dominating determinant. This result could be potentially explained both by strong forces for global integration of MNE operations, as well as the current stage of economic and technological development of transition economies.

Our findings with regard to the impact of MNE integration are in line with Gupta/Govindarajan (2000) showing that knowledge inflows from the parent corporation depend positively from formal integration and negatively with decision-marking autonomy at the subsidiary level. They also find partially positive evidence for absorptive capacity as a determinant. However, this is rather poorly approximated by a dummy for Greenfield operations, which are assumed to operate at a higher level of absorptive capacity in comparison to acquisitions. Our measures for subsidiary capability indicate more direct evidence for the impact of absorptive capacity. Furthermore, our model sheds light on the interaction of MNE integration and subsidiary capability in their impact on knowledge inflows. In this way we are able to integrate both organisational theory and knowledge-based views on knowledge transfer. Thus, the model of the IC framework could be a way forward in reducing the complexity of MNE operations and could be used in a predictive way with regard to the potential characteristics of foreign direct investment with regard to knowledge inflows.

On the other hand, the Gupta/Govindarajan (2000) model takes additional account of the motivational disposition that is not included in our framework. Furthermore, the models developed by Gupta/Govindarajan (1991, 1994, 2000) are more comprehensive from a knowledge-based perspective by capturing also knowledge inflows from peer subsidiaries as well as knowledge outflows from the local subsidiary to the parent as well as sister subsidiaries. However, Gupta/Govindarajan (2000) argue that knowledge inflows from the foreign parent to the local subsidiary are by far the largest in terms of magnitude.

We have to remember that knowledge processes and its organisation are dynamic. Our study delivered a cross sectional snapshot of foreign subsidiaries in transition countries with varying degrees of economic development. It does not answer the question in which way the knowledge flow processes will change in the future, however, some scenarios depending on the current state of the situations have been outlined above. In principal it seems to us that knowledge inflows depend on both MNE strategy as well as the technological capabilities of foreign subsidiaries. In terms of policy development the latter can be more easily targeted in particular with respect to human capital endowment to allow the

formation of a more dynamic competitive advantage in the region.

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Appendix:

Table A1 Standard deviation and cluster centre distances of four-cluster-solution

		I	II	III	IV
Standard deviation of distances to cluster centre		0,66	0,54	0,35	0,55
Eukild distances between cluster centres	I	0,000			
	II	1,913	0,000		
	III	2,181	2,556	0,000	
	IV	2,770	2,392	4,409	0,000

Table A2 Discriminant analysis – Means and Standard deviations

	Cluster							
	I		II		III		IV	
MNE Integration (MI)	Mean	StdD	Mean	StdD	Mean	StdD	Mean	StdD
Parent initiative for organisation of business functions	- 0,19	0,80	0,60	0,86	-0,77	0,69	0,55	0,87
Marketing undertaken at HQ level	- 0,22	0,71	- 0,7	0,68	- 0,86	0,47	1,34	0,59
Trade integration with foreign parent	- 0,19	0,80	0,04	0,79	- 0,75	0,43	1,12	0,81
Subsidiary Capability (SC)								
Subsidiary initiative for product/market scope	0,12	0,72	- 0,20	0,61	1,00	0,59	-1,10	0,71
Product/process development at subsidiary level	0,10	0,86	- 0,36	0,76	0,97	0,56	-0,77	0,80
Subsidiary as source of patents, licences, and R&D	- 0,84	0,61	0,77	0,64	0,57	0,78	-0,36	0,92

Table A3 *Standardised canonic coefficient s/ contribution of each variable to cluster result*

	Standardised canonic coefficients			Contribution of each variable in %
	1	2	3	
Parent initiative for organisation of business functions	0,329	0,410	-0,455	14,81
Trade integration with foreign parent	0,519	0,037	0,224	18,81
Marketing undertaken at HQ level	0,606	-0,081	0,530	22,50
Subsidiary initiative for product/market scope	-0,423	0,041	0,103	15,32
Product/process development at subsidiary level	-0,377	-0,242	0,461	15,40
Subsidiary as source of patents, licences, and R&D	-0,187	0,956	0,246	13,16

Table A4 *Functions for the cluster centroids*

	1	2	3
Cluster I	-0,301	-1,213	-0,350
Cluster II	0,343	1,400	-0,376
Cluster III	-2,913	0,159	0,412
Cluster IV	3,537	-0,138	0,411

Table A5 Trade structure across subsidiary roles (in %)

	Subsidiary Role							
	Quiescent		Active		Autonomous		Receptive	
	Mean	StdD	Mean	StdD	Mean	StdD	Mean	StdD
Sales to foreign owner	25,30	32,56	25,02	32,32	7,75	15,18	**73,24**	32,60
Ales to other foreign buyers	22,07	29,34	18,13	23,73	32,06	33,71	10,55	20,06
Sales to domestic buyers	**49,62**	38,63	**53,03**	39,02	**57,22**	34,99	12,21	23,05
Supplies from foreign owner	20,84	27,13	**35,77**	36,69	10,13	19,59	**49,28**	35,14
Other foreign suppliers	29,94	30,02	19,01	25,21	29,67	26,49	23,52	26,75
Supplies from domestic firms	**45,99**	34,37	**34,32**	31,16	**57,58**	30,29	22,49	26,03

Table A6 Country composition across subsidiary roles (in %)

		Subsidiary Role			
	Total sample	Quiescent	Active	Autonomous	Receptive
Estonia	12	16	7	13	9
Hungary	20	23	10	25	21
Poland	36	29	62	30	23
Slovakia	16	17	9	9	33

Slovenia	16	15	12	23	15

Table A7 Descriptive Statistics across subsidiary roles

	Total sample		Subsidiary Role							
			Quiescent		Active		Autonomous		Receptive	
	Mean	StdD	Mean	StdD	Mean	StdD	Mean	StdD	Mean	StdD
Technology class	2,83	0,95	3,00	0,98	2,48	0,88	3,00	0,90	2,79	0,97
Log employees/ size	4,97	1,59	4,58	1,51	4,93	1,82	5,17	1,42	5,3	1,51
Years since entry of foreign investor	17,3	27,1	17,27	27,1	19,24	27,4	22,8	31,15	10,9	12,1
Foreign equity share	71	37	71	37	74	31	37	48	89	24
Greenfield (in %)	57		67		38		37		84	

Table A8 Ordered Probit Estimation Result

	Importance of foreign parent for patents, licenses, and R&D		Importance of foreign parent for human capital formation		Productivity growth since entry of foreign investor	
	not important	extremely important	not important	extremely important	considerable reduction	considerable increase
y = Pr(dep variable = 1)/ Pr(dep variable = 5)	0,148	0,212	0,159	0,092	0,173	0,349
Dummy for FDI host economy (Poland as control group)						
Estonia	0,055	-0,059	0,002	-0,002	-0,011	0,018
Hungary	0,019	-0,023	0,140 **	-0,068 ***	-0,052	0,089
Slovakia	-0,037	0,052	-0,005	0,004	-0,041	0,071
Slovenia	-0,066 **	0,099 *	0,044	-0,027	-0,068 **	0,120 **
Dummy for technological class of industry (Lowtech as control group)						
MediumLowTech Industry	-0,097 ***	0,179 **	-0,043	0,036	0,151 **	-0,189 ***
MediumHighTech Industry	-0,082 ***	0,117 **	-0,020	0,014	0,058	-0,087
HighTech Industry	-0,080 ***	0,113 **	-0,047	0,035	-0,036	0,059
Firm-specific effects						
Size (Log number of employees)	0,005	-0,006	-0,003	0,002	-0,036 ***	0,057 ***
Age (Log years since establishement)	-0,009	0,012	-0,016	0,011	-0,012	0,019
Main exogenous variables (cluster III - autonomous subsdiaries - as control group)						
Cluster I (quiescent subsidiaries)	-0,067 **	0,094 *	-0,125 ***	0,114 ***	-0,058 *	0,097
Cluster II (active subsidiaries)	-0,180 ***	0,344 ***	-0,184 ***	0,218 ***	-0,098 ***	0,177 ***
Cluster IV (receptive subsidiaries)	-0,149 ***	0,279 ***	-0,159 ***	0,189 ***	-0,091 ***	0,163 **
N	367		375		395	
Wald Statistic	87,830		59,270		39,320	
Prob(Wald-Statistic)	0,000		0,000		0,000	
Schwarz Kriterium	1177, 50		1193,13		944,42	
Log Pseudo Likelyhood	-541,50		-549,15		-424,37	
Pseudo R-sqaured	0,066		0,054		0,046	