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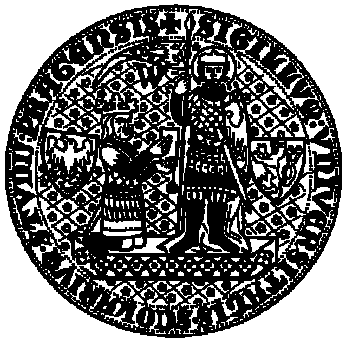

Master Thesis

Patterns of Internalization and Third Country Effects: Empirical Evidence from the Czech Republic

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Declaration of Authorship

I hereby declare that I compiled this thesis independently, using only the listed resources and literature.

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Abstract

This master thesis aims at determining the patterns of internalization of multinationals and at evaluating the potential effects of third countries on inward FDI in the Czech Republic. To meet these objectives, I employed the knowledge-capital model of Markusen et al. (1996) and the extended spatial lag model of Blonigen et al. (2005) on a firm-level dataset of foreign affiliates located in the Czech Republic for the period from 2003 to 2008. Empirical analyses were conducted on data at different levels of aggregation to demonstrate the relevance of data disaggregation and heterogeneity. The results provided an empirical evidence for horizontal and vertical motives of internalization, with the prevalence of either motive varying across the sectors and the levels of aggregation. Effects of third countries on inward FDI were found to exert impact on a number of sectors of activity. Nevertheless, statistical significance of the results appeared to be highly sensitive to the geographical composition of data.

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1
Introduction

During the last decade, the importance of foreign direct investment in the Czech Republic has grown substantially. The average FDI flows during the period 2003-2008 amounted to 3.3% of GDP, whilst the cumulative FDI stocks for the same period reached in average 35% of GDP. There is a plethora of empirical studies on determinants and impacts of the FDI on the Czech Republic itself or within a wider range of Central and Eastern European countries. Nonetheless, the number of studies on the pattern of internalization of multinationals (MNEs) activities and/or on the possible impact of third countries on the FDI in the Czech Republic is rather few.

Driven by this research gap, I have decided to carry out an empirical study to disentangle different types of FDI in the Czech Republic and to assess the third country effects on inward FDI in the Czech Republic.

In order to meet the first objective, I will employ the knowledge-capital model, developed by Markusen et al. (1996), whose specification allows for the distinction between the two main pattern of internalization, horizontal (market seeking) and vertical (efficiency seeking) FDI. This model has been chosen as it is by far the most comprehensive model built on economic theory that captures both types of FDI.

In order to meet the second objective, I will capture the third country effects through spatial linkage (spatial lag) model, in line with other empirical studies on the issue (e.g. Blonigen et al. 2005, 2007, Baltagi et al. 2005, Garretsen and Peeters 2008).

The contributions of the master thesis are several. To my best knowledge, this is the first empirical research on the pattern of internalization of multinationals in the Czech Republic. Studying the pattern of internalization of MNEs is meaningful, as each type of FDI impacts on and is affected by the host's economy in a different way[1]. In addition, the empirical testing of

[1] For instance, whilst horizontal FDI and trade are substitutes, vertical FDI and trade are complements. Horizontal FDI are more capital-intensive and hence are expected to create larger spillover effects, whilst vertical FDI are more labour-intensive and hence are expected to influence more significantly labour market (Beugelsdijk et

the knowledge-capital model in the context of the Czech Republic will contribute to enhance the validity and explanatory power of the model.

Another contribution of the work dwells in the empirical testing for third country effects on Czech inward FDI, as this will be the pilot research for this geographic area. Moreover, the spatial lag model employed does not capture only the third country effects, but also enables to identify more complex patterns of internalization, that go beyond the framework of the knowledge-capital model.

The last contribution of the thesis is the level of data aggregation, as the empirical analyses will be carried out on sector and firm-level data. It has been widely recognised by researchers that FDI analyses on aggregated country level data may provide inaccurate and blurred results, as determinants, impacts and types of FDI may vary across the sectors and across the firms. Data at disaggregated level enable to capture the sector and firm heterogeneity and thus provide more accurate results.

The thesis proceeds as follows. Chapter two summarizes the extant literature, both theoretical and empirical. Chapter three presents the theoretical background of the thesis. Chapter four specifies empirical models and hypotheses to be tested, sources of data and estimation approaches. Chapter five interprets the estimation results and chapter six concludes.

al. 2008). Horizontal FDI are positively correlated with volatility of supply shocks, while the opposite holds for vertical FDI (Aizenman and Marion 2004).

2
Literature Review

2.1 Introduction

The aim of this chapter is at providing literature review associated with factors determining the main patterns of internalization. Study of the extant literature revealed three sources of determinants that exert influence on the patterns of internalization: country characteristics, industry and firm heterogeneity and third country effects.

Country characteristics refer to traditional FDI determinants such as country size, relative factor endowment and trade costs. The main theoretical model encompassing these characteristics and their impact on the horizontal and vertical patterns of internalization is the knowledge-capital model, developed by Markusen et al. (1996) and Markusen (1997, 2002). Since this model is the workhorse model of my analysis, I will briefly introduce it in the first section of the chapter and I will provide a more detailed description of the model in the following chapter.

The development of the knowledge-capital model has triggered a wave of empirical studies aiming at detecting the existence of vertical FDI versus horizontal FDI. Early empirical works employed predominantly aggregated, country level data. With the availability of further data, it became clear that the industry and firm heterogeneity play a role in determining the pattern of internalization. Thus, in order to correctly determine the existence of vertical FDI versus horizontal FDI, it is not sufficient to study the data at aggregated, country level. Instead, it appears more appropriate to employ the data at more disaggregated level that allow for industry and firm heterogeneity. This issue is surveyed in the second section of the chapter.

The availability of more detailed data also enabled researchers to uncover new patterns of trade and FDI flows. In particular, they revealed that the integration strategies of multinationals are rather complex. The multinationals do not enter only into purely horizontal or purely vertical FDI, but they also engage in export platforms FDI from which they serve other countries or they slice up the production process and locate them in multiple nearby countries. These complex

internalization patterns suggest that the characteristics of third (adjacent) countries may affect the locational decisions of multinationals as well as their choice of internalization strategy. The relevant empirical literature on the issue is presented in the last section of the chapter.

2.2 Main Patterns of Internalization

Models of trade theory based on general equilibrium have identified two main patterns of internalization. According to the first pattern, firms become multinationals in order to reduce production costs, whereas the second pattern of internalization assumes that firms become multinationals in order to gain better access to foreign markets and to avoid trade costs. Models analyzing the determinants of the earlier pattern are the factor proportion or vertical models. The proximity concentration or horizontal models focus on the later pattern.

The vertical model of multinationals was first developed by Helpman (1984) and Helpman and Krugman (1985). The rationale behind the development of the model was a desire to define a general equilibrium theory, which states the conditions under which the multinationals emerge and which is capable of predicting the trade patterns under these conditions.

The basic idea behind the theory of vertical multinationals is the ability of firms to exploit factor price differences in the world by fragmenting the production process into stages and locating them into places where they can be most cheaply produced. Vertical FDI can be characterised as one directional trade in intermediate inputs or final products between divisions of the same firm in the sense that firms from richly endowed countries with human capital are active in the countries richly endowed in labour. Thus, the main motive for internalization in the vertical model is to attain lower production costs.

In the Helpman's (1984) and Helpman and Krugman's (1985) model, the headquarter services and plant production are undertaken in the same country unless there are factor price differences. However, the multinationals will emerge only if factor price differences and (or) factor intensity differences are high enough for firms to find it optimal to fragment the production process into stages and to separate them geographically. The fragmentation will tend to push up labour demand in foreign country and reduce the demand in home country, which will in turn lead towards the convergence in factor prices.

Concurrently with the vertical model of Helpman (1984), Markusen (1984) developed a horizontal model of multinationals, which was later on refined by Markusen and Venables (1998, 2000). The rationale behind the model formulation was an empirical observation of

the large volume of trade and direct investments between countries with similar labour and wealth endowments, which was at odds with the predictions of the vertical model.

The crucial assumption of the horizontal model is the existence of firm level scale economies and existence of transport costs (trade barriers). Horizontal direct investments refer to the firms producing similar final products in plants abroad as at home market, and these plants are supplied by headquarters services. Multinationals of this type represent an alternative to vertical multinationals and are characterised as market or asset-seeking, two-plant firms producing the same products abroad to serve the local market. The aim of horizontal multinationals is to decrease the trade costs associated with supplying the market from abroad and to exploit firm level economies of scale.

In the horizontal model, the firms face two options – either to serve the foreign market by exporting or via the production in the foreign country. The multinationals will emerge only if the plant specific economies of scale relative to firm-specific economies of scale are low enough and (or) the transport costs are high enough so that it pays to set up a plant abroad and produce the same products as at home.

The distinction between the vertical and horizontal multinationals is meaningful, since they do not differ only in the motive for internalization, but also in their impact on the economy. For instance, in the case of vertical MNEs, trade and FDI are complements; since the intermediate products or final goods are traded within the firms (parent and affiliates) until they reach the target markets to be sold. On the other hand, the horizontal MNE imposes a trade off between FDI and trade, since the production abroad is not shipped back home but is directly sold on the foreign markets.

Table 1 provides a summary of the vertical and horizontal models:

Table 1: Vertical vs. Horizontal Models Comparison

	Vertical (factor proportion) model	**Horizontal (proximity concentration) model**
Model assumptions	2x2x2 (two-factor, two-sector, two-country)	2x2x2 (two-factor, two-sector, two-country)
	Perfect competition	Imperfect Cournot competition
	Zero transport costs	Positive transport costs
	Constant returns to scale	Firm scale economies
Firm structure and production	Single plant producing intermediates or final products, fragmented production	Two plants producing same goods and services in both countries
	One-directional activity	Two-directional activity
Output division	Home country demand	Host country demand
	Trade and affiliate sales are complements	Trade and affiliate sales are substitutes
Main motives for internalization	Differences in factor endowments (prices)	High trade costs
		Similarity of countries in factor endowments (prices)
		Similarity in market sizes
		Plant level economies of scale are low relative to firm level economies of scale
Welfare effects	Increased in both countries	Increased in both countries
Income distribution	Reduced absolute wage differences across countries; alteration of relative wages within countries	Income in each country may be increased without changing the distribution of income.

Source: Helpman (1984), Markusen and Venables (1998, 2000)

The horizontal model expects both headquarters and production activities to use the factors of production in the same proportion or to use only one factor of production. This assumption induces factor prices to be similar and thus there is no reason for vertical multinationals to arise. On the other hand, the initial vertical model of multinationals developed by Helpman and Krugman (1985) assumed zero trade costs and no firm level scale economies. This assumption gives no reason for horizontal multinationals to emerge.

Led by these restrictions of the horizontal and vertical models, Markusen et al. (1996) and Markusen (1997, 2002) integrated the vertical and horizontal models in a single general equilibrium model, known as the knowledge-capital model (KC model). The main feature of the model was that it allowed trade costs between the countries to be positive and at the same time it assumed different factor intensities across activities, giving the motivations for both vertical and horizontal multinationals to emerge. In addition, the model assumed the existence of the knowledge based assets that create firm level scale economies. Thus, the knowledge-capital

model does not only unify horizontal and vertical motive, but it also brings a new aspect in the form of knowledge based assets.

In the knowledge-capital model, the vertical and horizontal MNEs arise endogenously. By encompassing both types of MNEs, the FDI between countries in the KC model is a function of all variables considered in the vertical and horizontal model together, comprising market sizes, relative factor endowments, trade costs and investment barriers.

The rationales behind the emergence of vertical or horizontal multinationals in the KC model remain consistent with those in the vertical and the horizontal models. Differences in factor prices give rise to vertical fragmentation whereas similarities in factor endowments induce horizontal activities. In addition, the knowledge-capital model predicts that the incentives for vertical MNEs are strongest when the home country is simultaneously small and skilled labour abundant. On the other hand, horizontal MNEs most likely emerge when the home country is slightly more skilled labour abundant than the host country. A more detailed description of the theory and empirical specification of the knowledge-capital model will be provided in the next chapter.

2.3 Empirical Evidence on the Knowledge-capital Model

2.3.1 Empirical Studies on Country Level Data

Carr et al. (2001) were the first who proposed an empirical specification drawn from the theoretical predictions of the knowledge-capital model. By pooling the U.S. inward and outward affiliate sales over the period 1986-1994, the authors found a strong support for the KC model. In particular, their results suggested that affiliate sales increased in the total income of the host and home countries, in skilled labour endowment differences and in convergence in income between the host and home countries, while reduced in dissimilarities in size. In addition, home countries which are simultaneously skilled labour abundant and small have higher affiliate sales. Lastly, a bilateral increase in parent and host country trade costs decreases affiliate production, so trade and investment are complements and generally decreases affiliate production when host country is a developing country but increases affiliate production when host country is high income country.

Markusen and Maskus (2001b) extended the work of Carr et al. (2001) by decomposing foreign affiliate production data into sales to the host country market and export sales. The aim of the paper was to obtain the horizontal versus vertical distinction that, according to the author, was not explicitly considered in Carr et al (2001). The estimation results fitted well the theory. Host country market size was more important for production for local sales than for export sales, while the opposite held for host country skilled labour scarcity. Investment and trade cots barriers of the host country exerted a stronger negative influence on production for export sales than on production for local sales. Unlike Carr et al. (2001) who tested the model on two-way data, Markusen and Maskus (2001b) examined the model on U.S. outward data only, since they enabled a breakdown of export sales into sales back to the home country and sales to third countries.

Nonetheless, Markusen and Maskus (2001b) found some quantitative difference compared to two way sample results of Carr et al. (2001). In particular, they found out that host country unskilled labour abundance had little effect on the production for export sales. This would suggest that U.S. outward investment was not primarily drawn by comparative advantage motive,

which was at odds with the results of Carr et al. (2001) where production for export sales was drawn to unskilled labour abundant countries. Markusen and Maskus (2001b) nevertheless noted that despite this discordance, the results are qualitatively similar to those of Carr et al. (2001) as unskilled labour abundance in the host is relatively more important for export sales.

Markusen and Maskus (2002a) performed a testing of the vertical, the horizontal and the knowledge-capital model against each other using the same dataset as Carr et al. (2001). Their results indicated that the horizontal could not be statistically distinguished from the knowledge-capital model, whilst the vertical model was decisively rejected. Based on this, they concluded that the horizontal investment is much more important than vertical investment motivated by factor endowment differences. In addition, the authors interpreted the results as supportive for the knowledge-capital model, but not distinguishable in aggregate data from the horizontal model and that the vertical model poorly characterized the overall pattern of world FDI activity.

Blonigen et al. (2002) argued that empirical specification of the knowledge-capital model in Carr et al. (2001) is mispecified in the proxy for skill labour differences. The authors claimed that when corrected for the misspecification, the econometric results provided the support for the horizontal model of MNEs. Nonetheless, in their reply, Carr et al. (2003) also pointed out flaws existing in the approach of Blonigen et al. (2002), specifically that the proposed alternative for the proxy of skilled difference is not consistent with the existing theory of the knowledge-capital model. In fact, they reckoned that it was the papers of Markusen and Maskus (2001b, 2002a), which correctly empirically translated the knowledge-capital model, not the one of Blonigen et al. (2002).

Davies (2002) argued that the empirical specification of Carr et al. (2001) must be amended by including a third order polynomial in skill differences to correctly capture some of the implied nonlinearities of the theoretical model. In particular, a cubic term would enable to detect the maximum point, where horizontal FDI peaks, and the inflection point, where horizontal multinationals are replaced by vertical multinationals. He found favorable evidence of the knowledge-capital model only when using FDI stocks as proxy for multinational activities and total years of schooling as proxy for skill endowments.

Braconier et al. (2002) used the wage as a proxy for skill labour and investigated the impact of wage costs on FDI data from Sweden and the USA. The authors found a strong evidence of

the knowledge-capital model, confirming the results of Carr et al. (2001). In particular, the authors found that the importance of vertical FDI is higher than claimed by previous studies. One of the reasons for this finding is that the authors used the data from Sweden, which is a small, skilled labour abundant country whereas the previous studies used solely data from the U.S. affiliate sales. According to the knowledge-capital model, the vertical FDI is more likely to emerge when the home country is small and skilled labour abundance. Their findings suggest that it is meaningful to estimate the data from other countries than the United States.

Later on, Braconier et al. (2003) extended their previous work (Braconier et al. 2002) by employing better data specifications for relative skill endowments and for affiliate sales, about which the authors claimed to have superior coverage as compared to previous studies. Braconier et al. (2003) confirmed the KC model and considered their empirical specifications to be comparable with the theoretical predications of the KC model. The authors conclude that in previous studies, the empirical specifications captured only indirectly the theoretical predications of the KC model, resulting in ambiguous results.

Recently, some researchers have focused on the econometric improvement of the knowledge-capital empirical specification. For instance, Mariel et al. (2009) undertook a time varying coefficient approach in testing the KC model, as they claimed that allowing the parameters of the model to vary over time made it possible to follow the changes in the nature of FDI, such as the conversion of vertical FDI to horizontal FDI between two converging economies. The authors tested non-parametrically a time varying coefficient variety of the knowledge-capital model on a bilateral panel data over 22 years and found out that the vertical component of the knowledge-capital model is relevant even for the countries with similar endowments. On the other hand, Tanaka (2009) addressed possible endogeneity in data in the KC model specification by using the system of generalized methods of moments (GMM) estimator and found a weak support for vertical component of FDI.

The ambiguous results of above mentioned studies have well documented the complexity of the knowledge-capital model, which cannot be solved to yield an unambiguous estimating equation. As noted by Carr et al. (2003, p. 995): *"...the knowledge-capital model, a hybrid of a vertical and a horizontal model, is a conceptually difficult one for estimation. Relationships predicted by the model are not only non-linear but non-monotonic. The implication of this is that*

there is room for reasonable disagreement as to what the appropriate estimation equation should be."

Another reason for the variance in the results is the selection of data. Firstly, the majority of studies employed the data on U.S. outward and/or inward affiliate sales/FDI. The United States is classified as a large and skilled labour country, which restricted the observation to an area in the North East section of the Edgeworth boxes (see Chapter 3 for further discussion). Thus, the results may have missed the vertical pattern as the knowledge-capital predicts that vertical FDI should flow primarily from small skilled-labour abundant countries. Secondly, the regression analyses in these studies were run on aggregated, country level data and thus ignored the possible firm or industry heterogeneity. This issue is discussed in the following section.

2.3.2 Empirical Studies on Industry and Firm Level Data

The knowledge-capital model, as well as the vertical and horizontal models, is based on the assumption of firm symmetry in predicting the patterns of internalization. Such an assumption implied that all firms export unless there is pressure for the formation of multinationals. However, with the availability of firm level data, empirical studies on foreign trade revealed that not all firms within an industry export nor are all industries engaged in foreign trade to the same extent. In view of these findings, certain trade theorist casted doubt on the validity of the symmetry assumption and included industrial and organisational heterogeneity in trade theory models instead (Antràs 2003, Melitz 2003, Helpman et al. 2004, Antràs and Helpman 2006).

The introduction of heterogeneity in international trade led to the recognition that the pattern of internalization may differ along sectoral or firm-specific characteristics, which in turn implied that cross country data alone may not be sufficient to disentangle the vertical or horizontal FDI patterns.

Yeaple (2003) noted that most of empirical studies detecting the existence of vertical FDI versus horizontal FDI are based on the aggregated data. By constructing comparative advantage indices for a group of countries, he revealed that in skilled labour scarce host countries, FDI flows are concentrated in low skill intensive industries, whereas in skilled labour abundant host countries, FDI flows are concentrated in high skill intensive industries.

This finding led him to argue that in order to test empirical relevance of the vertical FDI, it is not sufficient to simulate the patterns of FDI across countries while holding industry characteristics fixed. Instead, it is necessary to include an interaction term, which exploits both cross industry variation in factor intensity, as well as cross country variation in factor endowments. More specifically, he claims that it follows from the theoretical predictions of the vertical model, that FDI from industries intensive in a particular factor will flow to the countries abundant in that particular factor. He ran a regression equation of the knowledge-capital model, including in addition a vector of variables reflecting a potential host country's unit cost of production by sector. His results were strongly supportive for the vertical motive of internalization.

Hanson et al. (2003) have obtained a robust evidence for the vertical dimension of U.S. multinationals. The authors claimed, based on the results, that vertically motivated FDI are likely more important than what was suggested by Carr et al. (2001). According to them, the reason why they found strong evidence of vertical FDI was because of the use of micro-level data on foreign affiliates whereas previous work used data that were aggregated across the activities of a given affiliate and also across all affiliates.

Geishecker and Görg (2005) shared the same view as Hanson et al. (2003) by claiming that the "vertical investment controversy" in the paper of Carr et al. (2001) was due to the fact, that the authors used data on total aggregated affiliate sales which disregarded the potential heterogeneity in different types of multinational activity. Geishecker and Görg (2005) employed the specification of Blonigen et al. (2003) on bilateral FDI in manufacturing and services for a number of industrialized countries. Their results revealed a strong support of a vertical FDI component within manufacturing and horizontal FDI component within services industries. According to the authors, these findings clearly indicated that by allowing for heterogeneity, a more differentiated picture on patterns of internalization can be drawn.

Anghel (2007) followed the approach of Geishecker and Görg (2005) and tested the knowledge-capital model on a panel of affiliates of multinationals in 7 transition countries. In addition, she also considered separately different sectors of activity in both manufacturing and services and between various home countries of multinationals. By employing the empirical specification of Carr et al. (2001) on disaggregated data, Anghel (2007) proved that there is a combination of vertical and horizontal FDI in the region, with horizontal motive prevailing.

Based on the results, the author concluded that transition countries started being attractive for foreign investors not only because of their low unit labour costs, but also because of their market potential.

Waldkirch (2007) pointed out, that one of the biggest obstacles in determining the multinational activity remains the availability of high quality micro data, which is comparable across countries. Alfaro et al. (2009) used a firm level dataset to characterize global patterns of multinational activity and argued that data limitations have led the empirical literature to systematically underestimate vertical FDI, which is far more prevalent than previously thought. The authors used a combination of four digit sector level information and input-output tables to distinguish horizontal and vertical FDI by classifying a horizontal subsidiary as a plant in the same sector code as the foreign owner parent, and a vertical subsidiary as a plant that produces in sectors that are inputs to the foreign parent's product. The results showed the importance of vertical activity in terms of number of subsidiaries and number of employees.

Alfaro et al. (2009) claimed that due to the data limitations, there has been a misclassification of vertical FDI where subsidiaries supplying goods to their parents are located in the same two-digit Standard Industrial Classification code as their parents but in different industries when disaggregating to the four-digit level. Alfaro et al. (2009) dubbed this type of vertical FDI "intra-industry vertical FDI" and claimed them to be qualitatively different from "inter-industry vertical FDI" that cross two-digit industry codes. More specifically, the authors found out that intra-industry vertical FDI are not driven by comparative advantage (factor proportion) motive as inter-industry vertical FDI and they occur predominantly between rich countries with a small skill labour endowment differences. Multinationals tend to undertake intra-industry vertical FDI for high-skill and later stages of production and inter-industry vertical FDI for low-skill inputs from low-skill countries. The fact that intra-industry vertical FDI occurs predominantly between developed countries with small relative factor endowment differences made researchers to misclassify it as horizontal FDI. This is further enhanced by the data limitation, since the intra-industry vertical FDI is visible only at more disaggregated level (e.g. four digit level).

2.4 Third Country Effects and Complex Nature of Multinationals

Soon after the development of the knowledge-capital model, some researchers started emphasizing the role of hybrid multinationals, which are neither purely horizontal nor purely vertical. In their papers, the authors relaxed from the two country framework and instead put emphasis the role of endowments and trade and investment costs of third countries.

Ekholm et al. (2003), Yeaple (2003), Hanson et al. (2003) addressed a phenomenon of 'export platform' FDI, where a parent country invests in a host country with the aim to serve third markets with exports from the affiliates in the host country. Baltagi et al. (2005) focused on the "complex vertical" FDI, where a parent country sets up a vertical chain of production across multiple (nearby) countries to exploit the comparative advantage of various locations. Both export platform and complex vertical FDI suggest that FDI decisions cannot be properly captured without considering the effects of third countries and their omission in econometric estimations may lead to biased parameter estimates of the determinants of bilateral FDI.

The empirical studies that include third country effects in FDI analysis are rather rare. In general, these papers have indentified two potential channels for such effects: market proximity effect and spatial interactions.

Coughlin and Segev (2000) were the first who employed the spatial econometric techniques while controlling for standard determinants of FDI. The authors tested a spatial dependence on a sample of inward FDI to 29 Chinese regions and found evidence of positive spatial autoregression. The results indicated that increased FDI in a province has positive effects on FDI in nearby provinces.

In their studies of locational choice, Head and Mayer (2004) found out that market potential variable proxied as distance weighted average GDP's of adjacent countries exerted a positive influence on the locational choice of Japanese multinationals in Europe. In particular, their results indicated that a ten percent increase in a market potential variable raised by three to eleven percent the chance of a region being chosen, depending on the specification.

Blonigen et al. (2005) estimated the importance of parent market proximity effect and of interactions between FDI from different parents for a sample of US inward FDI data over 1983 to 1998 via a spatial lag regression. Their results revealed a strong positive effect of parent

market proximity. However, the impact of spatial lag appeared to be sensitive to data sample, as it turned out to be significant only for the sub-sample of European parents.

Baltagi et al. (2005) captured third countries effects through two types of spatial interaction – spatially lagged explanatory variables motivated by a three factor knowledge-capital model reflecting third country characteristics; and spatial autoregressive errors to control for regional interdependencies of stochastic shocks between host countries. The model was tested on a dataset of bilateral U.S. outward FDI stocks and affiliate sales at the industry level. The authors used inverse distance as spatial weights and found that weighted regressors were jointly significant at 1% level, indicating a strong importance of third country effects, emphasizing the role of U.S. complex outward FDI.

Blonigen et al. (2007) employed a similar approach as Baltagi et al. (2005) and tested third country effects via spatial interactions in the U.S. outbound foreign direct investment. In addition, they included a market potential variable proxied by spatially weighted market sizes of adjacent countries. They claimed that spatial lag can be grounded upon FDI theory by analyzing the importance of spatial lag combined with market potential for four categories of multinationals (i.e. pure horizontal and pure vertical, export platform and vertical complex FDI). Nevertheless, unlike Baltagi et al. (2005), they found that traditional determinants of FDI are robust to the inclusion of spatial interdependence, although the empirical evidence suggests the contrary. In addition, the authors also included country fixed effects to test for the third country effects and their results rendered spatial insignificant in most cases. This led the authors to conclude that the spatial autoregression can be captured by country fixed effects and the significance of spatial lag is sensitive to the selection of host countries.

Garretsen and Peeters (2008) took a similar approach as Blonigen et al. (2007) and employed a spatial lag model to test for the relevance of third country effects in the Dutch outbound FDI. The authors confirmed the findings of Blonigen et al. (2007) to a certain extent, since the estimation results revealed that the inclusion of fixed country effects reduced the importance of spatial lag significantly, although it remained statistically significant. In addition, Garretsen and Peeters (2008) also found evidence that the third country effects are transmitted through other channels, specifically through the market potential and tax variables.

2.5 Summary

This chapter provided a literature review of factors determining the internalization patterns of multinationals. It identified two main motives for internalization of production: the factor proportion motive, leading to vertical FDI and the market access motive, leading to horizontal FDI. These two motives are embedded in the knowledge-capital model of Markusen et al. (1996) and Markusen (1997, 2002), which provides a unifying framework for disentangling different type of foreign direct investment. According to the knowledge-capital model, country specific characteristics, such as market size, relative factor endowment and trade costs are important in determining the pattern of internalization.

Early empirical works testing the knowledge-capital model predominantly employed aggregated, country level data. Nonetheless, later empirical studies proved that the level of data aggregation may play a crucial role in determining the pattern of internalization. Data at more disaggregated level enables to detect the intra-industry nature of vertical FDI which is not revealed at more aggregated level. In addition, disaggregated data allows for industry and firm heterogeneity to take effect.

The existence of complex multinational strategies, such as export platform or complex vertical FDI suggests that the knowledge-capital model may not be accurate in explaining complex strategies since it deals only with pure horizontal and pure vertical FDI and omits third country effects, which may be relevant. The empirical studies captured the third country effects through market potential effect (or parent market proximity for inward FDI) and spatial interactions. The estimation results predominantly confirmed the relevance of market potential/parent market proximity effect. On the other hand, the evidence on the spatial linkage is somewhat ambiguous. While some studies confirmed its significance (e.g. Coughlin and Segev 2000, Baltagi et al. 2005, Garretsen and Peeters 2008), other studies (Blonigen et al. 2005, 2007) pointed out that the significance of spatial lag is sensitive to the data tested and can be substantially reduced by inclusion of fixed effects.

Based on the literature review, I have decided to employ the knowledge-capital model to disentangle the internalization pattern of multinationals in the Czech Republic. This model will be applied on data at firm and industry levels in order to control for possible heterogeneity effect. In addition, I will also test the relevance of third country effects on MNEs' decisions to invest in

the Czech Republic by including spatial lag and parent and host market proximities in the empirical model.

3
Model Background

3.1 Introduction

As noted in the previous chapter, the empirical model specification will be built based on the knowledge-capital model and the third country effects. Accordingly, this chapter will focus on these two issues with the aim at providing some insights in the theories behind them.

Since the knowledge-capital model is conceptually and theoretically more complex, a great deal of the chapter will be devoted to its discussion. Thus, the first section of the chapter starts with the KC model's assumptions, continues by equilibrium conditions discussion and then turns to the presentation of the simulation results. The second section of the chapter introduces the channels through which third countries may affect inbound FDI, with a special focus on spatial linkages.

3.2 The Knowledge-capital Model

3.2.1 Model Assumptions

The knowledge-capital model is a two factor, two sector and two country model set up on the following assumptions:

- There are two countries: home (parent) country *i* and foreign (host) country *j*.
- The countries consist of two sectors (*X* and *Y*): sector *Y* produces a homogenous product under constant returns to scale and perfect competition, while sector *X* produces goods under increasing returns to scale at firm level.
- Sector *X* encompasses a large number of imperfectly competitive firms that are symmetric, subject to constant elasticity of substitution (CES) and operate under Cournot competition.
- Sector *Y* serves as numeraire.
- There is free entry and exit of firms in sector *X*.
- Overall utility is separable and homothetic in its arguments.
- The utility of a representative consumer is a Cobb-Douglas function.
- There are two factors of production: skilled labour (*S*) and composite factor (*L*), including other factors (unskilled labour, land, capital). The factors are mobile between the two sectors but are not internationally mobile.
- There is no price discrimination; therefore the home price of a good equals its export price.
- All types of firms produce under the same marginal cost; therefore the prices of all goods produced in one country have the same price in equilibrium.
- There exist three different configurations of firms. Domestic (type-*d*) firms have headquarters and single plant in one country. They serve foreign markets by exports. Vertical or type-*v* firms have a headquarters and a single plant in different countries. These type of firms tend to locate high-skilled labour intensive headquarter services in the skilled-labour abundant host country. The production of the plant abroad is endogenously divided between the supply of the local market and the shipment back to the home

country. Horizontal or type-*h* firms refer to two-plant firms with a headquarters in one country and one of the plants in the other country. The production of type-*h* in a foreign (host) country is used entirely to supply the local foreign market.

- Fragmentation: knowledge-based assets and knowledge-generating activities might be located separately from production. The incremental costs of supplying asset's services to a foreign plant relative to the cost of supplying the services to a domestic plant are small. Fragmentation is not perfect, i.e. technology transfer incurs some costs. This can be expressed as:

$$F_i^h + F_j^h > F_i^v + F_j^v > F_i^d \tag{3.1}$$

where F_i are fixed costs incurred in the home country in units of skilled labour and F_j is fixed costs incurred in the foreign country in units of skilled labour

- Skilled-labour intensity: knowledge-based assets are skilled-labour intensive with respect to final production.
- The fragmentation and skilled labour intensity imply that knowledge based assets are located where skilled labour is at low cost and production is located where unskilled labour is at low cost. These give rise to vertical MNE.
- Jointness: the services of knowledge-based assets are at least partially joint inputs into multiple production facilities, i.e. they can be used simultaneously in more locations without reducing the services in any single location. The added cost to establish a second plant is small compared to the cost of setting up a company with a local plant, i.e. there are scale economies at firm level. Jointness implies production in different geographical locations and gives rise to horizontal MNE.
- The level of skilled-labour intensity in headquarters activities is higher than in production plants, including both plant-specific fixed and marginal costs. The level of skilled-labour intensity of a plant alone, without a headquarters, is higher than of the composite *Y* sector.[2] The level of skilled-labour intensity in two-plant type-*h* firms is higher than in a single-plant type-*d* or type-*h* firms. There are both firm-level and plant-level scale

[2] This assumption holds especially in developing countries, where branch plants of foreign multinationals might be more skilled-labour intensive than the whole economy.

economies, i.e. two-plant multinationals (type-*h*) have higher fixed costs than a single plant firm, but not twice as high. This can be expressed as:

$$2F_i^d > F_i^h + F_j^h > F_i^h > F_i^d \tag{3.2}$$

- One-plant type-*d* firms incur all the fixed costs in one country; one-plant type-*v* firms incur their fixed costs in both the headquarters country and in the plant-located country; two-plant type-*h* firms incur most of the fixed costs in the headquarters country.
- Headquarters activities are only skilled labour intensive, whereas integrated headquarters and plant activities (relevant for type-*h* firm) are both skilled and unskilled labour intensive.
- The production function of *Y* in country *i* (*j*) is a CES function, identical in both countries:

$$Y_i = \left[(1-a)S_{iy}^{\alpha} + aL_{iy}^{\alpha}\right]^{1/\alpha} \tag{3.3}$$

$$Y_j = \left[(1-a)S_{jy}^{\alpha} + aL_{jy}^{\alpha}\right]^{1/\alpha} \tag{3.4}$$

where S_{iy} and L_{iy} are the skilled and unskilled labour used in the *Y* sector of country *i*; $0 < \alpha < 1$ is a share parameter that determines the degree of substitubility of the factors and $(1/(1-\alpha))$ is the elasticity of substitution.

- Type-*d* firms undertake all their production in the home country and thus incur all costs in one country. The cost function of a national firm in country *i* is given by:

$$l_i L_i^d + s_i S_i^d = l_i[cX_{ii}^d + (c+\tau)X_{ij}^d + G] + s_i F_i^d \tag{3.5}$$

where l_i, s_i stands for price of unskilled and skilled labour L_i, S_i; *G* is the fixed costs incurred in units of unskilled labour and remains the same for any plant regardless of firm type and country; *c* is marginal cost of *X* production in units of skilled labour and τ is transport cost for *X* in units of skilled labour (the same for both directions); X_{ij}^d denotes sales in country *j* of a national firm based in country *i*.

- A type-*h* firm operates one plant in each country incurring fixed costs in both home and foreign countries. The cost function of a horizontal firm headquartered in country *i* is as follows:

$$l_i L_{ii}^h + l_j L_{ij}^h + s_i S_{ii}^h + s_j S_{ij}^h = l_i[cX_{ii}^h + G] + l_j[cX_{ij}^h + G] + s_i F_i^h + s_j F_j^h \tag{3.6}$$

- A type-*v* firm operates a plant abroad and has sales in both countries. Thus, a vertical multinational headquartered in country *i* has a cost function:

$$l_j L_{ij}^v + s_i S_{ii}^v + s_j S_{ij}^v = l_j [cX_{ij}^v + (c+\tau)X_{ii}^v + G] + s_i F_i^v + s_j F_j^v \quad (3.7)$$

3.2.2 Model Equilibrium

Given the cost functions in the sectors and the production function of the homogeneous sector *Y*, the equilibrium in the KC model is given by the market clearing conditions (determining the factor prices and the goods prices), national income condition, and equilibrium in the sector *Y* and equilibrium in the sector *X*. The equilibrium conditions in sector *X* are of vital importance, since they enable to define patterns of multinationals activities under different variables settings.

National income balance

In equilibrium, the firms obtain the income only from the sale of factors, since they make no profit, therefore the national income in countries *i* and *j* is given by the total national factor endowment:

$$M_i = s_i S_i^* + l_i L_i^* \quad (3.8)$$

$$M_j = s_j S_j^* + l_j L_j^* \quad (3.9)$$

where $S_i^*(S_j^*), L_i^*(L_j^*)$ are the total factor endowments of skilled and unskilled labour in country *i* and *j*.

Market clearing conditions

i. Factor prices

The constraints on labor supply (factor market clearing condition) is given by total factor endowment in country *i* and *j*, $L_i^*, S_i^*, L_j^*, S_j^*$:

$$L_i^* = L_{iy} + N_i^d L_i^d + N_i^h L_i^h + N_j^h L_j^h + N_j^v L_j^v \quad (3.10)$$

$$S_i^* = S_{iy} + N_i^d S_i^d + N_i^h S_i^h + N_i^v S_i^v + N_j^h S_j^h + N_j^v S_j^v \quad (3.11)$$

$$L_j^* = L_{jy} + N_j^d L_j^d + N_j^h L_j^h + N_i^h L_i^h + N_i^v L_i^v \quad (3.12)$$

$$S_j^* = S_{jy} + N_j^d S_j^d + N_j^h S_j^h + N_j^v S_j^v + N_i^h S_i^h + N_i^v S_i^v \quad (3.13)$$

where $N_i^d, N_i^h, N_i^v (N_j^d, N_j^h, N_j^v)$ indicate the number of active type-*d*, type-*h* and type-*v* firms headquartered in country *i* (*j*).

ii. <u>*Goods prices*</u>

According to the assumption, the utility of the representative consumer in each country is given by the Cobb-Douglas function:

$$U_i = X_{ic}^{\beta} Y_{ic}^{1-\beta} \tag{3.14}$$

where:

$$X_{ic} = N_i^d X_{ii}^d + N_j^d X_{ji}^d + N_i^h X_{ii}^h + N_j^h X_{ji}^h + N_i^v X_{ii}^v + N_j^v X_{ji}^v \tag{3.15}$$

is the aggregate consumption of *X* in country *i* and *j*; N_i^d is the number of type-d firms headquartered in country *i* that is active in equilibrium and Y_{ic} denotes the consumption of homogenous product *Y* in country *i*. The utility in country *j* is defined analogously.

In equilibrium, the consumers demand such a quantity of *X* and *Y*, so they maximize their utility, subject to the income constraint given in equations (3.8) and (3.9). The first order conditions of the Cobb-Douglas utility function gives following demands for *X* and *Y*[3]*:*

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[3] Let $X_{ic} = x_1, Y_{ic} = x_2$, then the utility functions (3.10) can be written as $U = x_1^{\beta} x_2^{1-\beta}$ and the first order condition is as follows :

$$\max_x \sum_{i=1}^{2} \beta_i \ln x_i$$

$$s.t. \quad M_i = p_i x_1 + x_x$$

$$L(x, \lambda) = \beta \ln x_1 + (1-\beta) \ln x_2 - \lambda(p_i x_1 + x_2 - M_i)$$

$$\nabla L(x, \lambda) = 0$$

$$\partial L(x, \lambda) / \partial x_1 = \beta / x_1 - \lambda p_i$$

$$\partial L(x, \lambda) / \partial x_1 = \beta / x_1 - \lambda p_i$$

$$\left.\begin{array}{l} \beta / 1-\beta = x_1 p_1 / x_2 \\ M_i = p_i x_1 + x_2 \end{array}\right\} x_1 = X_{ic} = \beta M_i / p_i, x_2 = Y_{ic} = (1-\beta) M_i$$

$$X_{ic} = {\beta M_i}/{p_i}, \qquad Y_{ic} = (1-\beta)M_i \tag{3.16}$$

$$X_{jc} = {\beta M_j}/{p_j}, \qquad Y_{jc} = (1-\beta)M_j \tag{3.17}$$

p_i, p_j denote the price of X produced in country i (j).

Equilibrium in sector Y is given by the zero profit condition, where marginal costs equal marginal price:

$$p_i^y = c_{iy}(l_i, s_i) \tag{3.18}$$

$$p_j^y = c_{jy}(l_j, s_j) \tag{3.19}$$

$$\Pi_i^y = p_i^y - c_i^y(s_i, l_i) = 0 \tag{3.20}$$

$$\Pi_j^y = p_j^y - c_j^y(s_j, l_j) = 0 \tag{3.21}$$

where p_i^y denotes the marginal price of product Y in countries i and $c_i^y(l_i, s_i)$ is the constant marginal production cost in country i.

Equilibrium in sector X:

Since the equilibrium in sector X is given by many unknowns and equations, the authors used the mathematical programming to model it. In particular, they employed the complementary slackness method, where each nonnegative (continuous) variable is associated with one inequality. A complementary variable is positive if inequality holds with equality, and it is zero otherwise.

The sector X produces under Cournot competition. Thus, in equilibrium:

- The output of X is determined by the pricing inequalities (marginal revenues ≤ marginal costs)
- The number of type-d and type-v firms are given by the free entry inequality (zero-profit condition, where markup revenues ≤ fixed costs)

i. *Pricing inequalities*

In Cournot equilibrium, the output per firm is constant and is given as a function of the mark-up over marginal cost. An optimal mark-up is determined as the ratio between the firm's market share and the price elasticity of demand in the market.

The first order condition of the profit maximization ($\partial \pi_x / \partial x = 0$) yields a unique equilibrium, which can be expressed as follows[4]:

$$\left.\begin{array}{l} \dfrac{p - c'}{p} = \dfrac{n_i}{\eta} \\ \dfrac{n_i}{\eta} = m \end{array}\right\} p(1-m) = c' \tag{3.22}$$

where p is the price of the product X, c denotes the marginal costs of X, n_i is the firm's market share, η is the elasticity of demand ($\eta = -p/QP'$) and m is the markup over marginal costs in the equilibrium.

Applying the pricing equation (3.22) to the KC model, we get six pricing inequalities, stating the output of X for all firms type headquartered in country i:

$$X_{ii}^{d}: \quad p_i(1-m_{ii}^{d}) \le l_i c \tag{3.23}$$

$$X_{ij}^{d}: \quad p_j(1-m_{ij}^{d}) \le l_i (c+\tau) \tag{3.24}$$

$$X_{ii}^{h}: \quad p_i(1-m_{ii}^{h}) \le l_i c \tag{3.25}$$

$$X_{ij}^{h}: \quad p_j(1-m_{ij}^{h}) \le l_j c \tag{3.26}$$

$$X_{ij}^{v}: \quad p_j(1-m_{ij}^{v}) \le l_j c \tag{3.27}$$

$$X_{ii}^{v}: \quad p_i(1-m_{ii}^{v}) \le l_j (c+\tau) \tag{3.28}$$

where

$$m_{ij}^{k} = \frac{X_{ij}^{k}}{X_{jc}} = \frac{p_j X_{ij}^{k}}{\beta M_j} \tag{3.29}$$

$$m_{ii}^{k} = \frac{X_{ii}^{k}}{X_{ic}} = \frac{p_i X_{ii}^{k}}{\beta M_i} \qquad k = d, h, v \tag{3.30}$$

are markups over marginal costs in the equilibrium and equal type-d, type-h and type-v firm's market shares in countries i and j, since utility is given by a Cobb-Douglas function homogeneous of degree one and the price elasticity of demand is 1. The pricing inequalities for firms headquartered in country j are defined similarly. By substituting markups in the pricing inequalities, we obtain the outputs for X produced in country i:

[4] For more details on the Cournot model see e.g. Vives (2000, chapter 4).

$$X \geq \beta M_i \frac{p_i - l_i c}{p_i^2} \qquad \text{for } X_{ii}^d, X_{ii}^h, X_{ji}^h, X_{ji}^v \tag{3.31}$$

$$X \geq \beta M_j \frac{p_j - l_j (c + \tau)}{p_j^2} \qquad \text{for } X_{ij}^d, X_{jj}^v \tag{3.32}$$

Analogous inequalities hold for goods produced in country *j*.

ii. *Free entry condition*

The free market entry condition is given by zero profit conditions stating the number of each type of firms in equilibrium. This can be expressed as the requirement that markup revenues are less than or equal fixed costs[5]:

$$N_i^d : p_i m_{ii}^d X_{ii}^d + p_j m_{ij}^d X_{ij}^d \leq l_i G + s_i F_i^d \tag{3.33}$$

$$N_j^d : p_j m_{jj}^d X_{jj}^d + p_i m_{ji}^d X_{ji}^d \leq l_j G + s_j F_j^d \tag{3.34}$$

$$N_i^h : p_i m_{ii}^h X_{ii}^h + p_j m_{ij}^h X_{ij}^h \leq l_i G + s_i F_i^h + l_j G + s_j F_j^h \tag{3.35}$$

$$N_j^h : p_j m_{jj}^h X_{jj}^h + p_i m_{ji}^h X_{ji}^h \leq l_i G + s_i F_i^h + l_j G + s_j F_j^h \tag{3.36}$$

$$N_i^v : p_i m_{ii}^v X_{ii}^v + p_j m_{ij}^v X_{ij}^v \leq l_j G + s_i F_i^v + s_j F_j^v \tag{3.37}$$

$$N_j^v : p_j m_{jj}^v X_{jj}^v + p_i m_{ji}^v X_{ji}^v \leq l_i G + s_i F_i^v + s_j F_j^h \tag{3.38}$$

If the outputs are positive, then (3.31) and (3.32) hold with equality and substituting them into (3.33) – (3.38) yields following quadratic inequalities stating the profit of each type of firms in equilibrium:

[5] Monopolistic competition literature quite often makes an assumption of the number of firms to be a continuous variable. This assumption was used by the authors as well in this model, when they put a free entry inequality restricting the profit to nonnegative values to be a complement to a continuous variable stating the number of firms active in equilibrium.

$$\pi_i^d = \beta\left[M_i\left(\frac{p_i - l_i c}{p_i} \right)^2 + M_j\left(\frac{p_j - l_i(c+\tau)}{p_j} \right)^2 \right] - l_i G - s_i F_i^d \le 0 \quad (3.39)$$

$$\pi_j^d = \beta\left[M_i\left(\frac{p_i - l_j(c+\tau)}{p_i} \right)^2 + M_j\left(\frac{p_j - l_j c}{p_j} \right)^2 \right] - l_j G - s_j F_j^d \le 0 \quad (3.40)$$

$$\pi_i^h = \pi_j^h = \beta\left[M_i\left(\frac{p_i - l_i c}{p_i} \right)^2 + M_j\left(\frac{p_j - l_j c}{p_j} \right)^2 \right] - l_i G - s_i F_i^h - l_j G - s_j F_j^h \le 0 \quad (3.41)$$

$$\pi_i^v = \beta\left[M_i\left(\frac{p_i - l_j(c+\tau)}{p_i} \right)^2 + M_j\left(\frac{p_j - l_j c}{p_j} \right)^2 \right] - l_j G - s_i F_i^v - s_j F_j^v \le 0 \quad (3.42)$$

$$\pi_j^v = \beta\left[M_i\left(\frac{p_i - l_i c}{p_i} \right)^2 + M_j\left(\frac{p_j - l_i(c+\tau)}{p_j} \right)^2 \right] - l_i G - s_i F_i^v - s_j F_j^h \le 0 \quad (3.43)$$

Each of the inequality (3.39) – (3.43) holds with equality if a firm type is active in equilibrium, and holds with inequality otherwise.

From (3.39) – (3.43) it can be seen that type-*h* firms have higher markup revenues than type-*d* or type-*v* firms, since the latter bear transport costs but at the same time, type-h firms have higher fixed costs than type-*d* and type-*v* firms.

When factor prices are different in two countries with similar sizes, single plant firms (either type-*d* or type-*v* firms) have a comparative advantage over the horizontal multinationals, since they draw the factor of production only from one country and thus can locate single plant in the low cost country, whereas horizontal multinationals draw factors of production from both countries and thus they have to incur high costs to locate a plant in the high cost country. Similarly, larger market favors again single plant firms, since they incur only trade costs on relatively small amount of output exported to the small market abroad. On the other hand, horizontal multinationals would have to incur high costs to install the production capacities.

An increase in total world income will increase the multinationals' profitability relative to profitability of national firms due to transport costs and is associated with the switch from high variable costs export to high fixed costs foreign plant, increasing the number of type-*h* firms.

When single plant firms dominate, the question of type-*d* versus type-*v* firms depends on factor price equalization reasoning, but not much on the market sizes effects. If factor prices differences are enough sufficient to outweigh any fragmentation costs, than a type-*v* firm headquartered in the skilled labour abundant country has lower fixed costs than a type-*d* firm headquartered in the other country, since fixed costs are assumed to be skilled labour intensive relative to homogenous product *Y*.

The type-*v* firm is most likely to emerge when the home country is small and skilled labour abundant. These stems from the fact that the fixed costs at firm level that give rise to multi plant economies of scale are relatively skilled labour intensive and are mainly incurred in the headquarters, therefore it pays to locate the headquarters in a skilled labour abundant country in order to exploit price factor differences. On the other hand, the location of a single plant depends predominantly on the market size. The bigger the local market, the more output is used to serve the local market, reducing the aggregate transport costs.

3.2.3 Simulation Results

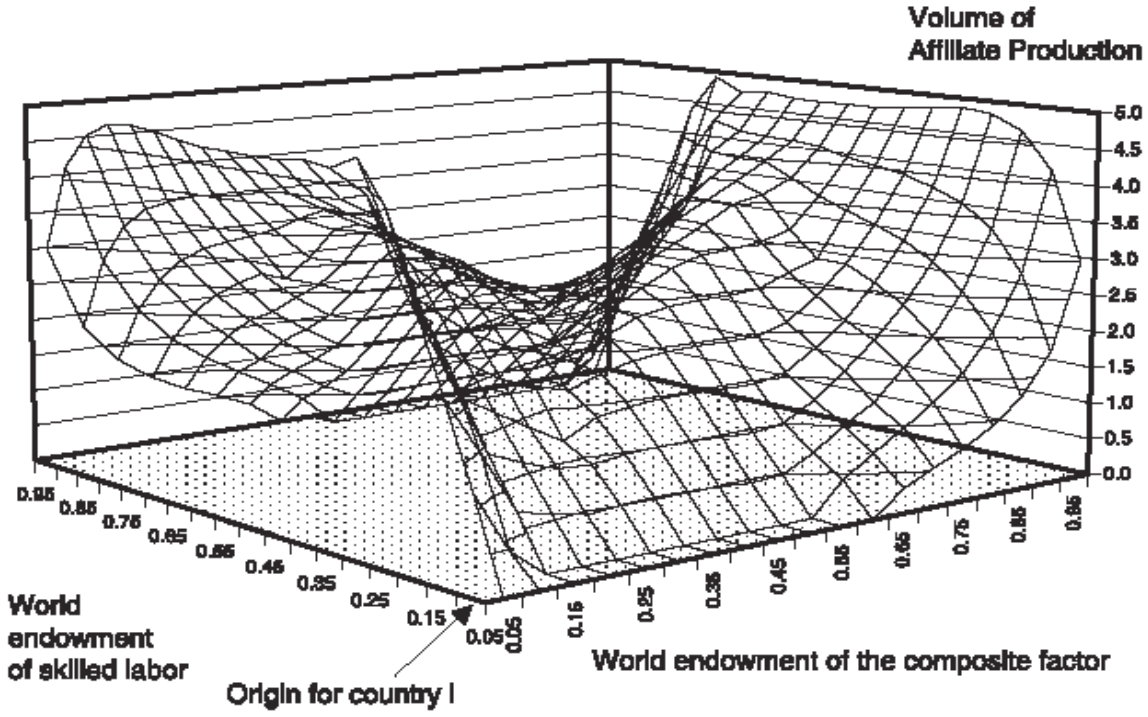
Due to the endogeneity of variables and complexity of the model, the comparative statics is of limited use here. Instead, Markusen et al. (1996) and Markusen (1997, 2002) used special software solver, Mathematical Programming System for General Equilibrium (MPS/GE), to calibrate the KC model with different values of parameters in order to obtain equilibrium regimes (i.e. types of firms active in equilibrium).

The authors calibrated the knowledge-capital model for both the number of multinational types active in equilibrium and the affiliate production in equilibrium. Representative simulation results are demonstrated with a series of world Edgeworth box diagrams. Here, I will limit the discussion on the simulation results for the affiliate production[6], since all testable predictions are derived from this.

Figures 1 presents simulation results on world affiliate production with moderate transport costs:

[6] The term affiliate production, affiliate sales and FDI are used interchangeably.

Figure 1: Volume of Affiliate Production under Moderate Transport Costs



Source: Markusen (2002, p. 146)

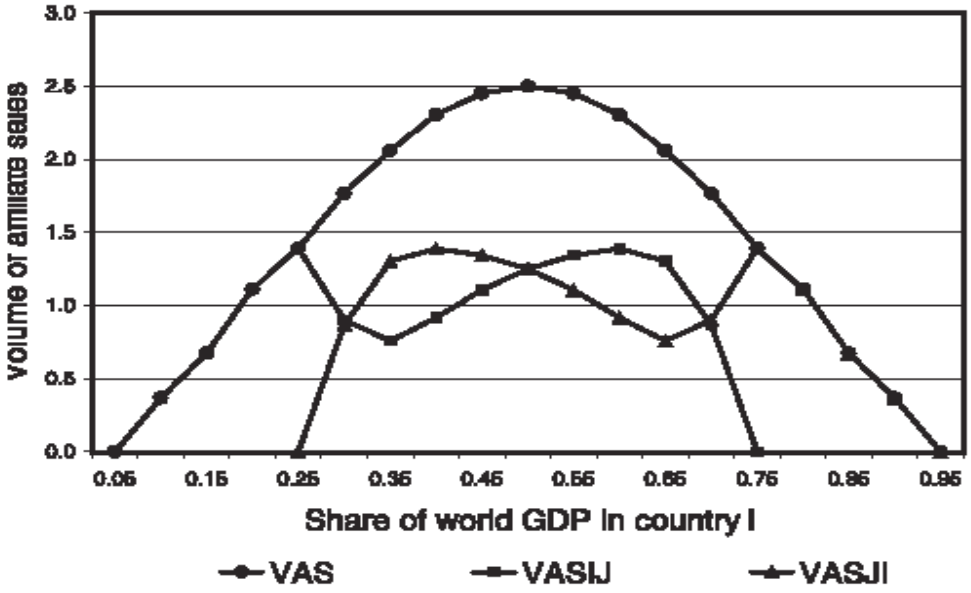
Figure 1 represents world Edgeworth box that indexes the world endowment of factors of production with the world endowment of skilled labour on one axis of the base and the composite (unskilled labour) on another axis of the base. The vertical axis measures the real volume of affiliate production of plants in country *j* of multinationals headquartered in country *i* (horizontal or vertical type) and vice versa. The total world endowments and size are held constant and any point within the box is a division between the countries *i* and *j*, with country *i* measured from the southwest corner and country *j* from the northeast corner. The countries have the same relative factor endowments but differ in size on the Southwest – Northeast diagonal. Above the diagonal, the home country (country *i*) is skilled labour abundant relative to the host country (country *j*). The approximate locus of equal incomes for the two countries lays on a line which is steeper than Northwest – Southeast diagonal and runs from approximately cell row 0.95/ column 0.30

southeasterly to the cell row 0.05/ column 0.70. The relative economic size of the country *i* grows along the diagonal from Southwest to Northeast.

Simulation of the affiliate sales in Figure 1 clearly indicates the nonlinearities in the knowledge-capital model. For instance, the effect of the differences in country size on affiliate size depends on the countries' relative endowments and vice versa.

Figure 1 shows that affiliate production follows an inverted U-shaped curve along the Southwest-Northeast diagonal. The total affiliate production is maximized in the midpoint of the SW-NE diagonal (in the centre area of the Edgeworth box), where both countries are identical in sizes and have similar relative endowments. Here, all firms are horizontal and half of the world output of good X is produced by affiliate plants and other half is produced by domestic plants of the horizontal multinationals. The affiliate production decreases towards either SW or NE corner, where the countries remain similar in relative endowments but differ in size. In this case, the national firms located in the large country will have the advantages as noted in previous section. The inverted U-shape of the horizontal affiliate sales can be better seen in Figure 2, which plots simulation results for affiliate sales along the SW-NE diagonal of the Edgeworth box, where countries have similar relative endowments but differ in sizes.

Figure 2: Volume of Affiliate Production along the Southwest-Northeast Diagonal

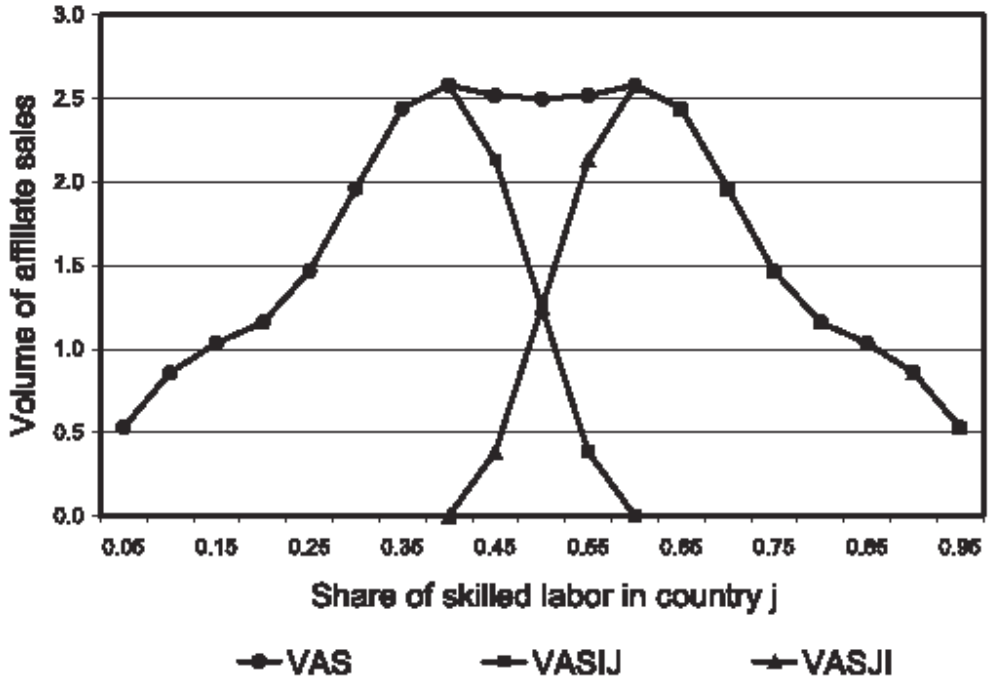


Source: Markusen (2002, p. 149)

VAS is the total volume of affiliate sales, *VASIJ* is the volume of affiliate sales of horizontal MNEs in country *j* with headquarters in country *i* and *VASJI* is similarly defined. Figure 2 reveals the non-monotonic characters of affiliate sales for the individual countries, with highest affiliate sales when the home country is moderately small ceteris paribus.

Coming back to Figure 1, it can be seen that the total affiliate production is highest in the Northwest and Southeast areas of the Edgeworth box, where one country is both moderately small and skilled labour abundant. Here, most multinationals are vertical headquartered in the small, skilled labour abundant country with plants located in the larger, unskilled labour abundant countries. This implies that if only vertical multinationals are active in equilibrium, then all the world output of good *X* is produced by affiliate plants. Figure 3 plots the affiliate sales along the approximate equal income (country sizes) locus Northwest – Southeast.

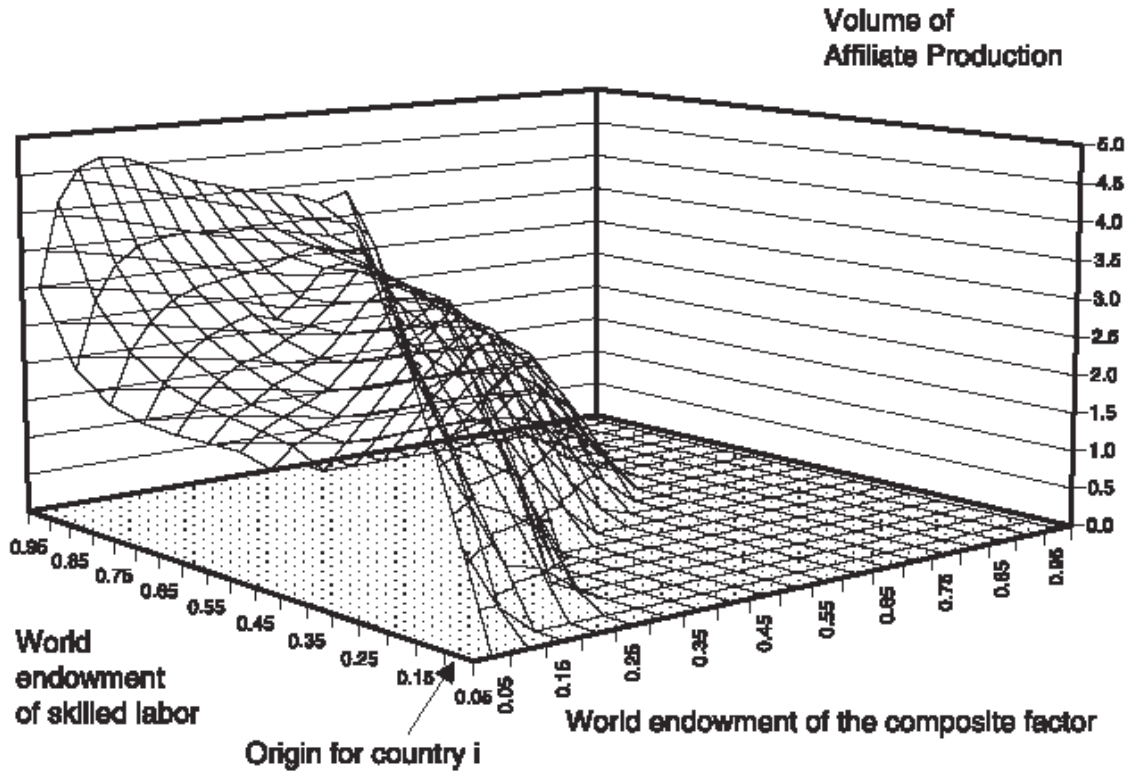
Figure 3: Volume of Affiliate Production along the Equal Income Locus Northwest - Southeast



Source: Markusen (2002, p. 150)

Figure 3 shows the inverted U-shaped character of affiliate sales when countries are equally large but differ in relative endowments. Here, the affiliate production is highest when the difference in relative endowments is rather moderate than extreme.

Figure 4: One Directional Affiliate Production by Country i Firms in Country j



Source: Markusen (2002, p. 148)

The fact that the affiliate production for both vertical and horizontal MNEs is highest when the headquarters are based in a moderately small and skilled abundant country can be well seen on Figure 4, which plots the affiliate sales in one direction only (i.e. affiliate production in country *j* of MNEs headquartered in country *i*).

3.3 Third Country Effects

3.3.1 Channels of Third Country Effects Transmission

For the empirical specification of the third country effects in my analysis, the study of Blonigen et al. (2005) is of special relevance, since it is to my knowledge the only study which deals with the inward FDI data. Other studies all focused on third country effects on outward FDI data. Blonigen et al. (2005) identified two potential channels through which third countries may affect FDI into a host country in a simple theoretical model of MNEs. The first channel refers to the parent market proximity effect (analogous to market potential for outbound FDI), i.e. to what extent the parent's country's proximity to other countries (markets) affect the parent's decision whether to service the host market through exports or through FDI. The second channel refers to the influence of the multinationals presented in a host country on each other (e.g. through positive spill-overs, agglomeration effects or crowding out effect).

A proxy for parent market proximity was constructed by Blonigen et al. (2005) in an analogous way as the market potential variable for outward data, i.e. as a distance weighted sums of third countries' GDP. However, whilst the market potential measures the host market proximity to additional surrounding countries, the parent market proximity measures the proximity of the parent country to other parent countries. Thus, this variable measures the ease with which a parent country can export from its home base.

From its definition, it is clear that the parent market proximity captures the effects of pure vertical FDI only. Thus, by including this variable, more complex form of FDI, such as export platform or complex vertical FDI are ruled out by assumption. This was not restrictive in the case of Blonigen et al. (2005), as they studied the U.S. inbound FDI. The U.S.A., due to their geographical position and country characteristics, are not likely to serve as export platform or to become one of the chains in complex vertical FDI.

Nonetheless, this is not true for the Czech Republic and therefore I will also include the market potential variable in the regression equation to capture more complex type of MNE's activities.

I will discuss these variables more later on in the empirical model specification, as the construction of their proxies is not technically difficult and their effect on inward FDI is rather straightforward.

The second channel through which third country may affect the FDI decisions is the influence of concurrent FDI from other parent countries on the MNE's production costs in the host country. This effect can be captured by spatial linkage, specifically by spatial lag model. Indeed, spatial lag is similar to time series autocorrelation, in which the dependent variable in one period is influenced by the dependent variable in previous period. However, unlike time series autocorrelation, spatial lag enables to assign the weights to variables of interest and thus provides a better specification of the interactions. For instance, countries that are likely to influence each other more (e.g. due to their proximity) are assigned with a larger weight and vice versa.

Since spatial interactions are not commonly used techniques in FDI estimation, it might be useful to briefly present the econometric mechanism behind before discussing the empirical specification of the spatial lag for inward FDI.

3.3.2 Spatial Dependence

When sample data have a locational component, two potential problems may arise that violate the Gauss-Markov assumptions of the regression models. Firstly, locational components may induce spatial dependence, i.e. sample data observed at one point in space may depend on values observed at other location. Secondly, there may be a spatial heterogeneity that refers to variation in relationships over space, i.e. for every observation made, a different relationship may hold due to the variance in either functional forms or the parameters.

The problem of spatial heterogeneity does not appear to be relevant for the case of FDI, therefore I will not discuss this issue further and will instead focus on the spatial dependence problem.

In spatial econometrics, spatial dependence can take two forms – as a spatially lagged dependent variable (Wy) or in the error structure ($E[\varepsilon_i\varepsilon_j]\neq 0$). The former is referred to as a spatial lag or spatial autoregressive model and the later is referred to as spatial error or spatial autocorrelation model.

The spatial lag model is appropriate for the assessment of the existence and strength of spatial interaction and takes a similar form as autoregressive time series model. The formal spatial lag regression model can be expressed as:

$$y = \rho Wy + X\beta + \varepsilon \tag{3.44}$$

where y is n elements vector of dependent variable, ρ is a spatial autoregressive coefficient ($\rho \in [-1;1]$), W is an $n \times n$ contiguity or spatial weights matrix, X is $n \times k$ matrix of explanatory variables, β is k element vector of coefficients and ε is an n element error terms vector.

A contiguity or spatial weights matrix is a fixed (non-stochastic) and positive matrix, that specifies for each location i (as the row) the neighbours (as the columns) corresponding to non-zero elements w_{ij}:

$$[Wy]_i = \sum_{j=1,..,N} w_{ij} y_j \tag{3.45}$$

The elements are row standardized in matrix W, such that for i, $\sum_j w_{ij} = 1$ and by convention, $w_{ii} = 0$, i.e. a location is never a neighbour of itself. The spatial matrix may be interpreted as a weighted average of the neighbours, with w_{ij} being the weights that are exogenous to the model. There is a quite wide range of spatial weights specification, for instance, weights can be based on whether two locations share a common border (Coughlin and Segev 2000), on distance decay (i.e. inverse distance or inverse distance squared) (Blonigen et al. 2007, Garretsen and Peeters 2008), on the structure of a social network, on economic distance, or on trade based interaction measures (Anselin 1999) etc. Despite a wide variety of possible spatial weights specifications, weights derived from contiguity or geographical arrangements are most widely used, since their exogeneity is unambiguous.

If the spatial lag is significant in equation (3.44), then ignoring spatial effects means that an explanatory variable has been omitted and the estimates of β are biased and statistical inferences are invalid.

The second form of spatial dependence is the spatial dependence in the regression disturbance term, referred to as spatial error or spatial autocorrelation. This model is appropriate

when the intention is to correct for potentially biasing influence of spatial autocorrelation due to the use of spatial data. The model can be formally expressed as

$$y = X\beta + \varepsilon \tag{3.46}$$

where

$$\varepsilon = \lambda W\varepsilon + \mu \tag{3.47}$$

λ is the spatial autoregressive coefficient, $\lambda \in [-1;1]$, μ is n by 1 vector of error terms and other notation is as before. The variable λ measures the degree of spill-over of the shocks in neighbouring locations on the dependent variable through the disturbance term. If the spatial autocorrelation is ignored, then the statistical inferences are invalid, nonetheless, unlike the spatial lag, the estimates remain unbiased.

3.3.3 Spatial Lag Specification for inward FDI

Since my primary interest is to test for the existence and strength of spatial interactions in the inward FDI, I will follow the approach of Blonigen et al. (2005), leave out spatial autocorrelation and focus solely on spatial lag testing.

As mentioned above, the spatial lag can be represented by a term $\rho.W.FDI$, where ρ is spatial autoregressive (spatial lag) coefficient, measuring the strength and sign of spatial relationship in FDI; W is the n by n spatial lag weighting matrix, which is row standardized, block-diagonal with each block capturing a single year's observations and *FDI* is the vector of foreign direct investment into the Czech Republic. Thus, the term *W. FDI* can be interpreted as a proximity-weighted average of FDI from alternative countries into a host country. For any year $t \in [2003,2008]$, W_t can be defined as:

$$W_t = \begin{bmatrix} 0 & w_t(d_{i,j}) & w_t(d_{i,k}) \\ w_t(d_{j,i}) & 0 & w_t(d_{j,k}) \\ w_t(d_{k,i}) & w_t(d_{k,j}) & 0 \end{bmatrix} \tag{3.48}$$

where $w_t(d_{i,j})$ is a functional form of the weights between any two pair of parent countries *i* and *j*. I will follow the same convention as in Blonigen et al. (2005, 2007), Baltagi et al. (2007) and Garretsen et Peeters (2008) and choose a simple inverse distance function as a weight, where

the shortest distance within the sample (i.e. 174 kilometres between Brussels and Amsterdam) gets the weight of unity and all other distances within a sample a weight that declines with distance, i.e. $w(d_{i,j}) = {}^{174}\!/_{d_{i,j}}, \forall i \neq j$, with $d_{i,j}$ being the air distance between any two parent countries' capitals. As distance is time-invariant, it follows that $W_{2003} = W_{2004} = W_{2008}$. Thus, the full spatial weight matrix will take the form:

$$W = \begin{bmatrix} W_{2003} & 0 & 0 \\ 0 & . & 0 \\ 0 & 0 & W_{2008} \end{bmatrix} \tag{3.49}$$

As noted earlier, a spatial lag measures the impact of concurrent FDI from other countries on the FDI from the parent country in question. If ρ is negative, then it indicates a crowding out effect of third countries FDI, i.e. the increase in other multinationals activities in a host country will increase the marginal costs of the MNE from the parent country in question. On the other hand, a positive spatial lag signalizes the spill-over effects, i.e. more FDI from other countries may lower the marginal costs of host production due to spill-overs. Nonetheless, a spatial lag coefficient is capable of capturing the net effect third country FDI, i.e. both mechanisms can coexist.

3.3 Summary

This chapter described the theoretical background for the empirical model specification, namely the knowledge-capital model and the model with third country effects. In the first part of the chapter, I presented the knowledge-capital model, its assumptions, equilibrium conditions and simulation results. Given the assumptions, the equilibrium in the knowledge model was attained when four conditions were fulfilled: the market clearing conditions, the national income condition and the equilibrium conditions in sector *Y* and *X*. As the model had many endogenous variables, the authors used the complementary slackness form to state the equilibrium conditions in sector *X* and applied mathematical programming to solve the model.

The simulation results, in particular the Edgeworth boxes, have proven as a useful tool to envisage the conditions under which different patterns of internalization emerge. The results revealed that the total affiliate production of horizontal multinationals follows an inverted U-shaped curve and reaches the peak when the both parent and host are similar in size and skilled labour endowment. Nonetheless, the affiliate production of individual countries has a non-monotonic character, with highest affiliate production when both parent and host have similar skilled labour endowment but the parent is moderately small.

With respect to vertical multinationals, the simulation results indicated highest total affiliate production in the Northwest and Southeast area of the Edgeworth box, where the home country is both moderately small and skilled labour abundant. However, even though vertical affiliate production is driven by the differences in relative factor endowment, it tends to be higher when the differences are rather moderate than extreme.

In the second part of the chapter I focused on the third country effects for inbound FDI data and discussed the two channels through which third countries may affect inbound FDI: the parent and host market proximity and the influence of concurrent FDI in the host country on each other. The effect of market proximity variables is rather straightforward; therefore I postponed the discussion of the impact of these variables to the next chapter, where empirical models will be specified. Instead, I aimed at discussing the spatial interactions, which capture the impact of concurrent FDI in the host country on each other. This effect can be proxied by a spatial lag variable, with a negative spatial lag coefficient indicating crowding out effects of third country FDI and a positive spatial lag coefficient signalling positive spill-over effect.

4
Research Methodology

4.1 Introduction

This chapter presents the research methodology and specifies the empirical models to be tested. In the first section, I define the empirical specifications for two empirical regression models. The first, baseline model aims at investigating whether the multinationals invest into the Czech Republic for the purpose of exploiting the factor price differences or to gain the access to the foreign markets. In order to do so, I employ the empirical specification of the knowledge-capital model based on Carr et al. (2001) and Markusen and Maskus (2002a), since these specifications were driven from the formal theory of the knowledge-capital model and are probably the most frequently employed ones in studies of the knowledge-capital model. The second model aims at testing the effect of third countries on multinationals' activities in the Czech Republic. The empirical specification of the model is in line with Blonigen et al. (2005, 2007) and Garretsen et Peeters (2008) and represents a combination of parent country gravity variables and third country effects variables.

Following the empirical specification, in the next section I derive 11 testable hypotheses, stating the expected effect of each independent variable on affiliate sales (FDI stock). In the last section, I introduce the sources the data were collected from, the level of data aggregation and the econometric methods to be applied.

4.2 Empirical Model Specification

4.2.1 The Baseline Model

Following Carr et al. (2001) and Markusen and Maskus (2002a), the knowledge-capital empirical specification (Model 1) can be expressed as follows:

$$\begin{aligned} Sales_{ijt} &= \beta_0 + \beta_1 SizeSum_{ijt} + \beta_2 SizeDiff_{ijt}^2 + \beta_3 SkillDiff_{ijt} + \beta_4 SkillDiff_{ijt} SizeDiff_{ijt} \\ &+ \beta_5 InvestCost_{jt} + \beta_6 TradeCosts_{it} + \beta_7 TradeCosts_{jt} + \beta_8 TradeCosts_{jt} SkillDiff_{ijt}^2 \\ &+ \varepsilon_{ijt} \end{aligned} \qquad (4.1)$$

$$t = \{2003,....,2008\}$$
$$i = \{1,...,20\}$$
$$j = \{1\}$$

In Model 1, sub-index *i* denotes a parent (home country), whilst sub-index *j* refers to the host country, which is in all cases the Czech Republic. The parent (home) country is defined as the country where the headquarters of multinationals are located. For the list of parent countries refer to Appendix 1. The host country is defined as the country where affiliates of multinationals are located.

The dependent variable $Sales_{ijt}$ is the volume of affiliate sales in thousand Euros and represents a proxy for the activity of affiliates of MNEs. I have decided to use this measure since it is a direct measure of MNE's foreign activity and also for consistency reasons, as the theory generates testable predictions on affiliate sales. I also include a second measure of FDI stocks to verify the robustness of the results.

The first two independent variables, $SizeSum_{ijt}$, $SizeDiff_{ijt}^2$ account for sum of real GDP in the parent and the host countries and the squared difference in real GDP between the parent and the host countries. According to the theory, these variables exert influence only on horizontal FDI, since vertical FDI are indifferent to the joint market size or the size difference between countries. The sum of real GDP is expected to have a positive sign, since it measures the size of the market (total demand). Carr et al. (2001) even posited a stronger hypothesis by assuming the elasticity of affiliate sales to the joint market size to be greater than one. The squared difference in the market size was introduced to capture the inverted U-shape of horizontal affiliate sales along the SW-NE diagonal, with a peak when the countries

have identical market sizes (see Figure 2). Therefore, the expected sign of this variable is negative.

The third variable $SkillDiff_{ijt}$ measures the skilled labour difference between the parent and the host countries ($SkillDiff_{ijt} = \left|Skill_{it} - Skill_{jt}\right|$). A positive sign of the variables indicates the presence of the vertical FDI, since the theory postulates that vertical MNEs tend to headquarter in a skilled labour abundance country. On the other hand, a negative sign provides an evidence for a horizontal component of the KC model, as this type of foreign activities is driven by similarities in skilled labour between the countries.

The impact of $SizeDiff_{ijt}$ and $SkillDiff_{ijt}$ on affiliate sales can be assessed in more detail by using the partial derivates:

$$\partial Sales_{ijt} / \partial SizeDiff_{ijt} = 2\beta_2 SizeDiff_{ijt} + \beta_4 SkillDiff_{ijt} \quad (4.2)$$

$$\partial Sales_{ijt} / \partial SkillDiff_{ijt} = \beta_3 + \beta_4 SizeDiff_{ijt} + 2\beta_8 TradeCost_{jt} \quad (4.3)$$

From (4.2) follows that when the countries have the same relative factor endowments, the marginal change of the affiliate sales on the size difference depends only on $2\beta_2 SizeDiff_{ijt}$. The theory predicts that when a host country is smaller, i.e. $SizeDiff_{ijt} > 0$, the horizontal activity between the host and the parent will decrease due to the decline in economies of scale, whilst the fixed costs remain unchanged. The analogous explanation holds when the host country becomes bigger, i.e. $SizeDiff_{ijt} < 0$. This confirms the negative expected sign of coefficient β_2 that was discussed earlier.

Equation (4.3) indicates that the overall effect of the skill difference on the affiliate sales depends on the skill difference itself, the market size difference the host country trade costs. When both countries have the same market size and the host country trade costs is zero, the expected sign of β_3 follows the same logic as discussed above, i.e. a positive sign provides an evidence for vertical FDI and a negative sign provides an evidence for horizontal FDI.

The coefficient β_4 accounts for the interaction term $SkillDiff_{ijt} SizeDiff_{ijt}$, a product between the skilled labour difference and market size difference between the host and the parent country and captures vertical FDI. According to the knowledge-capital model, when a parent country is both large and skilled labour abundant, the affiliate export (sales) of vertical MNEs will drop due to the growth in trade costs. This implies that

when $SkillDiff_{ijt} > 0$, the vertical FDI will diminish the bigger the parent country will become. Indeed, the knowledge-capital model predicts highest vertical FDI when the parent country is moderately small and skilled labour abundant. These suggest a negative sign for the coefficient β_4.

The other two variables, $TradeCost_{it}$, $TradeCost_{jt}$ account for the trade costs in the parent and the host countries. The marginal effect of host country trade costs on affiliate sales is given by

$$\partial Sales_{ijt} \Big/ \partial TradeCost_{jt} = \beta_6 + \beta_8 SkillDiff_{ijt}^2 \qquad (4.4)$$

From (4.4.) it follows that the host country trade costs affect the affiliate sales directly *per se*, and indirectly, via the interaction with squared skilled labour difference. A positive sign for the coefficient β_6 provides support for horizontal FDI, since higher trade costs make exports an unattractive option. The coefficient β_8 of the interaction term also captures the horizontal FDI. Carr et al. (2001) assumed a negative sign on this variable, since difference in relative skilled labour endowment reduces the horizontal FDI and thus decreases the positive effect of host country trade costs on the horizontal FDI. Nevertheless, Carr et al. (2001) marked this hypothesis as a weak one, since the effect of host country trade costs on affiliate sales is not symmetric around the SW-NE diagonal but it is highest when the parent country is moderately skilled labour abundant.

The parent trade costs are expected to discourage vertical FDI in favour of horizontal FDI due to higher costs of shipping the goods from the host country back to the parent country. The simulation results of the change in trade costs on affiliate production also reveals nonlinearities between the parent trade costs and skilled labour differences. However, this interaction term is not included in the model as Carr et al. (2001) noted a high collinearity between the interaction term and skilled labour difference variable.

4.2.2 The Spatial lag Model

As noted in the introduction, the spatial lag model aims at testing the existence and strengths of third country effects on inward FDI. To meet this objective, it is not appropriate to include the third country effects into the knowledge-capital model, since

the KC model was drawn upon a theoretical background and addresses only a specific set of variables. Instead, I employ an empirical specification of Blonigen et al. (2005), as they tested the third country effects for inbound FDI. In their model, the authors included a set of commonly used parent gravity variables and a quadratic time trend to capture the tendency of affiliate sales (FDI stocks) to grow over time. No host country variables were included since the Czech Republic was in all cases the only host country and the host country variables turned insignificant once a time trend was included. Thus, the spatial lag model (Model 2) takes the form as follows:

$$\begin{aligned} Sales_{ijt} &= \beta_0 + \beta_1 Population_{it} + \beta_2 GDP_{it} + \beta_3 Skill_{it} + \beta_4 TradeCosts_{it} + \beta_5 Dis\tan ce_{ij} \\ &+ \beta_6 Trend + \beta_7 Trend^2 + \beta_8 ParentMarketProximity_{it} + \beta_9 HostMarketProximity_{jt} \\ &+ \rho.\mathbf{W}.Sales_{ijt} + \varepsilon_{ijt} \qquad (4.5) \\ t &= \{2003,....,2008\} \\ i &= \{1,...,20\} \\ j &= \{1\} \end{aligned}$$

In Model 2, $Population_{it}$ denotes a population of parent country *i* in year *t*, GDP_{it} stands for parent's country *i* real GDP in year *t*, $Skill_{it}$ for parent's *i* skilled labour endowment in year *t*, $TradeCosts_{it}$ denotes parent's *i* trade costs in year *t*, $Dis\tan ce_{ij}$ measures the distance between the capital cities of parent *i* and the Czech Republic. All these variables but *Population* are defined in the same way as in Model 1. Lastly, *Trend* and $Trend^2$ stand for linear and quadratic time trend over the years 2003-2008.

As my aim is to determine the relevance and influence of the third country variables on MNE's activities and to test for impact of gravity variables, I will discuss the gravity variables possible influence and direction of their impact on affiliate sales and will restrict my discussion solely on the third country effects.

The coefficient β_8 measures the effect of parent country's proximity to non-host markets. The construction of this variable is taken from Blonigen et al. (2005), who found that the distance weighted sum of adjacent countries' GDPs as a measure for market proximity has the best fit for the data. The parent market proximity for parent *i* is defined as:

$$ParentMarketProximity_{it} = \sum_{i \neq k} {}^{174}\!/_{d_{ik}} GDP_{kt} \qquad (4.6)$$

where d_{ik} is the distance between the parent country *i* and another parent country *k* in the sample (refer to Appendix 1 for the list of parent countries); 174 kilometres is the shortest air distance between the pair of parent countries in the sample (Brussels and Amsterdam)

and GDP_{kt} is the real GDP of parent country *k* in time *t*.Thus, this variable measures the ease with which a parent country can export from its home base and provides evidence for vertical FDI. The expected sign of parent market proximity is positive.

The next variable, host market proximity (market potential), captures the effect of export platform FDI (a complex form of horizontal FDI) and is constructed in line with Baltagi et al. (2005), Blonigen et al. (2007) and Garretsen and Peeters (2008). Host market proximity for host country *j* is defined as:

$$HostMarket\,\mathrm{Pr}oximity_{jt} = \sum_{j \neq l} 252 \big/ d_{jl}\, GDP_{lt} \qquad (4.7),$$

where d_{jl} is the distance between the Czech Republic and another adjacent country *k* (an adjacent country is a Central and Eastern European country being a member of the European Union); 252 kilometres is the shortest air distance in the sample (between Prague and Vienna) and GDP_{lt} is real GDP of host country *l* in time *t*.

This variable captures the export platform FDI, since this type of investment is motivated by the size of proximate markets it may serve by exporting from the host country in question. In addition, it may also be relevant for complex vertical FDI, where multinationals fragment production activities and locate them in several geographic regions. This type of multinational activity is driven by the availability of low cost vertical suppliers. Therefore, if two adjacent host countries have similar supply network characteristics, the multinationals may find it profitable to set up part of the production chain in both countries, leading to a geographical clustering of complex vertical FDI. Blonigen et al. (2007) argued that the level of geographical clustering of FDI is highly correlated with host market proximity and hence host market proximity can proxy for both variables. Therefore, if host market proximity captures geographical clustering effect, the expected sign would be positive.

The last variable is a spatial lag that measures the impact of concurrent FDI from other parent countries on FDI from the parent country in question. ρ is a spatial lag coefficient, **W** is a spatial weight matrix, taking a form as defined in Chapter 3 and $Sales_{ijt}$ is the volume of affiliate sales in the Czech Republic in thousand Euros. A positive spatial lag coefficient ρ indicates spill-over effects whereas negative ρ infers crowding out effect (as discussed in the previous chapter).

In order to test for the significance of the third country effects, I will test the robustness of the results of Model 2 when excluding the third country variables and when including these variables.

Summary of expected signs of independent variable in Model 1 and Model 2 (excluding gravity variables) is exhibited in Table 2.

Table 2: Expected Signs of Independent Variables

Model 1

Variable	*Horizontal FDI*	*Vertical FDI*
$SizeSum_{ijt}$	(+)	0
$SizeDiff_{ijt}^{2}$	(-)	0
$SkillDiff_{ijt}$	(-)	(+)
$SkillDiff_{ijt} SizeDiff_{ijt}$	0	(-)
$TradeCost_{it}$	(+)	(-)
$TradeCost_{jt}$	(+)	0
$TradeCost_{jt} SkillDiff_{ijt}^{2}$	(-)	0
$Dist_{ij}$	(+)/(-)	(-)

Model 2

Variable	*Horizontal FDI*	*Vertical FDI*	*Export Platform FDI*	*Complex Vertical FDI*
$ParentMarket\ \mathrm{Pr}oximity_{it}$	0	(+)	0	0
$HostMarket\ \mathrm{Pr}oximity_{jt}$	0	0	(+)	(+)/0

4.2.2 Hypotheses Construction

The empirical specifications outlined above generate testable hypotheses. These hypotheses are formulated below, with null hypothesis stating no relationship between

two variables. The independent variable relevant for the hypothesis testing is stated in parentheses.

Hypothesis 1: A bilateral increase in parent and host country incomes (GDPs) increases sales of affiliates of parent country horizontal firms. ($SizeSum_{ijt}$)

Hypothesis 2: A convergence in income (GDP) between host and parent country increases sales of affiliates of parent country horizontal firms. ($SizeDiff_{ijt}^{2}$)

Hypothesis 3: A convergence in skilled labour endowment between host and parent country increases sales of affiliates of parent country horizontal firms whereas a divergence in skilled labour endowment between host and parent country increases sales of affiliates of parent country vertical firms. ($SkillDiff_{ijt}$)

Hypothesis 4: Parent country vertical affiliate sales are highest when parent country is both moderately small and skilled labour abundant. ($SkillDiff_{ijt} SizeDiff_{ijt}$)

Hypothesis 5: An increase in parent country trade costs decreases sales of affiliates of parent country vertical firms in favour of parent country horizontal firms. ($TradeCost_{it}$)

Hypothesis 6: An increase in host country trade costs increases sales of affiliates of parent country horizontal firms. ($TradeCost_{jt}$)

Hypothesis 7: Bilateral increase in host country trade costs and skilled labour difference between host and parent countries reduces sales of affiliates of parent country horizontal firms. ($TradeCost_{jt} SkillDiff_{ijt}^{2}$)

Hypothesis 8: Exclusion of variable capturing third country effects leads to omitted variable bias of the results.

Hypothesis 9: Parent proximity to third-country markets increases sales of affiliates of parent country vertical firms. ($ParentMarket\ \Pr oximity_{it}$)

Hypothesis 10: Host proximity to third-country markets increases sales of affiliates of parent country export platform firms and of complex vertical firms. ($HostMarket\ \Pr oximity_{jt}$)

Hypothesis 11: Presence of other FDI in host country may crowd out further FDI or induce positive externalities in host country. ($\mathbf{W}.Sales_{ijt}$)

4.3 Data Sources and Data Estimation Approach

4.3.1 Data Sources

In my data set, I use the panel annual data on affiliate sales and FDI stock of affiliates of foreign parent companies operating in the Czech Republic. The firm level data have been obtained from the commercial database Amadeus, collected by Bureau van Dijk. This database contains comprehensive financial information on over 14 million companies across Europe. For the purpose of my empirical analysis, I selected all foreign affiliates located in the Czech Republic, with foreign shareholder(s) owning at least 51% of the company. This selection criterion rendered a panel of 4 023 companies over a time span period from 2003 to 2008. However, as the data for more than half of companies in the selection were incomplete, the final panel of company data reduced to 1 466 companies.

The data compiled from Amadeus contained following information on the companies: company name, affiliate sales, total assets, number of employees, shareholders origin and their percentage of ownership and affiliates and shareholders NACE Rev.2 sector classification.

As already mentioned in previous section, I have decided to measure the MNEs activity via two proxies – affiliate sales and FDI stock. Affiliate sales are readily available for all companies from Amadeus in EUR thousands. As opposed to affiliate sales, data on FDI stock were not available on Amadeus, hence I computed them. OECD (1999) recommends FDI stock to be measured as the contribution of parent companies to their subsidiaries' total assets. Based on this definition, I computed the FDI stock for the companies in the sample for a respective year as a product of a company's total assets and the shareholder's percentage of ownership. Unfortunately, the percentage of ownership is only available for the last year data and thus I had to make an assumption of invariant ownership structure over the period 2003-2008. This assumption is not a strong one, as the probability of companies changing their ownership structure is rather low. However, due to this caveat, I will focus in the following chapter on the estimation results for affiliate sales and will report the results on FDI stock only for informative purpose.

Both affiliate sales and FDI stocks are transformed in real value via year-on-year GDP deflator provided by the Czech Statistical Office.

The independent variables are measured in line with Carr et al. (2001). Economic size of parent and host countries is proxied by real GDP in EUR millions, with 2000 as the base

year. The data are taken from Eurostat database. Skilled labour endowment is measured as a ratio of the sum of occupational categories 1 (legislators, senior officials and managers), 2 (professionals) and 3 (technicians and associate professionals) to total employment. The data were collected from the database of International Labour Organization.

Parent and host country trade costs were not proxied in the same way as Carr et al. (2001) due to the unavailability of data. Instead, I followed the approach of Gieshecker and Görg (2005) and Anghel (2007) and proxied the trade cost as the ratio of imports at CIF (i.e. at values including cost, insurance and freight) to export at FOB (free on board). The parent trade costs are then calculated as:

$$TradeCost_{it} = import_{ijt}^{CIF} \Big/ \exp ort_{jit}^{FOB} \tag{4.8}$$

Analogically, host country trade costs are defined as:

$$TradeCost_{jt} = import_{jit}^{CIF} \Big/ \exp ort_{ijt}^{FOB} \tag{4.9}$$

The data on import and export were downloaded from the Direction of Trade Statistics database of International Monetary Fund.

The data on population were compiled from OECD statistical database.

Finally, distance is measured as a geographical distance between two countries capital cities in kilometres. The data were taken from Macalester College economic research website.

Refer to Appendix 3 for the summary of variables definition and units of measurement.

4.3.2 Data Estimation Approach

Although the primary aim of this master thesis is to test the pattern of internalization at disaggregated firm level, I have decided to include empirical estimation of the data at different level of aggregation to comparison purposes.

As for the knowledge-capital model, the regression analysis is run on data at three levels of aggregation. Firstly, I summed up the individual firm data from a given parent country to obtain affiliate sales and FDI stock aggregated on country-by-country basis. Secondly, I summed up individual firm data from a given parent country and from a given industry to obtain affiliate sales and FDI stock data per sector of activity at country level. Lastly, I sorted data at firm level per sector of activity. Initially, I also sorted the firm level data at country level but the regression specification tests diagnosed collinearity for skill difference, the

second interaction variable and the distance, therefore I decided not to carry a regression for this category. The regression is run for both affiliate sales and FDI stock data for all levels of aggregation.

In order to determine the appropriate regression model, I ran the Breusch-Pagan test to verify the homoskedasticity of the data. The tests revealed heteroskedasticity for the majority of data. Even after the transformation of the data to logarithm, the heteroskedasticity was not removed. If the data are heteroskedastic, i.e. the variance of disturbances is not constant, the OLS estimation will still be unbiased and consistent, but will not be efficient any more. An alternative to OLS estimation for panel data in the presence of heteroskedasticity are Fixed effects (FE) or Random Effects (RE) models as they allow for heteroskedasticity across units. The FE model relaxes the assumption of constant regression function over time and space and the explanatory power of the model depends on the variation within the unit. The difference between the FE and RE models is that random effect model assumes no correlation between individual specific effects and independent variables, whereas fixed effects model assumes individual specific effects to be correlated with the independent variables. If the random effect holds, than the estimate is more efficient than the fixed effects model. However, the RE estimate is not consistent if the assumption fails to hold.

In order to choose among RE and FE model, I ran a Hausman specification test that evaluated the significance of RE estimator versus FE estimator. The p-value for all cases was below 10% level, rejecting the null hypotheses of the significance of random effect model in favour of FE model. In addition, the F-test that all disturbances are jointly zero reported also small p-value below 10% with high F-values, indicating significant individual effects.

An indisputable advantage of the use of FE model over the RE model is that FE estimator enables to control for unobserved heterogeneity of independent variables. As the Hausman and F-test were both in favour of the FE estimator, I will employ the FE estimator to test the knowledge-capital model. The data are tested in a data analysis and statistical software STATA, version 9.1.

As for the third country effects, I aggregated the data at country level and sorted them per sector of activities. Such an aggregation represents a reasonable compromise between the aggregated and firm level data. The reason why I did not test for third country effects for firm level data was due to the complexity of computation of a spatial lag. The third country effects are tested via OLS and maximum likelihood estimator, in line with Blonigen et al. (2005, 2007), Baltagi et al. (2007) and Garretsen et Peeters (2008). Unlike the knowledge-

capital model, the data for Model 2 do not suffer from heteroskedasticity after transforming them into natural logarithm and thus the OLS estimation can be employed without the loss of efficiency. The data will be again tested in statistical software STATA, version 9.1.

4.4 Conclusion

In this chapter, I presented the research methodology to be pursued for the empirical testing of the data.

In the first part, I defined two empirical estimation models. The first, baseline model was derived from the knowledge-capital theoretical model and aimed at disentangling the two motivation of the multinationals activity in the Czech Republic: the factor-price difference exploitation motive (vertical integration) and the market access motive (horizontal integration). This model stipulates effects of market size, skilled labour endowment and trade costs on affiliate sales (FDI stocks). The empirical specification of the model was adopted from Carr et al. (2001) and Markusen and Maskus (2002a), since these specifications are the most widely used ones in the empirical studies of the knowledge-capital model.

Following, I specified an spatial lag model to test the variables capturing possible third country effects. These variables concern parent market proximity, host market proximity and spatial lag. The empirical model was specified in the same way as Blonigen et al. (2005).

Once the empirical models and variables were specified, I formulated 11 testable hypotheses stating the relationship between each independent variable and affiliate sales. These hypotheses were subject to empirical testing and the results are presented in the following chapter.

In the following section, I introduced the sources the data were compiled from. The data on affiliate sales and FDI stocks were collected from Amadeus, a database containing detailed financial information on over 14 million companies across Europe. I selected data from the companies with foreign affiliate located in Czech Republic with ownership of at least 51% for the period from 2003 to 2008. Independent variables were taken from various sources.

Lastly, I defined the econometric method that will be employed for testing of the models. The baseline model will be tested via fixed effects model, whereas the spatial lag model will be tested by the maximum likelihood method and ordinary least squared estimation.

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5
Research Empirical Results

5.1 Introduction

This chapter presents the estimation results of the knowledge-capital model (baseline model) and third country effects model (spatial lag model) on a panel of annual data on affiliate sales and FDI stock of affiliates of foreign parent companies in the Czech Republic for the period from 2003 to 2008.

The chapter starts with the preliminary data analysis, giving some insights in patterns of internalization of multinationals in the Czech Republic.

The empirical results are presented and interpreted in the following section. As mentioned in the previous chapter, the regression of the baseline model is run for three different levels of aggregation: country aggregation, sectoral aggregation per countries and sectoral aggregation at firm-level. The results were consistent across the sectoral aggregation per parent countries and per individual firms for a number of sectors. In overall, they indicate the presence of both horizontal and vertical motive, with the prevalence of either motive varying across the sectors and the levels of aggregation. The results of the alternative model turned out to be highly sensitive to geographical composition of the data and so did the omitted variable bias.

5.2 Preliminary Data Analysis

Before carrying out the econometric analysis of the data, I found it would be helpful to provide some insight in the data via descriptive statistics. The geographical and sectoral composition of the data gives a rough idea about the patterns of internalization.

Table 3 presents the geographical composition of the multinationals activities in the Czech Republic for four indicators: FDI stocks, affiliate sales, total number of employees and number of affiliates for 2008. The table revealed that over 80% of affiliate sales and FDI stocks come from the European Union countries, with Germany, Netherlands, Austria and France taking the top four positions.

Table 3: Geographical Breakdown of the MNEs Activities in the Czech Republic, 2008 Data

Country	**FDI stocks**	**Affiliate sales**	**Employees**	**Number of affiliates**	**FDI stocks**	**Affiliate sales**	**Employees**	**Number of affiliates**
	(EUR mn)	(EUR mn)	(thousands)		(%)	(%)	(%)	(%)
Total	*87 781*	*5 919 284*	*337 702*	*1 466*	*100%*	*100%*	*100%*	*100%*
Countries breakdown:								
Germany	23 789	1 812 104	73 007	286	27%	31%	22%	20%
Netherlands	17 525	1 107 958	66 408	245	20%	19%	20%	17%
France	9 783	503 963	40 450	132	11%	9%	12%	9%
Austria	6 770	596 417	25 522	182	8%	10%	8%	12%
Great Britain	6 624	8 029	6 745	88	8%	0%	2%	6%
Japan	4 911	123 771	8 773	32	6%	2%	3%	2%
Switzerland	3 913	280 326	22 367	72	4%	5%	7%	5%
U.S.A.	3 731	166 073	18 046	112	4%	3%	5%	8%
Spain	1 876	135 312	9 973	44	2%	2%	3%	3%
Sweden	1 527	115 318	9 647	43	2%	2%	3%	3%
Slovakia	1 516	105 329	5 923	31	2%	2%	2%	2%
Belgium	1 443	117 244	8 939	47	2%	2%	3%	3%
Luxembourg	1 410	139 213	10 040	54	2%	2%	3%	4%
Denmark	801	80 099	10 613	26	1%	1%	3%	2%
Italy	721	81 424	5 160	28	1%	1%	2%	2%
South Korea	469	141 861	1 875	5	1%	2%	1%	0%
Finland	464	25 165	3 269	15	1%	0%	1%	1%
Norway	185	13 997	1 888	7	0%	0%	1%	0%
Hungary	172	10 107	900	5	0%	0%	0%	0%
Poland	150	4 920	780	12	0%	0%	0%	1%

Source: Own computation based on data from Amadeus

The European Union countries are developed countries with high GDP and have similar level of skilled labour endowment as the Czech Republic. These two factors suggest that the multinational activities in the Czech Republic will be to some extent driven by the horizontal motive.

Another option to look at patterns of internalization is via the sectoral breakdown. As mentioned in previous chapter, Amadeus enables to compile data about affiliate and parent's companies NACE Rev. 2 sector codes at four-digit level. Table 4 presents the 2008 affiliate sales detail per sector of activity of parent and affiliate companies. Vertical axis denotes sectors in which parent companies operate whilst horizontal axis denotes sector in which affiliate companies operate. If the parent and affiliate both operate in the same sector, it is plausible that the multinationals are horizontally integrated. If the affiliates' two-digit classification differs from those of parent companies, then the companies are likely vertically integrated.

As regards parent sector of activity, manufacturing, financial and insurance activities and wholesale and retail trade dominate in the structure of affiliate sales, accounting for more than 65% of the total affiliate sales in 2008 (this trend holds much the same also for the remaining years 2003 – 2007). As for affiliate sector of activity, manufacturing, wholesale and retail trade and transporting and storage sectors dominate, accounting for more than 75% of total affiliate sales (the remaining years 2003 – 2007 follow about the same pattern). Refer to Appendix 4 for sectoral breakdown of affiliate sales and FDI stocks per parent countries.

The fraction of affiliate sales operating in the same NACE sector as the parent company amounts to EUR million 40 958 in 2008, which represents about 47% of total affiliate sales. Thus, this ratio suggests 47% of affiliate sales to be horizontally integrated. Nevertheless, this method as well as the geographical breakdown of MNEs' activities is only a draft approximation of internalization pattern and a solid econometric analysis is needed to detect the pattern of multinationals activities.

Table 4: Affiliate Sales per Sector of Activities of Parent and Affiliate Company, 2008, EUR millions

p/a	*Total*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
1	*194*	***168***	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	13
2	*1 245*	49	***167***	0	0	0	0	95	0	12	485	0	0	20	60	46	0	310
3	*17*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
4	*27*	0	0	0	0	0	0	0	0	14	0	0	0	0	13	0	0	0
5	*3 375*	0	0	0	0	***2 681***	0	0	0	20	332	38	0	221	30	0	35	19
6	*7 129*	0	0	0	0	0	***2 465***	0	0	0	93	0	0	16	389	4 167	0	0
7	*16 057*	158	330	0	18	71	571	***770***	16	66	10 762	48	0	214	718	134	67	2 111
8	*0*	0	0	0	0	0	0	0	***0***	0	0	0	0	0	0	0	0	0
9	*2 153*	0	0	0	0	0	0	19	0	***1 865***	101	0	23	76	38	0	0	31
10	*31 977*	0	218	28	0	0	77	466	0	177	***22 132***	0	0	189	443	121	11	8 116
11	*2 533*	0	0	0	0	0	0	0	0	0	393	***48***	0	0	0	0	0	2 092
12	*134*	0	0	0	0	0	0	0	0	0	71	0	***0***	0	0	0	0	63
13	*8 186*	40	145	0	0	623	20	69	17	195	5 135	12	0	***658***	340	296	238	398
14	*201*	10	0	0	0	21	0	0	0	0	106	0	0	0	***55***	0	0	9
15	*2 382*	0	17	0	0	0	0	0	0	1 465	0	0	0	21	22	**750**	0	107
16	*473*	0	0	0	0	0	0	0	0	0	0	0	0	3	11	0	***459***	0
17	*11 632*	0	40	0	0	28	0	0	0	74	1 532	0	41	82	269	19	5	***9 539***
Total	*87 715*	*425*	*918*	*28*	*31*	*3 425*	*3 133*	*1 420*	*34*	*3 888*	*41 142*	*146*	*65*	*1 500*	*2 389*	*5 533*	*815*	*22 823*

Legend: 1) Accomodation and food service activities; 2) Administrative and support service activities; 3) Agriculture, foresty and fishing; 4) Arts, entertainment and recreation; 5) Construction; 6) Electricity, gas, steam and air conditioning supply; 7) Financial and insurance activities; 8) Human health and social work activies; 9) Information and communication; 10) Manufacturing; 11) Mining and quarrying; 12) Other services activities; 13) Professional, scientific and technical activities; 14) Real estate activities; 15) Transporting and storage; 16) Water supply; sewerage; waste management and remediation activities; 17) Wholesale and retail trade; repair of motor vehicles and motorcycles

Source: Own computation based on data from Amadeus

5.3 Baseline Model Empirical Results

5.3.1 Country Aggregation Empirical Results

Table 5 presents the estimation results of the knowledge-capital model for data aggregated at the country level for both affiliate sales and FDI stock. The table indicates similar results and statistical significance for affiliate sales and FDI stock, except for intercept.

The size sum and size difference squared have sign as predicted in the KC model and are both statistically significant at 1% level. These provide evidence for horizontal multinationals. The effect of skilled labour is less straightforward. The skilled labour difference coefficient is negative, suggesting the presence of horizontal FDI, however the statistical significance of the effect is weak. The interaction term between the size difference and skill difference is negative and statistically significant at 5% level, providing evidence for vertical FDI.

Parent trade costs are positive and statistically significant at 5% level, indicating that higher parent trade costs tend to discourage vertical MNEs whereas enhances horizontal MNEs. Host country trade cost coefficient is negative, providing the evidence for vertical MNEs, but the effect is not statistically significant. The second interaction variable between host country trade costs and skilled difference squared does not have sign as predicted but is not statistically significant.

The value of R-squared is relatively high in both estimations, indicating high goodness of fit.

In summary, the results at the country aggregated level are statistically significant for country size variables and the interaction term between the country size and skill differences. As these variables provide evidence for both vertical and horizontal components of the knowledge-capital model, it is not possible to determine which pattern prevails. The estimation results at more disaggregated levels will shed more light in the prevailing pattern of internalization of multinationals in the Czech Republic. The following sub-section presents the estimation results at sector level aggregated per parent countries.

Table 5: Baseline Model Estimation: Country Aggregation, Fixed Effects Model

	Affiliate sales	***FDI***
Size sum	8*	2186*
	(8.78)	(6.04)
Size difference squared	-0.42*	-92*
	(-7.45)	(-5.65)
Skilled labour difference	-1.01E+07	-1.08E+09
	(-0.26)	(-0.72)
Size difference x Skill difference	-22*	-1437***
	(-3.3)	(-1.9)
Trade cost parent	1.19E+06**	3.99E+07**
	(2.26)	(2.19)
Trade cost host	-2.50E+06	-1.48E+08
	(-1.42)	(-1.51)
Trade cost host x Skill difference squared	1.44E+07	3.12E+09
	(0.04)	(0.24)
Intercept	2.89E+06	-1.85E+09
	(1.2)	(-4.98)
R-squared	*0.51*	*0.31*
Observation	*120*	*120*
No of countries	*20*	*20*

t-statistics in parentheses; * significant at 1% level,
** significant at 5% level, *** significant at 10% level

5.3.2 Empirical Results per Sectors of Activity at Country Level

The fixed effect regression results of the knowledge-capital model per individual sectors aggregated at country level are presented in Table 6 below. These are results for affiliate sales and include sectors with more than 10 observations only (85 observations were lost). The corresponding results for the FDI stocks are for the majority of cases qualitatively and statistically similar to those of affiliate sales and are depicted in Appendix 6.

As for the secondary sector, the regression results reveal variances across the industries. It appears that the horizontal motive prevails in the manufacturing sectors, since all variables have signs supporting the horizontal component of the knowledge-capital model. However, the coefficients are statistically significant only for size sum and size difference squared and hence weaken the explanatory power of the KC model.

Table 6: Baseline Model Estimation: Sector Aggregation, Affiliate Sales, Fixed Effects Model

	Secondary sector				Tertiary sector							Quaternary sector
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Size sum	2.87*	2.72*	12.77*	0.21	0.17	0.35*	0.32	2.45*	4.94	8.53*	0.01	0.57*
	(3.26)	(1.74)	(4.82)	(0.9)	(1.58)	(7.17)	(1.36)	(7.4)	(0.47)	(8.33)	(0)	(2.73)
Size difference squared	-0.38	-0.15**	-0.50*	-0.16	0.00	-0.02*	-0.02***	-0.11*	1.63	-0.39*	-0.04	-0.02**
	(-0.79)	(-2)	(-3.61)	(-1.31)	(-0.84)	(-6.23)	(-1.62)	(-7.29)	(0.6)	(-7.35)	(-1.32)	(-1.87)
Skilled labour difference	1.26E+06	8.38E+06	-1.08E+07	2.9E+06*	-4.43E+05	-4.43E+05*	5.02E+04	-6.88E+05	-4.13E+06	7.96E+06**	-6.18E+06*	-8.52E+05
	(0.74)	(1.07)	(-1.15)	(3.39)	(-1.51)	(-2.64)	(0.07)	(-0.67)	(-0.4)	(-2.2)	(-2.38)	(-1.18)
Size difference x Skill difference	-0.15	-2.33	5.76	-2.66*	0.20	-0.21**	-0.31	-1.32**	5.23	-4.14**	-4.69**	0.07
	(-0.04)	(-0.66)	(1.06)	(-2.64)	(1.38)	(-2.1)	(-0.52)	(-1.82)	(0.24)	(-1.97)	(-2.3)	(0.14)
Trade cost parent	6.80E+04	-7.25E+05	1.25E+05	4.42E+04**	2.20E+04	6517**	-2.31E+03	5.53E+04**	-1.93E+05	1.33E+05*	1.24E+05	1.4E+05*
	(0.87)	(-1.13)	(1.15)	(2.32)	(1.6)	(2.07)	(-0.06)	(2.23)	(-0.49)	(3.04)	(1.01)	(4.34)
Trade cost host	1.18E+05	-7.05E+05	2.54E+04	2.01E+05*	1.32E+04	-7.53E+03	-8.12E+04	-3.38E+05*	-4.61E+05	-2.86E+05	-1.83E+05	3.42E+03
	(0.75)	(-1.26)	(0.04)	(6.61)	(0.47)	(-0.6)	(-1.32)	(-4.05)	(-0.5)	(-1.09)	(-0.93)	(0.06)
Trade cost host x Skill difference squared	-1.22E+04	5.04E+07	-8.02E+07	-4.88E+07*	5.87E+05	1.43E+06	1.15E+06***	1.36E+07**	3.10E+07	3.31E+07	2.92E+06	3.19E+06
	(0)	(0.72)	(-1.15)	(-3.16)	(0.22)	(1.17)	(1.76)	(1.77)	(0.45)	(1.23)	(0.13)	(0.62)
Intercept	-1.69E+06	-2.97E+06	-1.23E+07	-1.33E+05	-4.32E+05	-3.73E+05	-1.87E+05	-2.36E+06	-3.15E+07	-7.34E+06	1.84E+06	-8.13E+05
	(-3.94)	(-0.74)	(-4.33)	(-1.23)	(-2.34)	(-5.89)	(-0.46)	(-5.66)	(-1.27)	(-6.68)	(1.75)	(-2.78)
R-squared	*0.47*	*0.24*	*0.33*	*0.79*	*0.65*	*0.65*	*0.15*	*0.61*	*0.81*	*0.53*	*0.30*	*0.44*
Observation	*53*	*28*	*120*	*36*	*33*	*82*	*51*	*79*	*68*	*119*	*75*	*74*
No of countries	*9*	*5*	*20*	*6*	*6*	*14*	*9*	*15*	*49*	*20*	*14*	*13*

t-robust statistics in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Construction; 2) Electricity, gas, steam and air conditioning supply; 3) Manufacturing; 4) Water supply; sewerage; waste management and remediation activities; 5) Accomodation and food service activities; 6) Administrative and support service activities; 7) Financial and insurance activities; 8)Real estate activities; 9) Transporting and storage; 10) Wholesale and retail trade; repair of motor vehicles and motorcycles; 11) Information and communication; 12) Professional, scientific and technical activities

The results for the construction and the electricity, gas and steam sectors provide only a partial support for the knowledge-capital model, as the results are statistically significant solely for size sum and size difference squared variables for the electricity, gas and steam sector and statistically significant for size sum variable for construction sector. The remaining variables for these sectors have signs providing the support for both horizontal and vertical components of the KC model; nonetheless they have weak statistical significance. On the other hand, the water supply, sewerage and waste management sector appears to be driven by vertical motive, as the skill related variables are statistically significant and have signs supporting the presence of vertical component. The results indicate that the affiliate sales of the companies operating in this sector are driven by differences in skilled labour abundance.

Regarding the tertiary sector, the results vary considerably among the sectors. The accommodation and food service activities sector have regression results suggesting the prevalence of horizontal motive. However, as neither variable is statistically significant, this motive cannot be unambiguously affirmed. The same applies to the transporting and storage sector.

The results for administrative and support service activities sector, real estate sector and wholesale and retail trade sectors provide a strong support for the knowledge-capital model. Indeed, the results reveal the presence of both horizontal and vertical motives. Nonetheless, as there are more statistically significant variables providing evidence for the horizontal motive than for vertical motive, I conclude on the prevalence of the horizontal motive in these sectors.

The results for the financial and insurance activities sector and the information and communication sector support the knowledge-capital only partially. It appears that the financial and insurance sector is driven by the horizontal motive only marginally, since the only statistically significant variable supporting the horizontal motive is the size difference squared. As for the information and communication sector, it appears to be driven by the skilled labour abundance, with no clear prevalence of either horizontal or vertical motive.

The results for the professional, scientific and technical activities sector have coefficients with both sign and statistically significance supporting the presence of horizontal motive.

5.3.3 Empirical Results per Sectors of Activity at Firm Level

The regression results for the knowledge-capital model per sectors of activity at firm level for affiliate sales are presented in Table 7. As in previous case, only sectors with more than 10 observations were included in the regression. The corresponding results for FDI stocks are depicted in Appendix 7.

The results at firm level include in addition two industries from the primary sector, namely agriculture, forestry and fishing and mining and quarrying industries. The R-squared for these sectors are very high, indicating a good fit of the model to the data. In addition, the variables concerning the economic size and skill difference have signs supporting the horizontal component of the KC model. However, the statistical significance of the coefficients are rather weak, since the only statistically significant variables are sum size and size difference squared for the mining and quarrying industry.

As regards secondary sector, the regression results for the manufacturing industry confirm the horizontal motive that emerged in the regression results for sector aggregation. The results for the construction sector are in line with those from the sector aggregation. It appears the horizontal motive prevails in this sector, even though this motive is statistically supported only via size variables. The results from the electricity, gas, steam and air conditioning supply sector are ambiguous, as they indicate the presence of both vertical and horizontal components.

Concerning the tertiary sector, the results once more reveal diversity in pattern of internalization among the sectors. The regression results for water supply, sewerage and waste management sector indicate the prevalence of the vertical motive (as for sector aggregation). Nonetheless, the trade costs variables are all statistically significant and have coefficients with sign confirming the presence of horizontal motive. Hence, it appears that this sector is driven by both vertical and horizontal motive.

The accommodation and food service activities industry have results not confirming neither a horizontal nor a vertical motive as the magnitude of size difference variable is nil and the first interaction term is statistically significant but does not have sign as predicted by the KC model.

Table 7: Baseline Model Estimation: Firm Level Data, Affiliate Sales, Fixed Effects Model

	Primary sector		Secondary sector			Tertiary sector									Quaternary sector
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Size sum	1.59	0.37*	1.03*	0.81*	0.43*	0.08	0.11*	0.11*	79.79*	0.50*	0.02	0.14*	1.00*	0.34*	0.06**
	(1.12)	(4.03)	(4.27)	(3.38)	(8.49)	(0.92)	(3.3)	(5.18)	(4.46)	(4.79)	(0.14)	(4.93)	(2.86)	(9.39)	(2.24)
Size difference squared	-0.66	-0.12**	-0.22***	-0.036*	-0.01*	-0.06	0.00	0*	-3.44*	-0.02*	0.00	0.00*	-0.05*	-0.01*	0.00**
	(-1.28)	(-2.7)	(-1.72)	(-3.47)	(-5.86)	(-1.22)	(-1.31)	(-4.25)	(-4.7)	(-4.42)	(-0.19)	(-3.43)	(-3.83)	(-7.39)	(-2.02)
Skilled labour difference	-1.61E+06	-2.59E+05	9.93E+04	2.86E+06**	-4.65E+05**	7.99E+05*	-7.22E+04	-5.35E+04	4.06E+07	-5.39E+05	2.47E+04	1.71E+05**	-2.33E+05	-2.66E+05**	4.81E+04
	(-0.74)	(-0.92)	(0.2)	(2.11)	(-2.1)	(2.35)	(-0.87)	(-0.69)	(0.74)	(-1.39)	(0.02)	(2)	(-0.23)	(-1.86)	(0.5)
Size difference x Skill difference	-0.22	0.64	-0.21	-0.29	0.51*	-0.80**	0.18*	-0.01	-12.26	0.17	-0.04	0.15	-0.90	0.09	-0.03
	(-0.1)	(1)	(-0.2)	(-0.37)	(4.1)	(-2.01)	(2.76)	(-0.2)	(-0.22)	(0.74)	(-0.13)	(1.53)	(-0.75)	(1.08)	(-0.39)
Trade cost parent	1.37E+03	6.63E+02	8.90E+03	-7.08E+04	-1.99E+05*	1.42E+04***	4.15E+03	2.07E+03	-3.76E+06	3.36E+03	-2.84E+03	-4.04E+03	-6.55E+04	9.97E+03*	4.25E+03
	(0.07)	(0.1)	(0.36)	(-0.66)	(-3.98)	(1.81)	(0.82)	(1.19)	(-0.94)	(0.21)	(-0.08)	(-1.2)	(-1.35)	(2.99)	(1.09)
Trade cost host	2.50E+05	-1.25E+04	-1.98E+04	-9.57E+03	-4.78E+03	3.38E+04*	5.61E+03	7.11E+03	-1.21E+07*	-1.23E+04	3.30E+04	5.96E+03	-1.84E+05**	1.28E+04	-7.05E+03
	(1.93)	(-0.74)	(-0.55)	(-0.09)	(-0.31)	(3.29)	(0.61)	(1.18)	(-2.33)	(-0.38)	(0.43)	(0.71)	(-1.85)	(1.18)	(-0.89)
Trade cost host x Skill difference squared	-2.41E+07	3.97E+06	4.01E+06	4.12E+05	-4678452*	-1.21E+07**	5.38E+05	-5.08E+04	4.61E+08	9.24E+05	2.14E+06	-1.68E+06**	1.04E+07	1.76E+06	1.05E+06
	(-1.79)	(1.17)	(0.98)	(0.03)	(-2.57)	(-2.15)	(0.51)	(-0.08)	(0.83)	(0.22)	(0.21)	(-1.97)	(0.97)	(1.32)	(1.13)
Intercept	-6.85E+05	-1.56E+05	-6.50E+05	-1.30E+06	-6.27E+05	-1.80E+04	-1.76E+05	-1.68E+05	-8.28E+07	-9.06E+05	-3.59E+04	-1.51E+05	-6.06E+05	-5.08E+05	-7.86E+04
	(-0.98)	(-2.79)	(-4.82)	(-2.67)	(-7.07)	(-0.39)	(-4.91)	(-4.54)	(-2.9)	(-3.44)	(-0.11)	(-4.35)	(-1.52)	(-8.05)	(-1.59)
R-squared	*0.81*	*0.86*	*0.25*	*0.26*	*0.09*	*0.42*	*0.60*	*0.31*	*0.28*	*0.22*	*0.29*	*0.09*	*0.10*	*0.10*	*0.04*
Observation	*14*	*19*	*167.00*	*100.00*	*3089*	*96*	*76*	*210*	*132.00*	*246*	*17*	*500*	*242*	*1989*	*426*
No of companies	*3*	*5*	*30*	*20*	*574*	*17*	*18*	*41*	*25*	*48*	*4*	*146*	*47*	*388*	*93*

t-robust statistics in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Agriculture, forestry and fishing; 2) Mining and quarrying; 3) Construction; 4) Electricity, gas, steam and air conditioning supply; 5) Manufacturing; 6) Water supply; sewerage; waste management and remediation activities; 7) Accomodation and food service activities; 8) Administrative and support service activities; 9) Financial and insurance activities; 10) Information and communication; 11) Other services activities; 12) Real estate activities; 13) Transporting and storage; 14) Wholesale and retail trade; repair of motor vehicles and motorcycles; 15) Professional, scientific and technical activities

The results for administrative and support service activities are statistically significant for size sum and size difference squared variables. However, the magnitude of size difference squared variable is nil. The signs of other variables confirm the horizontal motive but their statistical significance is weak and thus the support for the horizontal motive in this sector is not strong.

The financial and insurance activities sector has results that are sensitive to size sum and size difference in a way providing the evidence for horizontal motive. Nevertheless, the prevalence of the horizontal motive is weak in this sector, as other variables do not always have signs as predicted for horizontal motive, albeit their statistical insignificance.

Regression results for information and communication, transporting and storage and wholesale and retail trade sectors indicate a good support for the horizontal motive, especially in case of wholesale and retail trade sector.

The pattern of internalization in the other services sector does not seem to be driven by either horizontal or vertical motives. The same applies for the professional, scientific and technical activities.

Results for real estate sector are ambiguous, providing support for both horizontal and vertical motives.

In overall, the results follow largely the predictions of the knowledge-capital model, even though the statistical significances of the coefficients are not strong in all cases. An interesting finding worth mentioning is the results for the host country trade costs, which contradicts the predictions of the knowledge-capital model for about half of sectors. In these cases, the results indicate that falling host country trade costs encourage the horizontal foreign investment. Indeed, such a result confirms the global empirical experience of the last two decades, since it has been observed that lower trade costs lead to higher horizontal FDI.

The explanation of the contradiction between theory and empirical evidence in the effect of host country trade costs can be found e.g. in Neary (2007), who comes up with two explanations. The first explanation concerns FDI in trading blocks, which is enhanced by falling trade cost. This horizontal FDI represents a form of export-platform FDI, where a foreign firm invests in one country in order to serve the entire block. The second explanation rests in cross-border mergers and acquisitions. This type of FDI has become quantitatively more important than greenfield FDI and is encouraged by lower trade costs, rather than higher trade costs. Thus, negative coefficients of host country trade costs in fact

may indicate the presence of other forms of internalization than just pure horizontal and pure vertical ones.

5.4 Spatial lag Model Empirical Results

Table 8 presents the estimation results for Model 2 per sectors of activity, aggregated at country level. As in Model 1, only sectors with more than 10 observations were tested. These are estimation results for affiliate sales, the results for FDI stocks are reported in Appendix 8.

Each sector exhibits two estimations – the first column displays the estimation results of the restricted model, excluding the third country effects whilst the second column displays the estimation results of the full model, including the third country effects variables. The rationale behind running two regressions is the assessment of the sensitivity of gravity variables to the inclusion of third country effects.

Looking at the restricted results, it appears that investment flows from large and wealthy countries (significant negative impact of population indicates wealthy countries, holding GDP equal) for construction, manufacturing, accommodation and food service activities, financial and insurance activities and information and communication activities. Further, accommodation and food service activities, administrative and support service activities, transporting and storage, wholesale and retail trade and professional, scientific and technical activities reported a positive correlation between affiliate sales and skilled labour of parent countries. Construction is the only sector with statistically significant negative influence of parent's skilled labour on affiliate sales. Affiliate sales in electricity, gas, steam and air conditioning supply and wholesale and retail trade sector are also positively correlated with the parent's country size, whilst the opposite holds for administrative and support service activities. Distance exerts statistically significant negative impact on all sectors but water supply, sewerage, waste management and remediation activities.

The inclusion of third country effects in the restricted model yields various results across the sectors. The OLS results remained robust to the inclusion of third country effects for following sectors: electricity, gas, steam and air conditioning supply, administrative and support service activities, real estate activities and transporting and storage sector. For the remaining sectors, the inclusion of third country effects either alters the statistical significance of gravity variables, or changes the sign of coefficients.

Table 8: Spatial lag Model Estimation: Full Sample, Affiliate Sales, OLS and Maximum Likelihood Estimations

	Secondary sector								Tertiary sector			
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	1	*1*	*2*	*2*	*3*	*3*	*4*	*4*	*5*	*5*	*6*	*6*
Parent population	-2.17*	-0.36	-0.45	-2.63*	-0.85*	-0.61*	-11.65	-0.34	-7.65*	-3.12	1.44*	1.25*
	(-4.57)	(-0.43)	(-0.62)	(-2.89)	(-3.7)	(-1.43)	(-6.89)	(-0.43)	(-4.23)	(2.62)	(7.3)	(4.61)
Parent GDP	2.77*	0.00	0.81**	3.11*	1.43*	-0.34*	12.36	-0.65	12.5*	-11.45**	-0.83*	-3.41*
	(6.06)	(1)	(0)	(0)	(0)	0.00	(0)	(0)	(5.25)	(0.06)	(0)	(0)
Parent skilled labour endowment	-16.21*	-9*	-2.19	-6.75*	1.22	0.66*	-13.52	-0.10	24.38*	2.69	7.16*	5.63*
	(-7.97)]	(-2.58)	(-0.91)	(-2.88)	(1.45)	(0.53)	(-6.74)	(-0.09)	(4)	(6.21)	(6.48)	(5.54)
Parent trade costs	0.07	0.29	0.45***	0.38**	0.30	-0.14	-0.89	0.17	-0.13	-0.30	0.12	0.1***
	(0.1)	(0.59)	(1.82)	(2.06)	(1.49)	(-1.03)	(-1.66)	(1.37)	(-0.17)	(0.49)	(0.86)	(1.83)
Distance	-1.38*	-1.42	-1.64*	-1.94*	-0.87*	0.14	1.51*	0.41*	-9.26*	8.47*	-0.57*	0.60
	(-4)	(-1.55)	(-20.96)	(-7.15)	(-5.65)	(0.17)	(5.66)	(2.56)	(-4.5)	(3.36)	(-4.85)	(1.54)
Trend	0.9***	-0.26	0.13	-0.39	0.46	0.15	0.17	1.74*	-1.51**	2.14	0.4***	0.86*
	(1.67)	(-0.28)	(0.92)	(1.31)	(1.63)	(0.41)	(0.45)	(8.48)	(-2.15)	(1.65)	(1.75)	(4.02)
$Trend^2$	-0.11	-0.08	0.00	-0.01	-0.05***	-0.06	-0.03	-0.08*	0.17***	-0.09	-0.03	-0.08*
	(-1.39)	(-1.5)	(0.08)	(-0.88)	(-1.23)	(-1.83)	(-0.61)	(-7.38)	(1.85)	(0.1)	(-1.06)	(-5.57)
Parent market proximity	--	0.39	--	-0.91	--	1.56	--	0.79*	--	14.61*	--	2.88*
		(0.24)		(-1.6)		(1.12)		(4.41)		(3.52)		(4.45)
Host market proximity	--	24.16***	--	-2.95	--	7.10	--	-15.43*	--	-11.44	--	0.65
		(1.77)		(-0.73)		(1)		(-5.49)		(16.39)		(0.27)
Spatial lag	--	-2.29*	--	-0.18	--	-0.41	--	-2.37*	--	-4.68*	--	-1.14*
		(-2.63)		(-0.86)		(-0.63)		(-14.4)		(1.6)		(-4.78)
Intercept	-11.05	-260.81	14.66	56.54	9.66	-80.48	-59.29	223.92	4.20	114.34	16.30	5.78
	(-3.54)	(-1.61)	(2.87)	(1.12)	(6.57)	(-0.98)	(-5.93)	(6.4)	(0.45)	(202.32)	(9.7)	(0.19)
R-squared	*0.69*	--	*0.98*	--	*0.56*	--	*0.69*	--	*0.66*	--	*0.72*	--
Observation	*53*	*53*	*28*	*28*	*117*	*117*	*36*	*36*	*36*	*36*	*78*	*78*
No of countries	*9*	*9*	*5*	*5*	*20*	*20*	*6*	*6*	*6*	*6*	*14*	*14*

t and z statistics in parentheses; * significant at 1% level, ** significant at 5% level; *** significant at 10 % level

Legend: 1) Construction; 2) Electricity, gas, steam and air conditioning supply; 3) Manufacturing; 4) Water supply; sewerage; waste management and remediation activities; 5) Accomodation and food service activities; 6) Administrative and support service activities;

Table 8: Spatial lag Model Estimation: Full Sample, Affiliate Sales, OLS and Maximum Likelihood Estimations cont'd

	Tertiary sector										Quaternary sector	
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	7	*7*	*8*	*8*	*9*	*9*	*10*	*10*	*11*	*11*	*12*	*12*
Parent population	-3.61*	-1.93	0.14	0.03	0.49**	0.39**	0.08	0.47	-1.2*	-2*	1.33	0.69
	(-3.79)	(-1.19)	(0.42)	(0.06)	(2.1)	(2.24)	(0.35)	(1.12)	(-2.73)	(-2.98)	(1.31)	(0.66)
Parent GDP	4.42*	0.77	0.06	1.70	0.38	2.63*	0.76*	-3.37**	1.59*	-0.77	-0.36	-4.47*
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Parent skilled labour endowment	-1.56	-1.23	0.59	0.60	7.09*	7.07*	1.99**	0.52	2.27	-1.57	5.21**	3.95***
	(-0.75)	(-0.81)	(0.5)	(0.37)	(5.53)	(7.67)	(2.01)	(0.56)	(1.12)	(-0.56)	(2.29)	(1.72)
Parent trade costs	-0.06	0.25	0.98*	0.42**	1.03*	0.75*	0.14	-0.14	0.32	0.55	-0.84	-0.33
	(-0.14)	(1.13)	(4.12)	(2.2)	(3.64)	(3.69)	(0.69)	(-1.2)	(0.53)	(1.44)	(-1.41)	(-0.68)
Distance	-2.01*	-1.56***	-0.91*	-1.98*	-2.3*	-3.59*	-1.28*	0.43	-0.55**	0.23	-1.03*	1.05
	(-7.43)	(-2.01)	(-4.93)	(-3.1)	(-14.89)	(-15.18)	(-7.83)	(0.53)	(-2.09)	(0.24)	(-3.94)	(1.63)
Trend	0.01	0.62	0.82**	-1.11	0.07	-0.51	0.53***	0.68**	0.09	0.04	0.06	-2.76*
	(0.03)	(1.37)	(2.12)	(-1.46)	(0.28)	(-1.13)	(1.76)	(1.94)	(0.17)	(0.06)	(0.12)	(-2.61)
$Trend^2$	-0.01	-0.08**	-0.04	0.04	0.02	0.03	-0.06	-0.11*	-0.02	-0.12**	0.02	-0.01
	(-0.12)	(-2.44)	(-0.67)	(0.87)	(0.44)	(1.19)	(-1.44)	(-4.44)	(-0.29)	(-2.35)	(0.26)	(-0.13)
Parent market proximity	--	1.68	--	-1.77***	--	-2.24*	--	3.73*	--	3.09**	--	5.04
		(1.26)		(-1.89)		(-6.21)		(2.9)		(1.92)		(3.84)
Host market proximity	--	2.50	--	27.32**	--	6.98	--	8.98**	--	17.62	--	61.7*
		(0.35)		(2.27)		(1.12)		(1.92)		(1.56)		(3.65)
Spatial lag	--	-2.26**	--	-0.18	--	0.45**	--	-1.95*	--	-2.59*	--	-2.3*
		(-2.26)		(-0.55)		(2.06)		(-3.49)		(-3.36)		(-3.32)
Intercept	-0.12	0.30	12.59	-310.43	22.17	-57.58	11.76	-86.81	8.39	-189.98	12.90	-749.61*
	(-0.02)	(0)	(5.89)	(-2.13)	(10.29)	(-0.75)	(7.3)	(-1.54)	(2.4)	(-1.4)	(2.1)	(-3.64)
R-squared	*0.92*		*0.52*		*0.82*		*0.54*		*0.42*		*0.54*	
Observation	*49*	*49*	*80*	*80*	*67*	*67*	*117*	*117*	*80*	*80*	*74*	*74*
No of countries	*9*	*9*	*15*	*15*	*12*	*12*	*20*	*20*	*14*	*14*	*13*	*13*

t and z statistics in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 7) Financial and insurance activities; 8)Real estate activities; 9) Transporting and storage; 10) Wholesale and retail trade; repair of motor vehicles and motorcycles; 11) Information and communication; 12) Professional, scientifc and technical activities

Regarding the effect of third country effects per se, the results are highly ambiguous. Contradictory to the theory, the effect of host and parent market potentials were found to be negative for a number of sectors.

A possible explanation for negative correlation between parent market proximity and affiliate sales may be the fact that parent market proximity also captures the effect of concurrent FDI from other parent countries (in this case the crowding out effect) since the bigger the size of other parent's market, the higher the potential investment to the host country. Regarding the negative effect of host country market potential on affiliate sales, it can proxy a competitive pressure of other host countries with similar characteristics that may lure the potential investments from parent countries away from the host country in question.

Coming back to the estimation results, the parent market proximity exerts statistically significant positive effects on water supply, sewerage, waste management and remediation activities, accommodation and food service activities, administrative and support service activities, wholesale and retail trade and information and communication sector. The positive effect of parent market proximity on affiliate sales provides empirical evidence for vertical pattern of internalization. This variable exerts a negative effect on real estate activities and transporting and storage sectors.

The host market potential has a positive statistically significant effect on affiliate sales for construction, real estate, wholesale and retail trade and professional, scientific and technical activities sector, indicating the presence of export platform FDI and complex vertical FDI. On the other hand, this variable statistically significantly impacts on water supply, sewerage, waste management and remediation activities.

The results for spatial lag indicate a crowding out effect for the majority of sectors, namely for construction, water supplies, sewerage, waste management and remediation activities, accommodation and food service activities, administrative and support service activities, financial and insurance activities, wholesale and retail trade, information and communication and professional, scientific and technical activities. The results reveal a positive spill-over effect only for transporting and storage sector.

It can be seen that the effects of the third country variable vary across the sectors and no clear conclusion can be drawn in general. In order to refine the results, I additionally run the regression for the European sub-sample, excluding the data from the U.S.A., Japan and Korea, as Blonigen et al. (2005, 2007) and Garretsen et Peeters (2008) reported sensitivity of third county effects on the geographical composition of the data. This holds true here as well,

nevertheless the results got worse as the effects of third country variable turned statistically insignificant for the majority of sectors. For the results for the European sub-sample refer to Appendix 9. Thus, it appears that the third country affect to some extent on the multinationals activities in the host country. Nonetheless, the significance of influence is sensitive to the geographical composition of the data and so does the omitted variable bias in case of their exclusion from the model.

5.5 Hypotheses Reconciliation

Table 9: Reconciliation of Hypotheses with Estimation Results

Alternative Hypothesis	Variable	Results provide evidence that Ha is true (zero hypothesis is rejected)															
		Country aggregation	Sector aggregation at country level														
			Sector aggregation at firm level														
			1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Hypothesis 1: A bilateral increase in parent and host country incomes (GDPs) increases sales of affiliates of parent country horizontal firms.	Size sum	Yes	n.a.	n.a.	**yes**	**yes**	**yes**	no	no	**yes**	no	no	n.a.	**yes**	no	**yes**	**yes**
			no	**yes**	**yes**	**yes**	**yes**	no	**yes**	**yes**	**yes**	**yes**	no	**yes**	**yes**	**yes**	**yes**
Hypothesis 2: A convergence in income (GDP) between host and parent country increases sales of affiliates of parent country horizontal firms.	Size difference squared	Yes	n.a.	n.a.	no	**yes**	**yes**	no	no	**yes**	**yes**	no	n.a.	**yes**	no	**yes**	**yes**
			no	**yes**	**yes**	**yes**	**yes**	no	no	no	**yes**	**yes**	no	no	**yes**	**yes**	no
Hypothesis 3: A convergence in skilled labour endowment between host and parent country increases sales of affiliates of parent country horizontal firms whereas a divergence in skilled labour endowment between host and parent country increases sales of affiliates of parent country vertical firms.	Skill difference	No	n.a.	n.a.	no	no	no	**yes**	no	**yes**	no	**yes**	n.a.	no	no	**yes**	no
			no	no	no	**yes**	**yes**	**yes**	no	no	no	no	no	**yes**	no	**yes**	no
Hypothesis 4: Parent country vertical affiliate sales are highest when parent country is both moderately small and skilled labour abundant.	Size difference x Skill difference	Yes	n.a.	n.a.	no	no	no	**yes**	no	**yes**	no	**yes**	n.a.	**yes**	no	**yes**	no
			no	no	no	no	no	**yes**	no	no	no	no	no	no	no	no	no
Hypothesis 5: An increase in parent country trade costs decreases sales of affiliates of parent country vertical firms in favour of parent country horizontal firms.	Parent trade costs	Yes	n.a.	n.a.	no	no	no	**yes**	no	**yes**	no	no	n.a.	**yes**	no	**yes**	no
			no	no	no	no	no	**yes**	no	no	no	no	no	no	no	**yes**	no
Hypothesis 6: An increase in host country trade costs increases sales of affiliates of parent country horizontal firms.	Host country trade costs	No	n.a.	n.a.	no	no	no	**yes**	no	no	no	no	n.a.	no	no	no	**yes**
			no	no	no	no	no	**yes**	no	no	no	no	no	no	no	no	no

Table 9: Reconciliation of Hypotheses with Estimation Results cont'd

Alternative Hypothesis	Variable	Results provide evidence that Ha is true (zero hypothesis is rejected)															
		Country aggregation	Sector aggregation at country level / Sector aggregation at firm level														
			1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Hypothesis 7: Bilateral increase in host country trade costs and skilled labour difference between host and parent countries reduces sales of affiliates of parent country horizontal firms.	Host country trade costs x Skill difference	No	n.a.	n.a.	no	no	no	**yes**	no	no	no	no	n.a.	no	no	no	no
			no	no	no	no	yes	**yes**	no	no	no	no	no	**yes**	no	no	no
Hypothesis 8: Exclusion of variables capturing third country effects lead to omitted variable bias of the results (results for full sample).	--	n.a.	n.a.	n.a.	**yes**	no	no	**yes**	**yes**	no	**yes**	**yes**	n.a.	no	no	**yes**	**yes**
			n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Hypothesis 9: Parent proximity to third-country markets increases sales of affiliates of parent country vertical firms.	Parent market proximity	n.a.	n.a.	n.a.	no	no	no	**yes**	**yes**	**yes**	no	**yes**	n.a.	no	no	**yes**	no
			n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Hypothesis 10: Host proximity to third-country markets increases sales of affiliates of parent country export platform firms (results for full sample).	Host market proximity	n.a.	n.a.	n.a.	**yes**	no	no	no	no	no	no	no	n.a.	**yes**	no	**yes**	**yes**
			n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Hypothesis 11: Presence of other FDI in host country may crowd out further FDI or induce positive externalities in host country (results for full sample).	Spatial lag	n.a.	n.a.	n.a.	**yes**	no	no	**yes**	**yes**	**yes**	**yes**	**yes**	n.a.	no	**yes**	**yes**	**yes**
			n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Legend: 1) Agriculture, forestry and fishing; 2) Mining and quarrying; 3) Construction; 4) Electricity, gas, steam and air conditioning supply; 5) Manufacturing; 6) Water supply; sewerage; waste management and remediation activities; 7) Accomodation and food service activities; 8) Administrative and support service activities; 9) Financial and insurance activities; 10) Information and communication; 11) Other services activities; 12) Real estate activities; 13) Transporting and storage; 14) Wholesale and retail trade; repair of motor vehicles and motorcycles; 15) Professional, scientific and technical activities

5.6 Conclusion

In this chapter, I presented the estimation results of two classes of empirical models. Firstly, I carried out the estimation of the knowledge-capital model for three levels of aggregation: country aggregation, sector aggregation at country level and sector aggregation at firm level to disentangle the possible patterns of internalization of MNEs in the Czech Republic.

The results confirmed the presence of both horizontal and vertical patterns, however the prevalence of these pattern differ across the levels of aggregation. The regression results for data aggregated at country level indicated both horizontal and vertical motives, with no clear prevalence of either type. By reconciling the results for aggregated data per sector of activity at both country and firm level, it appeared that horizontal motive tend to dominate in mining and quarrying sector, electricity, gas, steam and air conditioning supply, manufacturing and wholesale and retail trade sectors. The presence of both vertical and horizontal motive was found in water supply, sewerage, waste management and remediation activities and real estate activities sectors. For the remaining sectors, the results of the aggregated data differ at country and firm level, suggesting that either the knowledge-capital model is not an appropriate model for disentangling the pattern of internalization, or these sectors are driven by more complex types of internalization, such as export platform FDI or complex vertical FDI.

Following, I ran the regression of the spatial lag model to determine the effect of third country variables. The results indicated that the third country effects were highly sensitive to the geographical composition of the data. When testing the full sample, the third country effects revealed crowding out effect for all sectors but electricity, gas, steam and air conditioning supply, manufacturing and transporting and storage sectors. For the last mentioned sector, the results indicated a positive spill-over effect. The parent market proximity turned out to be statistically positively significant for water supply, sewerage, waste management and remediation activities, accommodation and food service activities, administrative and support service activities, wholesale and retail trade and information and communication sector, indicating a present of vertical motive of internalization. The host market potential has a positive statistically significant effect on affiliate sales for construction, real estate, wholesale and retail trade and professional, scientific and technical activities

sector, indicating the presence of export platform FDI and complex vertical FDI. This suggests that the multinational activities in the Czech Republic go beyond the simple pure horizontal versus vertical range and partly explains the poor fit of the knowledge-capital for the certain sectors of activity.

Contradictory to the theory, the results on parent and host market proximity revealed also a negative influence on a number of sectors. Specifically, the parent market proximity was statically significant and negative for real estate activities and transporting and storage sectors, whilst host country market proximity was statistically significant and negative for water supply, sewerage, waste management and remediation activities. The negative effect of parent market proximity may indicate a potential crowding out effect, whilst the negative host country market proximity effect may point out the competitive pressure from other host countries for potential inward foreign investments.

When the regression of the spatial lag model was run on a European sub-sample, the results turned out to be statistically insignificant for most of sectors. This suggests the variable bias resulting from third country effects omission depends on the geographical composition of the data.

Regarding the hypotheses confirmation, the results in overall provide the strongest support for Hypotheses 1 and 2, stating the relationship between the market size and affiliate sales of horizontally integrated multinationals. These hypotheses postulate that a bilateral increase in host and parent countries' GDP and/or a convergence in GDP between parent and host countries increases affiliate sales of horizontal multinationals.

Hypotheses stating the impact of skilled labour were confirmed only partially, implying that the skilled labour endowment/difference played in many sectors solely a minor role in multinationals decisions to invest in the Czech Republic. The rationale behind this rather surprising result may dwell in the inappropriate proxy for skilled labour, and other proxies such as direct labour costs or cost of employees may bring more distinct results. However, I decided to employ this proxy for skilled labour as in Carr et al. (2001) and Markusen and Maskus (2002a) for consistency reasons. Although a weak support of Hypothesis 4 may simply rest in the lack of vertical component in the tested data at disaggregated level.

Hypotheses about the trade cost of parent and host countries were confirmed solely in few sectors. A possible explanation of the contradicting results with the theoretical predictions

may be the presence of other type of internalization, such as export platform FDI or merger and acquisitions, which are driven by low trade costs.

Lastly, hypotheses concerning third country effects had only a limited validity, as they were relatively well supported for the full sample, especially the spatial lag variable; however the results on a European sub-sample rejected the hypothesis in favor of zero hypotheses stating no effect of third country effects on affiliate sales for the majority of sectors.

6
Conclusion

This master thesis utilizes the firm-level data for the period 2003-2008 provided by Amadeus database to investigate the pattern of internalization of multinationals in the Czech Republic and to evaluate the potential effects of third countries on inward FDI to the Czech Republic.

In order to disentangle the pattern of internalization, I applied the knowledge-capital model developed by Markusen et al. (1996). The model was tested on data aggregated at different levels of aggregation. In overall, the results provided an empirical evidence for both horizontal and vertical motives of internalization, with the prevalence of either motive varying across the sectors and the levels of aggregation. The variances in the results indicate the importance of the sector and firm-level heterogeneity and the level of data aggregation on determining the patterns of internalization. It appears that data at more disaggregated level enable to identify patterns that have been missed at aggregated level, as they were not observable at higher level of aggregation.

The empirical estimations provided a support for the knowledge-capital model only partially, as the results for the data at disaggregated level were statistically insignificant or yielded opposite signs than predicted by the model for some variables in a number of sectors, namely the interaction terms capturing the non-linearity of the model and the host and parent trade costs variables. This may indicate that the horizontal and vertical motives are not driven primarily by the comparative advantage or the market seeking motives as the knowledge-capital postulates, but the decision making process of multinationals takes into consideration more complex factors[7]. Further, the partial support of the knowledge-capital model may imply that there are different patterns of internalization, other than pure vertical and pure horizontal, that characterize multinationals activities in various sectors of activity.

[7] E.g. Alfaro and Charlton (2009) identified a high proportion of north-north vertical FDI with small skill differences between parent and host, where a subsidiary sources the inputs to its parent internally. This type of vertical FDI was found in high-skill sectors with stages of production close to parents' final stage of production.

To evaluate the third country effects, I employed a spatial lag model that incorporated spatial lag and host and parent market potentials variables. Apart from capturing third country effects, the parent and host market proximity also gauge more complex patterns of internalization, such as export-platform FDI and complex vertical FDI.

As for the knowledge-capital model, the results of the spatial lag model varied across the sectors. The results provided evidence for the existence of export platform and complex vertical FDI for a number of sectors and thus confirm the assumption that multinationals activities go beyond the simple horizontal and vertical range. The estimation results for spatial lag variable indicated a crowding out effect for the majority of sectors. Nevertheless, this is a net effect and as such, it features the dominant force and does not imply that no spillover effects exist. Parent and host market proximities where found to enhance inward FDI in some sectors and at the same time to discourage inward FDI in other sectors.

In order to refine the results, I carried out the regression of the spatial lag model for a European sub-sample and found out that effects of third country variables turned statistically insignificant for most sectors. This implies that the third country effects are highly sensitive to the geographical composition of the data, which is a constraint that weakens the general validity of the results.

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Appendices

Appendix 1: List of Parent (Home) Countries

Austria	*Italy*
Belgium	*Japan*
Germany	*Luxembourg*
Denmark	*Netherland*
Spain	*Norway*
Finland	*Poland*
France	*Sweden*
Great Britain	*Slovakia*
Switzerland	*U.S.A.*

Appendix 2: List of Potential Host Countries

Bulgaria	*Poland*
Estonia	*Romania*
Hungary	*Slovakia*
Lativa	*Slovenia*
Lithuania	

Appendix 3: Variables Definition and Units of Measurement

Variable	*Definition*	*Unit of Measurement*
$Sales_{ijt}$	*Affiliate sales in host country i of parent country j in time t*	EUR thousands
$FDIstock_{ijt}$	$TotalAsset_{ijt}\, x\%ofOwnership$	EUR thousands
$SizeSum_{ijt}$	$Size_{it} + Size_{jt}$	EUR millions
$SizeDiff_{ijt}^{2}$	$\left(Size_{it} - Size_{jt}\right)^{2}$	EUR millions
$SkillDiff_{ijt}$	$\left\lvert Skill_{it} - Skill_{jt} \right\rvert$	Index [0;1]
$SkillDiff_{ijt} SizeDiff_{ijt}$	$(Skill_{it} - Skill_{jt}) x (Size_{it} - Size_{jt})$	EUR thousands
$TradeCost_{it}$	$import_{ijt}^{CIF} \Big/ export_{jit}^{FOB}$	Index [0;∞]
$TradeCost_{jt}$	$import_{jit}^{CIF} \Big/ export_{ijt}^{FOB}$	Index [0;∞]
$TradeCost_{jt} SkillDiff_{ijt}^{2}$	$TradeCost_{jt} (Skill_{it} - Skill_{jt})^{2}$	Index [0;∞]
$Population_{it}$	*Total population of parent country*	Thousands
$Dist_{ij}$	*Geographical distance between 2 countries capital cities*	Kilometres
$ParentMarket\,\mathrm{Pr}oximity_{it}$	$\sum_{i \neq k} 174 \Big/ d_{ik}\, GDP_{kt}$	EUR millions
$HostMarket\,\mathrm{Pr}oximity_{jt}$	$\sum_{j \neq l} 252 \Big/ d_{jl}\, GDP_{lt}$	EUR millions
Spatial Lag	$\rho . \mathbf{W} . Sales_{ijt}$	EUR thousands

Appendix 4: Affiliate Sales per Sector of Activity and Parent Country, 2008, EUR millions

Parent	*Total*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
AT	6 770	42	42	0	0	898	0	506	34	90	1623	38	0	176	136	265	92	2827
BE	1 443	0	92	0	0	0	0	0	0	0	1094	0	0	25	13	0	0	219
DE	23 789	0	80	0	0	595	2267	622	0	1819	8974	12	65	212	736	4369	11	4027
DK	801	0	0	0	0	26	0	0	0	0	236	0	0	0	140	70	73	256
ES	1 876	0	0	0	0	658	0	0	0	0	977	0	0	34	10	0	35	161
FI	464	0	12	0	0	0	0	0	0	66	337	0	0	0	0	0	0	49
FR	9 783	85	33	0	0	1190	0	79	0	19	6439	0	0	134	89	81	442	1190
GB	6 624	147	132	0	0	0	221	21	0	36	1074	48	0	213	17	47	0	4668
HU	172	0	0	0	0	0	0	0	0	0	161	0	0	0	0	0	0	11
CH	3 913	0	26	0	0	12	0	0	0	105	2430	0	0	0	67	116	0	1156
IT	721	5	0	0	0	0	0	9	0	0	478	0	0	7	0	0	0	222
JP	4 844	0	20	0	0	0	0	0	0	0	4247	0	0	0	98	0	0	480
KR	469	0	0	0	0	0	0	0	0	0	318	0	0	0	152	0	0	0
LU	1 410	0	3	0	0	0	0	0	0	0	1058	0	0	0	155	0	0	194
NL	17 525	97	331	0	0	0	0	47	0	1389	8359	48	0	308	494	295	11	6146
NO	185	0	14	28	0	0	0	0	0	0	88	0	0	0	18	0	0	37
PL	150	0	0	0	0	0	0	0	0	3	20	0	0	0	0	0	0	127
SE	1 527	0	41	0	0	0	0	135	0	99	602	0	0	22	0	0	0	629
SK	1 516	0	16	0	18	45	625	0	0	32	323	0	0	0	200	34	0	224
US	3 731	49	75	0	13	0	19	0	0	229	1828	0	0	137	64	38	0	1279
Total	*87 715*	*425*	*918*	*28*	*31*	*3 425*	*3 133*	*1 419*	*34*	*3 888*	*40 664*	*146*	*65*	*1 268*	*2 389*	*5 315*	*665*	*23 902*

Legend: 1) Accomodation and food service activities; 2) Administrative and support service activities; 3) Agriculture, foresty and fishing; 4) Arts, entertainment and recreation; 5) Construction; 6) Electricity, gas, steam and air conditioning supply; 7) Financial and insurance activities; 8) Human health and social work activies; 9) Information and communication; 10) Manufacturing; 11) Mining and quarrying; 12) Other services activities; 13) Professional, scientific and technical activities; 14) Real estate activities; 15) Transporting and storage; 16) Water supply; sewerage; waste management and remediation activities; 17) Wholesale and retail trade; repair of motor vehicles and motorcycles

Source: Own computation based on data from Amadeus

Appendix 5: FDI Stock per Sector of Activity and Parent Country, 2008, EUR millions

Parent	*Total*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
AT	596 417	7 063	6 601	0	0	69 141	0	131 054	2 899	6 224	126 723	4 280	0	21 219	99 018	8 333	5 515	108 348
BE	117 244	0	3 115	0	0	0	0	0	0	0	101 027	0	0	1 262	3 379	0	0	8 461
DE	1 812 104	0	8 554	0	0	33 672	154 399	147 609	0	70 304	445 843	618	3 528	19 419	278 626	505 637	1 730	142 164
DK	80 099	0	0	0	0	1 176	0	0	0	0	20 109	0	0	0	25 041	6 397	10 443	16 932
ES	135 312	0	0	0	0	20 784	0	0	0	0	70 238	0	0	1 639	7 963	0	26 742	7 946
FI	25 165	0	531	0	0	0	0	0	0	4 065	17 012	0	0	0	0	0	0	3 557
FR	503 963	3 279	3 248	0	0	57 313	0	8 235	0	314	267 934	0	0	15 789	43 183	4 226	32 821	67 621
GB	357 251	5 383	2 600	0	0	0	8 351	8 502	0	1 976	80 240	7 906	0	15 531	19 006	6 221	0	201 534
HU	10 107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10 107
CH	280 326	0	17 803	0	0	3 386	0	0	0	11 378	179 698	0	0	0	18 725	3 243	0	46 094
IT	81 424	2 043	0	0	0	0	0	10 167	0	10 160	42 458	0	0	1 595	0	0	0	15 000
JP	123 771	0	1 237	0	0	0	0	0	0	0	76 541	0	0	0	7 656	0	0	38 338
KR	141 861	0	0	0	0	0	0	0	0	0	126 306	0	0	0	6 801	0	0	8 755
LU	139 213	0	1 468	0	0	0	0	0	0	0	96 065	0	0	1 853	26 163	0	0	13 665
NL	1 107 958	9 068	93 144	0	0	5 951	0	275	0	13 555	471 894	8 037	0	106 692	140 571	21 832	433	236 504
NO	13 997	0	682	7 665	0	0	0	0	0	0	0	0	0	0	299	0	0	5 351
PL	4 920	0	0	0	0	0	0	0	0	901	128	0	0	0	0	0	0	3 891
SE	115 318	0	1 382	0	0	0	0	2 246	0	12 814	48 241	0	0	1 615	0	0	0	49 019
SK	106 762	0	1 620	0	2 509	4 115	20 651	0	0	2 392	57 291	0	0	533	4 011	4 355	0	9 286
US	166 073	339	4 922	0	609	0	1 426	0	0	6 818	101 343	0	0	5 196	6 346	798	0	38 274
Total	*5 919 284*	*27 176*	*146 906*	*7 665*	*3 117*	*195 538*	*184 828*	*308 089*	*2 899*	*140 901*	*2 329 092*	*20 841*	*3 528*	*192 344*	*686 787*	*561 042*	*77 684*	*1 030 845*

Legend: 1) Accomodation and food service activities; 2) Administrative and support service activities; 3) Agriculture, foresty and fishing; 4) Arts, entertainment and recreation; 5) Construction; 6) Electricity, gas, steam and air conditioning supply; 7) Financial and insurance activities; 8) Human health and social work activies; 9) Information and communication; 10) Manufacturing; 11) Mining and quarrying; 12) Other services activities; 13) Professional, scientific and technical activities; 14) Real estate activities; 15) Transporting and storage; 16) Water supply; sewerage; waste management and remediation activities; 17) Wholesale and retail trade; repair of motor vehides and motorcydes

Source: Own computation based on data from Amadeus

Appendix 6: Baseline Model Estimation: Sector Aggregation, FDI Stock, Fixed Effect Model

	Secondary sector				Tertiary sector						
	1	2	3	4	5	6	7	8	9	10	11
Size sum	221.25*	2.72***	516.81*	37.65	41.74**	48.84*	255.64*	967.95*	1011.13*	478.29*	-269.70**
	(3.95)	(1.74)	(3.69)	(1.24)	(2.03)	(2.93)	(4.22)	(5.42)	(5.86)	(5.85)	(-2.22)
Size difference squared	-44.50	-0.15**	-25.44*	-12.28	-1.95**	-2.17*	-12.69*	-46.19*	-49.58*	-19.49*	7.88
	(-1.45)	(-2)	(-3.51)	(-0.78)	(-2.01)	(-2.87)	(-4.89)	(-5.84)	(-6.45)	(-4.56)	(1.39)
Skilled labour difference	2.09E0+08**	8.38E+06	-4.16E+08	2.14E+08	-6.89E+06	-1.61E+08*	2.68E+08	-3.09E+08	-1.02E+08	-8.38E+08*	-3.83E+08
	(1.92)	(1.07)	(-0.83	(1.87)	(-0.18)	(-3.24)	(1.5)	(-0.6)	(-0.21)	(-2.85)	(-0.88)
Size difference x Skill difference	-227.24	-2.33	-357.87	-134.72**	-17.07	-19.88	-186.98	-576.55	-582.82***	90.56	-431.40
	(-0.87)	(-0.66)	(-1.25)	(-1)	(-0.63)	(-0.56)	(-1.21)	(-1.4)	(-1.6)	(0.49)	(-1.27)
Trade cost parent	5.71E+06	-7.25E+05	-2.68E+05	2.81E+06	-2.52E+05	4.18E+06*	-8.60E+06	2.66E+07**	-2.89E+07	2.07E+07*	7.07E+06
	(1.15)	(-1.13)	(-0.05)	(1.11)	(-0.1)	(3.24)	(-0.89)	(2.02)	(-1.2)	(3.39)	(0.34)
Trade cost host	1.32E+06	-7.05E+05	-1.48E+07	1.66E+07*	-8626239***	-9.76E+06*	-4.94E+07*	-1.47E+08*	-1.93E+08*	-4.11E+07**	1.16E+07
	(0.13)	(-1.26)	(-0.41)	(4.08)	(-1.72)	(-2.68)	(-3.1)	(-3.36)	(-4.12)	(-1.96)	(0.35)
Trade cost host x Skill difference squared	2.54E+08	5.04E+07	-3.23E+09	3.93E+09**	6.36E+08	7.71E+08**	3.21E+09**	6.17E+09**	1.16E+10*	3.65E+09***	-5.13E+08
	(0.33)	(0.72)	(-0.86)	(-1.91)	(1.33)	(2.14)	(1.9)	(1.58)	(3.01)	(1.69)	(-0.18)
Distance	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Intercept	-1.20E+08	-2.97E+06	-3.44E+08	-2.81E+07	-5.69E+07	-3.63E+07	-2.69E+08	-8.75E+08	-8.72E+08	-4.51E+08	4.31E+08
	(-4.39)	(-0.74)	(-2.24)	(-1.95)	(-1.66)	(-1.61)	(-2.5)	(-3.56)	(-3.71)	(-4.92)	(2.51)
R-squared	0.51	0.24	0.22	0.67	0.27	0.43	0.45	0.47	0.51	0.37	0.11
Observation	53	28	117	36	36	78	49	80	67	117	80
No of countries	9	5	20	6	6	14	9	15	12	20	14

t-robust statistics in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Construction; 2) Electricity, gas, steam and air conditioning supply; 3) Manufacturing; 4) Water supply; sewerage; waste management and remediation activities; 5) Accomodation and food service activities; 6) Administrative and support service activities; 7) Financial and insurance activities; 8)Real estate activities; 9) Transporting and storage; 10) Wholesale and retail trade; repair of motor vehides and motorcydes; 11) Information and communication; 12) Professional, scientifc and

Appendix 7: Baseline Model Estimation: Firm Level Data, FDI Stock, Fixed Effects Model

	Primary sector		Secondary sector				Tertiary sector								Quaternary sector
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Size sum	-19.81	42.34*	72.40*	15.76	14.57*	0.08	16.09*	10.19**	79.79*	15.11*	2.81	58.48*	1.00*	15.44*	6.83
	(-0,89)	(3.37)	(4.06)	(0.52)	6.93	(0.92)	(3.09)	(1.96)	(4.46)	(1.54)	(0.28)	(3.21)	(2.86)	(10.81)	(1.13)
Size difference squared	12.75	1.29	-19.81**	-0.77	-0.64*	-0.06	-0.75*	-0.42**	-3.44*	-0.30	-0.14	-1.98*	-0.05*	-0.56*	-0.12
	(1.49)	(0.24)	(2.12)	(-0.58)	-6.25	(-1.22)	(-3.04)	(-1.86)	(-4.7)	(-0.75)	(-0.31)	(-2.66)	(-3.83)	(-8.05)	(-0.46)
Skilled labour difference	-5.39E+07	5.21E+07**	4.70E+07	9.51E+06	-1.21E+07	7.99E+05*	-2.65E+05	-3.92E+07*	4.06E+07	-1.15E+07	-2.63E+07	1.31E+07	-2.33E+05	-1.76E+06	-2.03E+07
	(-1.55)	(2.29)	(1.31)	(0.06)	-1.31	(2.35)	(-0.03)	(-2.29)	(0.74)	(-0.32)	(-0.29)	(0.27)	(0.23)	(-0.31)	(-0.95)
Size difference x Skill difference	100.92**	-106.44**	-91.18	-36.17	-1.86	-0.8**	-6.05	1.73	-12.26	24.65	2.14	56.53	-0.90	6.19**	9.11
	(2.65)	(-1.99)	(-1.22)	(-0.37)	-0.36	(-2.01)	(-0.61)	(0.19)	(-0.22)	(1.15)	(0.07)	(0.95)	(0.75)	(1.85)	(0.58)
Trade cost parent	1.01E+04	-9.53E+05	1.57E+06	8.41E+06	-412120**	14286***	-4.06E+05	748096***	-3.76E+06	3.98E+05	-2.88E+05	-1.55E+05	-6.55E+04	4.65E+05*	3E+06*
	(0.03)	(-1.2)	(0.81)	(0.62)	-1.98	(1.81)	(-0.61)	(1.6)	(-0.94)	(0.26)	(-0.1)	(-0.08)	(1.35)	(3.25)	(3.33)
Trade cost host	3.02E+05	-3.28E+06	-1.58E+06	-5.54E+05	1.23E+04	33856*	-2.74E+06**	-1.56E+06	-1.21E+07*	4.65E+06*	-1.22E+04	1.45E+06	-184671**	7.06E+05***	1.14E+06
	(0.13)	(-1.56)	(-0.62)	(-0.05)	0.02	(3.29)	(-2.08)	(1.28)	(-2.33)	(1.53)	0.00	(0.29)	-1.85	(1.63)	(0.63)
Trade cost host x Skill difference squared	1.82E+08	-3.46E+08	1.06E+08	-1.82E+08	-1.49E+08**	-1.21E+07**	1.52E+08	1.29E+08	4.61E+08	-2.94E+08	7.50E+07	-8.46E+08**	1.04E+07	8.99E+07***	-1.83E+07
	(0.74)	(-1.39)	(0.37)	(-0.11)	-1.89	(-2.15)	(0.96)	(1.07)	(0.83)	(-0.88)	(0.09)	(-1.91)	(0.97)	(1.67)	(-0.09)
Intercept	7.04E+06	-3.37E+07	-4.23E+07	-1.86E+07	-1.60E+07	-1.80E+04	-1.24E+07	-1.11E+07	-8.28E+07	-3.66E+07	-5.70E+06	-5.59E+07	-6.06E+05	-2.43E+07	-1.50E+07
	(0.71)	(-4.76)	(-4.17)	(-0.31)	(-4.28)	(-0.39)	(-2.31)	(-1.14)	(-2.9)	(-1.53)	(-0.2)	(-2.65)	-1.52	(-9.72)	(-1.36)
R-squared	*0.86*	*0.93*	*0.24*	*0.04*	*0.05*	*0.23*	*0.20*	*0.17*	*0.28*	*0.05*	*0.66*	*0.04*	*0.1*	*0.11*	*0.08*
Observation	*17*	*23*	*164*	*111*	*3079*	*101*	*88*	*204*	*132*	*257*	*17*	*609*	*249*	*2036*	*459*
No of companies	*3*	*5*	*30*	*20*	*574*	*17*	*18*	*41*	*25*	*48*	*4*	*146*	*47*	*388*	*93*

t-robust statistics in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Agriculture, forestry and fishing; 2) Mining and quarrying; 3) Construction; 4) Electricity, gas, steam and air conditioning supply; 5) Manufacturing; 6) Water supply; sewerage; waste management and remediation activities; 7) Accomodation and food service activities; 8) Administrative and support service activities; 9) Financial and insurance activities; 10) Information and communication; 11) Other services activities; 12) Real estate activities; 13) Transporting and storage; 14) Wholesale and retail trade; repair of motor vehicles and motorcycles; 15) Professional, scientific and technical activities

Appendix 8: Spatial lag Model Estimation: Full Sample, FDI Stock, OLS and Maximum Likelihood Estimations

	Secondary sector								Tertiary sector			
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	1	*1*	*2*	*2*	*3*	*3*	*4*	*4*	*5*	*5*	*6*	*6*
Parent population	-1.13*	-0.04	0.49	0.33	-0.79*	0.02	-7.79*	1.65	0.63	2.50	0.66**	-1.16***
	(-4.13)	(-0.11)	(1.11)	(0.55)	(-2.6)	(0.03)	(-7.17)	(1.23)	(0.56)	91.49)	(2.06)	(-1.55)
Parent GDP	1.81*	-1.15	0.45**	0.73	1.45*	2.52	8.38*	-1.20	1.40	-9.98*	-0.05	-1.06
	(6.84)	(0.15)	(1.94)	(1.06)	(4.66)	(1.18)	(7.16)	(-0.92)	(0.95)	(-2.54)	(-0.14)	(-0.66)
Parent skilled labour endowment	-10.30*	-6.24*	-6.53*	-6.57*	-0.46	0.14	-11.33*	1.26	15.91*	4.45	12.71*	2.90
	(-8.75)	(-3.67)	(-4.43)	(-4.18)	(-0.41)	(0.08)	(-8.79)	(0.68)	(4.20)	(1.12)	(7.07)	(1.11)
Parent trade costs	-0.31	-0.16	0.46*	0.48*	0.18	-0.21	-0.81**	0.02	-0.07	-0.24	0.81*	0.02
	(-0.74)	(-0.75)	(3.05)	(3.91)	(0.67)	(-1.24)	(-2.34)	(0.08)	(-0.15)	(-0.75)	(3.49)	(0.18)
Distance	-1.31*	-0.73***	-1.54*	-1.63*	-0.92*	-0.44	1.64*	0.14	-5.12*	3.82***	-1.48*	-0.35
	(-6.56)	(-1.59)	(-32.23)	(-8.98)	(-4.54)	(-0.37)	(9.56)	(0.51)	(-4.00)	(1.78)	(-7.78)	(-0.36)
Trend	0.29	0.14	0.45*	0.13	0.23	-0.09	0.15	0.39	-0.48	-0.17	0.36	0.65
	(0.94)	(0.36)	(5.27)	(0.67)	(0.62)	(-0.20)	(0.63)	(1.11)	(-1.09)	(-0.16)	(0.98)	(1.29)
$Trend^2$	-0.003	-0.002	-0.05*	-0.04*	-0.02	0.06	-0.02	-0.04**	0.06	-0.02	-0.01	-0.07**
	(-0.06)	(-0.08)	(-4.53)	(-3.95)	(-0.38)	(1.46)	(-0.72)	(-1.92)	(1.02)	(-0.26)	(-0.23)	(-2.05)
Parent market proximity	--	1.61**	--	-0.18	--	-1.75	--	-0.73*	--	6.91*	--	2.99**
	--	(1.99)	--	(-0.48)	--	(-0.88)	--	(-2.42)	--	(3.07)	--	(1.90)
Host market proximity	--	6.69	--	4.64***	--	-10.01	--	2.96	--	14.25	--	5.23
	--	(1.12)	--	(1.71)	--	(-1.13)	--	(0.62)	--	(1.36)	--	(0.91)
Spatial lag	--	-1.47*	--	0.07	--	2.10*	--	-2.06*	--	-2.05**	--	-1.34*
	--	(-3.72)	--	(0.5)	--	(2.46)	--	(-7.41)	--	(-1.99)	--	(-2.40)
Intercept	1.13	-58.30	8.95	-48.01	12.01	104.59	-38.88	11.32	38.38	-155.02	28.69	-49.24
	(0.62)	(-0.82)	(2.88)	(-1.43)	(6.20)	(1.02)	(-6.05)	(0.19)	(6.67)	(-1.20)	(10.51)	(-0.70)
R-squared	*0.82*	--	*0.99*	--	*0.37*	--	*0.87*	--	*0.84*	--	*0.62*	--
Observation	*53*	*53*	*28*	*28*	*117*	*117*	*36*	*36*	*36*	*36*	*78*	*78*
No of countries	*9*	*9*	*5*	*5*	*20*	*20*	*6*	*6*	*6*	*6*	*14*	*14*

standard errors in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Construction; 2) Electricity, gas, steam and air conditioning supply; 3) Manufacturing; 4) Water supply; sewerage; waste management and remediation activities; 5) Accomodation and food service activities; 6) Administrative and support service activities;

Appendix 8: Spatial lag Model Estimation: Full Sample, FDI Stock, OLS and Maximum Likelihood Estimations

	Tertiary sector										Quaternary sector	
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	7	*7*	*8*	*8*	*9*	*9*	*10*	*10*	*11*	*11*	*12*	*12*
Parent population	-4.91*	-2.76*	-0.46	0.74	0.88*	0.68***	-0.09	-0.35	-1.23*	-2.04*	-1.16	0.30
	(-5.34)	(-2.77)	(-1.00)	(0.73)	(2.61)	(1.77)	(-0.41)	(-0.94)	(-2.47)	(-2.66)	(-1.11)	(0.20)
Parent GDP	6.45*	2.72***	0.70	0.81	0.08	2.28*	0.83*	-0.69	1.55*	2.22	1.75	-1.78
	(6.39)	(1.63)	(1.45)	(0.43)	(0.25)	(2.54)	(3.90)	(-0.54)	(3.25)	(1.07)	(1.55)	(-0.81)
Parent skilled labour	-13.75*	-12.21*	0.68	3.98	6.92*	6.50*	1.29	0.05	-3.13	-6.20**	3.16	4.04*
	(-6.86)	(-7.14)	(0.42)	(1.43)	(3.78)	(3.31)	(1.47)	(0.07)	(-1.37)	(-1.91)	(1.35)	(2.73)
Parent trade costs	0.26	-0.03	1.23*	0.27	1.21*	0.94*	0.42*	-0.06*	-0.47	-0.19	0.59	0.09
	(0.60)	(-0.08)	(3.79)	(1.51)	(3.00)	(2.26)	(2.40)	(-0.70)	(-0.71)	(-0.43)	(0.97)	(0.51)
Distance	-2.12*	-1.90*	-1.39*	-1.66	2.62*	-3.70*	-1.03*	-0.13	-0.25	-0.93	-1.14*	0.002
	(-8.13)	(-4.78)	(-5.52)	(-1.38)	(-11.85)	(-7.18)	(-7.09)	(-0.18)	(-0.84)	(-0.81)	(-4.26)	(0.00)
Trend	0.78**	1.76**	1.08**	-0.71	0.38	-0.55	0.51**	0.09	0.61	0.64	0.15	-0.85**
	(1.90)	(1.96)	(2.05)	(-0.98)	(1.09)	(-0.63)	(1.92)	(0.35)	(1.05)	(0.78)	(0.29)	(-2.01)
$Trend^2$	-0.10***	-0.16*	-0.10	-0.03	-0.02	0.01	-0.05	-0.06	-0.09	-0.14*	0.01	-0.03
	(-1.66)	(-3.12)	(-1.35)	(-0.65)	(-0.33)	(0.17)	(-1.41)	(-3.24)	(-1.17)	(-2.44)	(0.08)	(-1.44)
Parent market proximity	--	0.96	--	-1.68	--	-2.05*	--	1.97***	--	-0.07	--	2.04
	--	(1.18)	--	(-1.02)	--	(-2.71)	--	(1.77)	--	(-0.04)	--	(1.09)
Host market proximity	--	-6.01	--	22.34**	--	11.59	--	9.92*	--	7.62	--	25.21*
	--	(-0.46)	--	(1.96)	--	(0.95)	--	(2.96)	--	(0.59)	--	(2.95)
Spatial lag	--	-2.16*	--	-0.01	--	0.58	--	-0.73***	--	-1.42***	--	-0.64
	--	(-2.92)	--	(-0.04)	--	(1.24)	--	(-1.70)	--	(-1.64)	--	(-1.26)
Intercept	-21.00	92.96	19.26	-240.01	27.71	-113.31	14.14	-110.21	5.68	-67.88	13.39	-295.06
	(-4.16)	(0.59)	(6.62)	(-1.75)	(9.00)	(-0.76)	(9.90)	(-2.74)	(1.44)	(-0.44)	(2.12)	(-2.85)
R-squared	*0.83*		*0.41*		*0.76*		*0.53*		*0.21*		*0.34*	
Observation	*49*	*49*	*80*	*80*	*67*	*67*	*117*	*117*	*80*	*80*	*74*	*74*
No of countries	*9*	*9*	*15*	*15*	*12*	*12*	*20*	*20*	*14*	*14*	*13*	*13*

standard errors in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 7) Financial and insurance activities; 8)Real estate activities; 9) Transporting and storage; 10) Wholesale and retail trade; repair of motor vehicles and motorcycles; 11) Information and communication; 12) Professional, scientifc and technical activities

Appendix 9: Spatial lag Model Estimation: European Sub-sample, Affiliate Sales, OLS and Maximum Likelihood Estimation

	Secondary sector								Tertiary sector			
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	1	*1*	*2*	*2*	*3*	*3*	*4*	*4*	*5*	*5*	*6*	*6*
Parent population	-2.17*	-2.48*	-1.36	-3.88**	-0.86*	-0.48	-11.65*	-5.88**	-10.87*	-1.37	1.61*	1.71*
	(-4.57)	(-3.49)	(-0.81)	(-2.16)	(-3.08)	(-1.15)	(-6.89)	(-2.51)	(-3.03)	(-0.31)	(7.37)	(4.5)
Parent GDP	2.77*	3.42*	1.93**	3.81**	1.41*	1.14*	12.36*	6.64*	15.00*	3.24	-0.97*	-1.05*
	(6.06)	(3.96)	(1.97)	(3.01)	(5.27)	(2.77)	(6.79)	(2.71)	(5.10)	(0.67)	(-4.47)	(-2.74)
Parent skilled labour endowment	-16.21*	-13.82***	-13.58*	-6.25	1.82	0.26	-13.52*	-13.71*	18.79***	4.98	8.95*	6.35*
	(-7.97)	(-2.69)	(-3.02)	(-1.12)	(1.29)	(0.18)	(-6.74)	(-5.47)	(1.70)	(0.61)	(5.97)	(4.75)
Parent trade costs	0.07	0.10	-0.74	-0.96**	0.07	-0.07	-0.89***	-0.81**	0.79	-0.98	-0.01	0.06
	(0.10)	(0.2)	(-1.30)	(-2.01)	(0.22)	(-0.59)	(-1.66)	(-2.53)	(0.76)	(-1.34)	(-0.05)	(1.01)
Distance	-1.38*	-0.61	-2.27*	-3.67*	-1.17*	-0.65	1.51*	1.15*	-7.29***	-3.08	-0.57*	-0.22
	(-4.00)	(-1.38)	(-10.56)	(-3.79)	(-5.20)	(-1.25)	(5.66)	(6.68)	(-1.79)	(-1.17)	(-2.84)	(-0.56)
Trend	0.90***	-0.48	0.22	0.48	0.34	0.33	0.17	0.79	-1.71***	-2.78	0.29	0.32
	(1.67)	(-0.38)	(1.62)	(1)	(1.08)	(0.75)	(0.45)	(0.95)	(-1.86)	(-1.58)	(1.15)	(1.1)
$Trend^2$	-0.11	0.18***	-0.01	0.01	-0.04	-0.06	-0.03	0.10	0.19***	0.26	-0.02	-0.04
	(-1.39)	(1.87)	(-0.58)	(0.21)	(-0.93)	(-1.31)	(-0.61)	(1.33)	(1.65)	(1.16)	(-0.61)	(-1.21)
Parent market proximity	--	-5.71**	--	4.88	--	1.89	--	0.62	--	4.11	--	0.87
		(-2.24)		(1.51)		(1.5)		(0.43)		(1.53)		(1.01)
Host market proximity	--	-23.39	--	-11.18	--	1.66	--	-34.16**	--	11.69	--	2.17
		(-0.91)		(-1.38)		(0.19)		(-2.13)		(0.32)		(0.37)
Spatial lag	--	6.26*	--	-0.15	--	-0.13	--	2.91***	--	3.02	--	-0.15
		(3.39)		(-0.17)		(-0.15)		(1.85)		(0.72)		(-0.25)
Intercept	-11.05	247.42	2.04	86.22	12.61	-37.71	-59.29	318.94	-13.84	-243.37	18.25	-22.85
	(-3.54)	(0.82)	(0.22)	(0.84)	(5.77)	(-0.36)	(-5.93)	(1.63)	(-0.68)	(-0.55)	(7.14)	(-0.33)
R-squared	*0.69*	--	*0.97*	--	*0.53*	--	*0.69*	--	*0.60*	--	*0.72*	--
Observation	*53*	*53*	*22*	*22*	*99*	*99*	*36*	*36*	*27*	*27*	*69*	*69*
No of countries	*9*	*9*	*4*	*4*	*17*	*17*	*6*	*6*	*5*	*5*	*12*	*12*

standard errors in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 1) Construction; 2) Electricity, gas, steam and air conditioning supply; 3) Manufacturing; 4) Water supply; sewerage; waste management and remediation activities; 5) Accomodation and food service activities; 6) Administrative and support service activities

Appendix 9: Spatial lag Model Estimation: European Sub-sample, Affiliate Sales, OLS and Maximum Likelihood Estimations

	Tertiary sector										Quaternary sector	
	OLS	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*	*OLS*	*ML*
	7	*7*	*8*	*8*	*9*	*9*	*10*	*10*	*11*	*11*	*12*	*12*
Parent population	-2.20**	-9.43*	0.07	0.35	0.36***	-0.27	0.11	0.04	-1.27*	-1.97**	2.03***	0.76
	(-1.92)	(-3.49)	(0.22)	(0.85)	(1.63)	(-0.66)	(0.41)	(0.08)	(-2.52)	(-2.44)	(1.59)	(0.4)
Parent GDP	2.71**	11.26*	0.08	-0.30	0.48**	0.88**	0.82*	0.77	1.64*	2.21*	-1.25	0.33
	(2.08)	(3.62)	(0.25)	(-0.68)	(2.24)	(2.06)	(2.96)	(1.48)	(3.52)	(2.77)	(-0.87)	(0.15)
Parent skilled labour endowment	-1.32	-1.03	3.00**	3.18	6.87*	1.43	1.82**	-0.03	1.92	-3.46	5.33**	0.89
	(-0.66)	(-0.99)	(1.95)	(1.48)	(5.9)	(1.26)	(1.80)	(-0.03)	(0.83)	(-0.95)	(2.26)	(0.27)
Parent trade costs	-0.55	-0.04	0.59**	0.43**	1.07*	-0.17	0.14	-0.13	0.36	0.28	-1.17***	-0.49
	(-1.14)	(-0.26)	(2.29)	(2.23)	(3.92)	(-1.1)	(0.67)	(-1.01)	(0.55)	(0.66)	(-1.73)	(-0.87)
Distance	-2.24*	-2.77*	-1.77*	-1.86*	2.86*	-2.36*	-1.36*	-1.16*	-0.63**	-0.63	-1.29*	-0.98
	(-7.89)	(-2.97)	(-7.27)	(-6.72)	(-14.78)	(-4.63)	(-8.29)	(-4.96)	(-1.83)	(-0.85)	(-3.50)	(-1.58)
Trend	0.07	0.19	0.69**	-1**	0.02	0.05	0.53***	-0.21	0.04	0.74	0.07	-2.24
	(0.17)	(0.62)	(1.98)	(-1.14)	(0.09)	(0.33)	(1.70)	(-0.41)	(0.08)	(0.71)	(0.13)	(-1.66)
$Trend^2$	-0.01	-0.04	-0.03	-0.14*	0.02	-0.01	-0.06	0.01	-0.02	-0.13	0.02	-0.08***
	(-0.11)	(-1.23)	(-0.55)	(-2.25)	(0.53)	(-0.49)	(-1.44)	(0.21)	(-0.2)	(-1.33)	(0.28)	(-0.72)
Parent market proximity	--	-1.45	--	-1.45	--	-0.25	--	-1.20	--	3.63	--	1.89
		(-0.72)		(-0.72)		(-0.24)		(0.96)		(1.51)		(0.74)
Host market proximity	--	2.17	--	2.17	--	5.22*	--	1.32	--	6.38	--	58.66**
		(0.3)		(0.3)		(4.69)		(0.13)		(0.3)		(2.14)
Spatial lag	--	-0.64	--	-0.64	--	-0.39	--	1.61***	--	-2.44	--	-0.94
		(-0.9)		(-0.9)		(-0.97)		(1.68)		(-1.28)		(-0.43)
Intercept	9.97	-23.27	20.85	-585.06	25.59	-34.97	11.29	-14.50	8.78	-88.05	19.30	-717.16
	(1.40)	(-0.27)	(8.14)	(-2.85)	(12.25)	(-2.21)	(6.29)	(-0.12)	(2.36)	(-0.34)	(2.16)	(-2.17)
R-squared	*0.67*	--	*0.66*	--	*0.87*	--	*0.59*	--	*0.40*	--	*0.53*	--
Observation	*44*	*44*	*68*	*68*	*61*	*61*	*102*	*102*	*69*	*69*	*67*	*67*
No of countries	*8*	*8*	*12*	*12*	*11*	*11*	*17*	*17*	*13*	*13*	*12*	*12*

standard errors in parentheses; ***significant at 10% level, **significant at 5% level, * significant at 1% level

Legend: 7) Financial and insurance activities; 8)Real estate activities; 9) Transporting and storage; 10) Wholesale and retail trade; repair of motor vehicles and motorcycles; 11) Information and communication; 12) Professional, scientifc and technical activities