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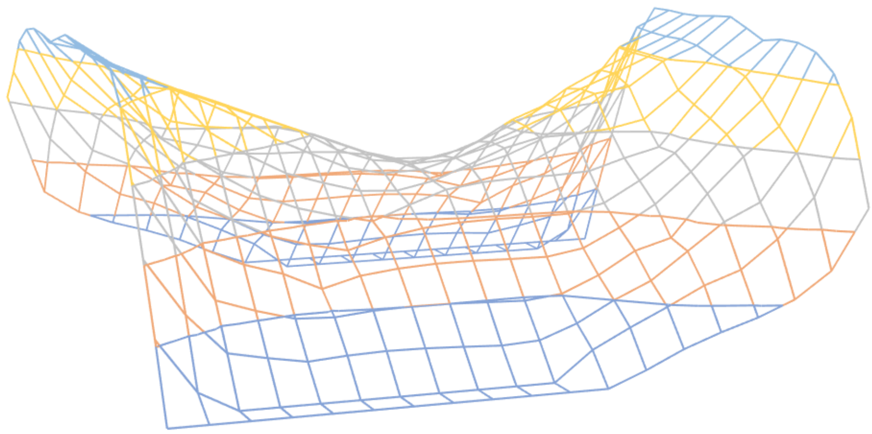
The Knowledge Capital Model Revisited

Modeling Multinationals in General Equilibrium and Estimating Country Size and Skill Effects on Affiliate Turnover for Manufacturing and Services Industries



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Abstract

The Knowledge Capital model – described in Markusen (2002) - is a general equilibrium model that allows horizontally integrated multinationals, vertically integrated multinationals, and national firms to arise endogenously, based on exogenous country characteristics such as size and relative skill endowments. Using numerical simulations, I show that the model predicts manufacturing affiliate sales 1) to increase in size similarities, 2) to increase in skill-endowment similarities, and 3) to be high when a country is both small and skilled-labor abundant. I estimate these predictions on bilateral panel data for 81 home countries and 76 host countries (period: 2008-2014), using two distinct regression specifications, using both occupational skill levels and human capital as a measure for skilled-labor abundance, and for both manufacturing and services industries. My manufacturing industries results are mixed but slightly supportive of the predictions of the KC model. Results for the services industries are strikingly similar. Since the predicted pattern of affiliate sales is expected to be different for services industries than for manufacturing industries, these similar results suggest that the uncovered effects are due to some unknown mechanisms that are not reflected in the model. The results question the credibility of the model as a tool to predict patterns of multinational activity.

Preface

This thesis serves as the concluding piece of a challenging and interesting year at the Erasmus School of Economics. I start with some words of gratitude. First of all, I would like to thank my supervisor, Prof. Dr. Jean-Marie Viaene. His expertise, advice and constructive criticism have been very helpful throughout this process and guided me in the right direction. I thank Dr. Julian Emami Namini for being willing to read and asses this thesis as second assessor, but also for some helpful starting tips on how to approach the programming of numerical simulations in GAMS. As well, I thank Dr. Henrik Braconier, Dr. Pehr-Johan Norbäck and Dr. Dieter Urban for sending me the data appendix of their research. This has been of great help.

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1. Introduction

The Knowledge Capital (KC) model is a general equilibrium model that allows horizontally integrated multinationals, vertically integrated multinationals, and national firms to arise endogenously, based on exogenous country characteristics such as size and relative skill endowments. The model can be used to predict patterns of firm types and affiliate sales for the manufacturing sector, in a two-country Edgeworth box setting for which the x-axis denotes skilled labor and the y-axis denotes unskilled labor. The volume of affiliate sales can be plotted on a vertical axis. The KC model is one of the few general equilibrium models that endogenize multinationals, alongside models of vertical multinationals (e.g., Helpman, 1984; Helpman and Krugman, 1984) and models of horizontal multinationals such as Markusen (1984) and Markusen and Venables (1998). General equilibrium models of multinationals are complex yet insightful: shocks to exogenous variables – e.g., trade costs or labor endowments - can be directly imposed to the model, to see how patterns of multinational activity are affected by changes in these variables.

Through numerical simulations, the KC model predicts a pattern of firm types in which horizontal multinationals are dominant when two countries are similar in size and endowments, vertical multinationals are dominant when one country is small and skilled-labor abundant, and national firms dominate when countries are similarly endowed but highly dissimilar in size. From these outcomes, a pattern of affiliate sales can be derived, which is more suitable for empirical estimation. What follows are three main predictions for the manufacturing industries: affiliate sales 1) increases in size similarities, 2) increases in skill-endowment similarities, and 3) is high when a country is both small and skilled-labor abundant (Markusen, 2002; Carr, Markusen and Maskus, 2001).

The model predictions have been estimated by several studies in the early 2000s, from which Carr, Markusen, and Maskus (2001) – hereafter: CMM - and Braconier, Norbäck and Urban (2005) – hereafter: BNU – are the most notable. CMM perform estimations on a sample of US-bilateral observations for the years 1986-1994. Their results are supportive of the predictions of the KC model. Although their approach was innovative and received positive appraisals, it also faced criticisms. For instance, Blonigen, Davies, and Head (2003) point out that skill endowment differences were incorrectly specified in the CMM regression specification. Other criticism comes from BNU, who explain that CMM's coverage of the factor-endowment space is too limited because their sample only includes US observations. They perform regressions on an extended sample, with better factor-endowment coverage and a longer timeframe (until 1998). They propose a new regression specification that is mapped directly from the two-country Edgeworth box setting of the model. The BNU results, too, are supportive of the predictions of the KC model.

In this thesis, I estimate the effects of country characteristics such as relative size and skilled-labor endowments on affiliate turnover[1] of multinational firms. I do this by using two specifications (CMM and BNU), using two distinct measurements of skilled-labor endowment (occupational skill levels and human capital), for two different industries (manufacturing and services). The estimations on the manufacturing sector can be viewed as a replication of the CMM and BNU studies. My objectives are to uncover to what

[1] A note on the terminology: my dependent variable is named *Turnover* and measures *Real Sales* of affiliates in country j of firms headquartered in country i. Thus, turnover is equivalent to sales. Furthermore, turnover/sales equals production in equilibrium.

extent the predictions of the KC model for manufacturing industries are supported in the most recent data and to see how the two different specifications compare regarding estimated effects, fitness and predictive power. These insights shed light on the relevance of the KC model and, more fundamentally, on the way in which affiliate turnover for manufacturing industries is driven by country characteristics. My estimations on the services sector can be viewed as a way to check for the robustness of my manufacturing results and to shed some new light on the credibility of the KC model. Estimations on services industries are relevant, given both the rapid growth of these industries and the fact that empirical evidence on services has traditionally lacked behind compared to manufacturing industries (Markusen and Strand, 2009).

I contribute to the literature in several ways. 1) I replicate the studies by CMM and BNU, showing how numerical simulations can be used to derive empirical predictions of the KC model for manufacturing industries, providing a syntax for these simulations which was not yet publicly available, and actualizing the CMM and BNU estimations for a 2008-2014 timeframe. 2) I improve the studies of CMM and BNU, using a more extensive data sample that is superior in coverage of factor-endowment combinations and the number of observations, and using a more reliable measurement of trade and investment conditions. 3) I add a new element to the existing literature by considering human capital as an alternative way to measure a country's skill-abundance. 4) I am the first to perform these estimations on affiliate turnover for services industries. 5) I check for robustness by explicitly controlling for effects of the 2008-2010 financial crisis, exploring the role of factor-endowments coverage by limiting the sample to only US-observations, and by including a measurement of bilateral symmetric trade costs.

For the manufacturing sector, I show that support for the predictions of the KC model is mixed but slightly positive. I also show that using human capital to capture skilled-labor abundance of a country, is an improvement to the model. Furthermore, I show that estimated effects for services industries and manufacturing industries are strikingly similar, suggesting that estimated effects of country characteristics on affiliate turnover are not sector-dependent. I will explain that this finding questions the credibility of the KC model as a tool to predict patterns of multinational activity.

This paper is structured as follows. In Section two, I provide an overview of the relevant literature. In Section three, I lay out the basic assumptions of the KC model and explain how I used numerical simulations to derive testable predictions from the model. In Section 4, I discuss the CMM and BNU papers and make an explicit comparison between the regressions specifications used in these studies. In Section 5, I discuss my empirical methodology. In Section 6, I present the empirical results from my analysis for manufacturing industries. In Section 7, I present the empirical results for the services industries regressions. In Section 8, I conclude.

2. Literature Review

The New Trade Theory, led by Krugman (1980), introduced increasing returns to scale, imperfect competition and product differentiation to trade models. As opposed to traditional general equilibrium trade models such as Ricardo and Hecksher-Ohlin – which rely on comparative advantage as the primary explanation of international trade – these new trade models were better capable of explaining trade in similar goods, between countries that are similar in factor endowments and technology. In early New Trade Theory models, such as Krugman (1980), firms are modeled as national firms (NE's): firms with a headquarter and single plant in the same country. Later – driven by empirical evidence that showed the importance of firms that operate internationally, through subsidiaries - models started to allow for multinational firms (MNE's).

Helpman (1984) and Markusen (1984) are the respective starting points for two types of general equilibrium trade models that incorporate MNE's: vertical and horizontal models. Helpman (1984) focusses on vertically integrated firms, modeling firm activity as being geographically separable: the production can be separated in a labor-intensive and a capital-intensive component and will be based on differences in factor intensities between countries. Assumed is that trade costs are zero, which means that firms do not have an incentive to have multiple plants in different countries, and thus are not involved in horizontal multinational activity. Related to this approach is Helpman and Krugman (1985). Markusen (1984) focusses on horizontally integrated firms: a firm may choose not to export to a foreign country, but to produce in a foreign subsidiary and thus avoid additional trade costs. Related to the horizontal approach are studies such as Horstmann and Markusen (1987), Brainard (1993), Horstmann and Markusen (1992) and Markusen and Venables (1998). Notable is Markusen and Venables (1998), who perform numerical simulations of a horizontal model, showing that multinational activity increases in similarities of sizes and endowments of countries. In the literature, support for the vertical model is weak, while the horizontal models receive moderately strong support (Brainard, 1993; Brainard, 1997; Carr, Markusen, and Maskus, 2001; Markusen and Maskus, 2001; Markusen and Maskus 2002; Blonigen, Davies, and Head, 2003).

The Knowledge Capital Model (KC model) is a synthesis of the vertical and horizontal models of multinationals. Thus, respectively, it allows a firms' production process to be both geographically separable (incentivized by cost advantages resulting from factor-endowment differences) as well as fully replicable in several locations (incentivized by a joint input characteristic of headquarter services, which allows for firm-level scale economies). It is described in Markusen et al. (1996), Markusen (1997) and Markusen (2002). Key predictions of the model (in a two-country Edgeworth-box setting, for manufacturing industries) are that horizontal multinationals dominate when countries are similar in size and endowments, and that vertical multinationals dominate when one country is both small and skilled-labor abundant. In these cases, multinational activity – measured with affiliate sales (or equivalent: production[2]) – peaks. In the other cases, national firms dominate. In Section 3, I will discuss the model and its predictions in more detail.

2 In equilibrium, sales equals production.

Several studies have subjected the predictions of the KC model to econometric estimation. One empirical challenge for estimations of the KC model is the lack of data that distinguishes between sales of horizontal and vertical multinationals. For this reason, testing the predicted pattern of horizontal multinationals, vertical multinationals, and national firms is difficult. Thus, the conventional approach in the literature has been to look at total volumes of affiliate sales, as the KC model also predicts volumes of affiliate sales based on country characteristics such as endowments differences and country size. I now provide a brief overview of this literature. In Section 4, I provide a detailed discussion of CMM and BNU, the two papers that form the basis of my empirical estimations later in this thesis.

CMM (discussed more thoroughly in Section 4) is the most well-known effort to estimate the empirical predictions of the KC model. CMM relate affiliate sales to several country-specific independent variables, for which the main variables capture GDP and relative skill endowments. Relative skill endowments are captured with the skill difference: the difference in the share of skilled-labor endowments between the home and host country. They use a cross-country panel data set that includes bilateral observations for the US, for the years 1986-1994. In all observations, the US is either the home or the host country, which has the disadvantage that all observations include at least one large, skilled-labor endowed country. The CMM results support the empirical predictions of the KC model.

Markusen and Maskus (2002) use the same CMM dataset to distinguish between the vertical, horizontal and KC model. They estimate the KC model with two modified versions of the same model which only allow for, respectively, horizontal and vertical multinational activity. Their results reject the vertical model and support both the horizontal and KC model.

Blonigen, Davies, and Head (2003) – hereafter: BDH - criticize the CMM approach, posing that in the empirical model of CMM the component that measures skill differences between countries, is incorrectly specified. CMM measure skill differences between country i and country j by subtracting the share of skilled labor (of the total employment) of country j from the share of skilled labor of country i. For some observations, this subtraction results in a positive skill difference and for others, in a negative skill difference. BDH argue that the sign of this difference term affects its interpretation, and that pooling these positive and negative values into one estimated coefficient, is incorrect. They propose specifications that resolve this issue and – using both the CMM dataset and an expanded dataset – they show that with these specifications, the KC model cannot be supported. In their 2003 paper, Carr, Markusen, and Maskus largely reject the BDH-critique. They argue that the specifications as proposed by BDH are not consistent with the theory of the KC model and, for instance, ignores that the KC model predicts different levels of affiliate sales for different endowment points in the Edgeworth box. They explain that other implications of the BDH study, including the finding that the horizontal model dominates the vertical model, have already been discussed in studies such as Brainard (1997), and Markusen and Maskus (2002).

Davies (2008) notes that the KC model predicts a nonmonotonic relationship between skill differences and affiliate sales, which is not captured with the CMM specification. The author poses alternative specifications that are based on CMM. One improvement is that he, in addition to the skill difference, also adds the squared term of this variable. He also uses FDI stock as an alternative measurement of multinational activity, in addition to affiliate sales. Using both the CMM data and the BDH expanded dataset, Davies (2008) finds support for the KC model in some of his regressions.

Where Markusen and Maskus (2002); Blonigen, Davies, and Head (2003); Carr, Markusen, and Maskus (2003) and Davies (2008) directly build upon the work by CMM – e.g., by adjusting some features of the CMM specification, or by including additional variables – and thus tend to improve existing empirical models, BNU (discussed more thoroughly in Section 4) take a different approach. BNU do not merely improve but redefine the existing empirical models. Their main point is that the CMM-based specifications are drawn *indirectly* from the theory of the KC model and that a regression specification – more specifically: the size and skill variables - should be derived *directly* from the two-country Edgeworth box setting of the model. One advantage of this approach is that it allows for a direct comparison between the empirical results and the models' predictions. Another improvement of BNU is their data coverage: they include not only US bilateral observations, as was the case in CMM, but various combinations of countries. Thus, the data includes many more factor-endowment combinations and has better coverage of the endowment space. BNU find strong support for the KC model. An interesting additional result is that BNU do not find support for the KC model when they use the CMM specification on their data sample.

The KC model served for numerous purposes in academic discussions of FDI and international trade flows. Examples of applications and extensions are Bergstrand and Egger (2007), Namini and Pennings (2009), Mariel, Orbe, and Rodríguez (2009), Markusen and Strand (2009), Kristjánsdóttir (2010) and Chellaraj, Maskus, and Mattoo (2013).

3. The Knowledge Capital Model

3.1 Model Structure

The version of the KC model that I use in this thesis is the one described in Markusen (2002)[3], which is adjusted for manufacturing industries. I will lay out the underlying assumptions, structure and simulation results of the model. For a full, technical description of the model, I refer to Markusen (2002). For a list of equations, I refer to Appendix A. A list of important notations can be found in Appendix B.

The KC model is a general equilibrium model that quantifies the volume of affiliate sales[4] and the emergence of horizontally fragmented multinationals, vertically fragmented multinationals and national firms, into a two-country Edgeworth box framework with unskilled labor on the x-axis and skilled labor on the y-axis. In the model, there are two countries (i and j), two homogenous goods (X and Y), and two homogenous factors (unskilled labor L and skilled labor S) that are mobile between the two industries but immobile between the two countries. Good Y serves as the numeraire. Good X is characterized by increasing returns to scale, Cournot competition, and free entry and exit of firms in the industry. In equilibrium, (a combination of) different types of multinationals arise(s) endogenously, given exogenous country characteristics such as trade cost and relative endowments of skilled and unskilled labor.

Central in the model are three assumptions about skilled-labor intensive services that are supplied by the headquarter of a firm - hereafter: headquarter services. These headquarter services are 'knowledge-based' and include intangible assets of firms such as blueprints, patents, human capital, and reputation. First, it is assumed that locational fragmentation between production and headquarter services is possible. Thus, firms can locate production in one country and their headquarters elsewhere. Second, headquarter services are assumed to be skilled-labor intensive relative to production. Third, headquarter services are assumed to be joint inputs for multiple production locations. This means that once supplied; multiple production plants can make use of the same headquarter services, at the same time and without many extra costs.

The above implies that there are six possible firm types: horizontal multinational firms with headquarters in country i or j and plants in both countries (type H_i and type H_j), vertical multinational firms with headquarters in country i or j and a production plant in the other country (type V_i and type V_j), and national firms with headquarters and a production plant on country i or j (type D_i and type D_j).

All firms pay both variable and fixed costs. Naturally, the cost structure differs per firm type. A type D_i firm incurs high-skilled fixed costs for its headquarters and low-skilled fixed costs for its production plant in country i. A type H_i firm incurs high-skilled fixed costs on its headquarters in country i, on low-skilled-fixed costs on both its production plants, and also on a small amount of high-skilled fixed costs for management and coordination of the foreign plant in country j. A type V_i firm incurs high-skilled fixed costs on its headquarters in country i, low-skilled fixed costs on its production plant in country j, and also some high-skilled fixed costs for management and coordination of the foreign plant in country j. Type D_i and V_i firms pay trade costs if they export to, respectively, country j and i. Type H_i firms never pay trade cost.

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3 In earlier descriptions of this model (e.g. Markusen et al, 1996; and Markusen, 1997) some assumptions and thus simulation results are slightly different.

4 Sales equals production in equilibrium.

The different firm types and their cost structures are summarized in Table 3.1. Fixed costs for unskilled labor (G) are assumed to be equal regardless of firm type. Fixed costs for skilled labor ($F_i^h, F_j^h, F_i^v, F_j^v, F_i^d, F_j^d$) depend on the firm type and country. Assumed is the following[5] (for firms headquartered in country i):

$$2 * F_i^d > F_i^h + F_j^h > F_i^d < F_i^h \tag{3.1}$$

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

The set of firms that are active is called the regime and can be plotted in a two-country Edgeworth box, thus given the endowments of the respective countries. The types of firms that are active and thus arise in equilibrium differ over the set of possible endowment points, given the different cost structures of the firm types and thus given the different ways in which firm types' profits respond to changes in the exogenous country characteristics.

Table 3.1 - Firm Types and Cost Structures*

Firm type	Definition	Fixed costs incurred by firm**	Variable costs incurred by firm**
Type $\boldsymbol{H_i}$ ($\boldsymbol{H_j}$)	Horizontal multinational that is headquartered in country i (j) and has plants in both country i and j. It does not export.	$z_i * F_i^h + w_i * G + z_j * F_j^h + w_j * G$	For sales in country i: $c_i(w_i, z_i)$ For sales in country j: $c_j(w_j, z_j)$
Type $\boldsymbol{V_i}$ ($\boldsymbol{V_j}$)	Vertical multinational that is headquartered in country i (j) and has a single plant in country j (i). It may export to country i (j).	$z_i * F_i^v + w_j * G + z_j * F_j^v$	For sales in country i: $c_j(w_j, z_j)(1+\tau)$ For sales in country j: $c_j(w_j, z_j)$
Type $\boldsymbol{D_i}$ ($\boldsymbol{D_j}$)	National firm that has its headquarters and its single plant in country i (j). It may export to country j (i).	$z_i * F_i^d + w_i * G$	For sales in country i: $c_i(w_i, z_i)$ For sales in country j: $c_i(w_i, z_i)(1+\tau)$

Notes: * A list of the used notations can be found in Appendix B ** Costs are denoted for firms headquartered in country i. Costs for i and j are symmetric.

3.2 Simulations and Empirical Predictions for Manufacturing Industries

The KC model can be formulated as a nonlinear complementarity problem and solved by performing numerical simulations. This has been done for several models that endogenize multinationals, e.g., in Markusen and Venables (1998) and Markusen (2002) for models of horizontal multinationals, and in Carr, Markusen and Maskus (2001) and Markusen (2002) for the KC model. I replicate the simulations for manufacturing industries performed in Markusen (2002) using Rutherford's (1995, 1999) Mathematical Programming System for General Equilibrium (MPS/GE), which is a subsystem of GAMS. The appendices in Markusen's book (2002), providing examples of simulations of simpler but comparable models, proofed very useful in performing the simulations. I provide my syntax in Appendix C of this thesis. My simulation

[5] $2 * F_i^d > F_i^h + F_j^h > F_i^d$ captures the jointness assumption; $F_i^d < F_i^h$ captures the high-skilled fixed costs that are incurred by the horizontal firm for management and coordination of the foreign plant in country j; $F_i^h + F_j^h > F_i^v + F_j^v > F_i^d$ captures the assumption that fragmentation is possible (i.e.: lower fixed costs for vertical firm compared to the horizontal firm), but that the transfer of technology leads to some extra costs for the vertical firm (i.e.: higher fixed costs for vertical firm compared to the national firm).

results are shown in Figure 3.1, Panels A-C, and in Appendix D. They match the results in Markusen (2002)[6] and are similar to the simulation results published in CMM.[7]

Figure 3.1 shows the results for the baseline case in which $tcost = 0.20$.

Figure 3.1A shows the pattern of multinational activity over a box with 200 factor-endowment combinations. Cell values show the set of firms that are active in equilibrium (the regime), given the cells factor-endowment combination. The cell value equals the sum of $I_i^d, I_j^d, I_i^v, I_j^v, I_i^h$ and I_j^h where $I_i^d = 100$, $I_j^d = 10$, $I_i^v = 2.0$, $I_j^v = 0.2$, $I_i^h = 0.01$ and $I_j^h = 0.001$ if the respective type is active, and 0 otherwise. Thus, cell value 102.01 means that in equilibrium the set of firms consists of type D_i, V_i and H_i firms. The figure shows that, when countries are similar in size and endowments (in the dark-blue shaded center of the box), only horizontal multinational firms are active. When country i is skilled-labor abundant, these multinationals are headquartered in country i (and vice versa). Vertical multinationals appear when one country is both small and skilled-labor abundant (in the left-upper or right-lower side of the box). National firms dominate (and thus multinational activity does not occur) when countries are equal in endowments but highly dissimilar in size (in the lower-left and upper-right corners of the box).

Figure 3.1B shows the plotted volume of affiliate sales, based on the same simulation results and thus for the same 200 factor-endowment combinations. Green-shaded (dark-colored) cells denote the highest values. For combinations where only national firms were active (as showed in Figure 1A), affiliate sales are zero. The highest values of affiliate sales occur when one country is both small and skilled-labor abundant. The values are plotted in Figure 3.1C. The plot shows the familiar saddle pattern, as displayed before in CMM (2001, p. 696) and Markusen (2002, p. 146). Between the country i origin and the country j origin (thus following the black dashed line), one can observe an inverted U-shape pattern. From these results, three testable, empirical predictions can be derived: 1) affiliate sales are highest when countries have similar sizes, 2) affiliate sales decrease in size dissimilarity and 3) affiliate sales peak when one country is both small and skilled-labor abundant.

The value of $tcost$ can be adjusted to examine the effect of an increase or decrease in trade costs on the pattern of firms and on the volume of affiliate sales. In Appendix D, Figures 1, 2 and 3, I show simulation results for three cases: $tcost$ = 0.15, $tcost$ = 0.20, and $tcost$ = 0.25. Figure 1 shows that a change in trade costs has opposite effects on vertical and horizontal multinationals: when increasing $tcost$ from 0.15 (Panel A) to 0.20 (Panel B) to 0.25 (Panel C), vertical multinationals become less dominant while horizontal multinationals become more dominant. Figure 2 shows the total values of affiliate sales for these three cases. Figure 3 shows the total values of affiliate sales for the case where $tcost$ = 0.25, minus the case where $tcost$ = 0.15. Most cells show an increase in affiliate sales. The largest values appear just outside of the center of the box, where horizontal multinationals grew more dominant. Some cells in the lower-left and upper-right sides of the box show a decrease in affiliate sales, reflecting the decrease in vertical multinational activity.

[6] My simulation results for the base case (tcost = 0.20) match the results in Markusen (2002) to the extent that the pattern of dominant firm types is identical and that the plotted values of affiliate sales/turnover show a similar saddle-shaped pattern. For some endowment points, there are (marginal) differences in regime and volumes of affiliate turnover. More on this in Appendix D.

[7] The simulations in CMM are based on a slightly different version of the KC model, described in Markusen et al (1996) and Markusen (1997). Thus, simulations results in CMM and Markusen (2002) are slightly different. These differences do not change the main predictions of the model.

Figure 3.1 - Simulation Results for the Base Case ($tcost = 0.20$).

Panel A.

Host country origin (country j)

1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	102.000	102.000	102.000	102.000	102.000	102.000	102.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	0.05
0.9	102.000	102.000	102.000	102.000	102.010	102.010	100.010	100.010	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.200	100.200	0.1
0.85	102.000	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.200	100.200	0.15
0.8	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.201	100.200	0.2
0.75	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.001	100.001	100.001	100.201	100.200	0.25
0.7	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.001	100.201	0.200	0.3
0.65	102.000	2.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	0.010	0.010	0.010	0.011	100.011	100.001	100.001	100.001	0.201	0.201	0.35
0.6	102.010	2.010	102.010	100.010	100.010	100.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	100.011	100.001	100.001	0.201	0.201	0.201	0.4
0.55	2.010	2.010	102.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	100.001	0.001	0.001	0.201	0.201	0.201	0.45
0.5	2.010	2.010	2.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.5
0.45	2.010	2.010	2.010	0.010	0.010	10.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.55
0.4	2.010	2.010	2.010	10.010	10.010	10.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	10.001	10.001	10.001	10.201	10.201	10.201	0.6
0.35	2.010	2.010	10.010	10.010	10.010	10.011	0.011	0.001	0.001	0.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	0.65
0.3	2.000	12.010	10.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.7
0.25	12.000	12.010	10.010	10.010	10.010	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.75
0.2	12.000	12.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	0.8
0.15	12.000	12.000	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	10.200	0.85
0.1	12.000	12.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.001	10.001	10.201	10.201	10.200	10.200	10.200	10.200	0.9
0.05	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.200	10.200	10.200	10.200	10.200	10.200	10.200	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

s_i

Home country origin (country i)

u_i

Panel B.

Host country origin (country j)

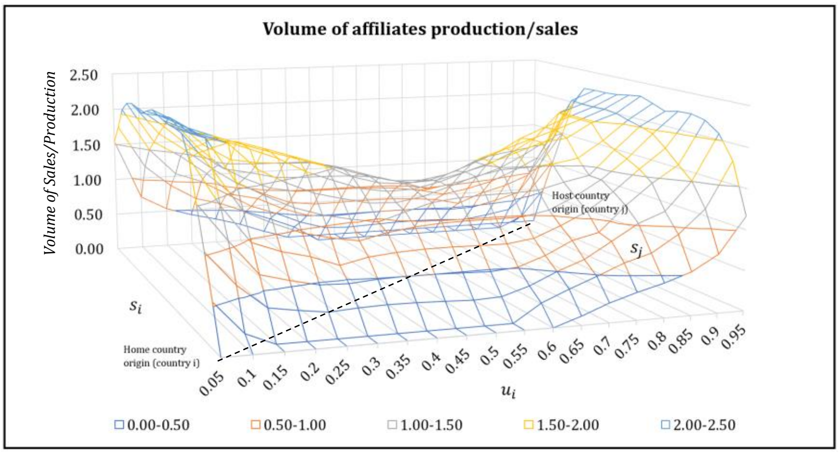
1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	1.543	0.726	0.536	0.426	0.340	0.240	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05
0.9	1.789	1.217	0.926	0.719	0.624	0.487	0.358	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.153	0.542	0.1
0.85	2.076	1.504	1.149	1.021	0.822	0.623	0.500	0.350	0.247	0.232	0.246	0.258	0.262	0.252	0.232	0.281	0.339	0.630	1.037	0.15
0.8	2.200	1.656	1.444	1.183	0.869	0.793	0.628	0.510	0.480	0.490	0.500	0.502	0.492	0.466	0.478	0.557	0.653	1.075	1.525	0.2
0.75	2.239	1.818	1.570	1.302	1.072	0.913	0.777	0.731	0.734	0.741	0.739	0.723	0.690	0.614	0.745	0.832	0.964	1.419	2.005	0.25
0.7	2.231	1.958	1.650	1.401	1.204	1.051	0.987	0.981	0.983	0.975	0.950	0.901	0.823	0.883	0.966	1.107	1.272	1.792	2.239	0.3
0.65	2.191	2.123	1.719	1.404	1.333	1.249	1.233	1.229	1.214	1.175	1.077	0.971	1.030	1.105	1.216	1.383	1.576	2.120	2.250	0.35
0.6	2.256	2.123	1.794	1.578	1.519	1.492	1.482	1.414	1.302	1.194	1.137	1.152	1.230	1.319	1.470	1.657	1.994	2.109	2.250	0.4
0.55	2.316	2.123	1.897	1.860	1.755	1.640	1.528	1.420	1.309	1.234	1.225	1.282	1.405	1.536	1.721	1.859	1.986	2.107	2.263	0.45
0.5	2.292	2.117	1.988	1.867	1.755	1.646	1.539	1.381	1.282	1.249	1.282	1.381	1.539	1.646	1.755	1.867	1.988	2.117	2.292	0.5
0.45	2.263	2.107	1.986	1.859	1.721	1.536	1.405	1.282	1.225	1.234	1.309	1.420	1.528	1.640	1.755	1.798	1.986	2.099	2.316	0.55
0.4	2.250	2.109	1.994	1.657	1.470	1.319	1.230	1.152	1.137	1.194	1.302	1.414	1.482	1.492	1.519	1.578	1.794	2.050	2.256	0.6
0.35	2.250	2.120	1.574	1.383	1.216	1.105	1.030	0.971	1.077	1.175	1.214	1.229	1.233	1.249	1.333	1.404	1.719	2.011	2.191	0.65
0.3	2.239	1.792	1.272	1.107	0.966	0.883	0.823	0.901	0.950	0.975	0.983	0.981	0.987	1.051	1.205	1.401	1.650	1.958	2.231	0.7
0.25	2.005	1.419	0.964	0.832	0.745	0.614	0.690	0.723	0.739	0.741	0.734	0.731	0.777	0.913	1.072	1.302	1.570	1.818	2.239	0.75
0.2	1.525	1.075	0.653	0.557	0.478	0.466	0.492	0.502	0.500	0.490	0.480	0.510	0.628	0.791	0.869	1.183	1.444	1.656	2.200	0.8
0.15	1.037	0.630	0.339	0.281	0.232	0.252	0.262	0.258	0.246	0.232	0.247	0.350	0.500	0.623	0.822	1.021	1.149	1.504	2.076	0.85
0.1	0.542	0.153	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.217	0.358	0.487	0.624	0.719	0.926	1.217	1.789	0.9
0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.240	0.340	0.426	0.536	0.726	1.166	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

s_i

Home country origin (country i)

u_i

Panel C.



Notes: Panel A) Cell values show what types of firms are active in equilibrium, given the cells factor-endowment combination. Cell value is the sum of $I_i^d, I_j^d, I_i^v, I_j^v, I_i^h$ and I_j^h where $I_i^d = 100, I_j^d = 10, I_i^v = 2.0, I_j^v = 0.2, I_i^h = 0.01$ and $I_j^h = 0.001$ if the respective type is active, and 0 otherwise.

4. CMM and BNU: a Comparison

Now follows a comparison of the CMM and BNU papers, which I discussed briefly in the above. For manufacturing industries, both papers regress real affiliate sales (1990 US$, millions) in the host country (j) of firms headquartered in the home country (i) on several explanatory and control variables that capture country characteristics.

CMM use cross-country, US bilateral panel data for the years 1986-1994, for a total of 37 countries. In every observation, the US serves as either the home or the host country. CMM estimate several models – OLS, WLS, and Tobit; without FE and with host country FE – for which the number of observations ranges from 509 to 628.

BNU use a dataset including a total of 56 home countries and 85 host countries, for the years 1986, 1990, 1994, and 1998. Due to the extended data coverage, it is not the case - as opposed to CMM – that all observations include the US and thus at least one large, skilled-labor abundant country. The dataset now also includes combinations of, for instance, small skilled-labor abundant countries with large unskilled-labor abundant countries. The latter is essential, because the KC model predicts affiliate sales to peak in the case of such factor-endowment combinations (vertical FDI), while the CMM study did not include these combinations. BNU estimate several models – OLS, WLS; without FE and with home and host country FE - for which the number of observations ranges from 507 to 1796.

The most notable difference between the CMM and BNU studies is the specification of the main regressors, i.e., the variables that measure country size and relative skilled-labor endowments. A comparison and graphical representation of the variables is shown in Table 4.1 (end of this section). On the left-hand side of this table, I show the variables and their construction. On the right-hand side, I show graphically how the two specifications can be related to a two-country World Edgeworth box setting. The main variables of BNU are drawn *directly* from the Edgeworth box, while the main variables of CMM are more *indirectly* related.

The CMM specification is showed in Panel A of Table 4.1. Differences in skilled and unskilled-labor endowments and the effects of country size are measured with the variables $SKILLDIF_{ij}$ and $GDPDIFSQ_{ij}$. $SKILLDIF_{ij}$ captures the skilled-labor abundance of country i. It is constructed by subtracting the total share of skilled labor (skilled labor divided by total employment) in country j from the total share of skilled labor in country i. The value of $SKILLDIF_{ij}$ is positive when country i is relatively well endowed in skilled labor (e.g., at point α in the Edgeworth box), and negative in the opposite case (e.g., at point γ). The authors expect its coefficient to have a positive sign. $GDPDIFSQ_{ij}$ captures the difference in size between the two countries, measuring the square of the difference in GDP between country i and j. When countries are equal in size (point β), $GDPDIFSQ_{ij}$ is zero. When countries are different in size, its value is positive (e.g., points A and C). The KC model predicts affiliate sales to decrease in size dissimilarity, and thus the coefficient on $GDPDIFSQ_{ij}$ has a negative expected sign. $INTER_{ij}$ (=$GDPDIF_{ij} * SKILLDIF_{ij}$) captures the interaction between size and skill-endowment. When $GDPDIF_{ij}$ and $SKILLDIF_{ij}$ both have a positive value, the KC model predicts affiliate sales to be low. Therefore, the expected sign on $INTER_{ij}$ is negative.[8] $INTER\_PROT_j$ $(= PROT_j * SKILLDIF_{ij}^2)$ is an interaction term between trade protection in country j ($PROT_j$) and skill level dissimilarity (the square of $SKILLDIF_{ij}$). It captures the KC models' prediction that host country trade costs negatively affect vertical multinational activity (which occurs mainly when skill levels are different). The sign of the coefficient is expected to be negative.

The BNU specification is showed in Table 4.1, Panel B. The figure on the right-hand side of Panel B shows that the skill and size variables are derived directly from the Edgeworth box: skill-abundance of country i ($SKILL_{ij}$) is calculated by dividing the country i world share of skilled labor (s_i) by its world share of unskilled labor (u_i). Then, country size can be derived from the values of s_i and u_i, by applying the Pythagoras principle: $SIZE_{ij} = \sqrt{s_i^2 + u_i^2}$. This is showed in the figure for the arbitrary endowment point A, where country i is relatively small and the two countries are equal in endowments. Expectations on signs of coefficients are, again, formed based on the theoretical predictions of the KC model. This implies that the authors expect the coefficient on $SKILL_{ij}$ to have a positive sign, and the coefficients on $SIZE_{ij}$ and $SIZESQ_{ij}$ to have – respectively – positive and negative expected signs. BNU also include an interaction term $INTER_{ij}$ $(= SIZE_{ij} * SKILL_{ij})$ between country size and skill level, and an interaction term $INTER\_PROT_j$ $(= SKILL_{ij}^2 * PROT_j)$ between the square of the skill level and trade protection in country j. Following the same reasoning as CMM, $INTER_{ij}$ has a negative expected sign, and $INTER\_PROT_j$ a negative expected sign.

Both CMM and BNU include several control variables. $SUMGDP_{ij}$ measures the sum of GDP of country i and j, and thus captures the joint market size. The expected sign is positive. Three variables are based on qualitative surveys of multinational enterprises by the World Economic Forum: $INVC_j$, $PROT_i$ and $PROT_j$. These variables are constructed by taking the average of several indices. $INVC_j$ captures the perceived costs of investing in country j. Higher investment costs should lead to lower investment in country j and thus lower affiliate sales in that country. The expected sign is negative. $PROT_i$ and $PROT_j$ capture perceived costs of exporting to country i and j, respectively. Simulations of the KC model suggest that trade costs have ambiguous effects on affiliate sales: an increase in trade costs is expected to increase sales of horizontal multinationals and decrease sales of vertical multinationals. Since the data does not distinguish between horizontal and vertical activity, directly estimating this prediction is not possible. CMM and BNU use theory to explain that $PROT_i$ can be associated with horizontal multinationals and $PROT_j$ with vertical multinationals, and thus include these two variables in their specification to indirectly estimate the prediction that trade costs have opposite effects on vertical and horizontal activity. Higher costs of exporting to country j should increase the incentive to produce in that country through an affiliate (horizontal activity). Therefore, the expected sign is on $PROT_j$ is positive. $PROT_i$ is expected to have a negative effect on affiliate sales, because the higher costs of exporting back from country j to headquarter country i (vertical activity) decreases the incentive to open a plant in country j. $DIST_{ij}$ measures the distance (km) between the two capital cities of country i and j. This variable controls for the effect that

[8] Another way to see this: when it is the case that country i is both small and skilled-labor abundant, then the value of $GDPDIF_{ij}$ is negative, $SKILLDIF_{ij}$ positive and thus the value of $INTER_i$ is negative. For this case, the KC model predicts high affiliate sales, which implies a negative expected sign on $INTER_i$.

distance may have on the perceived costs of investing ($INVC_j$) and the perceived costs of exporting ($PROT_j$) to a country. Because these two variables have opposite expected signs, the expected sign of $DIST_{ij}$ is ambiguous.[9]

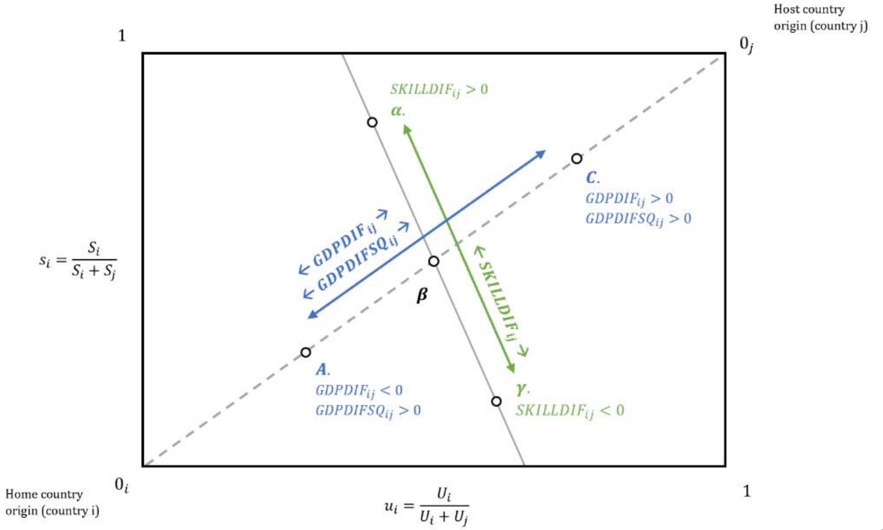
In their results, both CMM and BNU present coefficients that are consistent with expected signs and that are significant for all main regressors, suggesting support for the predictions of the KC model. As for CMM, coefficients on some of the control variables, e.g., $PROT_j$ and $INTERPROT_{ij}$, have correct signs but are not significant. As for BNU, results on control variables such as $PROT_i$ and $PROT_j$ are weaker and thus less conclusive. BNU also perform regressions with the CMM specification, while using their own, more extensive, dataset. Interestingly, they do not find empirical support for the KC model in these regressions, which shows that the two specifications produce different outcomes.

[9] The distance variable is time-invariant and thus effectively also functions as a control variable for country-pair fixed effects.

Table 4.1 - Comparison of the CMM and BNU Size and Skill Variables; Representation in a Two-Country Edgeworth Box Setting.

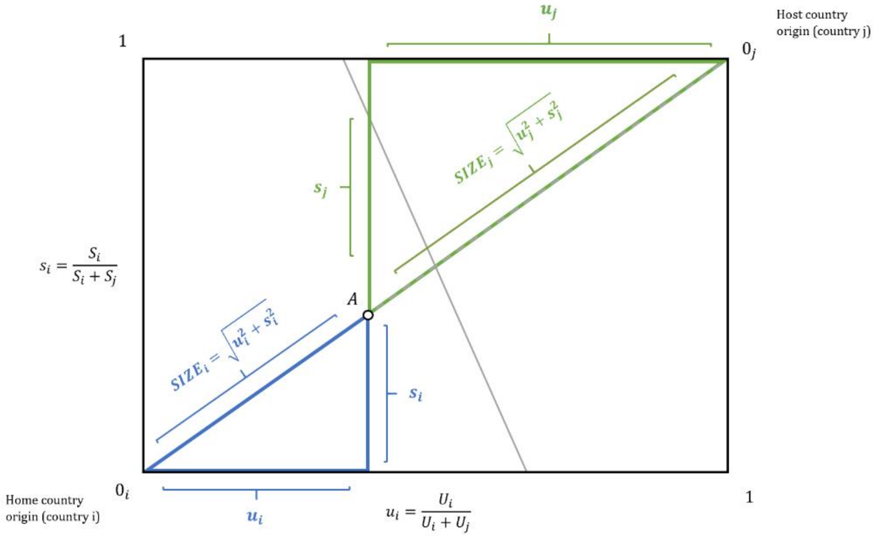
Panel A. CMM

Main regressors	Construction
$\boldsymbol{GDPDIFSQ_{i,j,t}}$	$=\left(GDP_i - GDP_j\right)^2$; denoted in constant 1990 US$
$\boldsymbol{SKILLDIF_{i,j,t}}$	$=\frac{S_i}{L_i}-\frac{S_j}{L_j}$ $S_{i,t}(S_{j,t})$ *is skilled labor endowment of* i (j); $L_{i,t}(L_{j,t})$ *is total labor endowment*
$\boldsymbol{INTER_{i,j,t}}$	$= GDPDIFSQ_{i,j,t} * SKILLDIF_{i,j,t}$
$\boldsymbol{INTERPROT_{i,j,t}}$	$= SKILLDIF_{i,j,t}^2 * PROT_{j,t}$



Panel B. BNU

Main regressors	Construction
$\boldsymbol{SIZE_{i,j,t}}$	$=\sqrt{s_{i,t}^2 + u_{i,t}^2}$ (Pythagoras principle) $s_{i,t} \equiv \frac{S_{i,t}}{S_{i,t}+S_{j,t}}$; $u_{i,t} \equiv \frac{U_{i,t}}{U_{i,t}+U_{j,t}}$ $S_{i,t}(S_{j,t})$ *is skilled labor endowment of* i (j) ; *U denotes unskilled labor*
$\boldsymbol{SIZESQ_{i,j,t}}$	$= SIZE_{i,j,t}^2$
$\boldsymbol{SKILL_{i,j,t}}$	$=\frac{s_{i,t}}{u_{i,t}}$
$\boldsymbol{INTER_{i,j,t}}$	$= SIZE_{i,j,t} * SKILL_{i,j,t}$
$\boldsymbol{INTERPROT_{i,j,t}}$	$= SKILL_{i,j,t}^2 * PROT_{j,t}$



Notes: the solid grey diagonal line in the Edgeworth box shows the approximate locus of equal incomes of country i and j.

5. Methodology

5.1 Empirical Model

5.1.1 Baseline model

My baseline estimations can be viewed as replications of CMM and BNU, because I actualize their estimations of affiliate sales in manufacturing industries, using the most recent data. Thus, I use two baseline specifications from which one is based on CMM (Equation 5.1) and one on BNU (Equation 5.2). Throughout this thesis, I refer to Equation 5.1 as 'the CMM specification' and Equation 5.3 as 'the BNU specification.' For descriptions, units of measurement, construction, and sources for all variables used in my models, I refer to Table 5.1.1 (general variables), Table 5.1.2 (CMM specification variables) and Table 5.1.3 (BNU specification variables).

CMM specification:

$$TURNOVER_{ij} = \alpha_1 + \alpha_2 * SUMGDP_{ij} + \alpha_3 * GDPDIFSQ_{ij} + \alpha_4 * SKILLDIF_{ij} + \alpha_5 * INTER_{ij} + \alpha_6 * TF_i + \alpha_7 * TF_j + \alpha_8 * IF_j + \alpha_9 * INTER\_TF_j + \alpha_{10} * DIST_{ij} + \varepsilon \quad \textbf{(5.1)}$$

BNU specification:

$$TURNOVER_{ij} = \alpha_1 + \alpha_2 * SUMGDP_{ij} + \alpha_3 * SIZE_{ij} + \alpha_4 * SIZESQ_{ij} + \alpha_5 * SKILL_{ij} + \alpha_6 * INTER_{ij} + \alpha_7 * TF_i + \alpha_8 * TF_j + \alpha_9 * IF_j + \alpha_{10} * INTER\_TF_j + \alpha_{11} * DIST_{ij} + \varepsilon \quad \textbf{(5.2)}$$

The specifications differ from the original CMM[10] and BNU[11] specifications in several of ways. I rename the dependent variable $RSALES_{ij}$ is to $TURNOVER_{ij}$, since this is more consistent with the notation used in my data sources.[12] As well, the $PROT_i$, $PROT_j$ and $INVC_j$ variables are replaced by – respectively - TF_i, TF_j and IF_j. The reason is that the $PROT_i$, $PROT_j$ and $INVC_j$ variables are indices based on qualitative and ordinal survey results, and I believe that these new variables – which are more quantitative and derived from a more relevant source - are to be preferred in this case. Also, data used for these original variables are not available, which would in any case disallow me to construct the exact same variables.

I follow the same reasoning as CMM and BNU to derive expectations on the signs of the coefficients, for which I refer to Section 4 of this thesis. My expectations are shown in Table 5.1.4. I recall: In the CMM specification, $GDPDIFSQ_{ij}$ captures dissimilarities in GDP – i.e., country size - and is expected to have a negative sign. $SKILLDIF_{ij}$ captures the difference in skilled-labor abundance between country i and j, where a positive value implies that country i is more skilled-labor abundant than country j. Since firms tend to locate their headquarters in skilled-labor abundant countries, and the dependent variable measures turnover of affiliates in country j of firms *headquartered in country i*, the coefficient on $SKILLDIF_{ij}$ has a positive expected sign. The value of $INTER_i$ is positive when a country is both large and skilled-labor

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10 Original CMM specification: $RSALES_{ij} = \alpha_1 + \alpha_2 * SUMGDP_{ij} + \alpha_3 * GDPDIFSQ_{ij} + \alpha_4 * SKILLDIF_{ij} + \alpha_5 * INTER_{ij} + \alpha_6 * PROT_i + \alpha_7 * PROT_j + \alpha_8 * INVC_j + \alpha_9 * INTER\_PROT_j + \alpha_{10} * DIST_{ij} + \varepsilon$

11 Original BNU specification: $RSALES_{ij} = \alpha_1 + \alpha_2 * SUMGDP_{ij} + \alpha_3 * SIZE_{ij} + \alpha_4 * SIZESQ_{ij} + \alpha_5 * SKILL_{ij} + \alpha_6 * INTER_{ij} + \alpha_7 * PROT_i + \alpha_8 * PROT_j + \alpha_9 * INVC_j + \alpha_{10} * INTER\_PROT_j + \alpha_{11} * DIST_{ij} + \varepsilon$

12 CMM and BNU use the term 'affiliate sales'. I choose to use the term 'affiliate turnover' since this is the term used in my original data source. In the context of my research, there is no difference in meaning. Also, I recall that in the KC model, turnover (or sales) equals production in equilibrium.

abundant, in which case the KC model predicts turnover to be low. Thus, I expect the coefficient on $INTER_i$ to have a negative sign. As for the BNU specifications' main regressors, the inverted U-shape relation between country sizes (as predicted by the KC model), implies a positive expected sign for $SIZE_{ij}$ and a negative expected sign for $SIZESQ_{ij}$. I expect $SKILL_{ij}$ to have a positive sign and, again, $INTER_{ij}$ to have a negative sign.

As for the control variables, I expect the coefficient on $SUMGDP_{ij}$, capturing joint market size, to have a positive sign. Coefficients on TF_j, TF_i and IF_j have an expected sign opposite to the variables they replace, because they capture freedom of trade and investment and not costs. TF_j captures freedom of trade in country j, which increases the ease of exporting to country j and thus lowers the incentive for production through affiliates: the expected sign is negative. TF_i captures trade freedom in country i and has a positive expected sign: if exporting back from country j (where the affiliate is located) to country i (where the headquarter is located) becomes easier, this increases the incentive to open an affiliate in country j. IF_j captures investment freedom in country j, which I expect to be positively related to affiliate turnover in country j. I expect that the coefficient on $INTER\_TF_j$ has a positive sign in both specifications, because trade freedom in country j should positively affect vertical multinational activity (which is predicted to occur mainly when skill endowments are different). The expected sign on $DIST_{ij}$ is, again, ambiguous.

I perform several alternative regressions to check for the robustness of my results. I control for the role of the global financial crisis, that occurred at the beginning of the 2008-2014 timeframe and might have affected the results. I also run regressions on a restricted sample of only US observations, to create a factor-endowments coverage that is similar to CMM. Furthermore, I check for robustness by running regressions that include an alternative measure for trade costs: TC_{ij}.

Table 5.1.1 – General Variables: Description, Construction and Data Sources

Variable name	Description	Variable construction and notes	Data source
Dependent variables:			
$\boldsymbol{TURNOVER_{i,j,t}}$ *US$, millions**	Real sales of affiliates in country j of firms headquartered in country i, for the total manufacturing** sector, in year t	Originally denoted in local currencies, converted to US dollars using OECD exchange rates; deflated by US wholesale price index (base year 2010)	OECD Statistics on Measuring Globalisation (OECD, 2018abc)
$\boldsymbol{S\_TURNOVER_{i,j,t}}$ *US$, millions*	Real sales of affiliates in country j of firms headquartered in country i, for the total services sector***, in year t	Originally denoted in local currencies, converted to US dollars using OECD exchange rates; deflated by US wholesale price index (base year 2010)	OECD Statistics on Measuring Globalisation (OECD, 2018abc)
Baseline regressors:			
$\boldsymbol{SUMGDP_{i,j,t}}$ *US$, billions**	Sum of GDP of country i and j, in year t	$= GDP_{i,t} + GDP_{j,t}$; denoted in constant 2010 US$	World Bank national accounts data (World Bank, 2018a)
$\boldsymbol{TF_{i,t}}$ ($\boldsymbol{TF_{j,t}}$) *Index variable*	Trade freedom in country i (j) in year t; index measure based on tariff rates and non-tariff trade barriers	Calculated values are retrieved from data source, and are based on the following formula (The Heritage Foundation, 2018a): $TF_{i,t} = (((Tariff_{max,t} - Tariff_{i,t}) / Tariff_{max,t} - Tariff_{min,t})) * 100) - NTB_{i,t}$	2018 Index of Economic Freedom (The Heritage Foundation, 2018a)
$\boldsymbol{IF_{j,t}}$ *Index variable*	Investment freedom in country j in year t; measure based on investment restrictions such as labor regulations and capital restrictions	Calculated values are retrieved from data source and are based on an evaluation of investment restrictions by The Heritage Foundation (2018b)	2018 Index of Economic Freedom (The Heritage Foundation, 2018b)
$\boldsymbol{DIST_{i,j}}$ *Kilometers*	Geographical distance between the capital cities of country i and j	Calculated values are retrieved from data source	GeoDist Database, CEPII (Mayer and Zignago, 2011)
Robustness regressors:			
$\boldsymbol{CRISIS_t}$ *Dummy variable*	Dummy variable for the financial crisis of 2008-2010	Dummy variable, denoting 1 for the years 2008, 2009 and 2010, and 0 otherwise	-
$\boldsymbol{TC_{i,j,t}}$ *Percentage*	Symmetric bilateral trade costs of country pair i and j, for agriculture and manufacturing sectors, in year t	Ad-valorem equivalent trade costs; Calculated values are retrieved from data source, and are based on the Inverse Gravity Framework by Novy (2009)	ESCAP World Bank Trade Cost Database (World Bank, 2018b)

Notes: * I denote $TURNOVER_{ij}$ in millions and $SUMGDP_{ij}$ in billions. CMM use millions for RSALES and billions for SUMGDP. BNU use millions for RSALES and dollar units for SUMGDP. ** Total manufacturing sector (ISIC, Rev. 4; Section C: Manufacturing; UN DESA (2008)). *** Total of services sectors (ISIC, Rev. 4; Sections: G) Wholesale and retail trade; repair of motor vehicles and motorcycles, H) Transportation and storage, I) Accommodation and food service activities, J) Information and Communication, K) Financial and insurance activities, L) Real estate activities, M) Professional, scientific and technical activities, N) Administrative and support service activities, P) Education, Q) Human health and social work activities, R) Arts, entertainment and recreation and S) Other service activities; UN DESA (2008)).

Table 5.1.2 – CMM Specification Variables: Description, Construction and Data Sources

Variable name	Description	Variable construction and notes	Data source
Baseline regressors:			
$\boldsymbol{GDPDIFSQ_{i,j,t}}$	Square of the difference between the GDP of country i and the GDP of country j, in year t	$= (GDP_i - GDP_j)^2$; denoted in constant 2010 US$	World Bank national accounts data (World Bank, 2018a)
$\boldsymbol{SKILLDIF_{i,j,t}}$	Difference between the share of skilled-labor endowments of country i and j, thus: share of skilled-labor endowment (compared to total labor endowment) of country i, minus share of skilled-labor endowment of country j, in year t	$= \frac{S_i}{L_i} - \frac{S_j}{L_j}$ $S_{i,t}(S_{j,t})$ *is skilled labor endowment of* i (j); $L_{i,t}(L_{j,t})$ *is total labor endowment*	ILO modeled estimates* (ILOSTAT, 2018)
$\boldsymbol{INTER_{i,j,t}}$	Interaction variable	$= GDPDIFSQ_{i,j,t} * SKILLDIF_{i,j,t}$	-
$\boldsymbol{INTER\_TF_{i,j,t}}$	Interaction variable	$= SKILLDIF_{i,j,t}^2 * TF_{j,t}$	-
Human Capital regressors:			
$\boldsymbol{EDUCDIF_{i,j,t}}$	Difference between the share of tertiary educated people of country i and j, thus: share of tertiary educated people in country i, minus the share of tertiary educated people in country i, in year t	$= \frac{T_i}{P_i} - \frac{T_j}{P_j}$ $T_{i,t}(T_{j,t})$ is the number of people in country i (j) with at least a tertiary education**; $P_{i,t}(P_{j,t})$ denotes total population	UNESCO Institute for Statistics (UNESCO UIS, 2018) World Bank World Development Indicators (The World Bank, 2018c)
$\boldsymbol{HCINTER_{i,j,t}}$	Interaction variable	$= GDPDIFSQ_{i,j,t} * EDUCDIF_{i,j,t}$	-
$\boldsymbol{HCINTER\_TF_{i,j,t}}$	Interaction variable	$= EDUCDIF_{i,j,t}^2 * TF_{j,t}$	-
Symmetric Bilateral Trade Costs regressors:			
$\boldsymbol{INTER\_TC_{i,j,t}}$	Interaction variable	$= SKILLDIF_{i,j,t}^2 * TF_{j,t}$	

Notes: * Skilled- and unskilled-labor endowment data used to construct the country size and skill-abundance variables, are classified according to ISCO-08. Occupation levels 3 and 4 are considered as skilled, 1 and 2 as unskilled. CMM and BNU use ISCO-68 and ISCO-88. ** This number is derived by multiplying a country's total population by the educational attainment share of a country (= at least completed short-cycle tertiary [ISCED 5 or higher], population 25+ years, both sexes; UNESCO UIS, 2018). This share considers *only people above age 25* and is multiplied by the *total population* and thus, $T_{it}(T_{jt})$ should be seen as an approximation of this number.

Table 5.1.3 – BNU Specification Variables: Description, Construction and Data Sources

Variable name	Description	Variable construction and notes	Data source
Baseline regressors:			
$\boldsymbol{SIZE_{i,j,t}}$ *Ratio*	Size of country i relative to country j, derived from relative skilled and unskilled-labor endowments of the two countries in an Edgeworth box context, in year t	$=\sqrt{s_{i,t}^2+u_{i,t}^2}$ (Pythagoras principle) $s_{i,t}\equiv\frac{S_{i,t}}{S_{i,t}+S_{j,t}}$; $u_{i,t}\equiv\frac{U_{i,t}}{U_{i,t}+U_{j,t}}$ $S_{i,t}(S_{j,t})$ *is skilled labor endowment of i (j) ; U denotes unskilled labor*	ILO modeled estimates* (ILOSTAT, 2018)
$\boldsymbol{SIZESQ_{i,j,t}}$	Square of $SIZE_{i,j,t}$	$=SIZE_{i,j,t}^2$	-
$\boldsymbol{SKILL_{i,j,t}}$ *Ratio*	Skill-abundance of country i relative to country	$=\frac{s_{i,t}}{u_{i,t}}$	-
$\boldsymbol{INTER_{i,j,t}}$	Interaction variable	$=SIZE_{i,j,t}*SKILL_{i,j,t}$	-
$\boldsymbol{INTER\_TF_{i,j,t}}$	Interaction variable	$=SKILL_{i,j,t}^2*TF_{j,t}$	-
Human Capital regressors:			
$\boldsymbol{HCSIZE_{i,j,t}}$ *Ratio*	Size of country i relative to country j, derived from relative education abundance of the two countries in an Edgeworth box context, in year t	$=\sqrt{t_{i,t}^2+n_{i,t}^2}$ (Pythagoras principle) $t_{i,t}\equiv\frac{T_{i,t}}{T_{i,t}+T_{j,t}}$; $u_{i,t}\equiv\frac{N_{i,t}}{N_{i,t}+N_{j,t}}$ $T_{i,t}(T_{j,t})$ is the number of people in country i (j) with at least a tertiary education**; N denotes non-tertiary educated people	UNESCO Institute for Statistics (UNESCO UIS, 2018) World Bank World Development Indicators (The World Bank, 2018c)
$\boldsymbol{HCSIZESQ_{i,j,t}}$	Square of $SIZE_{i,j,t}$	$=HCSIZE_{i,j,t}^2$	-
$\boldsymbol{EDUC_{i,j,t}}$ *Ratio*	Education-abundance of country i relative to country	$=\frac{t_{i,t}}{n_{i,t}}$	-
$\boldsymbol{HCINTER_{i,j,t}}$	Interaction variable	$=HCSIZE_{i,j,t}*EDUC_{i,j,t}$	-
$\boldsymbol{HCINTER\_TF_{i,j,t}}$	Interaction variable	$=EDUC_{i,j,t}^2*TF_{j,t}$	-
Symmetric Bilateral Trade Costs regressors:			
$\boldsymbol{INTER\_TC_{i,j,t}}$	Interaction variable	$=SKILL_{i,j,t}^2*TF_{j,t}$	-

Notes: * Skilled- and unskilled-labor endowment data used to construct the country size and skill-abundance variables, are classified according to ISCO-08. Occupation levels 3 and 4 are considered as skilled, 1 and 2 as unskilled. CMM and BNU use ISCO-68 and ISCO-88. ** This number is derived by multiplying a country's total population by the educational attainment share of a country (= at least completed short-cycle tertiary [ISCED 5 or higher], population 25+ years, both sexes; UNESCO UIS, 2018). This share considers *only people above age 25* and is multiplied by the *total population* and thus, $T_{it}(T_{jt})$ should be seen as an approximation of this number.

Table 5.1.4 - Expected Signs for Equations 5.1 and 5.2

CMM Specification (EQUATION 5.1)		BNU Specification (EQUATION 5.2)	
Variable	**Expected sign**	**Variable**	**Expected sign**
Main Regressors:		*Main Regressors:*	
$GDPDIFSQ_{ij}$	-	$SIZE_{ij}$	+
$SKILLDIF_{ij}$	+	$SIZESQ_{ij}$	-
$INTER_{ij}$	-	$SKILL_{ij}$	+
		$INTER_{ij}$	-
Control Variables:		*Control Variables:*	
$SUMGDP_{ij}$	+	$SUMGDP_{ij}$	+
TF_i	+	TF_i	+
TF_j	-	TF_j	-
$INTER\_TF_j$	+	$INTER\_TF_j$	+
IF_j	+	IF_j	+
$DIST_{ij}$	+/-	$DIST_{ij}$	+/-

5.1.2 Adjusting the Baseline Model to Explore the Role of Human Capital

I extend CMM and BNU by exploring the role of human capital, which means that I exchange skill-based variables for education-based variables. In the baseline model, the degree to which a country can be characterized as skilled-labor abundant is measured based on occupational skill levels of the country's labor force. In the human capital model, I use educational attainment of a country's population to measure the skill endowment of a country. For the CMM specification, this means that $SKILLDIF_{ij}$, $INTER_{ij}$ and $INTER\_TF_{ij}$ are exchanged for human capital regressors $EDUCDIF_{ij}$, $HCINTER_{ij}$, and $HCINTER\_TF_{ij}$ (described in Table 5.1.2)[13]. In the BNU specification, $SIZE_{ij}$, $SIZESQ_{ij}$, $SKILL_{ij}$, $INTER_{ij}$ and $INTER\_TF_{ij}$ are exchanged for $HCSIZE_{ij}$, $HCSIZESQ_{ij}$, $EDUC_{ij}$, $HCINTER_{ij}$ and $HCINTER\_TF_{ij}$ (described in Table 5.1.3)[14]. Expected signs on the human capital variables are equivalent to the variables they replace.

5.1.3 Adjusting the Baseline Model to Services Industries

In the final empirical section of this thesis, I shift my focus from manufacturing industries to services industries. I exchange the dependent variable $TURNOVER_{ij}$ of the baseline specifications, for $S\_TURNOVER_{ij}$ (described in Table 5.1.1). Apart from this, the specifications are identical. Again, I adjust the baseline services industries specifications to explore the role of human capital. I perform similar robustness checks. I note that less observations are available for services turnover than for manufacturing turnover (4415 for services turnover compared to 6345 for manufacturing turnover), which implies a smaller sample size. I do not explicitly derive expected signs for services regressions.[15]

[13] The correlation between $SKILLDIF_{ij}$ and $EDUCDIF_{ij}$ is 0.6836.

[14] The correlation between $SKILL_{ij}$ and $EDUC_{ij}$ is 0.6961.

[15] I refer to Footnote 43 for further explanation.

5.2 Data and Methods

My dataset comprises bilateral combinations of 81 home countries (country i) and 76 host countries (country j) for the years 2008-2014. All these countries are either OECD or top 100 economies (based on GDP; World Bank, 2018a). My turnover data consists of both outward and inward multinational activity data. For some country pairs, both inward and outward data are available. For these double values, the correlation between inward and outward data is 0.9213, which suggests some measurement error. I consider outward data as more reliable, so exclude the inward data for these observations. For several observations, the turnover value was classified as confidential.[16] They are left out. The data contains 6158 observations for $TURNOVER_{ij}$ in the full sample. Out of these, 3079 observations are zero values. They are kept.[17] Summary statistics for the manufacturing sample are provided in Appendix E, Table 1. Summary statistics for the services sample are provided in Appendix E, Table 2.

As discussed before, one of the weaknesses of the CMM study is the limited data coverage: the range of factor-endowment combinations included in the data is small because the large and skilled-labor endowed US is included in all country-pairs. Combinations such as a small, skilled-labor endowed country i (j) with a large, unskilled-labor endowed country j (i) do therefore not exist in the CMM data. Figure 5.1, retrieved from BNU (p. 776), shows that the observations in the CMM data are indeed primarily in the lower left-hand and the upper right-hand corner of the Edgeworth box. Figure 5.2, retrieved from BNU (p. 777), shows that the extended sample of BNU includes much more observations and has a broader range of factor-endowment combinations. The BNU data coverage is, in this respect, superior to the CMM data. Figure 5.3 shows all factor-endowment combinations of my manufacturing turnover sample. My sample has better coverage than CMM, with many more observations (5850 against 509 in the CMM baseline model) and a broader range of factor-endowment combinations. I improve the BNU coverage, using a higher number of observations (5850 against 1122 in the BNU baseline model) and not necessarily if it comes to the range of factor-endowment combinations: Figure 5.2 and Figure 5.3 show a similar 'shape' in the Edgeworth box.

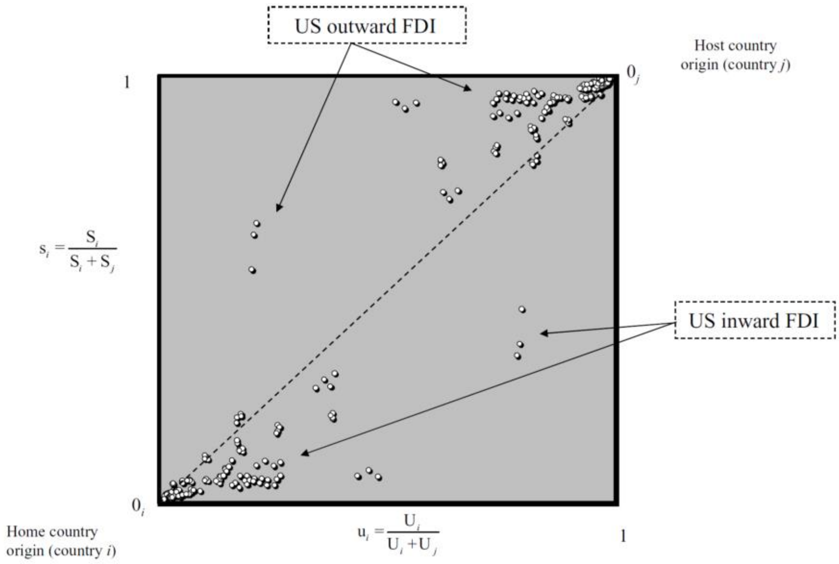
Finally, I have a few remarks on the econometrics applied in the analysis. Heteroskedasticity in the standard errors of the basic OLS regressions – indicated with a White test – will be problematic (inefficient regression estimators and inconsistent standard errors) if not appropriately addressed. Thus, I report robust - i.e., heteroskedasticity-consistent - standard errors for all regressions. CMM and BNU deal with this issue by performing a weighted least squares (WLS) regression, taking $SUMGDP_{ij}$ as the weight. I follow this approach and also include WLS results.[18] As well, I run fixed effects regressions to control for home and host country specific effects, and for year specific effects. I report Bayesian Information Criterion values for all regressions.

16 Observations classified as 'confidential' appeared across all types of countries (small, large, developed, less developed).

17 In this, I followed CMM and BNU, who also kept zero values.

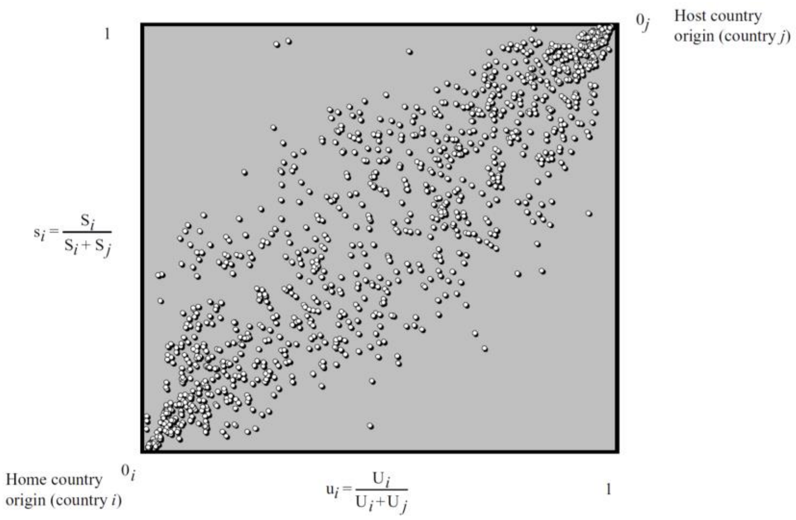
18 CMM also present Tobit regressions. They argue that in their dataset, observations for which the turnover value is classified as confidential are generally small, low-income countries, and that it is therefore justified to assume that these missing values are in fact zero values. Then, they use a Tobit regression to add these observations to the regression. In my own dataset, I observe confidential turnover values across all sorts of countries and income levels, and thus cannot make this assumption. For reasons of comparison, I performed Tobit regressions. They did not lead to new insights. I do not report these results.

Figure 5.1 - CMM Coverage of Factor-Endowment Pairs



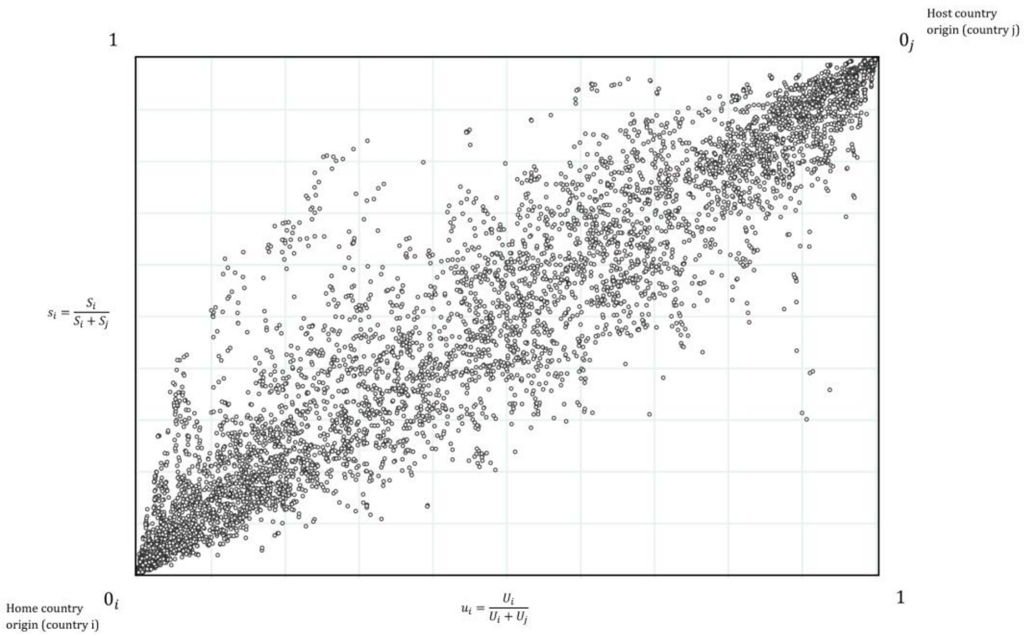
Source: Braconier, Norbäck, and Urban (2005), p. 776: "Figure 2. Illustrating the US Inbound and US Outbound Sample in CMM."

Figure 5.2 - BNU Coverage of Factor-Endowment Pairs



Source: Braconier, Norbäck, and Urban (2005), p. 777: "Figure 3. Illustrating the Coverage of the Extended Sample on Affiliate Sales."

Figure 5.3 – My Coverage of Factor-Endowment Pairs for the Manufacturing Turnover Sample.



6. Results for the Manufacturing Industries

6.1 Baseline Results

The analysis on the manufacturing industries turnover sample can be viewed as a replication of the CMM and BNU studies. Baseline results of this replication are shown in Table 6.1.1 and Table 6.1.2, respectively for the CMM and BNU specification. Coefficients are bold if they match expected sign. For each regression, I report BIC values.

I observe mixed support for the empirical predictions of the KC model.

The OLS and WLS results are very supportive. As for the CMM specification (Table 6.1.1, Columns 1 and 2), the main regressors $GDPDIFSQ_{ij}$, $SKILLDIF_{ij}$ and $INTER_{ij}$ all show coefficients that are highly significant (1%, 1% and 5% level, respectively) and match with expected signs. Thus, in line with expectations, results show that affiliate turnover decreases in country size dissimilarities (negative coefficient on $GDPDIFSQ_{ij}$), affiliate turnover increases in the skill endowment difference between country i and j (positive coefficient on $SKILLDIF_{ij}$), and affiliate turnover increases when country i is both small and skilled-labor abundant (negative coefficient on $GDPDIF_{ij}$). For the BNU specification (Table 6.1.2, Columns 1 and 2), results are similar: the signs on $SIZE_{ij}$ (positive sign) and $SIZESQ_{ij}$ (negative sign) coincide with the predicted inverted U-shape in affiliate turnover between the two countries' origins in the Edgeworth box. As well, affiliate turnover is showed to increase in the relative skill level of country i (positive sign on $SKILL_{ij}$). The significant and negative coefficient on $INTER_{ij}$ is in line with the models' prediction that affiliate turnover increases when a country is both small and skilled-labor abundant. These results coincide with the saddle-shaped plotted volume of affiliate turnover that is predicted by the KC model (Figure 3.1, Panel C) and thus, both specifications produce convincing evidence for the predictions that affiliate turnover 1) increases in size similarities, 2) increases in skill endowment similarities and 3) increases when a country is both small and skilled-labor abundant. As for the control variables, bot specifications yield highly significant coefficients on practically all variables.[19] The coefficients on $SUMGDP_{ij}$, TF_i, IF_j and $DIST_{ij}$ match expected signs, showing that affiliate turnover increases in joint market size, home country trade freedom and host country investment freedom, and decreases in distance. The variables that consider host country trade freedom (TF_j and interaction term $INTER\_TF_j$) do not match with my expectations.[20] I finally note that the WLS coefficients are stronger in absolute terms than the respective OLS coefficients, for almost all variables.

Results grow weaker when introducing fixed effects. This is true for both specifications, but interestingly, in a different way. As for the CMM specification (Table 6.1.1, Columns 3 and 4), introducing fixed effects weakens the support for the skill component of the specification ($SKILLDIF_{ij}$): the prediction

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[19] For all variables, except for TF_j in the CMM, WLS regression.

[20] This does not completely surprise me. I followed CMM and BNU in their expectation that this interaction term would positively affect turnover, since it captures vertical multinationals (who are primarily active when skill levels are different). However, skill differences alone are not sufficient to capture vertical multinationals, because the model predicts that this type of firm is active when countries are not only dissimilar in endowments, but also in size. The latter is not captured with this interaction term, and thus this term might not accurately capture vertical multinationals. Furthermore, I note that the used variables are different than the ones used in CMM and BNU: I use variables that measure trade *freedom* and not trade *costs*. I made the assumption that these variables simply measure the opposite, implying opposite signs.

that affiliate turnover increases in the skill difference between country i and j. For the BNU specification (Table 6.2.1, Columns 3 and 4), it is the interaction variable ($INTER_{ij}$) that is affected: the prediction that affiliate turnover peaks when a country is both small and skilled-labor abundant. The prediction that affiliate turnover increases in size similarities (captured with $GDPDIFSQ_{ij}$ in the CMM specification and with $SIZE_{ij}$ and $SIZESQ_{ij}$ in the BNU specification) receives strong support from both specifications. These are interesting results: they show that the outcomes depend on which specification is used, and thus are affected by the way in which variables are constructed.[21] The coefficients on most control variables lose their significance, except for $INTER\_TF_j$ and $DIST_{ij}$, and for $SUMGDP_{ij}$ in the CMM specification. The weak effects for the fixed effects regressions are unsatisfying, but not very surprising: many of the variables used in my regressions do not change much over time, which generally leads to large standard errors and less significant coefficients.

In Columns 5 and 6 of Table 6.1.1 and Table 6.1.2, I split the sample into two groups: observations for which the home country (country i) is skilled-labor abundant relative to the host country (country j) ($SKILL_{ij} > 1$, Column 5) and observations for which the host country (country j) is more skilled-labor abundant ($SKILL_{ij} < 1$, Column 6).[22] As for the CMM specification, most of the coefficients show similar signs and significance levels for the two groups. Interesting to see is how the coefficient on $SKILLDIF_{ij}$ is positive (and marginally significant; 10% level) in Column 5 but negative (and insignificant) in Column 6. Opposing signs for the two groups can also be observed for TF_i and TF_j. Although I should be cautious with drawing conclusions from these insignificant coefficients, I note that they at least suggest the possibility that signs and magnitudes of effects on affiliate turnover are indeed dependent on the relative skill level of countries. For the BNU specification, the signs on $SIZE_{ij}$, $SIZESQ_{ij}$ and $SKILL_{ij}$ are – although not always significant - similar for the two groups and match expectations. Interestingly, $INTER_{ij}$ has a negative coefficient (but insignificant) for the skilled-labor abundant group of countries (Column 5), while the sign is positive (and highly significant) for the unskilled-labor abundant group (Column 6).

21 For interesting discussions about the role of the model specification, I refer to Blonigen, Davies, and Head (2003); Carr, Markusen, and Maskus (2003); Braconier, Norbäck, and Urban, 2005; and Davies (2008).

22 Note that for both the CMM and BNU specification, I use the BNU skill-measure to make this distinction. I do this for reasons of comparison.

Table 6.1.1 – Baseline Results; CMM Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $SKILL_{ij}$ > 1	(vi) FE *(home and host country, year)* $SKILL_{ij}$ < 1
$SUMGDP_{ij}$	**5.359*** **	**9.991*** **	**9.993*** **	**9.841*** **	**9.949*** **	**9.305** **
	(0.417)	(0.161)	(2.783)	(2.864)	(3.472)	(4.726)
$GDPDIFSQ_{ij}$	**-0.000210*** **	**-0.000437*** **	**-0.000832*** **	**-0.000832*** **	**-0.000823*** **	**-0.000904*** **
	(2.86e-05)	(1.09e-05)	(9.31e-05)	(9.31e-05)	(0.000117)	(0.000145)
$SKILLDIF_{ij}$	**12,369*** **	**49,822*** **	**5,984**	**6,610**	**21,673* **	-25,083
	(1,596)	(4,486)	(7,404)	(7,547)	(11,470)	(15,261)
$INTER_{ij}$	**-1.881** **	**-5.021*** **	**-13.04*** **	**-13.06*** **	**-7.917*** **	**-18.81*** **
	(0.811)	(0.369)	(1.462)	(1.462)	(2.039)	(3.673)
TF_i	**336.6*** **	**612.6*** **	-149.4*	-79.54	-80.55	**45.76**
	(50.99)	(127.4)	(83.40)	(95.03)	(112.8)	(159.0)
TF_j	118.5***	**-25.45**	**-15.24**	34.75	147.7	**-159.9**
	(30.47)	(106.6)	(89.04)	(97.03)	(101.4)	(137.5)
$INTER\_TF_j$	-689.0***	-2,949***	-501.6***	-502.8***	-553.8**	-1,405***
	(96.23)	(204.4)	(147.0)	(147.2)	(239.1)	(468.9)
IF_j	**61.30*** **	**304.2*** **	**1.379**	-5.275	**15.29**	**23.68**
	(14.35)	(41.82)	(34.85)	(39.78)	(41.47)	(66.97)
$DIST_{ij}$	*-0.279****	*-1.523****	*-2.455****	*-2.452****	*-2.424****	*-2.294****
	(0.0426)	(0.114)	(0.458)	(0.459)	(0.598)	(0.837)
Constant	-46,571***	-82,615***	19,603**	10,252	-841.6	10,915
	(5,935)	(13,059)	(8,303)	(12,376)	(14,283)	(21,055)
Observations	6,029	6,029	6,017	6,017	3,453	2,558
R^2	0.364	0.449	0.600	0.600	0.650	0.592
$Adj. R^2$	0.3628	0.448	0.5903	0.5902	0.6378	0.5718
BIC	133720.6	143086	130665.4	130661.2	74633.9	55548.77

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic.

Table 6.1.2 – Baseline Results: BNU Replication; Manufacturing Industries

	$TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $SKILL_{ij} > 1$	(vi) FE *(home and host country, year)* $SKILL_{ij} < 1$
$SUMGDP_{ij}$	**3.048*** **	**4.503*** **	**0.817**	**0.584**	-0.112	-2.550
	(0.205)	(0.0841)	(2.250)	(2.256)	(2.637)	(3.344)
$SIZE_{ij}$	**28,543*** **	**133,231*** **	**28,393*** **	**28,387*** **	**32,121*** **	**5,386**
	(2,973)	(6,580)	(4,969)	(4,973)	(7,137)	(7,384)
$SIZESQ_{ij}$	**-20,109*** **	**-89,338*** **	**-25,032*** **	**-25,029*** **	**-31,768*** **	**-41,410*** **
	(1,842)	(3,430)	(2,656)	(2,659)	(3,800)	(6,542)
$SKILL_{ij}$	**2,775*** **	**18,695*** **	**9,056*** **	**9,078*** **	**6,799*** **	**16,967**
	(425.0)	(1,519)	(1,271)	(1,270)	(1,160)	(33,959)
$INTER_{ij}$	**-1,611** **	**-8,959*** **	**-1,276**	**-1,268**	**-2,951**	67,404***
	(808.1)	(2,592)	(2,141)	(2,138)	(2,390)	(17,088)
TF_i	**147.2*** **	**617.5*** **	-146.5	-107.7	**77.85**	-176.9
	(50.75)	(107.4)	(102.6)	(118.7)	(143.4)	(188.9)
TF_j	130.7***	726.6***	96.38	126.2	210.0**	**-190.6**
	(39.95)	(115.6)	(79.16)	(89.43)	(96.99)	(256.5)
$INTER\_TF_j$	-2.110***	-17.74***	-6.065***	-6.083***	-4.018***	-101.6
	(0.416)	(2.272)	(1.029)	(1.028)	(0.825)	(236.6)
IF_j	**59.82*** **	**355.1*** **	**10.52**	-1.006	-8.660	**146.3* **
	(15.10)	(45.93)	(41.69)	(50.05)	(50.32)	(87.81)
$DIST_{ij}$	*-0.384*** *	*-1.963*** *	*-2.632*** *	*-2.630*** *	*-2.822*** *	*-2.397*** *
	(0.0459)	(0.124)	(0.518)	(0.518)	(0.648)	(0.915)
Constant	-37,056***	-181,027***	6,368	1,916	-12,659	13,806
	(6,033)	(12,938)	(9,702)	(13,720)	(16,617)	(35,398)
Observations	6,029	6,029	6,017	6,017	3,453	2,558
R^2	0.323	0.345	0.438	0.438	0.535	0.450
$Adj.\,R^2$	0.3217	0.344	0.424	0.4236	0.5182	0.4228
BIC	134105	144134.3	132723.7	132721.4	75626.61	56319.42

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic.

6.2 Human Capital Results

Results of the human capital regressions are provided in Table 6.2.1 and Table 6.2.2.

I observe that both specifications are robust to exchanging the skill-based variables for education-based variables, and thus yield results that are similar to the baseline case.

The CMM human capital specification yields results (Table 6.2.1) that are almost identical to the baseline results in terms of significance and expected signs, with strong results on main regressors $GDPDIFSQ_{ij}$ and $HCINTER_{ij}$ in all regressions, and a coefficient on $EDUCDIF_{ij}$ that weakens when introducing fixed effects. Splitting the sample into an "$EDUC_{ij} < 1$"-group and an "$EDUC_{ij} > 1$"-group (Columns 5 and 6), does not change much in these results, except that for the latter group the effect of the interaction term $HCINTER_{ij}$ is stronger in absolute terms. Notable is the difference in absolute values of the coefficients on $EDUCDIF_{ij}$ and its baseline model counterpart $SKILLDIF_{ij}$. Following the OLS and WLS results, $EDUCDIF_{ij}$ has a smaller effect on affiliate turnover than $SKILLDIF_{ij}$. This suggests that, within the context of the model, country differences in skill endowments are more important to the volume of affiliate turnover than are differences in educational attainment. Results on the control variables are, generally, similar to the baseline case.

The BNU specification even seems to benefit from the human capital adjustment, with results (Table 6.2.2) that are slightly more supportive of the predictions of the KC model than the baseline results. Just as before, coefficients on the main regressors $HCSIZE_{ij}$, HC$SIZESQ_{ij}$ and $EDUC_{ij}$ are highly significant and match expected signs throughout all regressions; but importantly, the coefficient on $HCINTER_{ij}$ now maintains its significance (although only marginally) when introducing fixed effects. Splitting the sample in an "$EDUC_{ij} < 1$"-group and an "$EDUC_{ij} > 1$"-group (Columns 5 and 6, respectively) yields similar results as before. Notable is the observation that $EDUC_{ij}$ has a much stronger positive effect for countries that are relatively not well endowed in educated people (Column 6), than for the other group (Column 5). As for the control variables, the results are comparable to the baseline case, although coefficients are generally slightly weaker in terms of significance.

I note that the human capital model produces more favorable $Adj.R^2$ and BIC values than the baseline model for both the CMM and BNU specification, and for each of the six regression models. This shows that the human capital model performs better in goodness-of-fit and predictive power. Combined with the convincing regression results, this suggests that including human-capital-based skill-measures is an improvement to the model.

Table 6.2.1 – Human Capital Results: CMM Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $EDUC_{ij}$ > 1	(vi) FE *(home and host country, year)* $EDUC_{ij}$ < 1
$SUMGDP_{ij}$	**7.519*** **	**14.55*** **	**32.34*** **	**34.58*** **	**38.24*** **	**44.25*** **
	(0.651)	(0.240)	(1.496)	(5.623)	(3.713)	(8.489)
$GDPDIFSQ_{ij}$	**-0.000319*** **	**-0.000702*** **	**-0.00124*** **	**-0.00124*** **	**-0.00160*** **	**-0.00116*** **
	(4.78e-05)	(1.71e-05)	(2.55e-05)	(0.000167)	(9.42e-05)	(0.000229)
$EDUCDIF_{ij}$	**4,800** **	**22,803*** **	-3,722	**667.0**	**26,596* **	-22,722
	(2,328)	(3,978)	(12,596)	(10,043)	(14,683)	(29,785)
$HCINTER_{ij}$	**-3.675* **	**-5.594*** **	**-9.222*** **	**-9.286*** **	**-7.236*** **	**-17.39*** **
	(1.890)	(0.782)	(0.615)	(2.264)	(1.726)	(3.991)
TF_i	**570.6*** **	**1,923*** **	-397.5*	**34.61**	-963.1**	**248.1**
	(107.6)	(171.6)	(230.0)	(281.1)	(389.3)	(350.2)
TF_j	228.5***	231.2	257.1	428.8**	630.1***	**-31.40**
	(73.28)	(162.6)	(194.1)	(182.3)	(177.6)	(395.2)
$HCINTER\_TF_j$	-519.7***	-1,472***	-392.8**	-382.2***	-991.4**	-274.3
	(124.6)	(366.6)	(177.3)	(125.0)	(425.1)	(1,089)
IF_j	**36.77**	**156.2*** **	-112.5**	-72.95	-53.54	-5.460
	(24.83)	(59.29)	(49.48)	(51.97)	(44.98)	(89.54)
$DIST_{ij}$	*-0.101**	*-0.796****	*-0.739****	*-0.729*	*-1.745****	*-1.845*
	(0.0524)	(0.138)	(0.199)	(0.571)	(0.453)	(1.604)
Constant	-77,789***	-220,827***	-27,616	-87,984**	-22,162	-90,609
	(12,673)	(19,383)	(21,985)	(34,642)	(40,531)	(55,942)
Observations	3,741	3,741	3,731	3,731	2,048	1,676
R^2	0.433	0.543	0.663	0.664	0.791	0.697
$Adj. R^2$	0.4313	0.542	0.6523	0.6531	0.7797	0.677
BIC	82934.65	88503.2	80772.07	80757.28	42961.45	36480.22

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic.

Table 6.2.2 – Human Capital Results: BNU Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $EDUC_{ij} > 1$	(vi) FE *(home and host country, year)* $EDUC_{ij} < 1$
$SUMGDP_{ij}$	**3.307*** **	**5.051*** **	-0.973	-1.959	-8.394	**10.55**
	(0.264)	(0.121)	(5.663)	(6.028)	(5.552)	(10.04)
$HCSIZE_{ij}$	**34,817*** **	**180,511*** **	**45,698*** **	**45,474*** **	**63,198*** **	**12,391**
	(4,377)	(9,576)	(6,851)	(6,847)	(11,296)	(9,919)
$HCSIZESQ_{ij}$	**-22,460*** **	**-107,774*** **	**-31,388*** **	**-31,320*** **	**-30,371*** **	**-38,808*** **
	(2,408)	(4,628)	(3,762)	(3,765)	(4,768)	(7,274)
$EDUC_{ij}$	**4,931*** **	**36,541*** **	**12,822*** **	**12,752*** **	**7,719*** **	**94,804*** **
	(1,072)	(3,500)	(2,403)	(2,395)	(2,117)	(32,660)
$HCINTER_{ij}$	**-4,252*** **	**-34,748*** **	**-6,197***	**-6,112***	246.3	10,843
	(1,575)	(4,990)	(3,335)	(3,332)	(2,609)	(17,346)
TF_i	**115.2**	**1,236*** **	-231.6	-283.5	-296.9	-76.40
	(87.63)	(190.1)	(252.0)	(358.3)	(553.6)	(366.4)
TF_j	**-55.40**	510.5**	**-84.95**	**-78.30**	**-27.90**	133.1
	(76.12)	(200.2)	(168.8)	(193.7)	(199.4)	(534.0)
$HCINTER\_TF_j$	-6.213***	-56.42***	-14.27***	-14.18***	-7.519***	-485.9*
	(1.727)	(7.946)	(3.384)	(3.361)	(2.344)	(268.4)
IF_j	**81.44*** **	**356.1*** **	**1.888**	-33.61	**5.032**	**56.63**
	(22.43)	(71.70)	(64.75)	(70.10)	(65.98)	(89.80)
$DIST_{ij}$	*-0.289****	*-1.197****	*-1.364**	*-1.363**	*-1.446***	*-2.045*
	(0.0530)	(0.162)	(0.713)	(0.714)	(0.719)	(1.920)
$Constant$	-23,464**	-238,523***	21,889	30,964	29,733	-55,305
	(10,576)	(23,003)	(23,939)	(42,653)	(56,670)	(71,065)
$Observations$	3,741	3,741	3,731	3,731	2,048	1,676
R^2	0.344	0.345	0.444	0.445	0.545	0.525
$Adj. R^2$	0.3422	0.3436	0.4269	0.4262	0.5209	0.4935
BIC	83485.89	89856.83	82644.18	82642.26	44559.25	37240.4

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic.

6.3 Robustness Results

I now perform several robustness checks on the baseline and human capital results. Robustness results for the baseline specifications are showed and discussed in this section (Table 6.3.1 and Table 6.3.2). Robustness results of the human capital regressions are similar and instead of discussing these results in full detail, I just refer to the regression output in Appendix F, Tables 1 and 2.

The Role of the Financial Crisis

The beginning of the 2008-2014 timeframe is characterized by a global financial crisis, which might have affected the results. In addition to the year fixed effects model, I control for this by introducing a crisis dummy variable to the specification. The dummy is set for the years 2008, 2009 and 2010.[23] Results for the CMM specification are shown in Table 6.3.1 (Panel A, Columns 1 and 2), results for the BNU specification in Table 6.3.2 (Panel A, Columns 1 and 2). For both specifications, the OLS coefficient on $crisis$ is positive[24] and marginally significant (10%) and the coefficient in the fixed effects regression insignificant. Moreover, the inclusion of the crisis dummy does not seem to affect the results: coefficients and significance levels are practically unchanged as compared to the baseline results. This suggests that both the CMM and BNU specification produce results that are robust to shocks specific to crisis years 2008, 2009 and 2010.

The Role of Factor-Endowments Coverage

One of the main criticisms on the CMM study was their samples' limited coverage of factor-endowment combinations: only US-bilateral observations were included. Combinations for which one country was small and skilled-labor abundant and the other large and unskilled-labor abundant – situations for which the KC model predicts multinational activity to peak - did practically not occur. I now impose similar limitations on my own sample by restricting to a subsample that includes only US observations, to see to what extent this affects my results. Figure 6.3.1 shows the coverage of this restricted sample, which is indeed limited and resembles the coverage of the CMM sample (Figure 5.1). Results are shown in Tables 6.3.1 and 6.3.2, Panel B, Columns 1 and 2. I report results for an OLS model[25] and for a year and host country fixed effects model.[26]

As for the CMM specification (Table 6.3.1, Panel B), I observe the following. OLS (Column 1) coefficients on the main regressors ($GDPDIFSQ_{ij}$, $SKILLDIF_{ij}$, and $INTER_{ij}$) are highly significant (1%) and all match expected signs. Compared to the full sample results, estimated effects are stronger in absolute terms. Thus, when restricting the sample, results grow stronger. If this was also the case in the CMM study,

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23 My data shows a sharp decrease in affiliate turnover for these three years, which I attribute to the financial crisis. The years 2011-2014 show a more stable pattern.

24 This should not be interpreted as the crisis having a positive effect on affiliate turnover: the average volume of affiliate turnover has decreased sharply *during* the crisis years and has remained relatively stable in the remaining years of my timeframe. The volume of affiliate turnover was still at relatively high levels in the crisis years, which is reflected in a positive coefficient on the crisis variable.

25 Although not reported here, I observe similar results when using a WLS model.

26 Considering both home- and host country fixed effects would result in very weak results (insignificant coefficients on all variables), since the US is present in each observation. In CMM, the authors only controlled for host country fixed effects. I follow this line for regressions on the US sample. For regressions on the full sample, I always consider both home- and host country fixed effects.

then their estimated effects would have been overstated, or in other words: the results of the CMM study would have been weaker in case they would have used a more extensive sample.[27] As for the control variables, I observe highly significant coefficients on $SUMGDP_{ij}$, IF_j and $DIST_{ij}$, with stronger estimated effects in absolute terms. I also note insignificant coefficients on the two trade freedom variables and on the interaction term $INTER\_TF_j$. When introducing fixed effects, the coefficient on $INTER_{ij}$ loses its significance. This opposes the baseline results, for which it was the coefficient on $SKILLDIF_{ij}$ that weakened and not $INTER_{ij}$. I finally note that the sign on $SUMGDP_{ij}$ has flipped sign to negative. This implies a negative effect of joint market size on affiliate turnover, which sharply contradicts the positive coefficients on this variable in practically all other regressions presented so far.

In the BNU specification results (Table 6.3.2, Panel B), I observe highly significant (1%) OLS coefficients that match expected signs for three of the main regressors ($SIZE_{ij}$, $SIZESQ_{ij}$, and $INTER_{ij}$), but not for $SKILL_{ij}$. Coefficients on all variables are much stronger in absolute terms than in the full sample case. Just as for the CMM specification, the coefficient on $INTER\_TF_j$ is insignificant. When introducing fixed effects (Column 2), coefficients on all main regressors are highly significant. They match expected signs for $SIZE_{ij}$, $SIZESQ_{ij}$ and $SKILL_{ij}$, but interestingly not for $INTER_{ij}$, which now has a positive sign. Thus, although the results are convincing in terms of significance and absolute values of the coefficients, they do not match with the predictions of the KC model.

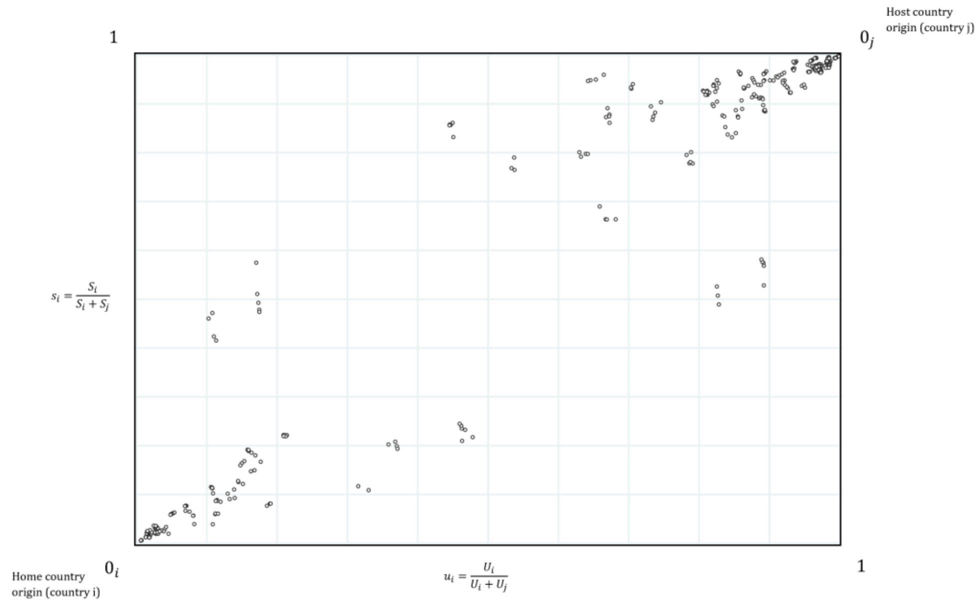
To sum up, the results suggest that the two specifications move into a different direction when restricting the sample: the CMM specification yields results that are slightly more supportive[28] and the BNU specification yields results that are less supportive to the KC models' predictions, as compared to the respective full sample regressions. Although this cannot be said with certainty, this result - combined with evidence provided in the BNU study - suggests the possibility that the CMM study found support for the KC model *because* their coverage of factor-endowment combinations was so limited. Caution is needed in drawing this conclusion, but at least the result tells that adequate coverage of the factor-endowment space is essential to the results.[29]

27 In fact, BNU use the CMM specification to perform regressions on their own, extended sample with improved factor-endowment coverage. They do not find support for the predictions of the KC model.

28 Specifically: more supportive in the OLS regressions in terms of absolute values of the coefficients, similarly weak support in the fixed effects regression.

29 It also raises some other interesting questions. What would happen to the results if *all* countries in the world would be included in the sample, thus also the least developed countries? Would the inclusion of more small and economically less developed countries lead to less supportive results when using the CMM specification, but more supportive results when using the BNU specification?

Figure 6.3.1 – US Subsample: Coverage of Factor-Endowment Pairs of my 2008-2014 Sample on Affiliate Turnover



The Role of Measurements for Trade Freedom

In the empirical model, I distinguish between home country trade freedom (TF_i) and host country trade freedom (TF_j). One advantage of this distinction is that it allows for estimating whether affiliate turnover is affected differently by home and host country trade conditions.[30] However, the KC model itself technically does not make this distinction. In fact, the model only knows a single variable for trade costs, which is symmetric and thus the same for both directions of trade.[31] To check for the robustness of my earlier results, I introduce a new measurement of trade costs which is more in line with this symmetry: symmetric bilateral trade costs (TC_{ij}). This variable replaces TF_i and TF_j. $INTER\_TF_j$ is replaced for $INTER\_TC_{ij}$. Since the KC model predicts that trade costs have opposite effects on horizontal multinationals and vertical multinational activity, I state my expectations on these two variables as ambiguous.

Results for the CMM specification are showed in Table 6.3.1 (Panel C), results for the BNU specification in Table 6.3.2 (Panel C). As for the CMM specification, I observe convincing OLS results: all coefficients are highly significant (1% level) and match their expected sign. As for the main regressors $GDPDIFSQ_{ij}$, $SKILLDIF_{ij}$, and $INTER_{ij}$, I observe coefficients that are stronger in absolute terms than was the case for my baseline results. Just as before, when including country and year fixed effects to the model (Column 2), I observe similar signs but a loss of significance for the coefficient on $SKILLDIF_{ij}$ and some of the control variables. The BNU specification also produces convincing OLS results, with highly significant

30 Following the reasoning of CMM and BNU, I expected that home country trade freedom would have a negative effect on affiliate turnover, while host country trade freedom would have a positive effect.

31 The KC model includes τ, which is a constant of proportionality between marginal production costs and trade costs (Markusen, 2002, p. 134). τ is multiplied with the marginal production costs of good X, resulting in transport costs per unit of X.

OLS coefficients on all variables. Importantly, the coefficients on the four main regressors ($SIZE_{ij}$, $SIZESQ_{ij}$, $SKILL_{ij}$, $INTER_{ij}$) show signs and significance levels that are equivalent to my baseline results and thus supportive to the KC model. When controlling for fixed effects, the coefficient on $INTER_{ij}$ loses its significance, which was also the case in the baseline results.

Coefficients on most of the control variables do not yield any surprises. However, when comparing the coefficients on the symmetric bilateral trade costs variable, things get a bit more interesting: the OLS regression yields a coefficient on TC_{ij} of 19.37 (1% level) when using the CMM specification, whereas using the BNU specification results in a coefficient of -13.64 (1% level).[32] The coefficients on $INTER\_TC_{ij}$ are negative for both specifications, but much stronger in absolute terms for the CMM case than for the BNU case (-172.1 against -0.220, respectively; 1% level).[33] Thus, the sign of the effect of trade costs depends on which specification is used. How to interpret this confusing result? One explanation could be the opposite effects that trade costs are predicted to have on horizontal multinationals and vertical multinationals: according to the KC model simulations, an increase in trade costs increases horizontal multinational activity, but decreases activity for vertical multinationals. It could be that the CMM specification more strongly captures horizontal activity, and the BNU vertical activity, which would then be an explanation to these contrasting signs.[34]

I finally note that for both specifications, $Adj.R^2$ values are similar to the baseline results. BIC values are lower, which suggests that exchanging the trade freedom variables for the symmetric bilateral trade costs variable, is an improvement to the specification.

32 For comparison reasons, I performed the same regressions but then without the interaction term $INTER\_TC_{ij}$. Results were similar.

33 Although not reported here, I also performed WLS regressions. Results were similar.

34 In Figure 5 (p. 784) of their paper, BNU plot the difference between their skill-measure and the CMM skill-measure and show that this difference peaks when the home country is both small and skilled-labor abundant, which is when the KC model predicts vertical multinationals to be active. Thus, for these cases the estimated effects of the skill-measure on affiliate turnover are stronger when using the BNU specification than when using the CMM specification. This implies that, indeed, the BNU specification leads to stronger effects when vertical activity is involved.

Table 6.3.1 – Robustness Results for the Baseline Regressions: CMM Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	A. Role of Financial Crisis		**B. Using Only US Data**		**C. Using Alternative Trade Costs Variable**	
	(i) OLS	(ii) FE *(home and host country)*[1]	(i) OLS	(ii) FE *(host country, year)*[2]	(i) OLS	(ii) FE *(home and host country, year)*
$SUMGDP_{ij}$	**5.359*** **	**9.914*** **	**11.03*** **	-121.8***	**5.598*** **	**10.64*** **
	(0.417)	(2.828)	(2.914)	(32.77)	(0.526)	(3.629)
$GDPDIFSQ_{ij}$	**-0.000209*** **	**-0.000832*** **	**-0.000696*** **	**-0.00609*** **	**-0.000218*** **	**-0.000867*** **
	(2.86e-05)	(9.31e-05)	(9.60e-05)	(0.00127)	(3.46e-05)	(9.94e-05)
$SKILLDIF_{ij}$	**12,335*** **	**6,092**	**134,536*** **	**136,466*** **	**15,031*** **	**9,918**
	(1,596)	(7,451)	(32,536)	(43,437)	(1,953)	(9,836)
$INTER_{ij}$	**-1.912** **	**-13.04*** **	**-9.622*** **	**-4.922**	**-2.619*** **	**-13.03*** **
	(0.810)	(1.462)	(2.939)	(3.475)	(0.929)	(1.528)
TF_i	**349.1*** **	-158.3*	-57.85	**1,194**		
	(51.94)	(83.85)	(803.8)	(1,023)		
TF_j	117.1***	**-18.79**	263.1	291.4		
	(30.53)	(89.99)	(375.6)	(472.4)		
$INTER\_TF_j$	-675.7***	-502.1***	-3,611	-3,231		
	(96.34)	(147.0)	(2,212)	(2,950)		
TC_{ijt}					*19.37****	*-9.068*
					(6.880)	(6.862)
$INTER\_TC_{ijt}$					*-172.1****	*-89.31**
					(38.05)	(47.80)
IF_j	**65.02*** **	-3.188	**355.8** **	**417.6**	**122.7*** **	**3.471**
	(14.82)	(39.74)	(180.8)	(278.0)	(17.03)	(43.67)
$DIST_{ij}$	*-0.277****	*-2.455****	*-3.101****	*-2.038**	*-0.484****	*-2.290****
	(0.0426)	(0.458)	(0.851)	(1.072)	(0.0751)	(0.474)
$CRISIS_t$	*833.0**	*-133.8*				
	(437.6)	(381.0)				
Constant	-48,123***	21,232**	853.6	3.165e+06***	-14,787***	4,276
	(6,035)	(9,940)	(101,072)	(779,605)	(2,153)	(9,608)
Observations	6,029	6,017	386	386	4,730	4,716
R^2	0.364	0.600	0.462	0.826	0.364	0.610
$Adj. R^2$	0.3631	0.5903	0.4486	0.7876	0.3632	0.598
BIC	133725.5	130674	9431.413	8989.008	105530.5	102914

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE. 2) For all fixed effects regressions on the US sample, I only consider host-country fixed effects.

Table 6.3.2 – Robustness Results for the Baseline Regressions: BNU Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	A. Role of Financial Crisis		B. Using Only US Data		C. Using Alternative Trade Costs Variable	
	(i) OLS	(ii) FE *(home and host country)*	(i) OLS	(ii) FE *(host country, year)*	(i) OLS	(ii) FE *(home and host country, year)*
$SUMGDP_{ij}$	3.048***	0.660	6.914**	20.77***	2.968***	-0.507
	(0.205)	(2.273)	(2.998)	(5.409)	(0.228)	(2.952)
$SIZE_{ij}$	28,605***	28,362***	548,776***	289,789***	30,758***	27,830***
	(2,971)	(4,968)	(72,836)	(97,374)	(3,517)	(5,596)
$SIZESQ_{ij}$	-20,097***	-25,019***	-316,998***	-419,759***	-21,510***	-25,774***
	(1,842)	(2,655)	(39,591)	(56,882)	(2,210)	(2,983)
$SKILL_{ij}$	2,826***	9,053***	33,204	91,181***	1,981***	5,798***
	(426.1)	(1,271)	(25,171)	(29,874)	(317.3)	(944.4)
$INTER_{ij}$	-1,671**	-1,250	-93,750***	170,966**	-2,023**	-76.13
	(805.0)	(2,144)	(25,582)	(82,630)	(856.8)	(2,455)
TF_i	157.0***	-164.3	7,246***	1,521		
	(51.46)	(104.2)	(1,069)	(1,046)		
TF_j	129.8***	89.31	2,344***	1,865***		
	(39.99)	(80.17)	(488.7)	(603.0)		
$INTER\_TF_j$	-2.148***	-6.063***	38.11	-133.9		
	(0.418)	(1.028)	(74.86)	(158.0)		
TC_{ijt}					-13.64***	11.07
					(3.910)	(8.946)
$INTER\_TC_{ijt}$					-0.220***	-0.681***
					(0.0686)	(0.187)
IF_j	63.59***	1.460	806.3***	23.81	90.82***	-27.80
	(15.63)	(47.85)	(189.5)	(275.5)	(18.11)	(57.38)
$DIST_{ij}$	-0.382***	-2.632***	-3.085***	-1.761*	-0.343***	-2.601***
	(0.0460)	(0.518)	(0.858)	(1.039)	(0.0695)	(0.557)
$CRISIS_t$	802.9*	-266.5				
	(456.8)	(437.8)				
Constant	-38,459***	9,623	-1.007e+06***	-614,998***	-13,528***	11,054
	(6,118)	(11,083)	(102,381)	(105,742)	(2,087)	(8,765)
Observations	6,029	6,017	386	386	4,730	4,716
R^2	0.323	0.438	0.469	0.859	0.322	0.437
$Adj. R^2$	0.322	0.4239	0.4554	0.8272	0.3211	0.4186
BIC	134110.3	132732.1	9431.615	8914.04	105841.2	104662.3

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE. 2) For all fixed effects regressions on the US sample, I only consider host-country fixed effects.

6.4 Discussion of Results

It is interesting to see that the two specifications lead to different conclusions, especially in the fixed effects regressions. The question now is: is there any way to decide which specification and thus which set of outcomes is to be preferred? The CMM specification produces more favorable BIC and $Adj.R^2$ values across almost all regressions performed.[35] Based on this, I could conclude that the CMM specification is to be preferred, because it performs better than the BNU specification in terms of explanatory power and data fit. However, in that case, I would ignore that the BNU specification is mapped directly from the theory of the KC model[36], which makes that the BNU specification is in fact the only justified specification if my goal is to literally estimate the predicted effects of the KC model. In other words, the CMM specification is on itself more suitable if the goal is to estimate relationships between skill and size characteristics and affiliate turnover, but the BNU specification is closer to the KC model and thus more suitable if the primary objective is to directly and explicitly test the predictions of the model. I consider both objectives as valuable and thus do not make an explicit choice between the two specifications.

I conclude that for manufacturing industries, support for the predictions of the KC model is mixed but slightly positive. The CMM specification yields strong support for the prediction that turnover is high for countries that are both small and skilled-labor abundant and increases in size similarities, and yields mixed support for the prediction that turnover increases in skill-endowment similarities. Results from the BNU specification favor the predictions that turnover increases in size and skill similarities, but show mixed support for the prediction that turnover increases in the combination of small size and skilled-labor abundance. When using human capital as a measurement of relative skill-endowments, results on the CMM specification are – generally – similar. Results on the BNU specification seem to benefit from the adjustment, with slightly better support of the empirical predictions of the KC model. Furthermore, results are robust to shocks specific for crisis years 2008, 2009 and 2010. Results of the two specifications diverge when restricting to a US-only sample, where results of the CMM specification grow slightly more supportive and results of the BNU specification less supportive. Also, considering symmetric bilateral trade costs as an alternative measure for trade conditions does not change the main results, but reveals that the CMM and BNU specifications capture different elements of the 'trade costs – affiliate turnover' relationship, with opposite signs on the trade costs variable.

[35] Except for the regressions on the US restricted sample, for which the BNU specification has a higher $Adj.R^2$ value.

[36] As explained in Section 4, and graphically showed in Table 4.1.

7. Results for the Services Industries

7.1 Baseline Results

In the above, I used the KC model to derive empirical predictions for manufacturing industries and estimated these predictions with the most recent data on affiliate turnover. In this section, I shift focus from manufacturing industries to services industries. Using the same regression specifications as before, I explore how country characteristics such as size, skill-endowments, and trade costs, affect affiliate turnover for the services sector.

The baseline results for the CMM specification are shown in Table 7.1.1. Results for the BNU specification are showed in Table 7.1.2.

Results on the CMM specification are mixed. For instance, I observe contradictory signs for the interaction variable ($INTER_{ij}$) in the OLS and WLS models, and a coefficient on $SKILLDIF_{ij}$ that weakens when introducing fixed effects. On the other hand, results on $GDPDIFSQ_{ij}$ are convincing across all regressions. Also, WLS and fixed effects results on $INTER_{ij}$ are convincing and consistent with one another. The evidence suggests that affiliate turnover for services industries increases in size similarities and is decreasing in the interaction term $INTER_{ij}$, which suggests that turnover is high when a country is both small and skilled-labor abundant.[37] Interestingly, this is very similar to the results for manufacturing industries in terms of signs and levels of significance. In absolute terms, coefficients are stronger for services industries than for manufacturing industries.[38] As for the control variables, I observe highly significant coefficients on $SUMGDP_{ij}$ (positive sign) and $DIST_{ij}$ (negative sign) across all regressions.[39] Results on the trade freedom variables are mixed for the OLS and WLS regressions, and weak for the fixed effects models. Notable are the highly significant, strong negative effect of TF_j in the WLS regression and the weak results on the interaction variable $INTER\_TF_j$.

Results on the BNU specification are compelling. All coefficients are highly significant (1% level) and show similar signs across the four different regression models (Columns 1-4). Results suggest that affiliate turnover for services industries increases in size and skill similarities, and is high for the case in which a country is both small and skilled-labor abundant. These results are striking: they exactly match the expected signs set for effects on *manufacturing* industries affiliate turnover. Thus, what the KC model predicts for manufacturing industries, is precisely what can be observed for services industries. Also, coefficients on the main regressors are stronger in absolute terms for most cases.[40] As for the control variables, I observe highly significant coefficients on $SUMGDP_{ij}$ (positive sign), TF_j (negative sign) and IF_j (positive sign) for the OLS and WLS models and for $DIST_{ij}$ (negative sign) across all regressions. The coefficient on $INTER\_TF_j$ is negative and highly significant for the WLS and fixed effects regressions.

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37 The latter I say with caution, because the OLS coefficient on the interaction variable is positive.

38 This is not a very spectacular result, since services affiliate turnover is – on average – higher than manufacturing affiliate turnover (I refer to the Summary Statistics for these variables).

39 I also observe coefficients on the distance variable that are stronger in absolute terms than was the case for manufacturing industries, but this does not mean that distance has a larger negative effect on services turnover than on manufacturing turnover: as I explained before, the distance variable effectively functions as a control variable for country-pair fixed effects, and thus should be interpreted with caution.

40 I refer to Footnote 38.

I finally note that $Adj.R^2$ and BIC values are more favourable for the services regressions than for the manufacturing regressions, across all regression models.

Table 7.1.1 – Baseline Results: CMM Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $SKILL_{ij}$ > 1	(vi) FE *(home and host country, year)* $SKILL_{ij}$ < 1
$\boldsymbol{SUMGDP_{ij}}$	7.936***	15.92***	19.15***	19.68***	16.32***	29.42***
	(0.753)	(0.283)	(5.320)	(5.475)	(4.707)	(8.655)
$\boldsymbol{GDPDIFSQ_{ij}}$	-0.000266***	-0.000750***	-0.00152***	-0.00152***	-0.00164***	-0.00176***
	(5.94e-05)	(2.17e-05)	(0.000163)	(0.000164)	(0.000182)	(0.000185)
$\boldsymbol{SKILLDIF_{ij}}$	-3,753	-26,703***	1,711	1,797	24,484	-15,416
	(4,978)	(8,957)	(9,907)	(10,754)	(14,941)	(25,378)
$\boldsymbol{INTER_{ij}}$	5.622**	-5.125***	-29.24***	-29.25***	-28.05***	9.403
	(2.201)	(1.020)	(3.761)	(3.771)	(5.466)	(7.122)
$\boldsymbol{TF_i}$	248.2**	160.0	-670.1	-482.6	8,116**	-927.8
	(104.2)	(310.0)	(471.7)	(1,093)	(3,679)	(905.1)
$\boldsymbol{TF_j}$	32.52	-993.8***	-6.480	10.88	30.48	97.66
	(37.09)	(203.5)	(72.39)	(79.20)	(78.33)	(175.6)
$\boldsymbol{INTER\_TF_j}$	-263.5	-2,425***	-120.3	-106.4	-691.6**	-412.9
	(219.4)	(418.9)	(180.5)	(180.8)	(293.3)	(911.3)
$\boldsymbol{IF_j}$	121.7***	803.8***	-82.53	-57.86	-102.5*	76.09
	(18.20)	(72.32)	(57.41)	(61.99)	(54.81)	(163.2)
$\boldsymbol{DIST_{ij}}$	*-0.348****	*-1.947****	*-7.225****	*-7.250****	*-3.407****	*-10.79****
	(0.0630)	(0.196)	(1.031)	(1.030)	(0.971)	(1.921)
Constant	-38,139***	-4,637	76,881**	56,506	-703,266**	70,252
	(9,903)	(29,928)	(38,509)	(94,439)	(317,122)	(77,815)
Observations	4,169	4,169	4,147	4,147	2,667	1,475
$\boldsymbol{R^2}$	0.408	0.528	0.732	0.732	0.750	0.833
$\boldsymbol{Adj.R^2}$	0.4071	0.527	0.7253	0.7252	0.7409	0.8227
BIC	94728.2	101737.9	90957.63	90953.58	57641.01	32207.61

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions.

Table 7.1.2 – Baseline Results: BNU Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $SKILL_{ij} > 1$	(vi) FE *(home and host country, year)* $SKILL_{ij} < 1$
$SUMGDP_{ij}$	5.825***	9.192***	4.757	5.568	4.795	-12.41*
	(0.529)	(0.152)	(4.562)	(4.481)	(3.923)	(7.331)
$SIZE_{ij}$	52,996***	305,524***	59,914***	59,863***	54,571***	112,520***
	(5,719)	(10,475)	(5,697)	(5,741)	(6,030)	(27,676)
$SIZESQ_{ij}$	-30,275***	-155,459***	-40,781***	-40,688***	-43,135***	-42,820***
	(3,137)	(5,689)	(4,018)	(4,027)	(4,863)	(6,987)
$SKILL_{ij}$	1,678***	16,347***	12,018***	11,938***	10,237***	-412,241***
	(549.6)	(1,761)	(1,195)	(1,206)	(1,124)	(147,614)
$INTER_{ij}$	-6,246***	-58,160***	-15,665***	-15,679***	-13,214***	-55,863*
	(1,241)	(3,456)	(2,449)	(2,457)	(2,336)	(32,823)
TF_i	19.39	-728.1**	-1,149*	-1,328	-135.9	315.2
	(138.4)	(294.0)	(670.4)	(1,451)	(3,403)	(1,417)
TF_j	-115.0***	-1,352***	161.2*	158.1	80.88	-2,088**
	(43.23)	(208.4)	(93.77)	(101.8)	(96.34)	(873.7)
$INTER\_TF_j$	-0.602	-11.97***	-7.454***	-7.406***	-6.047***	3,111***
	(0.417)	(2.111)	(0.849)	(0.854)	(0.743)	(1,046)
IF_j	104.8***	543.8***	46.47	47.81	-116.5	628.0***
	(19.82)	(75.72)	(76.29)	(83.71)	(78.36)	(232.8)
$DIST_{ij}$	*-0.421****	*-2.177****	*-7.433****	*-7.410****	*-4.192****	*-9.926****
	(0.0545)	(0.200)	(0.991)	(0.981)	(0.857)	(1.836)
Constant	-16,263	51,905*	97,764*	111,677	14,762	311,463*
	(12,660)	(29,479)	(54,255)	(124,811)	(295,473)	(158,960)
Observations	4,169	4,169	4,147	4,147	2,667	1,475
R^2	0.398	0.507	0.594	0.595	0.589	0.717
$Adj. R^2$	0.3968	0.5054	0.5839	0.584	0.573	0.6996
BIC	94807.38	101930.9	92687.96	92680.27	58980.77	32991.15

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions.

7.2 Human Capital and Robustness Results

In addition to the baseline regressions, I perform human capital and robustness regressions for the services industries.[41] To avoid becoming too repetitive, I do not discuss these results in full detail but refer to Appendix G, Tables 1-6. Tables 1-2 show the human capital results. Tables 3-4 show robustness results for the baseline regressions. Tables 5-6 show robustness results for the human capital regressions. In summary, I can say that the results on the main regressors are robust to exchanging skill-based variables for education-based variables, the inclusion of a crisis dummy to capture shocks in crisis years 2008-2010, and the use of an alternative measurement of trade costs.

7.3 Discussion of Results

One cannot ignore the parallels between the services industries results and the manufacturing industries results. For the CMM results, these parallels are to be observed primarily for the fixed effects regressions: the predicted effects of country size differences and the interaction variable have similar signs. For the BNU services results, I observe OLS and WLS results that are similar to the manufacturing sector on all four main regressors. Fixed effects results are similar in sign and significance for the size and skill variables, and even more convincing for the interaction term: all coefficients remain significant when introducing fixed effects, whereas the manufacturing industries regressions produced weak coefficients on $INTER_{ij}$ in the fixed effects regressions.[42] Thus, when using the BNU specification, the services industries data on affiliate turnover are more supportive to the KC models' predictions for manufacturing industries, *than are the actual manufacturing results.*

So, what conclusions can be derived from these services industries results? In some way, they add to the robustness of the results derived in the manufacturing industries analysis, since many of the uncovered patterns appear to be present for both manufacturing and services industries. This is interesting: there are substantial differences between these industries – e.g., regarding trade costs, fixed costs of production facilities, and assumptions on skilled-labor intensity of activities - but effects of size and skill characteristics are not so much different. For example, the evidence on both the CMM and BNU specifications strongly suggests that affiliate turnover increases in size similarities and that this is true for both industries. Results of the CMM specification suggest that both manufacturing and services affiliate turnover is high when a country is both small and skilled-labor abundant. Results of the BNU specification suggest that for both industries, affiliate turnover increases in skilled-labor abundance of the home country. In summary, these observations suggest that many of the estimated relationships are present in both manufacturing and services industries.

Whereas the services sector results add to the robustness of the effects uncovered in the previous sections, they have a very different implication for the robustness of the KC model *itself*. This applies particularly to the results of the BNU specification - which is directly mapped from the KC model theory and thus more suitable if the objective is to literally estimate the predictions of the model. It is, at the least, counterintuitive that numerical simulations based on complex assumptions specific to the manufacturing

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41 I do not perform regressions on a US subsample, because the number of US observations in the dataset is too small to derive meaningful results.

42 To see this, compare Table 7.1.2, Columns 3 and 4 to Table 6.1.2, Columns 3 and 4.

sector – e.g., assumptions on trade costs, fixed costs, and skilled-labor intensity of activities – produce empirical predictions that turn out to be more accurate for the services sector than for the manufacturing sector. The substantial differences between these two industries would, intuitively, suggest that the predicted pattern of affiliate turnover must be different too. I do not perform numerical simulations for the services industries[43], but assume that this pattern is indeed different. For instance, trade costs can be assumed to be (much) lower for services industries than for manufacturing industries, which benefits vertical multinationals but decreases incentives for horizontally integrated firms. At the same time, there will be differences in fixed costs, for instance for vertically integrated firms: a call-center in a low-income country will most likely require less fixed investments than a car factory.

Thus, while the predicted pattern is most likely different for the two industries, the data shows otherwise: effects are quite similar. This suggests that the uncovered effects do not actually result from the mechanisms that are present in the KC model (i.e., the tension between fixed costs for affiliates on the one hand, and trade costs of goods on the other) but that some other factors drive effects of size and skill characteristics on multinational activity. These factors are unknown and not reflected in the model. If this would indeed be the case, any correspondence between the observed effects and the models' predictions could be – at least partly – be regarded as coincidental. In conclusion, the similarities between my manufacturing and services results question the ability of the KC model to predict patterns of affiliate turnover.

[43] In fact, I did perform numerical simulations with services sector assumptions; for instance, with low or absent trade costs (which can be assumed to be the case for the services sector), or with different fixed costs assumptions. From this, I learnt that the model simulations are very sensitive to adjustments and that great care and expertise of services industries assumptions is needed to materialize credible services industries simulation results. I consider this as beyond the scope and feasibility of this thesis. Therefore, I choose to make the assumption that the predicted pattern for services industries, just cannot be identical to the predicted pattern for manufacturing industries.

8 Conclusion

The KC model predicts affiliate turnover for manufacturing industries 1) to increase in size similarities, 2) to increase in skill-endowment similarities, and 3) to be high when a country is both small and skilled-labor abundant. In this thesis, I estimated these predictions by using two specifications (CMM and BNU), using two ways to measure skilled-labor endowment (occupational skill levels and human capital), and for two different industries (manufacturing and services). I performed several robustness checks, i.e., showing that my results are robust to shocks specific to crisis years 2008, 2009 and 2010.

I replicated and improved the CMM and BNU studies and showed that both specifications are supportive of the models' predictions, but lead to slightly different outcomes. The CMM replication yields strong support for the prediction that turnover is high for countries that are both small and skilled-labor abundant and increases in size similarities, and mixed support for the prediction that turnover increases in skill-endowment similarities. Results from the BNU replication strongly favor the predictions that turnover increases in size and skill similarities, but show mixed support for the prediction that turnover increases in the combination of small size and skilled-labor abundance. Although it would be tempting to simply prefer one of the specifications and its set of outcomes (and reject the other) - for instance, based on performance indicators such as model fit and predictive power - I argued that both specifications are relevant in their own way. The CMM specification performs better and would be more suitable if the goal is to estimate general relationships between skill and size characteristics and affiliate turnover. The BNU specification is directly mapped from theory and thus closer to the KC model, which makes it more suitable if the primary objective is to directly and explicitly test the predictions of the model.

I used human capital as an alternative measure for skilled-labor abundance of a country and showed that this is an improvement to the regression models for manufacturing industries. Both specifications improve in terms of fit and predictive power. As for the estimated effects, results on the CMM specification are similar. Results on the BNU specification seem to benefit from the adjustment, with slightly better support for the empirical predictions of the KC model.

I performed estimations on both the manufacturing and services sector and showed that results are strikingly similar. Especially interesting were the results on the BNU specification: the services industries data strongly support all main predictions of the KC model for manufacturing industries. Thus, what the model predicts for manufacturing industries, is precisely what can be observed for the services industries. I explained that this adds to the robustness of the uncovered effects – it suggests that results are sector-independent – but weakens the credibility of the KC model itself as a tool to predict patterns of multinational activity.

To conclude, I can say that support for the KC models' predictions for manufacturing industries, is mixed but moderately positive. Although many of my results coincide with the CMM and BNU studies, they are not as convincing as in the respective studies. It could be that the more extensive data coverage, the larger number of observations, or the improved measurements of trade and investment conditions are the reason for these different results. Another possibility is that underlying mechanisms and determinants of FDI simply have changed over the past decades. Nevertheless, the data on affiliate turnover are still more supportive than they are not supportive of the predictions of the model. In previous studies – for instance the original CMM and BNU studies, but also the work of Markusen and Maskus (2002), Blonigen, Davies, and Head (2003), or Davies (2008) – results similar to those in my research would have given rise to the conclusion that the KC model works well if it comes to predicting patterns of affiliate turnover. However, my services sector analysis sheds a completely different light on these results. The strikingly similar effects of size and skill characteristics on affiliate turnover show that the empirical model does not discriminate between services and manufacturing industries. As I explained, this questions the KC models' credibility as a tool to predict those patterns. But before jumping to conclusions on this matter, it is important that I note the following. General equilibrium models on multinational firms are scarce and thus - although there is reason to question its validity - we should be cautious with rejecting the KC model. Although not perfect, it might still be better, more realistic, or otherwise more insightful than its general equilibrium counterparts. To know if this is true, renewed empirical evidence is needed to assess how other models, e.g., vertical approaches led by Helpman (1984) or horizontal approaches described in studies such as Markusen (1984) and Markusen and Venables (1996), perform compared to the KC model. In future research, the importance of considering industries other than manufacturing, should not be understated.

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10 Appendices

Appendix A The KC Model; List of Model Equations

Presented here is a list of equations and assumptions of the KC model, as described in Chapter 7 in Markusen (2002). A list of notations is provided in Appendix B. For further explanation of the equations and assumptions, I refer to Markusen (2002).

1. $Y_i = \left(aL_{i\gamma}^{\alpha} + (1-a)S_{i\gamma}^{\alpha}\right)^{\frac{1}{\alpha}}$ $\qquad i = 1,2$

2. $c_i(w_i, z_i) = w_i c_w + z_i c_z$

   $t_i(w_i,\ z_i) = w_i \tau c_w + z_i \tau c_z = \tau c_i(w_i,\ z_i)$
3. $fc_i^d(w_i,\ z_i) = z_i F_i^d + w_i G$
4. $fc_i^{\mathrm{h}}(w_i, z_i, w_j, z_j) = z_i F_i^{\mathrm{h}} + w_i G + z_j F_j^{\mathrm{h}} + w_j G$
5. $fc_i^v(z_i, w_j, z_j) = z_i F_i^v + w_j G + z_j F_j^v$

6. $2F_i^d > F_i^{\mathrm{h}} + F_j^{\mathrm{h}} > F_i^d < F_i^{\mathrm{h}}$

   $F_i^h + F_j^h > F_i^v + F_j^v > F_i^d$

7. $G = 2,\ F_i^d = 11,\ \left[F_i^{\mathrm{h}} = 12, F_j^{\mathrm{h}} = 4\right],\ \left[F_i^v = 9, F_j^v = 4\right]$

8. $M_i = w_i L_i + z_i S_i$
9. $U_i = X_{ic}^{\beta} Y_{ic}^{1-\beta}$

   $X_{ic} \equiv N_i^d X_{ii}^d + N_j^d X_{ji}^d + N_i^{\mathrm{h}} X_{ii}^{\mathrm{h}} + N_j^{\mathrm{h}} X_{ji}^{\mathrm{h}} + N_i^v X_{ii}^v + N_j^v X_{ji}^v$
10. $X_{ic} = \beta M_i / p_i$

    $Y_{ic} = (1-\beta) M_i$

11. $p_i\left(1 - m_{ii}^d\right) \le c_i(w_i, z_i)$ $\qquad \left(X_{ii}^d\right)$
12. $p_j\left(1 - m_{ij}^d\right) \le c_i(w_i, z_i) + t_i(w_i,\ z_i) = c_i(w_i, z_i)(1+\tau)$ $\qquad \left(X_{ij}^d\right)$
13. $p_i\left(1 - m_{ii}^{\mathrm{h}}\right) \le c_i(w_i, z_i)$ $\qquad \left(X_{ii}^{\mathrm{h}}\right)$
14. $p_j\left(1 - m_{ij}^{\mathrm{h}}\right) \le c_j(w_j, z_j)$ $\qquad \left(X_{ij}^{\mathrm{h}}\right)$
15. $p_j\left(1 - m_{ij}^v\right) \le c_j(w_j, z_j)$ $\qquad \left(X_{ij}^v\right)$
16. $p_i(1 - m_{ii}^v) \le c_j(w_j, z_j) + t_j(w_j,\ z_j) = c_j(w_j,\ z_j)(1+\tau)$ $\qquad (X_{ii}^v)$

17. $m_{ij}^k = \frac{X_{ij}^k}{X_{jc}} = \frac{p_j X_{ij}^k}{\beta M_j}$ $\qquad k = d, \mathrm{h}, v \qquad i, j = 1,2$
18. $p_i m_{ii}^d X_{ii}^d + p_j m_{ij}^d X_{ij}^d \le fc_i^d(w_i, z_i)$ $\qquad \left(N_i^d\right)$
19. $p_j m_{jj}^d X_{jj}^d + p_i m_{ji}^d X_{ji}^d \le fc_j^d(w_j, z_j)$ $\qquad \left(N_j^d\right)$
20. $p_i m_{ii}^{\mathrm{h}} X_{ii}^{\mathrm{h}} + p_j m_{ij}^{\mathrm{h}} X_{ij}^{\mathrm{h}} \le fc_i^{\mathrm{h}}(w_i, z_i, w_j, z_j)$ $\qquad \left(N_i^{\mathrm{h}}\right)$
21. $p_j m_{jj}^{\mathrm{h}} X_{jj}^{\mathrm{h}} + p_i m_{ji}^{\mathrm{h}} X_{ji}^{\mathrm{h}} \le fc_j^{\mathrm{h}}(w_i, z_i, w_j, z_j)$ $\qquad \left(N_j^{\mathrm{h}}\right)$
22. $p_i m_{ii}^v X_{ii}^v + p_j m_{ij}^v X_{ij}^v \le fc_i^v(z_i, w_j, z_j)$ $\qquad (N_i^v)$
23. $p_j m_{jj}^v X_{jj}^v + p_i m_{ji}^v X_{ji}^v \le fc_j^v(w_i, z_i, z_j)$ $\qquad (N_j^v)$

24. $X \geq \beta M_i \frac{p_i - c_i(w_i, z_i)}{p_i^2}$ $\qquad for\ X_{ii}^d, X_{ii}^{\mathrm{h}}, X_{ji}^{\mathrm{h}}, X_{ji}^v$

25. $X \geq \beta M_j \frac{p_j - c_i(w_i, z_i)(1+\tau)}{p_j^2}$ $\qquad for\ X_{ij}^d, X_{jj}^v$

26. $\beta \left[M_i \left(\frac{p_i - c_i}{p_i} \right)^2 + M_j \left(\frac{p_j - c_i(1+\tau)}{p_j} \right)^2 \right] \leq fc_i^d(w_i, z_i)$ $\qquad (N_i^d)$

27. $\beta \left[M_i \left(\frac{p_i - c_j(1+\tau)}{p_i} \right)^2 + M_j \left(\frac{p_j - c_j}{p_j} \right)^2 \right] \leq fc_j^d(w_j, z_j)$ $\qquad (N_j^d)$

28. $\beta \left[M_i \left(\frac{p_i - c_i}{p_i} \right)^2 + M_j \left(\frac{p_j - c_j}{p_j} \right)^2 \right] \leq fc_i^{\mathrm{h}}(w_i, z_i, w_j, z_j)$ $\qquad (N_i^{\mathrm{h}})$

29. $\beta \left[M_i \left(\frac{p_i - c_i}{p_i} \right)^2 + M_j \left(\frac{p_j - c_j}{p_j} \right)^2 \right] \leq fc_j^{\mathrm{h}}(w_i, z_i, w_j, z_j)$ $\qquad (N_j^{\mathrm{h}})$

30. $\beta \left[M_i \left(\frac{p_i - c_j(1+\tau)}{p_i} \right)^2 + M_j \left(\frac{p_j - c_j}{p_j} \right)^2 \right] \leq fc_i^v(z_i, w_j, z_j)$ $\qquad (N_i^v)$

31. $\beta \left[M_i \left(\frac{p_i - c_i}{p_i} \right)^2 + M_j \left(\frac{p_j - c_i(1+\tau)}{p_j} \right)^2 \right] \leq fc_j^v(w_i, z_i, z_j)$ $\qquad (N_j^v)$

Appendix B The KC Model; List of Notations

Presented here is a list of notations of the KC model, used throughout the text and in Appendix A. My notation is identical to the notation used in Markusen (2002).

Markusen (2002), p. 132:

Y_i	Output of good Y in country i	$i = 1,2$
L_{iy}	Unskilled labor used in the Y sector in country i	
S_{iy}	Skilled labor used in the Y sector in country i	
$1/(1-\alpha)$	Elasticity of substitution	

Markusen (2002), p. 133:

Superscripts d, v, h	Denote whether a variable refers to national firms (d), vertical multinationals (v) or horizontal multinationals (h)	$i = 1,2$
N_i^h, N_i^v, N_i^d	Number of active type h, v or d firms in country i	

Markusen (2002), p. 134:

p_i	Price of X (in terms of Y) in country i	$i = 1,2$
w_i	Wage of unskilled labor in country i	
z_i	Wage of skilled labor in country i	
c_i	Marginal cost of X production in country i, for all firm types	
c_{iw}, c_{iz}	Factor-price derivatives of c give X-sector unit input requirement for factors L and S in country i	
t_i	Transport cost for X	
M_i	Income of country i	
X_{ij}^k	Sales of a type-k firm ($k = d, v, h$) headquartered in country i with sales in market j	
m_{ij}^k	Markup of a type k-firm ($k = d, v, h$) headquartered in country i with sales in market j	
fc_i^k	Fixed costs of a type-k firm ($k = d, v, h$) headquartered in country i	
τ	Constant of proportionality between marginal productions costs and trade costs	

Markusen (2002), p. 135:

G	Fixed costs incurred in units of unskilled labor	
F_i^h	Skilled-labor requirements for a type-h firm headquartered in country i	

F_j^h	Skilled-labor requirements for a type-h firm headquartered in country j
F_i^v	Skilled-labor requirements for a type-v firm headquartered in country i
F_j^v	Skilled-labor requirements for a type-v firm headquartered in country j
F_i^d	Skilled-labor requirements for a type-d firm headquartered in country i
F_j^d	Skilled-labor requirements for a type-d firm headquartered in country j

Markusen (2002), p. 136:

U_i	Utility of the representative consumer in country i
X_{ic}	Consumption of good X in country i
Y_{ic}	Consumption of good Y in country i

Appendix C The KC Model; GAMS/MSPGE Syntax for Numerical Simulations

Presented here is the syntax I used for the numerical simulations of the KC model, written in GAMS and MPS/GE programming language. I used syntax for simulations of a horizontal model of multinationals, provided in Appendix 5 of Markusen (2002, p. 383) (and other tutorials in this book) as an example for my own code and to learn about the MPS/GE programming language. The most significant differences between the horizontal model code of Markusen and my own code are to be found in the introduction of vertical multinationals, KC model assumptions (e.g., jointness, fragmentation, the skilled-labor intensity of headquarter services), trade costs, and the modeling of fixed costs for skilled and unskilled labor. All notations and commands are consistent with the horizontal model code provided in Markusen (2002).

<u>Model code for the baseline case (tcost=0.20):</u>

```
$ONTEXT
        YI      YJ      XMI     XMJ     NMI     NMJ     WI      WJ      CONSI   CONSJ   ENTM
CYI     100                                             -100                                    0
CYJ             100                                             -100                            0
CXI                     100                             -100                                    0
CXJ                             100                             -100                            0
FCM                                     20      20                                      -40     0
LI      -90             -60             -2      -2                      154                     0
SI      -10             -20             -12     -4                      46                      0
LJ              -90                     -2      -2                              154             0
SJ              -10             -60     -4      -12                             46              0
UTILI                           -20                     200             -200                    0
UTILJ                                                           200             -200            0
MKI                     -10     -10                                                     20      0
MKJ                     -10     -10                                                     20      0
        0       0       0       0       0       0       0       0       0       0       0
$OFFTEXT

SET C /1*19/;
SET R /1*19/;
ALIAS (R,RR);
SCALAR UP /0/;
PARAMETERS
FMI
FMJ
ENDOWIS
ENDOWJS
ENDOWIL
ENDOWJL
FDI
FDJ
FVI
FVJ
TCOST
ROW
COL
SCALE(R)
TMC(R,C)
MNIE(R,C)
MNJE(R,C)
NEI(R,C)
NEJ(R,C)
VNEI(R,C)
VNEJ(R,C)
MI(R,C)
MJ(R,C)
DI(R,C)
DJ(R,C)
VI(R,C)
VJ(R,C)
VAS(R,C)
```

```
REGIME(R,C)
SHAREIM(R,C)
SHAREJM(R,C)
SHAREIV(R,C)
SHAREJV(R,C)
WELFAREI(R,C)
WELFAREJ(R,C)
MODELSTAT(R,C);
FMI = 8;
FMJ = 8;
FDI = 5.2;
FDJ = 5.2;
TCOST = 0.2;
FVI = 6;
FVJ = 6;
$ONTEXT
$MODEL:BOX
$SECTORS:
YI YJ
WI WJ
XMI XMJ
XDI
XDII
XDIJ
XDJ
XDJI
XDJJ
XVI
XVII
XVIJ
XVJ
XVJJ
XVJI
NMI NMJ
NI NJ
NVI NVJ
$COMMODITIES:
CY
UTILI UTILJ
SI SJ
LI LJ
CXI CXJ
CXDI
CXDJ
CXVI
CXVJ
FCM
FCI FCJ
FCVI FCVJ
$CONSUMERS:
CONSI CONSJ
ENTM
ENTI ENTJ
ENTVJ ENTVI
$AUXILIARY:
NMIT
NMJT
NIT
NJT
NVIT
NVJT
MARKMI
MARKMJ
MARKDII
MARKDIJ
MARKDJI
MARKDJJ
MARKVII
MARKVIJ
MARKVJJ
MARKVJI
```

```
$PROD:YI s:3.0
O:CY Q:100.0
I:SI Q:10.0
I:LI Q:90.0
$PROD:YJ s:3.0
O:CY Q:100.0
I:SJ Q:10.0
I:LJ Q:90.0
$PROD:XMI
O:CXI Q:80. A:ENTM N:MARKMI
I:LI Q:60.
I:SI Q:20.
$PROD:XMJ
O:CXJ Q:80. A:ENTM N:MARKMJ
I:LJ Q:60.
I:SJ Q:20.
$PROD:XDI
O:CXDI Q:80.
I:SI Q:20.
I:LI Q:60.
$PROD:XDII
O:CXI Q:80. A:ENTI N:MARKDII
I:CXDI Q:80.
$PROD:XDIJ
O:CXJ Q:80. A:ENTI N:MARKDIJ
I:CXDI Q:80.
I:SI Q:(20.*TCOST)
I:LI Q:(60.*TCOST)
$PROD:XDJ
O:CXDJ Q:80.
I:SJ Q:20.
I:LJ Q:60.
$PROD:XDJI
O:CXI Q:80. A:ENTJ N:MARKDJI
I:CXDJ Q:80.
I:SJ Q:(20.*TCOST)
I:LJ Q:(60.*TCOST)
$PROD:XDJJ
O:CXJ Q:80. A:ENTJ N:MARKDJJ
I:CXDJ Q:80.
$PROD:XVI
O:CXVJ Q:80.
I:SJ Q:20.
I:LJ Q:60.
$PROD:XVII
O:CXI Q:80. A:ENTVI N:MARKVII
I:CXVJ Q:80.
I:SJ Q:(20.*TCOST)
I:LJ Q:(60.*TCOST)
$PROD:XVIJ
O:CXJ Q:80. A:ENTVI N:MARKVIJ
I:CXVJ Q:80.
$PROD:XVJ
O:CXVI Q:80.
I:SI Q:20.
I:LI Q:60.
$PROD:XVJJ
O:CXJ Q:80. A:ENTVJ N:MARKVJJ
I:CXVI Q:80.
I:SI Q:(20.*TCOST)
I:LI Q:(60.*TCOST)
$PROD:XVJI
O:CXI Q:80. A:ENTVJ N:MARKVJI
I:CXVI Q:80.
$PROD:NMI s:0.0
O:FCM
I:LI Q:(FMI*1/10)
I:LJ Q:(FMI*1/10)
I:SI Q:(FMI*6/10)
I:SJ Q:(FMI*2/10)
$PROD:NMJ s:0.0
```

```
O:FCM
I:LI Q:(FMJ*1/10)
I:LJ Q:(FMJ*1/10)
I:SI Q:(FMJ*2/10)
I:SJ Q:(FMJ*6/10)
$PROD:NI
O:FCI
I:LI Q:(FDI*2/13)
I:SI Q:(FDI*11/13)
$PROD:NJ
O:FCJ
I:LJ Q:(FDJ*2/13)
I:SJ Q:(FDJ*11/13)
$PROD:NVI s:0.0
O:FCVI
I:SI Q:(FVI*9/15)
I:LJ Q:(FVI*2/15)
I:SJ Q:(FVI*4/15)
$PROD:NVJ s:0.0
O:FCVJ
I:LI Q:(FVJ*2/15)
I:SI Q:(FVJ*4/15)
I:SJ Q:(FVJ*9/15)
$PROD:WI s:1.0
O:UTILI Q:200.
I:CXI Q:80. P:1.25
I:CY Q:100.
$PROD:WJ s:1.0
O:UTILJ Q:200.
I:CXJ Q:80. P:1.25
I:CY Q:100.
$DEMAND:CONSI
D:UTILI
E:SI Q:(46.*ENDOWIS)
E:LI Q:(154.*ENDOWIL)
$DEMAND:CONSJ
D:UTILJ
E:SJ Q:(46.*ENDOWJS)
E:LJ Q:(154.*ENDOWJL)
$DEMAND:ENTM
D:FCM
$DEMAND:ENTI
D:FCI
$DEMAND:ENTJ
D:FCJ
$DEMAND:ENTVJ
D:FCVJ
$DEMAND:ENTVI
D:FCVI
$CONSTRAINT:NMIT
NMIT =G= NMI;
$CONSTRAINT:NMJT
NMJT =G= NMJ;
$CONSTRAINT:NIT
NIT =G= NI;
$CONSTRAINT:NJT
NJT =G= NJ;
$CONSTRAINT:NVIT
NVIT =G= NVI;
$CONSTRAINT:NVJT
NVJT =G= NVJ;
$CONSTRAINT:MARKMI
MARKMI*(NMIT+NMJT)*(XMI + XDJI + XDII + XVII + XVJI) =G= XMI;
$CONSTRAINT:MARKMJ
MARKMJ*(NMIT+NMJT)*(XMJ + XDIJ + XDJJ + XVJJ + XVIJ) =G= XMJ;
$CONSTRAINT:MARKDII
MARKDII*(NIT)*(XMI + XDII + XDJI + XVII + XVJI) =G= XDII;
$CONSTRAINT:MARKDIJ
MARKDIJ*(NIT)*(XMJ + XDIJ + XDJJ + XVJJ + XVIJ) =G= XDIJ;
$CONSTRAINT:MARKDJI
MARKDJI*(NJT)*(XMI + XDII + XDJI + XVII + XVJI) =G= XDJI;
```

```
$CONSTRAINT:MARKDJJ
MARKDJJ*(NJT)*(XMJ + XDJJ + XDIJ + XVJJ + XVIJ) =G= XDJJ;
$CONSTRAINT:MARKVII
MARKVII*(NVIT)*(XMI + XDII + XDJI + XVII + XVJI) =G= XVII;
$CONSTRAINT:MARKVIJ
MARKVIJ*(NVIT)*(XMJ + XDJJ + XDIJ + XVJJ + XVIJ) =G= XVIJ;
$CONSTRAINT:MARKVJJ
MARKVJJ*(NVJT)*(XMJ + XDJJ + XDIJ + XVJJ + XVIJ) =G= XVJJ;
$CONSTRAINT:MARKVJI
MARKVJI*(NVJT)*(XMI + XDII + XDJI + XVII + XVJI) =G= XVJI;
$OFFTEXT

$SYSINCLUDE MPSGESET BOX
NMI.L = 0;
NMJ.L = 0;
NMIT.L = 0;
NMJT.L = 0;
NI.L = 0;
NJ.L = 0;
NIT.L = 0;
NJT.L = 0;
NVI.L = 2.0;
NVJ.L = 2.0;
NVIT.L = 2.0;
NVJT.L = 2.0;
CXI.L = 1.25;
CXJ.L = 1.25;
MARKMI.L = .2;
MARKMJ.L = .2;
MARKDII.L = .2;
MARKDIJ.L = .2;
MARKDJJ.L = .2;
MARKDJI.L = .2;
MARKVII.L = .2;
MARKVIJ.L = .2;
MARKVJJ.L = .2;
MARKVJI.L = .2;
XMI.L = 0;
XMJ.L = 0;
XDI.L = 0;
XDII.L = 0;
XDIJ.L = 0;
XDJ.L = 0;
XDJJ.L = 0;
XDJI.L = 0;
XVI.L = 1.0;
XVII.L = 1.0;
XVIJ.L = 1.0;
XVJ.L = 1.0;
XVJJ.L = 1.0;
XVJI.L = 1.0;
CY.FX = 1.0;
NMIT.LO = 0.001;
NMJT.LO = 0.001;
NIT.LO = 0.001;
NJT.LO = 0.001;
NVIT.LO = 0.001;
NVJT.LO = 0.001;

BOX.ITERLIM = 5000;
OPTION MCP=MILES;
OPTION SOLPRINT=OFF;
OPTION LIMROW=0;
OPTION LIMCOL=0;
$OFFSYMLIST OFFSYMXREF OFFUELLIST OFFUELXREF

LOOP(C,
LOOP(RR,
LOOP(R$( (1-UP)$(ORD(R) EQ ORD(RR) ) +
UP$(ORD(R) EQ CARD(R)-ORD(RR)+1) ),
ROW = ORD(R);
```

```
COL = ORD(C);
ENDOWJS = (ROW)*.1;
ENDOWJL = (2 - .1*COL);
ENDOWIS = (2 - .1*ROW);
ENDOWIL = (COL)*.1;
UTILI.L = MAX(UTILI.L, 1.E-4);
UTILJ.L = MAX(UTILJ.L, 1.E-4);
FCM.L = MAX(FCM.L, 1.E-4);
FCI.L = MAX(FCI.L, 1.E-4);
FCJ.L = MAX(FCJ.L, 1.E-4);
FCVI.L = MAX(FCVI.L, 1.E-4);
FCVJ.L = MAX(FCVJ.L,1.E-4);
$INCLUDE BOX.GEN
SOLVE BOX USING MCP;
MODELSTAT(R,C) = BOX.MODELSTAT - 1.;
MNIE(R,C)$(NMI.L GE 0.3) = 0.01;
MNJE(R,C)$(NMJ.L GE 0.3) = 0.001;
NEI(R,C)$(NI.L GE 0.3) = 100;
NEJ(R,C)$(NJ.L GE 0.3) = 10;
VNEI(R,C)$(NVI.L GE 0.3) = 2.0;
VNEJ(R,C)$(NVJ.L GE 0.3) = 0.2;
REGIME(R,C) = MNIE(R,C) + MNJE(R,C) + NEI(R,C) + NEJ(R,C) + VNEI(R,C) + VNEJ(R,C);
MI(R,C) = NMI.L$(NMI.L GE 0.3);
MJ(R,C) = NMJ.L$(NMJ.L GE 0.3);
DI(R,C) = NI.L$(NI.L GE 0.3);
DJ(R,C) = NJ.L$(NJ.L GE 0.3);
VI(R,C) = NVI.L$(NVI.L GE 0.3);
VJ(R,C) = NVJ.L$(NVJ.L GE 0.3);
SHAREJM(R,C)$(MI(R,C) + MJ(R,C)) = MJ(R,C)/(MI(R,C) + MJ(R,C));
SHAREIM(R,C)$(MI(R,C) + MJ(R,C)) = MI(R,C)/(MI(R,C) + MJ(R,C));
SHAREJV(R,C)$(VI(R,C) + VJ(R,C)) = VJ(R,C)/(VI(R,C) + VJ(R,C));
SHAREIV(R,C)$(VI(R,C) + VJ(R,C)) = VI(R,C)/(VI(R,C) + VJ(R,C));
VAS(R,C) = (CXI.L*XMI.L*SHAREJM(R,C) +
CXJ.L*XMJ.L*SHAREIM(R,C)+CXI.L*XVII.L*SHAREJV(R,C)+CXJ.L*XVIJ.L*SHAREIV(R,C)+CXI.L*XVJI.L*SHAR
EJV(R,C)+CXJ.L*XVJJ.L*SHAREIV(R,C))/CY.L;
WELFAREI(R,C) = WI.L;
WELFAREJ(R,C) = WJ.L;
);
);
IF (UP, UP = 0; ELSE UP = 1; );
);
DISPLAY WELFAREI, WELFAREJ;
DISPLAY MI, MJ, DI, DJ;
DISPLAY VAS;
DISPLAY REGIME;
DISPLAY MODELSTAT;
```

Appendix D, Simulation Results; Effect of a Change in TCOST

Presented here are simulation results for three cases: A) $tcost$ = 0.15, B) $tcost$ = 0.20, and C) $tcost$ = 0.25. Figure 1 shows the firm regime. Figure 2 shows the volume of affiliate sales. Note that Panel B in both figures - showing the base case with $tcost$ = 0.20 - is identical to the simulation results showed in Section 3 of this thesis. Figure 3 shows the volume of affiliate sales for the $tcost$ = 0.25 case minus the $tcost$ = 0.15 case.

I acknowledge that there are (small) asymmetries in my simulation results, especially for the $tcost$ = 0.15 and $tcost$ = 0.25 cases. The overall pattern is consistent with theory and matches the results in Markusen (2002), but there simply are some odd values, for instance in the left-upper corner of Panel A of Figure 1, the left-upper corner of Panel C of Figure 1, or at the edges of the dark-blue centre of the box in Panel C of Figure 1. In the search for a solution to this problem, I found that when I alter the order of the production blocks in the MPS/GE syntax, the simulation results *slightly* change: the overall pattern is unaffected, but the odd values now appear at different points in the box[44]. Unfortunately, I do not have a theoretical explanation for these odd values. Since the overall pattern (and thus the main outcomes of the simulations) is robust to these modifications, I leave it at this and simply choose to ignore the odd values.

44 This is surprising, because to the best of my knowledge, changing the order of the production blocks should not change the results.

Appendix D, Figure 1 – Firm Regime for Three Cases: $tcost = 0.15$; $tcost = 0.20$; $tcost = 0.25$.

Panel A; $tcost = 0.15$.

Host country origin (country j)

1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	100.010	102.000	102.000	102.000	102.000	102.000	102.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	0.05
0.9	100.010	102.000	102.000	102.000	102.000	102.010	100.010	100.010	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.200	100.200	0.1
0.85	100.010	102.000	102.000	102.000	102.010	100.010	100.010	100.010	100.000	100.000	100.000	100.000	100.010	100.000	100.001	100.001	100.201	100.200	100.200	0.15
0.8	102.000	102.000	102.000	102.000	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.001	100.001	100.001	100.201	100.200	100.200	0.2
0.75	102.000	102.000	102.000	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.001	100.201	100.200	100.200	0.25
0.7	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.001	100.201	0.200	0.200	0.3
0.65	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.011	100.001	100.001	100.001	100.201	0.201	0.200	0.35
0.6	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	0.010	0.010	0.011	100.011	100.001	100.001	100.001	0.201	0.201	0.201	0.200	0.4
0.55	102.000	102.010	102.010	102.010	100.010	100.010	0.010	0.010	0.011	0.011	0.011	0.011	100.001	100.001	0.001	0.001	0.201	10.201	10.200	0.45
0.5	102.000	102.010	102.010	100.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	10.001	10.201	10.201	10.200	0.5
0.45	102.000	102.010	2.010	0.010	0.010	10.010	10.010	0.011	0.011	0.011	0.011	0.001	0.001	10.001	10.001	10.201	10.201	10.201	10.200	0.55
0.4	2.000	2.010	2.010	10.010	10.010	10.010	10.010	10.011	0.011	0.001	0.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	0.6
0.35	2.000	2.010	2.010	10.010	10.010	10.010	10.011	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	0.65
0.3	2.000	2.000	12.010	10.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	0.7
0.25	2.000	12.000	12.010	10.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.200	10.200	10.200	0.75
0.2	12.000	12.000	12.010	10.010	10.010	10.010	10.001	10.001	10.001	10.000	10.001	10.001	10.001	10.001	10.201	10.200	10.200	10.200	10.200	0.8
0.15	12.000	12.000	12.000	10.010	10.010	10.001	10.000	10.000	10.000	10.000	10.000	10.001	10.001	10.001	10.201	10.200	10.200	10.200	10.200	0.85
0.1	12.000	12.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.001	10.001	10.201	10.200	10.200	10.200	10.200	10.200	0.9
0.05	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.200	10.200	10.200	10.200	10.200	10.200	10.200	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Rows: s_i; columns: u_i. Home country origin (country i)

Panel B; $tcost = 0.20$ (base case).

Host country origin (country j)

1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	102.000	102.000	102.000	102.000	102.000	102.000	102.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	0.05
0.9	102.000	102.000	102.000	102.000	102.010	102.010	100.010	100.010	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.200	100.200	0.1
0.85	102.000	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.200	100.200	0.15
0.8	102.000	102.000	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.201	100.200	0.2
0.75	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.001	100.001	100.001	100.201	100.200	0.25
0.7	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.001	100.201	0.200	0.3
0.65	102.000	2.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	0.010	0.010	0.010	0.011	100.011	100.001	100.001	100.001	0.201	0.201	0.35
0.6	102.010	2.010	102.010	100.010	100.010	100.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	100.011	100.001	100.001	0.201	0.201	0.201	0.4
0.55	2.010	2.010	102.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	100.001	0.001	0.001	0.201	0.201	0.201	0.45
0.5	2.010	2.010	2.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.5
0.45	2.010	2.010	2.010	0.010	0.010	10.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.55
0.4	2.010	2.010	2.010	10.010	10.010	10.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	10.001	10.001	10.001	10.201	10.201	10.201	0.6
0.35	2.010	2.010	10.010	10.010	10.010	10.011	0.011	0.001	0.001	0.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	0.65
0.3	2.000	12.010	10.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.7
0.25	12.000	12.010	10.010	10.010	10.010	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.75
0.2	12.000	12.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	0.8
0.15	12.000	12.000	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.200	10.200	10.200	0.85
0.1	12.000	12.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.001	10.001	10.201	10.201	10.200	10.200	10.200	10.200	0.9
0.05	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.200	10.200	10.200	10.200	10.200	10.200	10.200	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Rows: s_i; columns: u_i. Home country origin (country i)

Panel C; $tcost = 0.25$.

Host country origin (country j)

1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	0.210	102.000	102.000	102.000	102.000	102.000	102.010	100.010	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	0.05
0.9	100.210	102.000	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.000	100.010	100.010	100.010	100.010	100.010	100.001	100.001	100.200	0.1
0.85		102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.200	0.15
0.8	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.200	0.2
0.75	102.000	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.011	100.001	100.001	100.001	100.200	0.25
0.7	102.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	100.010	0.010	0.010	100.011	100.011	100.001	100.001	100.201	0.201	0.3
0.65	2.010	102.010	102.010	100.010	100.010	100.010	100.010	100.010	0.010	0.010	0.010	0.010	0.011	100.011	100.011	100.001	100.001	0.201	0.201	0.35
0.6	2.010	2.010	102.010	0.010	100.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	100.011	100.001	100.001	0.201	0.201	0.201	0.4
0.55	2.010	2.010	2.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.201	0.201	0.201	0.45
0.5	2.010	2.010	2.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.5
0.45	2.010	2.010	2.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.001	0.201	0.201	0.201	0.55
0.4	2.010	2.010	2.010	10.010	10.010	10.011	0.011	0.011	0.011	0.001	0.001	0.001	0.001	0.001	0.001	10.001	0.001	10.201	0.201	0.6
0.35	2.010	2.010	2.010	10.010	10.011	10.011	0.011	0.001	0.001	0.001	0.001	10.001	0.001	10.001	10.001	10.001	10.201	10.201	0.201	0.65
0.3	2.010	12.010	10.010	10.010	10.011	10.011	0.001	0.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	0.7
0.25	12.000	10.010	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.75
0.2	12.000	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	0.8
0.15	12.000	10.010	10.010	10.011	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	10.200	0.85
0.1	12.000	10.010	10.010	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.001	10.201	10.201	10.201	10.200	10.200	10.200	0.9
0.05	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.001	10.201	10.200	10.200	10.200	10.200	10.200	10.200	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Rows: s_i; columns: u_i. Home country origin (country i)

Notes: Cell values show what types of firms are active in equilibrium, given the cells factor-endowment combination. Cell value is the sum of $I_i^d, I_j^d, I_i^v, I_j^v, I_i^h$ and I_j^h where $I_i^d = 100$, $I_j^d = 10$, $I_i^v = 2.0$, $I_j^v = 0.2$, $I_i^h = 0.01$ and $I_j^h = 0.001$ if the respective type is active, and 0 otherwise.

Appendix D, Figure 2 – Volume of Affiliate Sales for Three Cases: $tcost = 0.15$; $tcost = 0.20$; $tcost = 0.25$.

Panel A; $tcost = 0.15$.

Host country origin (country j)

s_i (1)	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	1.496	0.672	0.482	0.372	0.294	0.220	0.114	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05
0.9	1.496	1.140	0.845	0.663	0.528	0.439	0.288	0.156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.542	0.1
0.85	1.496	1.425	1.090	0.866	0.732	0.535	0.444	0.246	0.000	0.000	0.000	0.000	0.126	0.000	0.114	0.161	0.265	0.653	1.038	0.15
0.8	2.149	1.590	1.245	0.969	0.925	0.741	0.538	0.311	0.187	0.243	0.121	0.311	0.317	0.297	0.369	0.450	0.637	1.138	1.526	0.2
0.75	2.197	1.680	1.335	1.226	0.956	0.831	0.609	0.450	0.493	0.536	0.561	0.568	0.513	0.526	0.626	0.739	0.978	1.613	2.008	0.25
0.7	2.200	1.725	1.467	1.339	1.082	0.905	0.722	0.742	0.783	0.807	0.810	0.791	0.702	0.756	0.883	1.027	1.343	2.071	2.247	0.3
0.65	2.181	1.744	1.614	1.418	1.188	1.004	0.993	1.031	1.052	1.050	1.019	0.961	0.884	0.989	1.143	1.317	1.726	2.131	2.245	0.35
0.6	2.158	1.730	1.692	1.486	1.293	1.249	1.282	1.300	1.291	1.194	1.137	1.118	1.064	1.226	1.407	1.890	1.998	2.118	2.204	0.4
0.55	2.143	1.876	1.754	1.570	1.512	1.539	1.528	1.420	1.309	1.234	1.225	1.266	1.283	1.471	1.676	1.812	1.988	2.026	2.163	0.45
0.5	2.144	1.955	1.828	1.756	1.755	1.645	1.512	1.381	1.282	1.249	1.282	1.381	1.512	1.645	1.755	1.756	1.828	1.955	2.144	0.5
0.45	2.163	2.026	1.988	1.812	1.676	1.471	1.283	1.266	1.225	1.234	1.309	1.420	1.528	1.539	1.512	1.570	1.754	1.876	2.143	0.55
0.4	2.204	2.118	1.998	1.609	1.407	1.226	1.064	1.118	1.137	1.194	1.291	1.300	1.282	1.249	1.293	1.486	1.692	1.730	2.158	0.6
0.35	2.245	2.131	2.017	1.317	1.143	0.989	0.884	0.961	1.019	1.050	1.052	1.031	0.993	1.004	1.188	1.418	1.614	1.744	2.181	0.65
0.3	2.247	2.071	1.343	1.027	0.883	0.756	0.702	0.791	0.810	0.807	0.783	0.742	0.722	0.905	1.082	1.339	1.467	1.725	2.200	0.7
0.25	2.249	1.613	0.978	0.739	0.626	0.526	0.513	0.568	0.561	0.536	0.493	0.450	0.609	0.831	0.956	1.226	1.335	1.680	2.197	0.75
0.2	1.526	1.138	0.637	0.450	0.369	0.297	0.317	0.311	0.286	0.000	0.187	0.311	0.538	0.732	0.925	0.969	1.245	1.590	2.149	0.8
0.15	1.038	0.653	0.217	0.161	0.114	0.131	0.000	0.000	0.000	0.000	0.000	0.246	0.445	0.535	0.732	0.866	1.090	1.425	2.017	0.85
0.1	0.542	0.161	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.156	0.288	0.439	0.528	0.663	0.845	1.140	1.725	0.9
0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.114	0.220	0.294	0.372	0.482	0.672	1.114	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Home country origin (country i)

u_i

Panel B; $tcost = 0.20$ (base case).

Host country origin (country j)

s_i (1)	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	1.543	0.726	0.536	0.426	0.340	0.240	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05
0.9	1.789	1.217	0.926	0.719	0.624	0.487	0.358	0.217	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.153	0.542	0.1
0.85	2.076	1.504	1.149	1.021	0.822	0.623	0.500	0.350	0.247	0.232	0.246	0.258	0.262	0.252	0.232	0.281	0.339	0.630	1.037	0.15
0.8	2.200	1.656	1.444	1.183	0.869	0.793	0.628	0.510	0.480	0.490	0.500	0.502	0.492	0.466	0.478	0.557	0.653	1.075	1.525	0.2
0.75	2.239	1.818	1.570	1.302	1.072	0.913	0.777	0.731	0.734	0.741	0.739	0.723	0.690	0.614	0.745	0.832	0.964	1.419	2.005	0.25
0.7	2.231	1.958	1.650	1.401	1.204	1.051	0.987	0.981	0.983	0.975	0.950	0.901	0.823	0.883	0.966	1.107	1.272	1.792	2.239	0.3
0.65	2.191	2.123	1.719	1.404	1.333	1.249	1.233	1.229	1.214	1.175	1.077	0.971	1.030	1.105	1.216	1.383	1.576	2.120	2.250	0.35
0.6	2.256	2.123	1.794	1.578	1.519	1.492	1.482	1.414	1.302	1.194	1.137	1.152	1.230	1.319	1.470	1.657	1.994	2.109	2.250	0.4
0.55	2.316	2.123	1.897	1.860	1.755	1.640	1.528	1.420	1.309	1.234	1.225	1.282	1.405	1.536	1.721	1.859	1.986	2.107	2.263	0.45
0.5	2.292	2.117	1.988	1.867	1.755	1.646	1.539	1.381	1.282	1.249	1.282	1.381	1.539	1.646	1.755	1.867	1.988	2.117	2.292	0.5
0.45	2.263	2.107	1.986	1.859	1.721	1.536	1.405	1.282	1.225	1.234	1.309	1.420	1.528	1.640	1.755	1.798	1.986	2.099	2.316	0.55
0.4	2.250	2.109	1.994	1.657	1.470	1.319	1.230	1.152	1.137	1.194	1.302	1.414	1.482	1.492	1.519	1.578	1.794	2.050	2.256	0.6
0.35	2.250	2.120	1.574	1.383	1.216	1.105	1.030	0.971	1.077	1.175	1.214	1.229	1.233	1.249	1.333	1.404	1.719	2.011	2.191	0.65
0.3	2.239	1.792	1.272	1.107	0.966	0.883	0.823	0.901	0.950	0.975	0.983	0.981	0.987	1.051	1.205	1.401	1.650	1.958	2.231	0.7
0.25	2.005	1.419	0.964	0.832	0.745	0.614	0.690	0.723	0.739	0.741	0.734	0.731	0.777	0.913	1.072	1.302	1.570	1.818	2.239	0.75
0.2	1.525	1.075	0.653	0.557	0.478	0.466	0.492	0.502	0.500	0.490	0.480	0.510	0.628	0.791	0.869	1.183	1.444	1.656	2.200	0.8
0.15	1.037	0.630	0.339	0.281	0.232	0.252	0.262	0.258	0.246	0.232	0.247	0.350	0.500	0.623	0.822	1.021	1.149	1.504	2.076	0.85
0.1	0.542	0.153	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.217	0.358	0.487	0.624	0.719	0.926	1.217	1.789	0.9
0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.240	0.340	0.426	0.536	0.726	1.166	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Home country origin (country i)

u_i

Panel C; $tcost = 0.25$.

Host country origin (country j)

s_i (1)	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95	2.100	0.785	0.599	0.465	0.351	0.249	0.196	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05
0.9	2.575	1.295	0.961	0.815	0.646	0.512	0.384	0.273	0.182	0.146	0.000	0.149	0.151	0.147	0.131	0.094	0.126	0.142	0.541	0.1
0.85	0.000	1.518	1.317	1.050	0.852	0.694	0.553	0.445	0.396	0.387	0.388	0.389	0.383	0.368	0.339	0.348	0.430	0.501	1.034	0.15
0.8	2.242	1.873	1.490	1.216	0.955	0.843	0.716	0.650	0.632	0.629	0.626	0.615	0.594	0.559	0.505	0.622	0.731	0.850	1.519	0.2
0.75	2.202	1.966	1.604	1.342	1.141	0.994	0.910	0.882	0.873	0.864	0.846	0.815	0.765	0.692	0.746	0.919	1.028	1.135	1.986	0.25
0.7	2.427	2.016	1.689	1.375	1.282	1.178	1.137	1.121	1.105	1.078	1.030	0.951	0.847	0.889	1.010	1.163	1.320	1.648	2.247	0.3
0.65	2.440	2.053	1.771	1.566	1.455	1.400	1.376	1.352	1.304	1.188	1.077	0.971	1.031	1.129	1.265	1.426	1.604	2.082	2.238	0.35
0.6	2.406	2.171	1.873	1.879	1.672	1.638	1.529	1.414	1.303	1.194	1.137	1.152	1.233	1.357	1.508	1.673	1.993	2.106	2.240	0.4
0.55	2.332	2.152	2.007	1.875	1.755	1.640	1.529	1.420	1.309	1.234	1.225	1.282	1.405	1.604	1.728	1.859	1.986	2.105	2.253	0.45
0.5	2.282	2.117	1.988	1.867	1.755	1.646	1.539	1.381	1.282	1.250	1.282	1.381	1.539	1.646	1.755	1.867	1.988	2.117	2.282	0.5
0.45	2.253	2.105	1.986	1.859	1.755	1.604	1.405	1.282	1.225	1.234	1.309	1.420	1.529	1.640	1.755	1.875	2.007	2.152	2.332	0.55
0.4	2.240	2.106	1.993	1.673	1.508	1.357	1.233	1.152	1.137	1.194	1.303	1.414	1.529	1.638	1.765	1.742	1.971	2.099	2.406	0.6
0.35	2.238	2.082	1.900	1.426	1.265	1.129	1.031	0.971	1.077	1.188	1.304	1.352	1.526	1.400	1.455	1.566	1.771	2.053	2.440	0.65
0.3	2.247	1.648	1.320	1.163	1.010	0.889	0.847	0.951	1.030	1.078	1.105	1.121	1.137	1.178	1.282	1.375	1.689	2.016	2.427	0.7
0.25	1.986	1.135	1.028	0.919	0.746	0.692	0.765	0.815	0.846	0.864	0.873	0.882	0.910	0.994	1.145	1.342	1.604	1.966	2.202	0.75
0.2	1.519	0.850	0.731	0.622	0.505	0.559	0.594	0.615	0.626	0.629	0.632	0.650	0.716	0.843	0.955	1.216	1.490	1.873	2.242	0.8
0.15	1.034	0.501	0.430	0.348	0.339	0.368	0.383	0.389	0.388	0.387	0.396	0.445	0.553	0.676	0.852	1.050	1.317	1.518	2.132	0.85
0.1	0.541	0.142	0.126	0.094	0.131	0.147	0.151	0.149	0.144	0.146	0.182	0.273	0.391	0.512	0.646	0.815	0.961	1.295	1.852	0.9
0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.196	0.249	0.351	0.465	0.599	0.785	1.219	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Home country origin (country i)

u_i

Appendix D, Figure 3 - Volume of Affiliate Sales for the Case “$tcost = 0.25$ minus $tcost = 0.15$”.

Host country origin (country

s_i

1	0.95	0.9	0.85	0.8	0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25	0.2	0.15	0.1	0.05	0_j
0.95		0.113	0.117	0.093	0.057	0.029	0.082	0.102	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.05
0.9		0.155	0.116	0.152	0.118	0.073	0.096	0.117	0.182	0.146	0.000	0.149	0.151	0.147	0.131	0.094	0.126	0.142	-0.001	0.1
0.85		0.093	0.227	0.184	0.120	0.159	0.109	0.199	0.396	0.387	0.388	0.389	0.257	0.368	0.225	0.187	0.165	-0.152	-0.004	0.15
0.8	0.093	0.283	0.245	0.247	0.030	0.102	0.178	0.339	0.445	0.386	0.505	0.304	0.277	0.262	0.136	0.172	0.094	-0.288	-0.007	0.2
0.75	0.005	0.286	0.269	0.116	0.185	0.163	0.301	0.432	0.380	0.328	0.285	0.247	0.252	0.166	0.120	0.180	0.050	-0.478	-0.022	0.25
0.7	0.227	0.291	0.222	0.036	0.200	0.273	0.415	0.379	0.322	0.271	0.220	0.160	0.145	0.133	0.127	0.136	-0.023	-0.423	0.000	0.3
0.65	0.259	0.309	0.157	0.148	0.267	0.396	0.383	0.321	0.252	0.138	0.058	0.010	0.147	0.140	0.122	0.109	-0.122	-0.049	-0.007	0.35
0.6	0.248	0.441	0.181	0.393	0.379	0.389	0.247	0.114	0.012	0.000	0.000	0.034	0.169	0.131	0.101	-0.217	-0.005	-0.012	0.036	0.4
0.55	0.189	0.276	0.253	0.305	0.243	0.101	0.001	0.000	0.000	0.000	0.000	0.016	0.122	0.133	0.052	0.047	-0.002	0.079	0.090	0.45
0.5	0.138	0.162	0.160	0.111	0.000	0.001	0.027	0.000	0.000	0.001	0.000	0.000	0.027	0.001	0.000	0.111	0.160	0.162	0.138	0.5
0.45	0.090	0.079	-0.002	0.047	0.079	0.133	0.122	0.016	0.000	0.000	0.000	0.000	0.001	0.101	0.243	0.305	0.253	0.276	0.189	0.55
0.4	0.036	-0.012	-0.005	0.064	0.101	0.131	0.169	0.034	0.000	0.000	0.012	0.114	0.247	0.389	0.472	0.256	0.279	0.369	0.248	0.6
0.35	-0.007	-0.049	-0.117	0.109	0.122	0.140	0.147	0.010	0.058	0.138	0.252	0.321	0.533	0.396	0.267	0.148	0.157	0.309	0.259	0.65
0.3	0.000	-0.423	-0.023	0.136	0.127	0.133	0.145	0.160	0.220	0.271	0.322	0.379	0.415	0.273	0.200	0.036	0.222	0.291	0.227	0.7
0.25	-0.263	-0.478	0.050	0.180	0.120	0.166	0.252	0.247	0.285	0.328	0.380	0.432	0.301	0.163	0.189	0.116	0.269	0.286	0.005	0.75
0.2	-0.007	-0.288	0.094	0.172	0.136	0.262	0.277	0.304	0.340	0.629	0.445	0.339	0.178	0.111	0.030	0.247	0.245	0.283	0.093	0.8
0.15	-0.004	-0.152	0.213	0.187	0.225	0.237	0.383	0.389	0.388	0.387	0.396	0.199	0.108	0.141	0.120	0.184	0.227	0.093	0.115	0.85
0.1	-0.001	-0.019	0.126	0.094	0.131	0.147	0.151	0.149	0.144	0.146	0.182	0.117	0.103	0.073	0.118	0.152	0.116	0.155	0.127	0.9
0.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.102	0.082	0.029	0.057	0.093	0.117	0.113	0.105	0.95
0_i	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1

Home country origin (country i)

u_i

Notes: I ignore the three cells in the upper-left corner (blue-shaded) of the box due to odd values in my simulation results for these factor-endowment combinations.

Appendix E, Methodology; Data and Methods; Summary Statistics

Appendix E, Table 1 - Summary Statistics for Manufacturing Industries Sample

Variable name	Obs.	Mean	Std. Dev	Min.	Max.
General variables:					
$\boldsymbol{TURNOVER_{i,j,t}}$	6,345	4475.64	19260.97	0	307805
$\boldsymbol{SUMGDP_{i,j,t}}$	6,107	2560.945	4015.372	28.23199	24542.19
$\boldsymbol{TF_{i,t}}$	6,329	85.85271	4.038622	41.4	95
$\boldsymbol{TF_{j,t}}$	6,199	83.75043	6.621415	44.2	95
$\boldsymbol{TC_{i,j,t}}$	4,778	122.8689	60.44588	5.253573	674.6324
$\boldsymbol{IF_{j,t}}$	6,199	70.45411	16.82338	0	95
$\boldsymbol{DIST_{i,j}}$	6,342	4920.789	4638.566	59.61723	19586.18
CMM-specific variables:					
Baseline variables:					
$\boldsymbol{GDPDIFSQ_{i,j,t}}$	6,107	1.63E+07	5.18E+07	0.012857	2.62E+08
$\boldsymbol{SKILLDIF_{i,j,t}}$	6,345	0.031893	0.146803	-0.45784	0.526248
$\boldsymbol{INTER_{i,j,t}}$	6,107	27.84755	654.9993	-3323.06	5585.256
$\boldsymbol{INTER\_TF_{i,j,t}}$	6,199	1.788044	2.491472	1.14E-07	20.24457
Human Capital variables:					
$\boldsymbol{EDUCDIF_{i,j,t}}$	3,762	0.012954	0.12781	-0.4927	0.497988
$\boldsymbol{HCINTER_{i,j,t}}$	3,762	147.855	703.8495	-3063.63	5489.346
$\boldsymbol{HCINTER\_TF_{i,j,t}}$	3,743	1.393778	1.798242	1.98E-07	21.6993
Robustness variables:					
$\boldsymbol{INTER\_TC_{i,j,t}}$	6,152	3.827057	7.197198	2.01e-07	100.3719
BNU-specific variables:					
Baseline variables:					
$\boldsymbol{SIZE_{i,j,t}}$	6,345	0.670075	0.459069	0.003138	1.412966
$\boldsymbol{SIZESQ_{i,j,t}}$	6,345	0.659712	0.660254	9.85E-06	1.996472
$\boldsymbol{SKILL_{i,j,t}}$	6,345	1.437163	1.271966	0.287689	19.2605
$\boldsymbol{INTER_{i,j,t}}$	6,345	0.754136	0.503508	0.004644	3.243217
$\boldsymbol{INTER\_TF_{i,j,t}}$	6,199	276.5749	877.1175	7.39916	23704.79
Human Capital variables:					
$\boldsymbol{HCSIZE_{i,j,t}}$	3,762	0.682939	0.453049	0.003883	1.411914
$\boldsymbol{HCSIZESQ_{i,j,t}}$	3,762	0.671605	0.655096	1.51E-05	1.993502
$\boldsymbol{EDUC_{i,j,t}}$	3,762	1.213764	0.735066	0.102696	10.61549
$\boldsymbol{HCINTER_{i,j,t}}$	3,762	0.732793	0.479406	0.003076	2.28709
$\boldsymbol{HCINTER\_TF_{i,j,t}}$	3,743	164.9839	324.6937	0.721382	8226.274
Robustness variables:					
$\boldsymbol{INTER\_TC_{i,j,t}}$	6,152	757.7112	3547.525	2.966442	134451.5

Appendix E, Table 2 - Summary Statistics for Services Industries Sample

Variable name	Obs.	Mean	Std. Dev	Min.	Max.
$\boldsymbol{S\_TURNOVER}_{i,j,t}$	4,415	6136.783	26037.61	0	428468.1
$\boldsymbol{SUMGDP}_{i,j,t}$	4,252	2109.332	2969.557	32.49843	23569.41
$\boldsymbol{TF}_{i,t}$	4,413	86.63732	2.380085	44.2	95
$\boldsymbol{TF}_{j,t}$	4,252	82.54158	7.320106	44.2	95
$\boldsymbol{TC}_{i,j,t}$	3,313	121.2755	67.13175	3.65474	674.6324
$\boldsymbol{IF}_{j,t}$	4,252	67.81162	18.3974	10	95
$\boldsymbol{DIST}_{i,j}$	4,412	5048.25	4566.881	59.61723	19586.18
CMM-specific variables:					
Baseline variables:					
$\boldsymbol{GDPDIFSQ}_{i,j,t}$	4,252	7742484	3.16e+07	.2546679	2.61e+08
$\boldsymbol{SKILLDIF}_{i,j,t}$	4,415	.0725256	.1425196	-.3515115	.558984
$\boldsymbol{INTER}_{i,j,t}$	4,252	-25.61819	390.3547	-4235.834	3200.152
$\boldsymbol{INTER\_TF}_{i,j,t}$	4,252	1.952299	2.708086	2.83e-06	20.24457
Human Capital variables:					
$\boldsymbol{EDUCDIF}_{i,j,t}$	2,587	-.0009995	.1246178	-.4979879	.344711
$\boldsymbol{HCINTER}_{i,j,t}$	2,587	52.48054	417.5613	-1533.477	3993.681
$\boldsymbol{HCINTER\_TF}_{i,j,t}$	2,571	1.289714	1.667583	6.94e-07	16.96265
Symmetric Bilateral Trade Costs variables:					
$\boldsymbol{INTER\_TC}_{i,j,t}$	3,313	4.140002	7.936464	1.86e-06	100.3719
BNU-specific variables:					
Baseline variables:					
$\boldsymbol{SIZE}_{i,j,t}$	4,415	.6373903	.4471375	.0016236	1.411304
$\boldsymbol{SIZESQ}_{i,j,t}$	4,415	.606153	.626939	2.64e-06	1.99178
$\boldsymbol{SKILL}_{i,j,t}$	4,415	1.709277	1.64771	.490212	21.79452
$\boldsymbol{INTER}_{i,j,t}$	4,415	.7834702	.5186062	.0075573	3.386157
$\boldsymbol{INTER\_TF}_{i,j,t}$	4,252	417.871	1351.701	20.88275	30305.07
Human Capital variables:					
$\boldsymbol{HCSIZE}_{i,j,t}$	2,587	.7083601	.4475899	.0014513	1.408285
$\boldsymbol{HCSIZESQ}_{i,j,t}$	2,587	.7020332	.6484203	2.11e-06	1.983266
$\boldsymbol{EDUC}_{i,j,t}$	2,587	1.218719	.7981616	.1271475	8.029949
$\boldsymbol{HCINTER}_{i,j,t}$	2,587	.7446807	.4638647	.0039737	2.252769
$\boldsymbol{HCINTER\_TF}_{i,j,t}$	2,571	170.5924	348.2686	1.105788	4919.831
Symmetric Bilateral Trade Costs variables:					
$\boldsymbol{INTER\_TC}_{i,j,t}$	3,313	994.3735	4398.667	2.966442	134451.5

Appendix F Results for the Manufacturing Industries; Robustness Results

Appendix F, Table 1 – Robustness Results for the Human Capital Regressions: CMM Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	D. Role of Financial Crisis		**E. Using Only US Data**		**F. Using Alternative Trade Costs Variable**	
	(i) OLS	(ii) FE *(home and host country)*[1]	(i) OLS	(ii) FE *(host country, year)*[2]	(i) OLS	(ii) FE *(home and host country, year)*
$SUMGDP_{ij}$	**7.531*** **	**33.31*** **	**21.91*** **	-111.4**	**8.105*** **	**35.49*** **
	(0.652)	(5.507)	(3.453)	(45.82)	(0.803)	(5.662)
$GDPDIFSQ_{ij}$	**-0.000320*** **	**-0.00124*** **	**-0.000798*** **	**-0.00589*** **	**-0.000346*** **	**-0.00125*** **
	(4.78e-05)	(0.000166)	(0.000125)	(0.00174)	(5.65e-05)	(0.000171)
$EDUCDIF_{ij}$	**4,752** **	-2,177	**31,469** **	**134,640* **	**8,805*** **	**6,480**
	(2,337)	(10,038)	(14,453)	(81,034)	(2,863)	(14,309)
$HCINTER_{ij}$	**-3.684* **	**-9.249*** **	**-3.655**	7.975	**-4.317** **	**-10.08*** **
	(1.890)	(2.264)	(7.929)	(9.835)	(2.075)	(2.527)
TF_i	**551.6*** **	-295.9	**3,166*** **	**3,235*** **		
	(106.3)	(221.1)	(783.2)	(1,232)		
TF_j	230.7***	276.2*	646.0	1,189		
	(73.66)	(157.3)	(543.0)	(782.0)		
$HCINTER\_TF_j$	-526.1***	-392.9***	-3,112	-4,544		
	(124.3)	(124.7)	(4,221)	(6,423)		
TC_{ijt}					*43.29****	*-17.14*
					(10.62)	(12.66)
$HCINTER\_TC_{ijt}$					*-405.1****	*-89.21*
					(94.43)	(84.53)
IF_j	**31.89**	-82.58	**133.1**	-207.4	**108.8*** **	-60.33
	(26.24)	(51.54)	(278.0)	(408.7)	(25.21)	(61.60)
$DIST_{ij}$	*-0.103**	*-0.742*	*-2.254**	*-3.181***	*-0.443****	*-0.651*
	(0.0527)	(0.569)	(1.197)	(1.397)	(0.103)	(0.663)
$CRISIS_t$	*-679.1*	*992.7***				
	(574.4)	(451.6)				
Constant	-75,710***	-42,944*	-448,501***	2.739e+06**	-19,096***	-58,044***
	(12,462)	(24,127)	(99,219)	(1.090e+06)	(3,180)	(13,533)
Observations	3,741	3,731	266	258	2,842	2,834
R^2	0.433	0.663	0.566	0.813	0.438	0.678
$Adj. R^2$	0.4313	0.6526	0.5512	0.7606	0.4359	0.6642
BIC	82941.33	80776.68	6453.503	6026.19	63515.68	61756.41

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE. 2) For all fixed effects regressions on the US sample, I only consider host-country fixed effects.

Appendix F, Table 2 – Robustness Results for the Human Capital Regressions: BNU Specification; Manufacturing Industries

	$TURNOVER_{i,j}$					
	D. Role of Financial Crisis		**E. Using Only US Data**		**F. Using Alternative Trade Costs Variable**	
	(i) OLS	(ii) FE *(home and host country)*	(i) OLS	(ii) FE *(host country, year)*	(i) OLS	(ii) FE *(home and host country, year)*
$SUMGDP_{ij}$	**3.307*****	-1.529	**17.68*****	**23.17***	**3.230*****	**0.976**
	(0.264)	(5.869)	(4.519)	(11.79)	(0.296)	(6.464)
$HCSIZE_{ij}$	**34,821*****	**45,590*****	**428,600*****	**104,389**	**36,723*****	**50,371*****
	(4,374)	(6,844)	(90,869)	(159,340)	(5,139)	(8,003)
$HCSIZESQ_{ij}$	**-22,458*****	**-31,355*****	**-264,201*****	**-429,194*****	**-24,107*****	**-33,551*****
	(2,410)	(3,761)	(48,712)	(130,534)	(2,917)	(4,243)
$EDUC_{ij}$	**4,937*****	**12,785*****	**107,736*****	**147,810***	**3,052*****	**8,682*****
	(1,074)	(2,398)	(30,576)	(80,238)	(777.0)	(1,600)
$HCINTER_{ij}$	**-4,257*****	**-6,143***	**-69,253***	**481,626****	**-3,920****	**-6,238***
	(1,570)	(3,334)	(39,225)	(243,629)	(1,757)	(3,719)
TF_i	**116.8**	-294.1	**7,085*****	**1,793**		
	(88.85)	(265.1)	(1,434)	(2,001)		
TF_j	**-55.47**	**-97.60**	1,801**	2,245*		
	(76.26)	(169.7)	(778.9)	(1,226)		
$HCINTER\_TF_j$	-6.222***	-14.20***	-346.6***	-1,165		
	(1.734)	(3.372)	(129.4)	(708.3)		
TC_{ijt}					*-20.09****	*-9.042*
					(6.090)	(14.83)
$HCINTER\_TC_{ijt}$					*-0.577**	*-2.309****
					(0.304)	(0.547)
IF_j	**81.80*****	-16.69	**1,129*****	-303.8	**66.57*****	-67.44
	(23.82)	(68.47)	(303.8)	(399.2)	(22.86)	(86.58)
$DIST_{ij}$	*-0.289****	*-1.361**	*-2.031**	*-2.881***	*-0.157**	*-1.237*
	(0.0533)	(0.713)	(1.095)	(1.417)	(0.0904)	(0.817)
$CRISIS_t$	*53.00*	*-616.1*				
	(616.3)	(627.8)				
$Constant$	-23,644**	31,373	-1.165e+06***	-735,216***	-14,285***	-2,061
	(10,607)	(28,154)	(143,074)	(201,104)	(3,006)	(17,687)
$Observations$	3,741	3,731	266	258	2,842	2,834
R^2	0.344	0.445	0.503	0.816	0.343	0.446
$Adj. R^2$	0.3421	0.4269	0.4832	0.7632	0.3412	0.422
BIC	83494.11	82651.55	6495.598	6027.641	63963.75	63301.88

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. Coefficients are bold if the sign matches expectations. For variables with ambiguous expectations, coefficients are italic. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE. 2) For all fixed effects regressions on the US sample, I only consider host-country fixed effects.

Appendix G Results for the Services Industries; Human Capital and Robustness Results

Appendix G, Table 1 – Human Capital Results: CMM Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $EDUC_{ij} > 1$	(vi) FE *(home and host country, year)* $EDUC_{ij} < 1$
$SUMGDP_{ij}$	10.01***	20.10***	51.14***	53.60***	19.31**	70.89***
	(0.911)	(0.327)	(10.14)	(10.71)	(8.282)	(11.68)
$GDPDIFSQ_{ij}$	-0.000393***	-0.000897***	-0.00193***	-0.00194***	-0.00107***	-0.00229***
	(8.56e-05)	(2.66e-05)	(0.000232)	(0.000233)	(0.000338)	(0.000179)
$EDUCDIF_{ij}$	-578.3	-30,209***	-26,053*	-20,347	3,860	6,192
	(2,870)	(7,022)	(14,346)	(14,326)	(21,896)	(32,339)
$HCINTER_{ij}$	-8.414	-22.93***	-23.91***	-23.96***	-22.42***	-16.93***
	(5.352)	(1.464)	(5.470)	(5.480)	(4.726)	(5.276)
TF_i	208.1	358.2	-1,115*	-43.21	-2,326	-1,384
	(217.0)	(384.3)	(676.0)	(4,128)	(5,306)	(2,975)
TF_j	362.9***	660.7***	323.4	268.0	163.7	304.8
	(90.25)	(238.1)	(198.7)	(199.6)	(193.4)	(381.4)
$HCINTER\_TF_j$	-777.0***	-2,332***	-396.0**	-376.8**	29.22	801.1
	(190.4)	(500.9)	(179.1)	(178.1)	(815.8)	(848.4)
IF_j	38.88	264.0***	-265.8***	-191.4***	-109.8*	-130.4
	(31.09)	(85.15)	(79.79)	(71.63)	(65.01)	(126.0)
$DIST_{ij}$	*-0.0890*	*-0.221*	*-4.649****	*-4.675****	*-2.682****	*-3.382****
	(0.0651)	(0.199)	(1.283)	(1.259)	(0.433)	(0.905)
Constant	-60,210***	-143,089***	28,075	-70,746	182,998	-8,811
	(22,053)	(37,424)	(58,980)	(368,931)	(456,419)	(261,759)
Observations	2,569	2,569	2,554	2,554	1,304	1,246
R^2	0.468	0.655	0.743	0.744	0.585	0.825
$Adj.R^2$	0.4663	0.6538	0.7342	0.7341	0.5566	0.8129
BIC	57891.08	61523.6	55464.42	55459.29	27398.25	27191.66

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions.

Appendix G, Table 2 – Human Capital Results: BNU Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*	(iv) FE *(home and host country, year)*	(v) FE *(home and host country, year)* $EDUC_{ij}$ > 1	(vi) FE *(home and host country, year)* $EDUC_{ij}$< 1
$SUMGDP_{ij}$	5.896***	9.376***	3.564	3.848	12.23*	8.765
	(0.635)	(0.203)	(15.07)	(16.06)	(6.688)	(17.41)
$HCSIZE_{ij}$	74,460***	349,170***	85,562***	84,597***	47,991***	84,230***
	(8,702)	(12,325)	(8,889)	(8,892)	(6,752)	(13,922)
$HCSIZESQ_{ij}$	-38,417***	-154,879***	-48,934***	-48,651***	-25,537***	-69,184***
	(3,967)	(6,057)	(5,539)	(5,554)	(3,467)	(10,913)
$EDUC_{ij}$	11,838***	74,259***	19,334***	19,081***	4,040**	73,789*
	(2,059)	(4,647)	(3,651)	(3,655)	(1,741)	(40,554)
$HCINTER_{ij}$	-14,825***	-107,898***	-31,504***	-31,118***	-5,001**	-25,330
	(3,196)	(6,381)	(6,157)	(6,199)	(2,480)	(25,121)
TF_i	-392.1*	-1,224***	-2,697***	-8,294	-14,851***	-1,284
	(221.0)	(460.1)	(991.7)	(6,651)	(3,918)	(1,743)
TF_j	-80.65	-102.5	417.1	267.1	156.9	897.6
	(76.67)	(296.3)	(303.1)	(306.1)	(213.4)	(650.6)
$HCINTER\_TF_j$	-15.08***	-117.3***	-23.76***	-23.23***	-3.729**	-229.0
	(3.097)	(10.72)	(4.755)	(4.737)	(1.858)	(349.0)
IF_j	82.64***	331.2***	-12.25	-76.09	-112.6	16.75
	(26.08)	(102.9)	(104.3)	(91.49)	(71.58)	(165.4)
$DIST_{ij}$	*-0.324****	*-1.287****	*-5.533****	*-5.463****	*-2.624****	*-5.007****
	(0.0573)	(0.236)	(1.566)	(1.494)	(0.466)	(1.466)
Constant	4,589	-47,453	201,782***	704,995	1.266e+06***	1,561
	(21,074)	(45,473)	(78,057)	(584,384)	(341,273)	(172,451)
Observations	2,569	2,569	2,554	2,554	1,304	1,246
R^2	0.409	0.508	0.494	0.497	0.562	0.553
$Adj. R^2$	0.4068	0.5065	0.4759	0.4778	0.5317	0.5223
BIC	58169.42	62440.88	57204.78	57189.44	27475.81	28365.51

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions.

Appendix G, Table 3 – Robustness Results for Baseline Regressions: CMM Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	A. Role of Financial Crisis			B. Using Alt. Trade Costs Variables		
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*[1]	(i) OLS	(ii) WLS	(iii) FE *(home and host country, year)*
$SUMGDP_{ij}$	7.948***	15.90***	19.15***	8.932***	15.66***	18.89***
	(0.754)	(0.283)	(5.454)	(0.955)	(0.367)	(7.190)
$GDPDIFSQ_{ij}$	-0.000266***	-0.000748***	-0.00152***	-0.000345***	-0.000754***	-0.00158***
	(5.95e-05)	(2.17e-05)	(0.000163)	(6.74e-05)	(2.62e-05)	(0.000164)
$SKILLDIF_{ij}$	-3,816	-26,154***	1,726	-14,270***	-70,691***	-1,928
	(4,985)	(8,957)	(10,538)	(5,104)	(9,240)	(14,096)
$INTER_{ij}$	5.594**	-5.292***	-29.24***	4.084	-6.752***	-30.35***
	(2.193)	(1.023)	(3.766)	(2.587)	(1.211)	(3.901)
TF_i	267.3**	182.5	-670.1			
	(105.0)	(310.1)	(471.2)			
TF_j	24.55	-1,011***	-6.453			
	(37.48)	(203.6)	(71.84)			
$INTER\_TF_j$	-258.2	-2,440***	-120.3			
	(220.4)	(418.8)	(180.7)			
TC_{ijt}				*24.96***	*-81.65****	*-1.678*
				(10.40)	(31.48)	(6.778)
$INTER\_TC_{ijt}$				*175.7****	*1,209****	*56.68*
				(67.06)	(249.0)	(50.17)
IF_j	125.6***	809.4***	-82.65	159.4***	625.2***	-71.63
	(18.40)	(72.34)	(63.01)	(19.70)	(60.58)	(69.16)
$DIST_{ij}$	*-0.349****	*-1.947****	*-7.225****	*-0.596****	*-1.505****	*-7.198****
	(0.0629)	(0.196)	(1.032)	(0.0805)	(0.299)	(1.181)
$CRISIS_t$	*1,284*	*3,692***	*-4.229*			
	(806.6)	(1,796)	(591.4)			
$Constant$	-39,709***	-6,333	76,894**	-20,655***	-59,117***	18,142
	(10,004)	(29,928)	(38,336)	(3,228)	(5,889)	(16,943)
$Observations$	4,169	4,169	4,147	3,267	3,267	3,241
R^2	0.409	0.528	0.732	0.421	0.537	0.741
$Adj. R^2$	0.4073	0.5273	0.7253	0.4196	0.5363	0.7327
BIC	94733.74	101742	90965.96	74646.32	79865.63	71463.04

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE.

Appendix G, Table 4 – Robustness Results for the Baseline Regressions: BNU Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	A. Role of Financial Crisis			**B. Using Alt. Trade Costs Variables**		
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*[1]	(i) OLS	(ii) WLS	(iii) FE *(home and host country, year)*
$\boldsymbol{SUMGDP_{ij}}$	5.830***	9.178***	4.707	5.966***	8.429***	3.223
	(0.529)	(0.152)	(4.601)	(0.614)	(0.192)	(6.265)
$\boldsymbol{SIZE_{ij}}$	53,028***	305,289***	59,916***	61,257***	294,643***	64,725***
	(5,719)	(10,467)	(5,698)	(7,043)	(12,651)	(6,656)
$\boldsymbol{SIZESQ_{ij}}$	-30,301***	-155,261***	-40,779***	-34,386***	-153,206***	-45,066***
	(3,140)	(5,685)	(4,019)	(3,830)	(7,007)	(4,719)
$\boldsymbol{SKILL_{ij}}$	1,681***	16,416***	12,021***	1,776***	9,677***	8,784***
	(549.4)	(1,760)	(1,195)	(560.4)	(1,406)	(1,242)
$\boldsymbol{INTER_{ij}}$	-6,257***	-58,235***	-15,658***	-8,159***	-53,286***	-18,533***
	(1,241)	(3,454)	(2,454)	(1,502)	(3,816)	(3,037)
$\boldsymbol{TF_i}$	35.10	-683.5**	-1,149*			
	(135.2)	(294.2)	(669.6)			
$\boldsymbol{TF_j}$	-122.6***	-1,373***	161.8*			
	(44.35)	(208.3)	(93.06)			
$\boldsymbol{INTER\_TF_j}$	-0.605	-12.06***	-7.456***			
	(0.417)	(2.109)	(0.849)			
$\boldsymbol{TC_{ijt}}$				*10.05*	*-125.8****	*31.44****
				(8.970)	(31.10)	(9.652)
$\boldsymbol{INTER\_TC_{ijt}}$				*0.0281*	*0.269*	*-1.241****
				(0.120)	(0.633)	(0.308)
$\boldsymbol{IF_j}$	108.3***	548.7***	44.11	71.84***	144.2**	48.76
	(20.64)	(75.68)	(83.36)	(19.94)	(68.32)	(91.05)
$\boldsymbol{DIST_{ij}}$	*-0.422****	*-2.178****	*-7.434****	*-0.527****	*-1.015****	*-7.780****
	(0.0543)	(0.200)	(0.991)	(0.0943)	(0.313)	(1.168)
$\boldsymbol{CRISIS_t}$	*1,175*	*4,938****	*-82.29*			
	(817.7)	(1,828)	(669.8)			
Constant	-17,506	48,373	98,038*	-24,550***	-77,833***	19,463
	(12,433)	(29,485)	(53,954)	(3,749)	(7,879)	(13,774)
Observations	4,169	4,169	4,147	3,267	3,267	3,241
$\boldsymbol{R^2}$	0.399	0.507	0.594	0.402	0.500	0.588
$\boldsymbol{Adj.R^2}$	0.397	0.5062	0.5838	0.4005	0.4986	0.5747
BIC	94813.4	101931.9	92696.28	74759.5	80128.24	72975.72

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE.

Appendix G, Table 5 – Robustness Results for Human Capital Regressions: CMM Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	A. Role of Financial Crisis			**B. Using Alt. Trade Costs Variables**		
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*[1]	(i) OLS	(ii) WLS	(iii) FE *(home and host country, year)*
$SUMGDP_{ij}$	10.02***	20.32***	51.90***	11.26***	21.45***	58.16***
	(0.911)	(0.326)	(10.56)	(1.127)	(0.428)	(10.98)
$GDPDIFSQ_{ij}$	-0.000393***	-0.000911***	-0.00193***	-0.000461***	-0.000947***	-0.00194***
	(8.55e-05)	(2.65e-05)	(0.000232)	(9.56e-05)	(3.16e-05)	(0.000232)
$EDUCDIF_{ij}$	-948.3	-34,695***	-25,373*	701.4	-30,790***	-39,331**
	(2,886)	(6,994)	(14,091)	(3,188)	(8,055)	(19,059)
$HCINTER_{ij}$	-8.458	-23.38***	-23.91***	-9.498*	-26.22***	-25.82***
	(5.344)	(1.453)	(5.473)	(5.656)	(1.613)	(5.719)
TF_i	173.7	275.5	-1,061			
	(216.3)	(381.2)	(685.3)			
TF_j	368.7***	734.3***	292.9			
	(90.48)	(236.3)	(197.6)			
$HCINTER\_TF_j$	-773.5***	-2,279***	-393.0**			
	(190.7)	(496.7)	(179.0)			
TC_{ijt}				*57.13****	*129.8****	*-7.425*
				(14.74)	(34.75)	(9.687)
$HCINTER\_TC_{ijt}$				*-390.1****	*-826.1***	*23.66*
				(120.7)	(407.2)	(86.48)
IF_j	31.85	189.7**	-245.8***	156.9***	526.8***	-201.6**
	(31.39)	(85.15)	(79.02)	(28.65)	(68.16)	(80.61)
$DIST_{ij}$	*-0.0895*	*-0.183*	*-4.656****	*-0.645****	*-1.311****	*-4.950****
	(0.0654)	(0.197)	(1.283)	(0.109)	(0.313)	(1.484)
$CRISIS_t$	*-1,222*	*-11,379****	*615.2*			
	(852.6)	(1,695)	(670.3)			
$Constant$	-56,885***	-134,441***	22,805	-26,660***	-88,985***	-68,966***
	(21,986)	(37,128)	(60,988)	(4,114)	(6,521)	(24,755)
$Observations$	2,569	2,569	2,554	2,018	2,018	2,001
R^2	0.469	0.661	0.743	0.479	0.662	0.752
$Adj. R^2$	0.4665	0.6596	0.7341	0.4774	0.6610	0.7404
BIC	57896.88	61486.6	55471.48	45824.7	48478.43	43773.29

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE.

Appendix G, Table 6 – Robustness Results for the Human Capital Regressions: BNU Specification; Services Industries

	$SERVICES\_TURNOVER_{i,j}$					
	A. Role of Financial Crisis			B. Using Alt. Trade Costs Variables		
	(i) OLS	(ii) WLS	(iii) FE *(home and host country)*[1]	(i) OLS	(ii) WLS	(iii) FE *(home and host country, year)*
$SUMGDP_{ij}$	5.895***	9.374***	2.326	5.867***	8.510***	5.701
	(0.635)	(0.202)	(15.78)	(0.715)	(0.245)	(16.85)
$HCSIZE_{ij}$	74,405***	349,560***	85,520***	78,613***	334,315***	91,299***
	(8,703)	(12,328)	(8,899)	(10,152)	(15,370)	(9,924)
$HCSIZESQ_{ij}$	-38,417***	-155,006***	-48,932***	-40,936***	-150,217***	-53,790***
	(3,968)	(6,057)	(5,542)	(4,661)	(7,749)	(6,174)
$EDUC_{ij}$	11,742***	74,038***	19,312***	7,569***	39,120***	13,724***
	(2,064)	(4,649)	(3,651)	(1,725)	(3,636)	(2,753)
$HCINTER_{ij}$	-14,798***	-108,157***	-31,446***	-14,551***	-98,681***	-34,044***
	(3,193)	(6,383)	(6,169)	(3,597)	(7,477)	(6,767)
TF_i	-420.9*	-1,259***	-2,788***			
	(217.3)	(460.9)	(996.6)			
TF_j	-77.74	-92.60	467.2			
	(76.81)	(296.4)	(295.9)			
$HCINTER\_TF_j$	-14.92***	-116.6***	-23.73***			
	(3.096)	(10.73)	(4.750)			
TC_{ijt}				*-4.670*	*-206.5****	*29.50***
				(10.47)	(41.23)	(14.38)
$HCINTER\_TC_{ijt}$				*-1.858***	*-10.65****	*-4.731****
				(0.782)	(3.549)	(1.197)
IF_j	77.89***	316.3***	-46.68	44.88*	231.3***	-78.42
	(26.94)	(103.5)	(100.9)	(27.03)	(87.49)	(104.6)
$DIST_{ij}$	*-0.325****	*-1.281****	*-5.522****	*-0.295****	*0.103*	*-6.432****
	(0.0575)	(0.236)	(1.565)	(0.103)	(0.386)	(1.904)
$CRISIS_t$	*-938.8*	*-2,582*	*-1,051*			
	(885.6)	(2,027)	(1,026)			
Constant	7,554	-43,298	210,784***	-31,242***	-112,823***	10,345
	(20,757)	(45,584)	(80,979)	(5,424)	(10,688)	(38,646)
Observations	2,569	2,569	2,554	2,018	2,018	2,001
R^2	0.409	0.509	0.494	0.404	0.499	0.493
$Adj.R^2$	0.4068	0.5066	0.4760	0.4009	0.4966	0.4698
BIC	58176.17	62447.1	57211.46	46107.01	49282.95	45208.94

Notes: Standard errors in parentheses. *** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level. No coefficients are bold because no expected signs were derived for the services industries regressions. 1) Due to collinearity issues with the crisis dummy, I show home and host country FE for this regression, and no year FE.