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Multinational Enterprises and New Trade Theory: Evidence for the Convergence Hypothesis

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Abstract

According to the 'convergence hypothesis' multinational companies will tend to displace national firms and trade as total market size increases and as countries converge in relative size, factor endowments, and production costs. Using a recent model developed by Markusen and Venables (1998) as a theoretical framework, we explicitly develop empirical measures to proxy bilateral FDI between two countries and address their properties with regard to the convergence hypothesis. Using a panel of data of country pairs over the years 1985-96 we econometrically test for the relationship between convergence and bilateral FDI. Our results provide some empirical support for the convergence hypothesis.

Outline

1. Introduction
2. Theoretical Framework
3. Measuring the Convergence Hypothesis
4. Data Set
5. Econometric Methodology
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Non-Technical Summary

Between 1988 and 1997, foreign direct investment (FDI) has grown far more than trade. In real terms, the total combined outward FDI stock of the EU, US, and Japan rose at an average of 10.5% against an increase of 2.6% in trade. This trend implies that in the industrialised world production by multinational enterprises (MNEs) is replacing national production, at least in the sense of supplying goods between countries.

On the theoretical side, however, New Trade Theory (NTT) has mainly focused on providing support for the increased importance of trade between industrialised countries and the prevalence of intra-industry specialization between them, rather than the growing importance of multinationals relative to trade. In recent years there have, however, been a number of theoretical models within the framework of NTT that can explain some of the observed pattern of multinational production. In these models firms are seen as being willing to engage in direct investment instead of alternatives such as exporting or licensing if firm level economies of scale are important relative to plant level economies. A model developed by Markusen and Venables (1998) probably provides the most coherent framework within which to analyse the increasing importance of FDI relative to trade in the world economy. They show that the convergence of countries in size and relative endowments shifts the regime from national to multinational firms, a phenomenon termed the 'convergence hypothesis'.

Our paper utilises this model to define and discuss empirical equations with which to analyse this convergence hypothesis. Specifically, using these equations, we investigate how total market size, differences in the market size and factor endowments of host and home countries, transport costs and plant level scale economies (relative to firm level scale economies) impact on the level of two way multinational activity between the two countries. To this end we make use of a panel dataset for the period 1985 to 1996, which allows us to analyse changes in bilateral investment behaviour between a set of OECD countries over time.

Our results support the convergence hypothesis to some extent. Overall market size tends to increase, while differences in market size tend to reduce bilateral MNE activity. While the role of differences in relative endowments of human or physical capital skilled workers is not clear from our results, R&D intensity, which serves to proxy the importance of firm level scale economies, and a common language in home and host country significantly increase bilateral MNE activity. We also find that for many cases transportation costs, contrary to the convergence hypothesis, are negative determinants, although these findings are in line with similar findings in the literature. Breaking down our sample into EU and non-EU pairs we find that a large number of our results in aggregate still hold, although, given the small sample size particularly for EU country pairs, these results must be viewed with some caution.

1 Introduction

High-income industrialised countries are both the most important source and destination for foreign direct investment (FDI). For example, in 1997, the total outward FDI stock of the Triad was equal to 2441 billion US dollars and 63% of this amount concerned FDI stock within the Triad.[1] In view of the substantial rise of both intra- and inter industry trade between industrialised countries, this feature may not seem that startling. However the important fact to consider is that FDI has grown far more than trade: in real terms, the total outward FDI stock rose at an average of 10.5% p.a. between 1988 and 1997 against an increase of 2.6% p.a. in trade. This evidence is in line with the observation by Markusen (1998, p.753), that "most of the growth in North Atlantic economic activity since the early 1980s has been in investment, not trade". These trends, thus, mean that in the industrialised world multinational production is replacing national production, at least in the sense of supplying goods between countries. For example between 1984 and 1995 UNCTAD (1997) estimated that sales by multinational enterprises (MNE) were higher than the total exports of goods and services.

In looking for a theoretical rationale for these patterns one observes that much of the New Trade Theory (NTT) has expended its efforts on providing support for the increased importance of trade between industrialised countries and the prevalence of intra-industry specialization between them, rather than the growing importance of multinationals relative to trade (Markusen and Venables, 1998).[2] The theoretical challenge in terms of the pattern of production of MNEs, however, lies in attempting to explain the existence of MNEs within the general equilibrium theory of trade. Put differently, one needs models to explain why some firms choose to invest abroad rather than exporting. To achieve this trade economists have mainly relied on Dunning's OLI framework (1977) as a starting point. Accordingly, MNEs are seen as firms which internalise a specific ownership advantage that provides them with some market power. Firms

[1] These figures are taken from the UN International Trade Statistics Yearbook (1997) and the World Investment Report (1999). Trade figures are for the period 1990-1997 and concern merchandises only. The Triad refers to the EU, the US and Japan.

[2] For example, Krugman (1979) and Helpman and Krugman (1985) suggest that trade between countries with similar factor proportions is likely to be mostly in differentiated products and increasing return to scale activities, which contrasts clearly with the Heckscher-Ohlin (HO) neoclassical model where inter industry trade occurred as a consequence of factor proportion differences. See, however, Falvey (1981) for a model of intra-industry trade with a role for differences in factor endowments.

are willing to exploit this through FDI instead of exports in order to benefit from some location advantage and to avoid possible asset dissipation that may occur with licensing for example.

This line of reasoning has resulted in a (relatively) small number of theoretical models within the framework of NTT that can explain some of the observed pattern of multinational production: see, for example, the pioneering analyses of Markusen (1984), Ethier (1986), Helpman (1984 and 1985) and Brainard (1993). In these models firms are seen as being willing to engage in direct investment instead of alternatives such as exporting or licensing if firm level economies of scale are important relative to plant level economies. This may be the case if, for example, R&D activity is important for the firm, as R&D has some of the characteristics of a public good; in particular, the output of R&D can be transferred between different plants within the firm at low or zero costs (Markusen, 1995). FDI may then displace trade when countries are relatively similar in both size and factor endowments, as pointed out by Markusen and Venables (1998).[3]

The model developed by Markusen and Venables (1998) probably provides the most coherent framework within which to analyse the increasing importance of FDI relative to trade in the world economy. Using a two-country model they show that the convergence of countries in size and relative endowments shifts the regime from national to multinational firms, a phenomenon termed the 'convergence hypothesis' according to which "multinational production will tend to displace national firms and trade as the two countries converge in (a) relative size, (b) relative factor endowments, and (c) relative production costs" (Markusen and Venables, 1996, p. 172)[4].

Our paper utilises the Markusen-Venables (1998) model to define and discuss empirical equations with which to analyse this convergence hypothesis. Specifically, using these equations, we investigate how total market size, differences in the market size and factor endowments of host and home countries, transport costs and plant level scale economies (relative to firm level scale economies) impact on the level of two way multinational activity between the two countries. To this end we make use of a panel dataset for the period 1985 to

[3] These models refer to horizontal FDI where foreign affiliates produce similar goods to those produced in the home country in order to exploit firm specific economies of scale.

[4] As the authors point out this is not simply due to trade disappearing with the convergence in relative factor

1996, which allows us to analyse changes in bilateral investment behaviour between a set of OECD countries over time.

There have been a number of recent papers which are related to our work. Ekholm (1995) examines the level and determinants of foreign production by home *i* firms in host *j* using data on FDI stocks for a number of OECD countries and also analyses the determinants of two-way multinational activity between countries *i* and *j*. Ekholm (1997, 1998) extends this work using employment data for the US and Sweden. She finds that foreign production and the level of two-way MNE activity are positively related to similarities in GDP and relative endowments of human capital between the host and home country, while similarities in the endowments of physical capital do not seem to affect foreign production to any great extent. Also, total market size is found to be a positive determinant of multinational activity. Using data on US multinationals, Brainard (1997) investigates the determinants of exports vs. sales by multinationals in the host country. She finds that multinational production abroad increases with higher transport costs and trade barriers, and the less important are plant level scale economies. Complementary work by Markusen and Maskus (1999) and Carr et al. (2000), also using US data, furthermore highlights the importance of market size, size differences, and differences in factor endowments between host and home country for the multinationals' decision to produce abroad for the host country market or for exports to third country markets.[5]

We extend this work in at least two ways. Firstly, we analyse bilateral multinational activity for a number of OECD country pairs. Secondly, we link our indices explicitly to the Markusen and Venables (1998) model and the convergence hypothesis, i.e., the displacement of indigenous firms by multinationals when countries become more similar in terms of size and endowments. The remainder of the paper is structured as follows. In Section 2 we outline the theoretical framework upon which our empirical analysis is based. We discuss the empirical measurement of the convergence hypothesis in Section 3 and describe the dataset used in Section 4. Section

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endowments and production costs.

[5] There have, of course, been numerous other empirical studies of FDI and the activities of multinational companies in the literature. These studies, however, mainly examine one way multinational activity only, i.e., the dependent variable is the unilateral activity of multinationals from home to host country, and they do not explicitly examine the effect of size and endowment differences between host and home country. See, for example, Kravis and Lipsey (1982), Culem (1988), Wheeler and Mody (1992), Head et al. (1995), Barrell and

5 contains an outline of our empirical methodology and Section 6 presents the results of the econometric estimations. Concluding remarks are provided in the final section.

2 Theoretical Framework

We begin with a brief review of the structure and main results of the Markusen and Venables (1998) model, hereafter referred to as MV. We do not provide a detailed account of it; for further details, the reader should refer to the appendix and the exposition of the original MV model. Our objective is to provide a basis for the test of the *convergence hypothesis* interpreting the MV main findings in terms of MNE's employment. Hence, we focus on the main equations necessary to allow us to derive an index of cross-FDI intensity based on employment data.

The MV model derives the conditions necessary for multinationals to dominate within a general equilibrium framework of trade with increasing return to scale and imperfect competition (the NTT framework). The elements considered are differences in size, factor proportions, the importance of trade costs, etc, between two countries: *h* and *f*. Each economy is identical and consists of two industries producing homogenous goods and using two production factors: *L* (labour) and *R* (resources). *L* is mobile between *X* and *Y* industries but internationally immobile. *L* is used in both sectors but *R* is used only in the *Y*-sector. Both goods are traded and only *X* entails a positive transport cost between *h* and *f*, which is represented by a variable quantity of *L* used in transport activities. Factor unit prices *r* (for *R*) and *w* (for *L*) are derived from marginal products of these factors in *Y* production.[6]

The analysis focuses on the *X*-sector in which FDI occurs. This industry is characterized by Cournot-type competition and the equilibrium is defined by free entry and exit of firms with zero profits. The variable under scrutiny is the number of active firms in equilibrium represented by *m* and *n*, where *m* represents the equilibrium number of multinational firms and *n* the equilibrium number of national firms. Symbols m_i and n_i are also used to identify the type of

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Pain (1996, 1999).

[6] Appendix 1 shows the derivation of factor prices, see equations *A.1-A.3*.

firm we refer to and subscripts are used to represent the country where the firm has its headquarters, for example m_i refers to MNEs with headquarter located in country *i*.[7]

In a Cournot model with identical firms and homogenous products firm behaviour is characterised as follows:

- n_i firms sell in market *j* through exports. These firms incur an additional variable cost related to the transportation of *X* from *i* to *j* represented by *t*.[8] Fixed costs may be decomposed into a firm-level and a plant-level fixed cost. The former is represented by an amount of labour *F* needed for organizational activities, R&D etc., and the latter is due to the use of an additional quantity of labour *G*, needed for productive activities. All these costs are incurred in country *i*.
- m_i firms sell in market *j* through FDI. These firms incur an additional fixed cost with FDI, the fixed cost related to the new plant in *j*. As a consequence, multinationals have the same firm-specific fixed labour requirement *F* and a plant-specific fixed labour requirement equal to *G*, both employed in the home country *i plus* an additional fixed labour requirement *G* in the host country *j* where it locates its affiliate to sell *X*.

Each firm-type is then identified with a particular cost function according to the preceding features. The different cost functions between type-*n* and type-*m* firms determine in turn different demands for labour. Type-*n* firms located in *i* have the following demand for labour:

$$l_i^n = cX_{ii}^n + (c+t)X_{ij}^n + G + F \qquad i, j = h, f, i \neq j \tag{1}$$

where X_{ii}^n and X_{ij}^n denote the quantities sold in countries *i* and *j* respectively.[9] The constant *c* represents the marginal labour requirement.

Multinationals have a different demand for labour since their productive activity is divided between *h* and *f*. The term l_i^m represents the total demand for labour of a multinational headquartered in country *i* and can be decomposed into l_{ii}^m and l_{ij}^m, that represent the demand in home and host country respectively:

[7] Symbols *i* and *j* are used throughout the paper in order to avoid replications of equations for countries *h* and *f* since we assume that both countries are identical.
[8] The transport cost *t* is represented by an amount of labour used for transportation and we assume that *t* is the same both for shipping goods from *i* to *j* and from *j* to *i*.

$$l_i^m = l_{ii}^m + l_{ij}^m \quad i, j = h, f \text{ and } i \neq j \tag{2}$$

$$l_{ii}^m = cX_{ii}^m + G + F \quad i, j = h, f \quad \text{and } i \neq j \tag{3}$$

$$l_{ij}^m = cX_{ij}^m + G \quad i, j = h, f \quad \text{and } i \neq j \tag{4}$$

Accordingly, multinationals avoid transportation costs but incur twice the plant-fixed cost of national firms since they use a fixed quantity of labour equal to *2G* instead of *G*, the quantity of labour used by type-*n* firms.[10]

The differences in cost functions in turn determines the differences in the relative profitability of each firm type. With free entry in the market of *X*, profits are zero so that the relative performance of each firm-type falls with the number of active firms. All other variables of interest, such as trade or employment can be derived from the equilibrium number of firms. Using this theoretical framework, MV show that MNEs (as outlined in appendix 2) will have an advantage relative to type-*n* firms when:

1. The overall market is large.
2. The markets are of similar size.
3. Labour costs are similar.
4. Firm-level scale economies are large relative to plant-level scale economies.
5. Transport costs are high.

These results provide a strong basis for the convergence hypothesis since, as noted by Markusen and Venables (1998, p.196) "convergence of countries h and f in either size or relative endowments shifts the regime from national to multinational firms."

3 Measuring the convergence hypothesis

From an empirical perspective, the preceding results raise several issues. The first is a problem common to many empirical analyses of general equilibrium trade models: the models are usually designed to describe the relationships between two countries, while in the real world, trade and foreign investment concern a large number of countries (see Bowen et al., 1998). This makes the model restrictive in applicability but it helps to understand the determinants of FDI, and

[9] The equilibrium values for *X* are given by *A.14-A.17* in appendix 1.

[10] In each country, labour is also employed by type-*n* firms (with a total demand represented by $n_i.l_i^n$) and by firms in *Y*-sector (L_{iY}). Equation (A3) in the appendix 1 gives the clearing condition in the labour market.

provides a rigorous framework in order to define the equations to test. In the special case of MNE activities, an investor in one country may be primarily concerned by the accession to a third (neighbouring) market. This is especially true in the case of FDI in the European Union where the reduction of market fragmentation and barriers to trade between countries led firms to reorganize their activity within the area in order to benefit from the potential gain of an integrated market.[11] In our empirical analysis we take account of this by also estimating the model separately for EU countries only.

The second issue is a data related problem. As Markusen and Venables point out, the results of the MV model could be expressed in terms of the following index:

$$I_{MV} = \frac{m_h + m_f}{m_h + m_f + n_h + n_f} \tag{5}$$

that is, the share of multinationals in the total number of firms. The number in turn depends on the values of the exogenous parameters that determine the relative profitability of each firm-type. Hence, the MV model and its results are specifically concerned with the *number* of multinational firms (relative to indigenous firms). This may prove problematic in terms of measuring the convergence hypothesis for a number of reasons. The number of active firms may not reflect the relative importance of MNEs. In the real world, firms have different production scales and the number of MNEs is not a reliable measure of MNE importance. In contrast, employment data are likely to be better able to reflect the importance of MNEs, because they take into account relative size. Also, employment data are a better measure of MNE presence than FDI flows or stocks since a growing share of investment is made with funds raised locally (Markusen, 1998).

Ideally, therefore, the equivalent of the share of multinational firms in terms of employment should be:

$$I_{MV}^{empirical} = \frac{(m_h l_{hh}^m + m_h l_{hf}^m + m_f l_{ff}^m + m_f l_{fh}^m)}{(n_h l_h^n + n_f l_f^n + m_h l_{hh}^m + m_h l_{hf}^m + m_f l_{ff}^m + m_f l_{fh}^m)} \tag{6}$$

[11] See European Commission (1996) for evidence on the impact of the Single Market Programme on the location of industries in the EU.

that is, the proportion of total employment between two countries *h* and *f* that is due to MNEs. However, the data typically used in empirical studies relate to total employment in multinationals in the host country (and not in the home country), so that one cannot generally calculate the numerator in (6) because we have no information concerning $m_h l_{hh}^m$ and $m_f l_{ff}^f$. The closest approximation that one may be able to calculate is therefore:

$$Y_1 = \frac{(m_h l_{hf}^m + m_f l_{fh}^m)}{(n_h l_h^n + n_f l_f^n + m_h l_{hh}^m + m_h l_{hf}^m + m_f l_{ff}^m + m_f l_{fh}^m)} \qquad (7)$$

which is simply the share of MNEs' employment in the host country of total employment between both countries. However, this index raises two problems. First, it can take on high values even when there is little bilateral FDI. Consider, for example, that one country is much larger than the other and, because of this size effect, in the presence of increasing returns a MNE will preferably locate in the larger country. We allow for this by introducing a second index which tries to correct Y_1 by taking the minimum of the two terms in the numerator. This gives us the following index:

$$Y_2 = \min\left[\frac{(m_f l_{fh}^m)}{(n_h l_h^n + m_h l_{hh}^m + m_f l_{fh}^m)}, \frac{(m_h l_{hf}^m)}{(n_f l_f^n + m_f l_{ff}^m + m_h l_{hf}^m)}\right] \qquad (8)$$

The second problem arises from the hypothesis made concerning the demand for labour described by (2)-(4). A closer look at the theoretical model reveals that we cannot directly use the MV results to interpret either Y_1 or Y_2.

To understand this point consider a simple case. From the model one knows that each MNE uses a fixed number of workers equal to $F+2G$, since they are formed by two plants and one headquarter based in the home country. MNEs in their home country require an additional number of workers since they incur an additional fixed cost, represented by G. The consequence is that when multinationals dominate, following the MV conditions outlined in the previous section, the demand for labour in the home country increases by more than the demand for labour in the host country. The immediate consequence is that we cannot draw clear-cut conclusions on the behaviour of Y_1 and Y_2 from the MV results. When the equilibrium number of multinationals rises the denominator of the preceding indicators can rise more than its

numerator depending on how MNE's employment in their home country behaves with respect to national firms employment. The model does not provide a clear answer on this and we have to rely on the empirical estimates provided in the next section.

Alternatively one could consider a third index that can be more directly interpreted following the basic model:

$$Y_3 = 1 - \frac{\left| m_f l_{fh}^m - m_h l_{hf}^m \right|}{m_f l_{fh}^m + m_h l_{hf}^m} \qquad (9)$$

This refers to the notion of cross-country FDI [12]. Here we show how the MV results can be directly used to interpret Y_3 since it uses only MNEs employment data in host countries. We can rewrite equation (4), which we can express for $i = h$ and $j = f$ with some modifications as

$$l_{fh}^m = c\alpha_h M_h + G \qquad (10)$$

where M is total income in h. The term α_h is a function of X_{fh}^m. Using the equilibrium value of X_{fh}^m we can show that:[13]

$$\alpha_h = \beta \frac{p_h - w_h c}{p_h} \qquad (11)$$

Similarly, we can derive the equilibrium value of l_{hf}^m

$$l_{hf}^m = c\alpha_f M_f + G \qquad (12)$$

with

$$\alpha_f = \beta \frac{p_f - w_f c}{p_f} \qquad (13)$$

Under the symmetric equilibrium l_{hf}^m and l_{fh}^m are identical. In order to clarify our presentation, we express total demand for labour from multinationals based in h and f as a function of the equilibrium number of firms:[14]

$$L_{hf}^m = m_h \, l_{hf}^m \qquad (14)$$

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[12] This index is in fact similar to the intra-industry trade index proposed by Grubel and Lloyd (1975). A similar index has been used by Ekholm (1995, 1997, 1998).

[13] The result for this is given by equation *A.17* (appendix 1) replacing *i* by *f* and *h* by *j*.

[14] The equilibrium number of multinationals is given by the free entry conditions, see equations (A8)-(A9) in appendix 1.

$$L^m_{fh} = m_f \; l^m_{fh} \qquad (15)$$

In order to see how Y_3 behaves with the exogenous variables of the model, we use the type of analysis carried out by MV to derive our results concerning L^m_{hf} and L^m_{fh} for five cases; the impact of a change in (i) total income, (ii) the distribution of income, (iii) factor proportions, (iv) plant versus firm-fixed costs and (v) transport costs. As in MV, we assume that countries *h* and *f* are identical, which implies that, initially, commodity and factor prices as well as income, are identical in both countries.[15]

Case 1: Change in total income: $dM_h = dM_f > 0$

The impact on L^m_{hf} and L^m_{fh} can be represented by:

$$dL^m_{hf} = l^m_{hf} \; dm_h + m_h \; dl^m_{hf} \quad = (c\mathrm{a}_f M_f + G) \; dm_h + m_h \; c\mathrm{a}_h > 0$$

$$dL^m_{fh} = l^m_{fh} \; dm_f + m_f \; dl^m_{fh} \quad = (c\mathrm{a}_h M_h + G) \; dm_f + m_f \; c\mathrm{a}_f > 0$$

Following MV, we have $dm_h = dm_f > 0$ since the relative profitability of multinationals rises compared to national firms. With a positive number of m_h and m_f firms, the other components are all positive.

We can then write:

$$dM_h = dM_f > 0 \quad \Rightarrow dY_3 > 0$$

Case 2: Change in the distribution of income: $dM_h = -dM_f > 0$

The impact on L^m_{hf} and L^m_{fh} is as follows:

$$dL^m_{hf} = l^m_{hf} \; dm_h + m_h \; dl^m_{hf} \quad = \; 0 + m_h \; c\mathrm{a}_h > 0$$

$$dL^m_{fh} = l^m_{fh} \; dm_f + m_f \; dl^m_{fh} \quad = - m_h \; c\mathrm{a}_h + 0 \quad < 0$$

The equilibrium values of m_h and m_f are not affected by this change and the change in l^m_{hf} and l^m_{fh} is exactly opposite given that countries are symmetric in all respects. Accordingly, the

[15] All changes affecting the equilibrium number of firms in the five cases considered here are explained in more detail in appendix 2.

numerator of Y_3 does not change but the denominator rises. The final outcome is a decrease in Y_3:

$$dM_h = -dM_f > 0 \quad \Rightarrow dY_3 < 0$$

Case 3: Change in unit labour cost: $dw_f = -dw_h > 0$ with $i=f$ and $j=h$.

This change can be equally considered as a change in factor proportions:

$$d\,\Delta\left[\frac{L}{R}\right] = -d\,\Delta\left[\frac{L}{R}\right] > 0$$

with: $\mathrm{d}\ w = \frac{w_i}{r_i} - \frac{w_j}{R_j} = \Delta\left[\frac{L}{R}\right]$ *and* $\Delta(0) = 0$ *and* $\Delta'(.) > 0, \Delta''(.) = 0$

Here the impact is straightforward since a_h and a_f are descreasing function of w_h and w_f respectively: $dL^m_{hf} > 0$ and $dL^m_{fh} < 0$ and Y_3 falls, we can then state that:

$$dw_f = -dw_h > 0 \quad \Rightarrow dY_3 < 0$$

Case 4: Change in firm versus plant cost ratio: $dF = -dG > 0$

The symmetric change is in fact used by MV to get a relative measure of the change in the relative profitability of type-*m* firms vs. type-*n* firms. Type-*n* firms are not directy affected since their losses (*dF>0*) are exactly identical to their gains (*–dG>0*), so that total fixed costs do not change. For MNEs, however, total fixed cost falls and the relative profitability of MNEs rises compared to national firms. There is a dual effect on labour demand since foreign affiliates lower their use of labour (because of -*dG*), while the number of active MNEs increases following MV. We have:

$$dL^m_{hf} = l^m_{hf}\ dm_h - m_h$$

$$dL^m_{fh} = l^m_{fh}\ dm_f - m_f$$

The final outcome depends on the relative values of $l^m_{ij} dm_i$ *and* m_i *with* $i = f, h$ *and* $i \neq j$.

As a consequence, the model does not yield unambiguous results as to whether the numerator of Y_3 will increase or decrease with such a symmetric change.

Case 5: Change in transport costs: $dt > 0$

This does not directly affect the demand for labour of the MNE. However, there is an indirect impact through type-*n* firms' employment since their profitability falls and, according to MV, $dn<0$. With national firms employing less labour, multinationals' employment rises and the indirect effect of $dt > 0$. Consequently the numerator Y_3 will increase as *t* increases.

Before turning to the empirical tests, it is worthwhile summarizing the advantages and disadvantages of Y_1-Y_3 in terms of testing the convergence hypothesis. While the most obvious choice of measure of displacement of indigenous firms by MNEs, Y_1 may in some cases not be ideal for capturing bilateral FDI between countries. However, for both Y_1 and Y_2, generally available data do not include multinationals' employment in their home country, so that that the indices may not necessarily be directly interpreted in terms of the model. On the other hand, the interpretation of Y_3 is straightforward from a theoretical point of view but it does not provide an explicit test of the convergence hypothesis since the displacement of multinationals by domestic firms is implicit and taken as given by the confrontation between firm-types. The impact of changes in exogenous variables on type-*n* firms is taken as given and, as a consequence of this, Y_3 only provides direct evidence for the idea that when countries converge, the degree of cross-FDI rises.

4 Data Set

In order to assess the convergence hypothesis empirically, our primary variable is the extent of FDI between country pairs and is constructed from the OECD data base *Measuring Globalisation: The Role of Multinationals in OECD Economies 1999 Edition*.[16] This data source provides a set of detailed statistical data for assessing and analysing the role played by multinationals in the industrial sectors of 16 OECD countries constructed from national sources. For the purpose of this paper, we need to construct measures of bilateral FDI, in terms of employment, between country pairs and thus need data on MNEs' employment between any two countries in the same year. Given the nature of the data, this was only possible for the manufacturing sector as a whole, rather than individual subsectors. We were able to do so for

[16] This data was previously published as 'Activities of Foreign Affiliates in OECD Countries'.

27 country pairs over a number of years, providing us with a data sample size of 118 for which we have provided summary statistics in Table 1.

As can be seen, there is a considerable variety of country pairs, all of which are between developed countries. The sample years and size also differs for each country pair. For example our proxy for bilateral FDI, Y_1, varies considerably across these, from 1.66 to 0.01, for Netherlands-Sweden and Japan-Sweden, respectively.[17] The correlation coefficient between Y_1 and Y_2 is 0.96, implying that may be a good proxy for both displacement of indigenous industry by MNEs and bilateral FDI. In contrast, the correlation coefficient between Y_3 and Y_1 and Y_2 is 0.69 and 0.55, respectively. Thus this measure of bilateral FDI may not be a particularly good proxy for displacement.

[Table 1 here]

5 Econometric Methodology

In order to estimate empirically the effect of the above factors on the intensity of cross-direct investment we use the following basic model,[18]

$$Y_{ij} = \beta_0 + \beta_1[\ln(GDP_i)+\ln(GDP_j)] + \beta_2(abs(GDP_i-GDP_j)) + \beta_3((abs(SEND_i-SEND_j)) + \beta_4((abs(CEND_i-CEND_j)) + \beta_5[\ln(RD_i)+\ln(RD_j)] + \beta_6(DIST_{ij}) + \beta_7(LANG_{ij}) + e_{ij} \quad (16)$$

where Y_{ij} is two-way multinational activity between countries i and j measured in terms of employment using the three indices discussed in Section 3, GDP_s is gross domestic product of country $s = i,j$, $SEND_s$ is country s' relative endowment of skilled labour, $CEND_s$ is country s' relative endowment of physical capital, RD_s is a proxy of country s' research intensity, $DIST_{ij}$ is the distance between the capitals of i and j, and $LANG_{ij}$ is a dummy variable set equal to one if countries i and j have a common language.

The first four terms on the right hand side of the equation relate to size and relative endowments. They are included to test the predictions that multinational employment between

[17] For both the summary statistics and the regression results we have multiplied both Y_1 and Y_2 by 100.
[18] The definition of the explanatory variables and their data sources are summarised in appendix 3.

two countries increases as (i) total market size increases and countries grow more similar in (ii) size and (iii) relative endowments. We measure relative endowments of skilled workers using two alternative proxies, (i) the share of employment in R&D activity relative to total employment in the country, and (ii) the percentage of students enrolled in secondary school education in the total population in the country. Relative physical capital endowments are measured as per capita capital stock in the country.

The MV model also predicts that multinational employment can be expected to be more important if firm-level scale economies are large. Therefore, R&D intensity is included to proxy the importance of firm-level scale economies. A country pair's R&D intensity is calculated as the sum of each country's per capita R&D expenditures. This in some way captures the "knowledge-capital model" referred to by Markusen (1995) in which multinationals are seen as firms exploiting some ownership advantage through investment abroad. The ability to exploit such advantages is more likely in industries in which knowledge intensive production is important. As a consequence, multinationals are associated with high ratios of R&D relative to sales and employ a large proportion of qualified workers. From an empirical perspective this implies that multinationals are more likely to exist in countries were industry is R&D-intensive. In the MV model this variable corresponds to *F*, the firm-specific fixed cost.

Furthermore, the MV model suggests that multinationals can be assumed to be important relative to national firms if transport costs and trade barriers are high. We include the distance between the two countries as a rough proxy in the empirical formulation to take account of this. Finally, the equation also includes a dummy variable set equal to one if countries share a common language, since a common language can be assumed to reduce transaction costs of setting up subsidiaries abroad and should, therefore, favour multinational production.

It should be noted that equation (16) is similar to a gravity equation as used in empirical work in international trade (see, for example, Bergstrand, 1985, McCallum, 1995, Frankel et al., 1998) and, more recently, in the analysis of the activities of multinational companies (Ekholm, 1995, 1997, 1998, Brainard, 1997, Markusen and Maskus, 1999, Carr et al., 2000). While the theoretical foundations for using gravity equations in trade are, however, debatable (see

Deardorff, 1984 and Evenett and Keller, 1998) the MV model appears to provide a coherent theoretical framework for the use of gravity equations for the analysis of the activities of multinational companies.

6 Econometric Results

Our results for estimating (16) using standard OLS techniques for our total sample for the indices Y_1, Y_2 and Y_3 are given in Table 2.[19] For all three indices we find that total market size (*GDP*) and the absolute difference in relative market size (*ABSGDP*), are significantly positive and negative determinants of bilateral multinational activity, although in the case of Y_3, *ABSGDP* does not turn out to be statistically significant. Despite this the results are in line with the convergence hypothesis, i.e., the share of bilateral FDI of total manufacturing employment of country pairs increases as total market size increases and as countries become more similar in size.

[Table 2 here]

The evidence on the effect of differences in relative endowments is less clear-cut, however. While the first proxy of endowments of skilled workers, *SEND1*, is statistically insignificant in all specifications, *SEND2* turns out to be significantly negative in the case of Y_1 but positive and significant in the case of Y_3. Differences in physical capital intensity turn out positive in all specifications but are only statistically significant in those that utilise *SEND2*. We thus find evidence for the convergence hypothesis in terms of relative endowments only for the specification using Y_1 and *SEND2* (as proxy of relative human capital endowments) and even in that case, the proxy of physical capital endowments is not as one would expect.[20,21]

[19] One could argue that given the panel nature of our data set that perhaps we should have controlled for country pair fixed effects. However, we chose not to do so for two reasons. Firstly, given our sample size and the large number of country pairs this would have considerably reduced the degrees of freedom. Secondly, given that for each country pair the time period covered is generally only a few years and many of our explanatory variables, such as relative market size or relative factor endowments, will not have varied to any great extent over short time periods, controlling for country pair fixed effects would have purged from our equation exactly what we are trying to measure. Hence, our estimation always assumes that country pair specific fixed unobservables are not correlated with the explanatory variables.

[20] We also re-ran the regressions including only one measure of resource endowments, i.e., either *SEND1*, *SEND2* or *CEND*. The results, which are not reported here, are qualitatively similar to the ones reported herein, however.

[21] One should note, however, that Markusen (1998) in his review of the literature also states that, "a high volume of outward direct investment is positively related to a country's endowment of skilled labour and insignificantly

In all specifications, we find a positive and significant coefficient on the proxy for firm level economies of scale, *RD*. As noted earlier, the nature of our independent variable did not allow us, within the framework of the MV model, to predict a priori what effect this proxy for the importance of firm-level fixed costs would have on bilateral FDI. However, our results indicate that the relationship is clearly positive and statistically significant.

Our results also show that countries with a common language experience greater bilateral FDI. In contrast, the greater the distance between two country's capitals the lower is bilateral FDI. This latter result is contrary to the convergence hypothesis. However, Markusen (1998, p. 736) notes that there is weak evidence that FDI is primarily motivated by the avoidance of tariffs or measurable transport costs. This may be particularly the case for vertical FDI, where the production of intermediate goods is in low-cost locations but the final good is assembled in the home country. In this case, the multinational may wish to locate as near as possible to the home country to avoid transportation costs for shipping the intermediate good between host and home country. Also, Brenton et al. (1999) note that distance may be negatively related to FDI since the costs of operating overseas are likely to rise with distance because of, for example, higher communication costs and higher costs of placing personnel abroad.

The opposite sign we report for distance could possibly be due to the fact that our sample contains mainly European firms with strong cross-investment during the period under study.[22] Moreover, the distance between countries may not be a perfect proxy for transport costs. For instance, it may also reflect cultural differences between countries - countries that are further apart may also be culturally more distinct from each other and, as Kumar (2000) finds for US and Japanese FDI, foreign investment is positively related to cultural proximity.

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or negatively related to its physical capital endowment" (p. 736).

[22] The increased level of integration has translated into a significant decrease in barriers for goods, services and factor movements within the Union, lowering the segmentation of markets and enhancing the rationalization of production as noted by Muchielli and Burgenmeier (1991). The fall in trade barriers may act in favour of vertical FDI since intermediate goods are more easily traded within the firm. The fact that investment occurs between developed countries means that there is still a scope for production rationalization and cost minimization within the firm even if labour costs are similar between locations. Labour skills may be diversified across countries or regions and this in turn may provide a rationale for relocation of productive activities when trade barriers are being removed. On the other hand, factor costs may still be different between industrialized countries, even if those differences are lower than comparing to developing countries. The combination of low internal barriers to trade and still high barriers to external trade may provide a valid reason for cost reduction

Part of the drawback of estimating (16) for our total sample of country pairs is that we are pooling within EU, across the EU and outside the EU data. The nature of bilateral FDI may, however, be intrinsically different for country pairs within these three groupings. To examine how this may affect our results we also sub-divided our sample into those with bilateral FDI within the EU and those for which at least one country was not in the EU at the time. Note, however, that particularly for the EU sample, all results must be viewed with some caution given the relatively small sample size.

The results for estimating (16) for the sample of EU country pairs only are given in Table 3. Reducing our sample to bilateral FDI within the EU does not alter our results in terms of relative market size, distance or R&D intensity, although the coefficients on distance and R&D intensity turn out to be statistically insignificant in the case of Y_3.[23] Total market size also turns only out to be statistically significant and positive in two out of six cases. In terms of relative factor endowments we find that both *SEND1* and *CEND* are statistically significant for the dependent variable Y_1, but both have a positive effect. Differences in physical capital endowments also turn out to be positive and statistically significant for Y_2, although the proxies for human capital endowments are statistically insignificant in that case.

[Table 3 here]

For the non-EU sample, the results of which are reported in Table 4, the proxy for differences in physical capital endowments are statistically insignificant in all specifications, while differences in country size and the proxy for R&D intensity are only significant in one and three specifications respectively although with similar signs as in the overall sample. Our findings are much in line with the overall sample, however, for total market size, human capital endowments, language and distance variables.

[Table 4 here]

The consistently negative and statistically significant sign on the distance variable in all specifications is particularly puzzling. The MV model clearly predicts that multinationals

through FDI in low-wages countries when factor intensities between stages of production differ.

[23] The language dummy is dropped for the EU sample because none of the country pairs share a common language.

become relatively more important as transport costs increase, but, assuming that transport costs increase with distance, our results suggest the opposite – closeness favours FDI. As pointed out above, distance may not be a perfect proxy for transport costs, however. In the absence of detailed data on the actual level of transport costs between countries, we, therefore, in an extension to the basic empirical model replace the distance variable with an indicator of the importance of trade flows between two countries. This may serve as a proxy for transport costs if we assume that countries trade more the lower are transport costs. Specifically, we calculate the variable as $OPEN_{ij} = (X_{ij} + M_{ij})/(GDP_i + GDP_j)$ where X_{ij} are exports from country *i* to *j*, and M_{ij} are imports into country *i* from country *j*.

The results are reported in Table 5. Overall these are similar to the results reported previously and we find that the trade variable has a positive sign and is statistically significant in four out of six cases. This is again in contrast with the MV model, which predicts that high transport costs favour FDI. The positive sign then provides further evidence that this relationship is more complex for a number of reasons – not least because trade and FDI may be complements rather than substitutes (Markusen, 1983).

[Table 5 here]

In the estimations thus far we have assumed that it is the size of the individual country that matters. Arguably, however, it may be the case that for EU countries it is not the size of the individual EU member country, but the size of the total EU that attracts FDI (both from extra-EU and intra-EU sources) to serve the large EU market (see Görg and Ruane, 1999 for a discussion). In an alternative specification we re-calculated both *GDP* and *ABSGDP* to take account of this. *GDP* is calculated as total EU GDP if we analyse a pair of EU countries, the sum of total EU GDP and individual country GDP in the case of one EU country and one non-EU country, and the sum of individual country GDP for two non-EU countries. *ABSGDP* is calculated as the difference between EU GDP and country GDP in the case of one EU and one non-EU country. Otherwise, it is calculated as the difference of individual country's GDPs.

The results of the estimations using these measures are presented in Table 6. While the coefficients on *ABSGDP* are negative and statistically significant as expected in all cases, the

results on the *GDP* variable are rather disappointing. While it turns out to be statistically significant and positive for the total sample, breaking the sample up into EU country pairs and non-EU country pairs yields statistically insignificant results in all cases. Assuming the convergence hypothesis is correct, this casts doubt on the assertion that it is the total EU market size, rather than individual country size that matters for investment decisions, although again we have to be cautious in drawing conclusions due to the small sample sizes, particularly for the EU sample.

[Table 6 here]

7 Conclusion

In this paper we investigate whether multinational companies tend to displace indigenous firms and trade as countries become more similar in size, factor endowments and production costs and as total market size increases. To do so we explicitly relate our empirical measures of bilateral FDI between two countries to a recent theoretical model developed by Markusen and Venables (1998). We set out to test this for a panel of OECD country pairs over the period 1985-96.

Our results support the convergence hypothesis to some extent. Overall market size tends to increase, while differences in market size tend to reduce bilateral MNE activity. While the role of differences in relative endowments of human or physical capital skilled workers is not clear from our results, R&D intensity, which serves to proxy the importance of firm level scale economies, and a common language in home and host country significantly increase bilateral MNE activity. We also find that for many cases transportation costs, contrary to the convergence hypothesis, are negative determinants, although these findings are in line with similar findings in the literature. Breaking down our sample into EU and non-EU pairs we only find that a large number of our results in aggregate still hold, although, given the small sample size, particularly for EU country pairs, these results must be viewed with some caution.

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Table 1: Summary Statistics of Y1, Y2, and Y3 (means) for Country Pairs

Country Pair	Years	Y1*	Y2*	Y3
France - Germany	91-94	1.27	0.30	0.48
France - Italy	89,93	1.27	0.49	0.77
France - Japan	91-96	0.09	0.003	0.07
France - Netherlands	95-96	1.13	0.19	0.34
France - Sweden	93-96	0.59	0.10	0.33
France – UK	91-92, 95-96	1.48	0.64	0.86
France – US	91-96	1.79	0.83	0.93
Germany - Italy	85, 87, 89	0.46	0.09	0.41
Germany - Japan	90-94	0.10	0.03	0.59
Germany - Sweden	90-94	0.20	0.06	0.62
Germany - UK	87, 91, 92	0.57	0.17	0.66
Germany - US	85, 87, 89-94	1.93	0.85	0.88
Italy – Japan	91	0.03	0.001	0.03
Italy - Netherlands	95	0.38	0.001	0.002
Italy - Sweden	91, 95	0.87	0.01	0.01
Italy – US	87, 89, 91, 93, 95	0.62	0.10	0.30
Japan - Netherlands	95-96	0.05	0.02	0.77
Japan - Sweden	91, 96	0.01	0.002	0.53
Japan – UK	90-96	0.27	0.02	0.13
Japan – US	90-96	1.19	0.21	0.36
Netherlands - Sweden	95-96	1.66	0.46	0.56
Netherlands - UK	95-96	1.00	0.34	0.68
Netherlands - US	95-96	0.73	0.25	0.70
Sweden - UK	91-92, 95-96	0.51	0.14	0.54
Sweden - US	90-96	0.43	0.07	0.33
UK – US	85, 87, 90-92, 95-96	3.56	1.53	0.86

*Multiplied by 100

Table 2: Total Sample

	Y1		Y2		Y3	
GDP	0.264***	0.257***	0.135***	0.121***	0.107***	0.095***
	(0.049)	(0.047)	(0.024)	(0.021)	(0.025)	(0.025)
ABSGDP	-0.150***	-0.176***	-0.048**	-0.060***	-0.012	-0.012
	(0.054)	(0.047)	(0.022)	(0.020)	(0.023)	(0.020)
SEND1	15.988	---	3.374	---	-19.363	---
	(29.030)		(15.009)		(24.230)	
SEND2	---	-0.006***	---	-0.002	---	0.005***
		(0.003)		(0.002)		(0.002)
CEND	0.316	0.405**	0.131	0.243***	0.106	0.262**
	(0.205)	(0.178)	(0.092)	(0.082)	(0.116)	(0.134)
RD	0.190***	0.187***	0.068***	0.077***	0.039***	0.060***
	(0.032)	(0.030)	(0.015)	(0.015)	(0.014)	(0.015)
LANG	2.518***	2.543***	1.152***	1.192***	0.273***	0.306***
	(0.129)	(0.120)	(0.070)	(0.074)	(0.063)	(0.086)
DIST	-1.2e-04***	-1.2e-04***	-5.3e-05***	-5.1e-05***	-5.0e-04***	-4.7e-04***
	(1.49e-05)	(1.31e-05)	(7.76e-06)	(7.31e-06)	(1.0e-04)	(1.1e-04)
CONS	-3.481***	-3.223***	-1.806***	-1.732***	-0.987***	-1.159***
	(0.618)	(0.637)	(0.319)	(0.303)	(0.337)	(0.314)
N	105	98	105	98	105	98
F($ß_i$=0)	103.86***	129.93***	88.98***	75.06***	12.16***	12.88***
R^2	0.80	0.85	0.76	0.81	0.38	0.45

Notes: 1. Heteroskedasticity consistent standard error (White, 1980) in parentheses

2. *, **, *** signify ten, five, and one per cent significance levels, respectively.

Table 3: EU-country pairs

	Y1		Y2		Y3	
GDP	0.108**	-0.042	0.043***	-0.028	-0.008	-0.074
	(0.044)	(0.057)	(0.015)	(0.022)	(0.046)	(0.055)
ABSGDP	-0.408***	-0.549***	-0.222***	-0.294***	-0.180*	-0.276***
	(0.098)	(0.093)	(0.044)	(0.042)	(0.089)	(0.094)
SEND1	170.658*	---	44.062	---	7.961	---
	(92.950)		(32.205)		(66.925)	
SEND2	---	-0.005	---	-0.001	---	0.009
		(0.007)		(0.003)		(0.008)
CEND	0.705***	-0.035	0.342***	0.056	0.001	-0.149
	(0.177)	(0.215)	(0.083)	(0.123)	(0.252)	(0.306)
RD	0.234***	0.143***	0.076***	0.042**	0.022	0.016
	(0.027)	(0.049)	(0.013)	(0.019)	(0.032)	(0.050)
LANG	---	---	---	---	---	---
DIST	-3.9e-04*	-1.9e-04*	-1.3e-04*	-0.8e-04***	-1.9e-03	-1.7e-03
	(2.7e-04)	(1.0e-04)	(8.6e-05)	(4.5e-05)	(1.9e-03)	(1.1e-03)
CONS	-1.715**	1.508	-0.634**	0.739*	0.857	1.784
	(0.774)	(0.945)	(0.268)	(0.373)	(0.791)	(0.948)*
N	31	27	31	27	31	27
F($ß_i$=0)	22.10***	26.84***	19.52***	19.22***	2.4**	4.02***
R^2	0.81	0.83	0.79	0.85	0.38	0.46

Notes: 1. Heteroskedasticity consistent standard error (White, 1980) in parentheses

2. *, **, *** signify ten, five, and one per cent significance levels, respectively.

Table 4: Non-EU country pairs

	Y1		Y2		Y3	
GDP	0.483***	0.440***	0.224***	0.197***	0.153***	0.128***
	(0.055)	(0.053)	(0.031)	(0.029)	(0.047)	(0.044)
ABSGDP	0.005	-0.100*	-0.006	-0.027	0.005	0.021
	(0.067)	(0.060)	(0.033)	(0.032)	(0.039)	(0.034)
SEND1	-28.867	---	-4.940	---	-24.367	---
	(40.880)		(24.613)		(35.570)	
SEND2	---	-0.008***	---	0.001	---	0.005**
		(0.004)		(0.002)		(0.002)
CEND	-0.157	0.135	-0.078	0.090	0.113	0.201
	(0.318)	(0.220)	(0.160)	(0.120)	(0.179)	(0.182)
RD	0.055	0.102***	0.022	0.044**	0.028	0.048*
	(0.041)	(0.030)	(0.022)	(0.019)	(0.027)	(0.025)
LANG	2.319***	2.287***	1.040***	1.076***	0.195***	0.257***
	(0.133)	(0.131)	(0.076)	(0.081)	(0.068)	(0.097)
DIST	-1.7e-04***	-1.9e-04***	-8.9e-05***	-8.4e-05***	-7.4e-04***	-5.9e-04***
	(2.1e-05)	(2.3e-05)	(1.2e-05)	(1.3e-05)	(1.5e-04)	(1.9e-04)
CONS	-5.415***	-4.800***	-2.526***	-2.360***	-1.424***	-1.510***
	(0.682)	(0.671)	(0.348)	(0.317)	(0.508)	(0.423)
N	74	71	74	71	74	71
F(ß$_i$=0)	126.65***	144.20***	93.52***	81.75***	13.05***	14.85***
R^2	0.87	0.91	0.84	0.87	0.50	0.55

Notes: 1. Heteroskedasticity consistent standard error (White, 1980) in parentheses

2. *, **, *** signify ten, five, and one per cent significance levels, respectively.

Table 5: Extensions – Openness Indicator

	Total Sample		EU Country Pairs		Non-EU country pairs	
	Y1	Y3	Y1	Y3	Y1	Y3
GDP	0.066*	0.023	-0.059	-0.050	0.262***	0.081***
	(0.036)	(0.017)	(0.051)	(0.069)	(0.085)	(0.029)
ABSGDP	-0.110*	0.022	-0.521***	-0.281***	0.145	0.103**
	(0.060)	(0.028)	(0.074)	(0.096)	(0.093)	(0.045)
SEND2	0.002	0.009***	-0.003	0.010	0.006	0.011***
	(0.004)	(0.002)	(0.006)	(0.009)	(0.004)	(0.002)
CEND	0.588***	0.363**	-0.086	-0.086	0.054	0.202
	(0.222)	(0.164)	(0.178)	(0.291)	(0.315)	(0.253)
RD	0.182***	0.062***	0.172***	0.038	0.079*	0.043*
	(0.033)	(0.016)	(0.051)	(0.052)	(0.049)	(0.025)
LANG	2.865***	0.288***	---	---	2.771***	0.261**
	(0.170)	(0.095)			(0.183)	(0.105)
OPEN	0.002***	0.001***	0.002**	0.001	0.001**	0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
CONS	-1.680**	-0.679**	0.995	1.004	-4.206***	-1.486***
	(0.681)	(0.316)	(0.875)	(0.845)	(1.294)	(0.403)
N	95	95	27	27	68	68
$F(\beta_i=0)$	67.26***	9.51***	27.61***	2.88**	52.74***	11.75***
R^2	0.73	0.31	0.86	0.43	0.78	0.43

Notes: 1. Heteroskedasticity consistent standard error (White, 1980) in parentheses

2. *, **, *** signify ten, five, and one per cent significance levels, respectively.

Table 6: Extensions – EU GDP

	Total Sample		EU Country Pairs		Non-EU country pairs	
	Y1	Y3	Y1	Y3	Y1	Y3
GDP	0.046*	0.035***	-0.133	-1.555	-0.434	-0.108
	(0.026)	(0.011)	(1.636)	(1.969)	(0.348)	(0.109)
ABSGDP	-0.264***	-0.105***	-0.531***	-0.224***	-0.803**	-0.250*
	(0.034)	(0.017)	(0.083)	(0.082)	(0.388)	(0.127)
SEND2	-0.002	0.005***	-0.007	0.006	0.002	0.006***
	(0.004)	(0.002)	(0.007)	(0.007)	(0.005)	(0.002)
CEND	-0.044	0.062	0.062	0.114	-0.111	0.132
	(0.242)	(0.146)	(0.270)	(0.274)	(0.362)	(0.178)
RD	0.110***	0.035**	0.157**	0.055	0.103**	0.048***
	(0.033)	(0.015)	(0.063)	(0.052)	(0.043)	(0.018)
LANG	2.374***	0.195**	---	---	2.318***	0.191**
	(0.166)	(0.083)			(0.180)	(0.089)
DIST	-1.1e-03***	-0.6e-03***	-1.5e-03	-0.9e-03	-1.4e-03***	-0.6e-03***
	(0.2e-0.3)	(0.1e-03)	(1.0e-03)	(0.9e-03)	(0.3e-03)	(0.1e-03)
CONS	0.367	0.089	1.997	14.387	9.215	2.573
	(0.349)	(0.177)	(14.310)	(17.620)	(6.360)	(2.039)
N	98	98	27	27	71	71
F($ß_i$=0)	101.11***	20.62***	27.72***	3.30**	83.47***	22.23***
R^2	0.80	0.51	0.82	0.44	0.83	0.58

Notes: 1. Heteroskedasticity consistent standard error (White, 1980) in parentheses

2. *, **, *** signify ten, five, and one per cent significance levels, respectively.

Appendix 1: Main equations in MV model.

1.1 Factor prices and total income.

The demand for labour in sector *Y* is derived from the production function of this industry:

$$Y_i = L_{iy}^{a} R_i^{1-a} \qquad with \quad i = h, f \quad and \quad 0 < a < 1 \qquad (A.1)$$

Factor prices are given by their marginal productivity in Y production since Y is the numeraire:

$$w_i = a\left(\frac{L_{iy}}{R_i}\right)^{a-1} \quad , r_i = (1-a)\left(\frac{L_{iY}}{R_i}\right)^{a} \quad i = h, f \qquad (A.2)$$

Equilibrium in labour market of country *i* is represented by:

$$\overline{L_i} = L_{iY} + L_i^n + L_i^m + L_j^m \quad with\ L_i^n = n_i l_i^n,\ L_i^m = m_i l_{ii}^m \quad and\ L_j^m = m_j l_{ji}^m \qquad (A.3)$$

where $\overline{L_i}$ is the total endowment in labour for country *I* and L_{iY} is the demand for labour from *Y*-industry.

There are no profits in the model and national income correspond to the sum of total factor rewards:

$$M_i = w_i L_i + r_i R_i \qquad i = h, f \qquad (A.4)$$

where M_i represents the total income. Full employment guarantee that $L_i = \overline{L_i}$ and $R_i = \overline{R_i}$.

These are the *"macro-conditions"* providing the general framework in which FDI and trade occur. In what follows we focus on the equilibrium in *X* industry.

1.2 Equilibrium in sector X.

The demand for *X* is derived from a Cobb-Douglas utility function homogenous of degree one.

$$U_i = X_{ic}^{b}\ Y_{ic}^{1-b}, \quad X_{ic} = n_i X_{ii}^{n} + n_j X_{ji}^{n} + m_i X_{ii}^{m} + m_j X_{ji}^{m} \qquad (A.5)$$

Given the properties of the utility function, expenditure for *X* is proportional to the elasticity *ß* and demand for *X* may be expressed as:

$$X_{ic} = b\ M_i / p_i \qquad (A.6)$$

As a consequence, price elasticity of demand is one and consumer assign a constant share of their income to spend on *X* and *Y*. Each firm sets its own price over its marginal cost and firm's markup may be represented by its market share:

$$e_{ij}^{k} = p_j X_{ij}^{k} / \beta M_j \qquad with \quad k = n, m \ \ and \ i, j = h, f \qquad (A.7)$$

The term β is the constant share of income spent on X and p_j denotes the price of X in country j. These prices will be identical for firms based in the same country since X is homogenous. But with positive transport costs and active national firms, prices and quantities differ between i and j because of higher marginal cost related to export.

The model is completed the model with the assumption that free entry condition drive profits to zero so that markup revenues cover exactly fixed costs as noted by the following equations:

$$p_i e_{ii}^{n} X_{ii}^{n} + p_j e_{ij}^{n} X_{ij}^{n} = w_i (G + F) \qquad with \quad i, j = h, f \ \ and \ i \neq j \qquad (A.8)$$

$$p_i e_{ii}^{m} X_{ii}^{m} + p_j e_{ij}^{m} X_{ij}^{m} = w_i (G + F) + w_j G \quad with \quad i, j = h, f \ \ and \ i \neq j \qquad (A.9)$$

Firms in X-industry fix their prices over their marginal cost and pricing equations may be expressed as:

$$p_i \left(1 - e_{ii}^{n}\right) = w_i \ c \qquad (A.10)$$

$$p_i \left(1 - e_{ij}^{n}\right) = w_i \ (c + t) \qquad (A.11)$$

$$p_i \left(1 - e_{ii}^{m}\right) = w_i \ c \qquad (A.12)$$

$$p_j \left(1 - e_{ij}^{m}\right) = wj \ c \qquad (A.13)$$

We do not write equations (*A.10*)-(*A.13*) in a complementary-slackness forms since we assume that right hand side are always positive and that all firms-types exist at the equilibrium with zero profit.

Equations (*A.10*)-(*A.11*) denotes the prices for type-*n* firms in *i* and *j* respectively, while (*A.12*) and (*A.13*) are for type-*m* firms in *i* and *j*.

Replacing (*A.7*) into (*A.10*)-(*A.13*) gives the following expressions for individual outputs:

$$X_{ii}^{n} = \beta M_i \frac{p_i - w_i c}{p_i^2} \qquad (A.14)$$

$$X_{ij}^{n} = \beta M_j \frac{p_j - w_i (c + t)}{p_j^2} \qquad (A.15)$$

$$X_{ii}^{m} = \beta M_i \frac{p_i - w_i c}{p_i^2} \qquad (A.16)$$

$$X_{ij}^{m} = \beta Mj \frac{p_j - w_j c}{p_j^2} \qquad (A.17)$$

Appendix 2: Further details concerning MV results.

Following MV, we can derive separately the impact of the exogenous variables on the equilibrium number of firms holding the other endogenous variables constant. Accordingly, I_{MV} increases when:

The overall market is large since FDI is a better option than exporting to reach foreign markets given the increasing return nature of the model. Multinationals avoid transport costs but have to cope with higher fixed costs, they have then to reach higher production levels than national firms to obtain non-negative profits. This constraint is being relaxed when market size allow multinational firms to cover their fixed costs with markup revenue. This can be formally represented by the impact of an increase in income for both countries as stated by MV:

$$dM_h = dM_f > 0 \quad \Rightarrow \quad dm_h = dm_f > dn_h = dn_f \geq 0$$

The ***markets are of similar size***, because different market sizes would provide a clear advantage for firms to locate in the large market and export a marginal part of their product to the disadvantaged (small) country. Type-*n* firms advantage would translate into type-*m* firms relative disadvantage and some (or all) of them would have to leave the market. From MV this means that:

$$dM_h = -dM_f > 0 \quad \Rightarrow \quad dn_h > dm_h = dm_f = 0 > dn_f$$

Factor endowments are similar, then the factor proportion differences and H-O arguments becomes less important for countries' specialization. With significant factor proportions differences countries would specialize according to their relative endowment in *L* and *R* and national firms would locate in the advantaged country (labour abundant). Export is a better option in this case since multinationals are constraint to produce in *high cost* countries by definition. The impact of a larger labour costs difference could be represented as:

$$dw_f = -dw_h > 0 \quad \Rightarrow \quad dn_h > dm_h > 0 > dm_f > dn_f$$

Firm-level scale economies are large relative to plant-level scale economies, i.e. *F* is large relative to *G*. Since multinationals incur twice the plant-fixed cost *G*, then they benefit from lowers *G*, i.e., relatively high *F* while national firms are less affected by this. Multinational profitability would then rise relatively to national firms. This can be represented formally by the impact of a symmetric change in plant vs. firm-specific cost:

$$dF = -dG > 0 \quad \Rightarrow \quad dm_h = dm_f > 0 > dn_f = dn_h$$

Transport costs are high, in this case export is simply a costly option compared to FDI. Following MV, we have:

$$dt > 0 \quad \Rightarrow \quad dm_h = dm_f = 0 > dn_h = dn_f$$

Appendix 3: Definitions of the Variables and data sources:

Variable	Description	Data Source
Y_{ij}	indicators of bilateral foreign employment, defined by equations (7), (8) and (9).	OECD database: Measuring Globalisation, The role of Multinationals in OECD economies, 1999 Edition and Stan Database, OECD to derive bilateral total employment in manufactures.
GDP	$\ln(GDP_i)+\ln(GDP_j)$, expressed in constant US dollars 1995	AMECO database, European Commission- DG ECFIN
ABSGDP	$abs(GDP_i-GDP_j)$, expressed in constant US dollars 1995	AMECO database, European Commission- DG ECFIN.
SEND1	$abs(SEND_i-SEND_j)$; difference in the share of employment in R&D activity relative to total employment in the country (*see note below).	OECD Science, Technology and Industry Scoreboard, Benchmarking Knowledge based economies, OECD 1999, and Stan database.
SEND2	$abs(SEND_i-SEND_j)$; difference in the percentage of students enrolled in secondary school education in the total population in the country	UNESCO and AMECO database, European Commission- DG ECFIN
CEND	$abs(CEND_i-CEND_j)$; difference in the physical capital stock per capita	AMECO database, European Commission- DG ECFIN
RD	$(\text{R\&D Expenditure / Total Employment})_i$ + $(\text{R\&D Expenditure / Total Employment})_j$	Research and Development Expenditure in Industry (ANBERD), OECD 1999
LANG	language dummy variable: 1- same language; 0 - different language	Jon Haveman database available at: http://www.eiit.org/Trade.Resources/TradeData.html
DIST	spherical distance between countries' capitals	Jon Haveman database available at: http://www.eiit.org/Trade.Resources/TradeData.html
$OPEN_{ij}$	$(X_{ij}+M_{ij})/(GDP_i+GDP_j)$, where X and M are bilateral exports and imports respectively.	International Trade by Commodities Statistics ITCS database, 1988-1997, OECD

* Note:

These numbers have been obtained using per ten thousands number of R&D workers (obtained from the OECD Science, Technology and Industry Scoreboard) and applying this to the total number of employees (obtained from Stan database).

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