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ABSTRACT

Investment Liberalization and International Trade

This Paper estimates the cross-price elasticity of exports with respect to investment costs for bilateral relations between 36 countries. We show that the effect of reducing foreign direct investment costs on exports depends on country characteristics and trade costs as predicted by the Markusen (1997, 2002) model. When countries differ in relative factor endowments and trade costs are low, investment liberalization stimulates exports, whereas when countries are similar in terms of relative factor endowments and size, and trade costs are moderate to high, investment liberalization reduces exports.

JEL Classification: F12, F14 and F23
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Investment Liberalization and International Trade

1. Introduction

The rapid growth in foreign direct investment (FDI) over the last few decades, from 5 percent of world GDP in 1980 to 10 percent in 1995 (World Investment Report, 1997), has spurred a large body of literature examining the determinants and effects of FDI. This rapid increase in FDI has occurred in the context of reductions in barriers to investment throughout the world, and the empirical evidence shows that investment liberalization stimulates FDI.[1] The effects of FDI can be wide reaching, with evidence suggesting that FDI impacts significantly on trade, employment and factor prices.[2] Much of the empirical literature on FDI and trade has focused on whether FDI stimulates or substitutes for trade, usually with exports regressed on some measure of FDI and some other control variables. As well as suffering from the obvious endogeneity problems, this approach has produced mixed results, with some studies finding FDI to have a positive impact on trade, and others a negative impact. This is hardly surprising given the variety of motives underlying FDI and the different types of FDI.

In this paper we focus on the trade relationship from quite a different perspective. We take account of the fact that reducing investment costs can stimulate different types of FDI in different circumstances, which in turn affects the impact on trade. According to theory, whether FDI promotes or substitutes for trade depends on the type of FDI stimulated (see Markusen 1997, 2002, and Markusen and Maskus 2002). If FDI is vertical, where multinational firms geographically split stages of production, this is likely to stimulate trade. Whereas, if FDI is horizontal, where multinational firms produce final goods in multiple locations, this is likely to substitute for trade. Unfortunately, it is not possible to separate the data into horizontal and vertical FDI. However, theory does provide some guidance by linking the type of FDI that is likely to arise to directly observable country characteristics.

Markusen (1997, 2002) provides a unified model where both horizontal and vertical FDI arise endogenously and depend on country characteristics, such as differences in relative skilled labor endowments and country size differences, and on the level of trade costs. Based on this model, we postulate a relationship between investment costs and exports that depends on these variables. We regress exports on country size differences, relative skill endowment differences, trade costs, and investment costs, and interactions of investment costs with these country characteristics, using bilateral country level data for 36 countries from 1986 to 1994.

Our approach contributes to a well-established empirical literature on the relationship between trade and FDI, in a number of ways. We overcome the inherent endogeneity problem prevalent in studies that include FDI as the explanatory variable by estimating the effects of the costs of direct foreign investment on exports. Investment costs can be thought of as the "price" of investment that is exogenous to firms. Our measure of investment costs is a comprehensive one, based on factors such as foreign investment controls, immigration laws, hiring and firing practices, anti-trust laws, state control of enterprises and the accessibility of local and foreign capital markets.[3] Whilst these measures could be criticized because of their subjective nature they can be defended as good indicators of the perceptions of multinational firms. The indices indicate an overall fall over the sample period from an average of 41.3 to 33.2, reflecting the investment liberalization that has taken place. Countries with the lowest investment cost indices include Denmark, Hong Kong and New Zealand and those with the highest include Indonesia, India and Korea.

Investment costs are interacted with country characteristics and trade costs. In this way, we allow for country heterogeneity in the relationship between trade and investment and test whether the theory's predictions are confirmed by the data. We show that the impact of investment liberalization on trade depends on country characteristics and trade costs as predicted by theory. When countries differ in relative factor endowments and trade costs are

low, investment liberalization stimulates exports. When countries are similar in size and relative factor endowments, and trade costs are high investment liberalization reduces exports.

These results are also interesting from a policy perspective, given that governments directly influence investment costs. A clear understanding of the implications of investment liberalization will also facilitate successful progress of WTO negotiations on the General Agreement on Trade in Services (GATS), affecting FDI restrictions. We have made a step in this direction by showing that investment liberalization has a significant impact on trade and providing estimates of the magnitude of these effects.

The remainder of this paper is set out as follows. Section 2 provides an overview of the empirical literature. Section 3 describes the theoretical framework and develops the hypotheses. Section 4 contains details of the data and discusses the results, and Section 5 presents a summary and conclusions.

2. Empirical Literature

Many studies have examined the relationship between trade and FDI by regressing exports on FDI and a host of other explanatory variables. Their results have been extremely mixed. Many of the early studies found that FDI stimulated exports, usually in cross-section regressions with either firm level or industry data (Blomström, Lipsey and Kuchycky 1988; Lipsey and Weiss 1981, 1984; Swedenborg 1979). However, Blomström *et al* found FDI substituted for exports in some industries and Belderbos and Sleuwaegen (1998) found that FDI substituted for trade in all industries.

Studies with pooled data also produced mixed results. With Swedish firm level data for 1974 to 1990, Svensson (1996) finds a negative relationship between bilateral exports and FDI for finished goods, positive for exports of intermediate goods, and a negative net effect that was

insignificant. However, when third country effects were included, the study showed a significant net substitution effect. With Austrian industry level data pooled across seven years, Pfaffermayr (1996) found a complementary relationship.

Using firm-level data for Japanese manufacturing firms, Head and Ries (2001) found a net complementary effect between trade and FDI, with substitution effects occurring for firms that do not export intermediate inputs. Blonigen (2001) disaggregates even further, using data at the product level for Japanese automobiles and parts plus 11 other final goods. He finds a substituting relationship between FDI and trade for nearly all products but a complementary one for cars. Using country level pooled data Clausing (2000) finds a positive coefficient on affiliate sales indicating complementarity between exports and FDI.

Simultaneity is a common problem with these studies since both exports and FDI are endogenous. Some studies have tried to overcome the endogeneity of FDI by using various econometric techniques such as two-stage least squares and three-stage least squares, with one-period lagged FDI used as the instrumental variable. There are two main problems with this approach. First, is the validity of the instrumental variable. If one-period lagged FDI is correlated with current FDI this implies it will also be serially correlated with exports, hence the issue of endogeneity is not properly addressed. Second, is the question of interpretation. It is not clear what structural equation is being estimated when regressing exports on FDI since both variables are chosen by the same agents: a firm must decide whether to serve a foreign market by exporting goods or by locating a plant in the foreign country. Hence, the firm may adjust the level of exports and FDI in response to some third factor.

In contrast to many studies, Clausing (2000) addresses the issue of endogeneity by regressing exports on taxes and average employee compensation, which are used as proxies for investment costs, in a gravity equation. Similarly, in a cross-sectional study of 33 countries for 1982, Grubert and Mutti (1991) estimated an export equation with effective tax rates as a

proxy for investment costs. Both studies found a complementary relationship. Clausing reports that an increase in the tax/income ratio of one percent reduces exports by 0.62 percent and an increase in average compensation of one percent reduces exports by 0.33 percent. It is not clear that employee compensation would be capturing differences in foreign direct investment costs – it is more likely to be picking up differences in human capital and/or differences in productivity, which would also stimulate FDI. Furthermore, there is some disagreement on how important tax policies are for attracting or repelling FDI. For instance, Markusen (1995, p.171) argues that there is little support for the idea that tax avoidance is an important motive for FDI. It seems that firms first choose foreign production locations and then minimize taxes.

Another limitation of previous studies is that they constrain the relationship between trade and FDI, or trade and 'price variables' to be the same across all countries. Pain and Wakelin (1998) tested whether the relationship between trade and FDI was indeed the same across countries. They regressed exports on outward and inward FDI, and a group of control variables, and tested whether the slope coefficients were the same across a sample of OECD countries: they found that there was significant country heterogeneity on the relationship between FDI and trade. We draw on Markusen (1997,2002) to explain this heterogeneity in analyzing the effect of investment costs in trade.

3. Theory of FDI

We link our empirical analysis to a theoretical framework developed by Markusen (1997, 2002), which allows horizontal and vertical FDI to arise endogenously.[4] Whether FDI is horizontal or vertical is relevant for this study as it affects the relationship predicted between international trade and investment costs. Markusen and Maskus (2002) draw out the implications of how direct foreign investment liberalization affects trade. In general, investment liberalization is expected to stimulate FDI. However, whether it also stimulates

trade depends on whether the increase in FDI is of the horizontal or vertical type. They show that investment liberalization stimulates trade if FDI is vertical and substitutes for trade if FDI is horizontal. The type of FDI stimulated by investment liberalization depends on the differences between country size, relative skill endowments and trade costs.

Model

The Markusen (1997, 2002) model has two countries, two factors of production (skilled and unskilled labor) and two sectors. The countries can differ in size and relative factor endowments. Both sectors produce homogenous goods: one is perfectly competitive with constant returns to scale technology; and the other is imperfectly competitive, with Cournot competition and free entry and exit, and increasing returns to scale technology both at the firm and plant level. It is this imperfectly competitive sector that is of interest for the purposes of our study. Firms in this sector have two production stages: headquarter services, which produce blueprints, formulas and managerial services, are assumed to use skilled labor intensive technology; and the final goods assembly stage, which uses unskilled labor intensive technology. International trade is subject to trade costs.

Three types of firms may emerge: (i) vertical multinational firms (MNEs), which have their headquarters in the source country and their final assembly plant in the host country; (ii) horizontal MNEs, which have their headquarter services in the source country and final assembly plants in both the host and the source country; and (iii) national firms. It is assumed that the fixed cost of setting up two plants is less than double the amount of a single-plant firm, giving rise to multi-plant economies of scale, which are relevant for horizontal MNEs. This is due to the joint-input property of the knowledge capital in the headquarter services. Firms choose whether to supply the foreign country by exporting or by setting up a local plant. Their choice depends on the multi-plant scale economies relative to the trade costs, and differences in country size and relative factor endowments.

The assumption of different relative factor intensities for different stages of production can provide a motive for vertical FDI, and positive trade costs can provide a motive for horizontal FDI. Markusen (1997, 2002) shows that horizontal MNEs dominate when countries are of similar size and relative factor endowments, provided that trade costs are not too low. The firm faces a tension between the cost of setting up an additional plant and the saving on trade costs. If trade costs are low, it is not worthwhile incurring the cost of setting up an additional plant; the firm would be better off exporting. However, if trade costs are high, firms have an incentive to serve the foreign country by producing the good abroad. Hence, this increased horizontal FDI would substitute for exports.[5]

If the two countries differ in relative factor endowments, one country has an advantage over the other in terms of factor prices, favoring vertical MNEs. Markusen (1997, 2002) shows that vertical MNEs are likely to dominate when factor proportions are very different between the two countries and trade costs are not too high. Here, there is an advantage in splitting different stages of production. With two stages of production, the firm would locate its headquarters in the relatively skilled-labor abundant country and its final production stage in the unskilled-labor abundant country. It is important that trade costs are not too high as vertical MNEs are associated with large volumes of intra-firm trade, with one country exporting headquarter services and importing final goods. Vertical MNE sales are particularly high when the source country (with the headquarter services) is small and skilled labor abundant and the host country is large and unskilled labor abundant, and transport costs are not too high. However, if countries differ in size but not in relative factor endowments then national firms located in the large country will be favored to avoid costly capacity in the small market.

From theory to data

In general, the model predicts that horizontal FDI substitutes for trade and vertical FDI creates trade. For example, suppose investment liberalization by country *j* stimulates

horizontal FDI from country *i*. Instead of exporting final goods to country *j*, a country *i* MNE will export headquarter services and produce final goods in country *j*. Hence, investment liberalization in country *j* will lead to a fall in exports of final goods from country *i* to *j*. And from the model, we know that horizontal FDI is more likely to arise when countries are similar in size and relative factor endowments and trade costs are not too low. This brings us to our first hypothesis:

Hypothesis 1: *When countries are similar in size and relative factor endowments, and trade costs are moderate to high, lower investment costs reduce exports (the cross price elasticity of exports with respect to investment costs is positive).*

Linking vertical FDI and trade is a little more complicated. To illustrate, suppose that investment liberalization by country *j* stimulates vertical FDI from country *i*. Now, instead of exporting final goods to country *j*, a country *i* MNE will export skill-intensive headquarter services and import unskilled-intensive final goods. Since headquarter services are unmeasured in the trade data we may not see this increase of exports. However, if we allow for trade in intermediate inputs then vertical FDI may in fact lead to an increase in exports from country *i* to *j*. Another complication arises when taking a two-country model to a multi-country world. In a multi-country world, country *j* may not necessarily export final goods back to country *i* but may use country *j* as a base to export to the rest of the world. Hence, the trade creating effect of vertical FDI may not necessarily show up in bilateral relations. To properly account for trade in intermediate inputs in a multi-country setting would require major extensions to the theoretical literature, which is beyond the scope of this paper. However, we can infer from existing theory that once we allow for trade in intermediate inputs and more than two countries, investment liberalization is more likely to stimulate exports (but may leave imports unchanged) when countries differ in relative factor endowments and size, and trade costs are low.[6] This brings us to our second hypothesis.

Hypothesis 2*: When countries differ in relative factor endowments and in size, and trade costs are low, then lower investment costs stimulate exports (the cross price elasticity of exports with respect to investment costs is negative).*

Of course there are always difficulties in taking theory to the data. In this case, the problem is compounded because the complexity of the model makes it impossible to derive closed form solutions so the results are generated using numerical simulations,[7] hence we do not know what functional form the reduced form equations should take. Furthermore, the model only considers cases where FDI is either banned or allowed so we need to infer the effects of gradual changes in investment costs. In light of this, we utilize the standard gravity model and augment it with investment costs, which we interact with trade costs and the country characteristics identified in the Markusen model in order to allow for country heterogeneity in the relationship between trade and investment costs. [8] We test our hypotheses by estimating the following equation:

$$\begin{aligned}\ln X_{ij} &= \beta_o + \beta_1 \ln Y_j + \beta_2 \ln Y_j + \beta_3 \ln PC_i + \beta_4 \ln PC_j + \beta_5 \ln DY_{ij} + \beta_6 \ln DSKILL_{ij} \\ &\quad + \beta_7 \ln TC_j + \beta_8 \ln DIST_{ij} + \beta_9 PTA_{ij} + \beta_{10} BD_{ij} + \beta_{11} LD_{ij} \\ &+ \gamma_1 \ln IC_j + \gamma_2 (\ln IC_j * \ln DY_{ij}) + \gamma_3 (\ln IC_j * \ln DSKILL_{ij}) + \gamma_4 (\ln IC_j * \ln TC_j) \\ &+ \delta_1 \ln IC_i + \delta_2 (\ln IC_i * \ln DY_{ij}) + \delta_3 (\ln IC_i * \ln DSKILL_{ij}) + \delta_4 (\ln IC_i * \ln TC_i) + \varepsilon_{jt}\end{aligned} \quad (1)$$

The dependent variable in equation (1), X_{ij}, is the nominal value of exports from country *i* to country *j*. Standard explanatory variables in gravity equations are country size, Y_i and Y_j measured by real gross domestic products; per capita incomes,[9] PC_i and PC_j; trade costs, TC_j, and distance $DIST_{ij}$. Trade is expected to be increasing in country size and per capita income ($\beta_1 > 0,\ \beta_2 > 0,\ \beta_3 > 0,\ \beta_4 > 0$) and decreasing in distance and trade costs ($\beta_7 < 0, \beta_8 < 0$). Gravity equations also usually include dummies such as a border dummy, BD_{ij}, preferential trading agreement dummies, PTA_{ij}; and a language dummy, LD_{ij}, which are all expected to be trade creating ($\beta_9 > 0, \beta_{10} > 0, \beta_{11} > 0$). This captures the possibility that

sharing a common border or language, or increased level of integration between countries may increase trade over and above that picked up by other variables.

Some gravity equations also include absolute differences in relative factor endowments (e.g., see Frankel *et al* 1995), which is expected to be trade creating. Similarly, we include the absolute difference in the relative skilled labor endowments between countries *i* and *j*, $DSKILL_{ijt} = \left| \frac{L_i^s}{L_i} - \frac{L_j^s}{L_j} \right|$ and expect $\beta_6 > 0$. We also include absolute differences in country size, DY_{ij}. We hypothesize that an increase in country size difference reduces exports, that is, intra-industry trade is maximized when countries are of equal size $\beta_5 < 0$ - this would be the case in a differentiated products model such as Helpman and Krugman (1995).

The main relationship we are interested in is how investment costs affect trade flows, where IC_j measures the cost of a foreign firm locating a plant in country *j*. The overall effect of reducing IC_j on trade flows from country *i* to *j* (i.e. the cross-price elasticity of exports with respect to investment costs) can be examined by taking the partial derivative of $\ln X_{ij}$ with respect to IC_j in equation (1):

$$\frac{\partial \ln X_{ij}}{\partial \ln IC_j} = \gamma_1 + \gamma_2 \ln DY_{ij} + \gamma_3 \ln DSKILL_{ij} + \gamma_4 \ln TC_{jt}. \qquad (2)$$

If investment liberalization stimulates horizontal FDI then exports from *i* to *j* should fall, hence $\frac{\partial \ln X_{ijt}}{\partial \ln IC_{jt}}$ would be positive. However, if investment liberalization stimulates vertical FDI then exports from *i* to *j* may rise, indicating that $\frac{\partial \ln X_{ijt}}{\partial \ln IC_{jt}}$ is likely to be negative.

We expect investment liberalization to stimulate horizontal FDI when countries are similar in terms of size and relative skill endowments, and trade costs are moderate to high (*Hypothesis 1*). Evaluating equation (2) when *DY* and *DSKILL* are small and trade costs are positive, we hypothesize the elasticity is positive for high values of trade costs, hence $\gamma_4 > 0$.

If countries differ in relative factor endowments, and trade costs are low, we expect investment liberalization to stimulate vertical FDI (*Hypothesis 2*), and hence the elasticity to be negative. Therefore we hypothesize that $\gamma_2 < 0, \gamma_3 < 0$.

It should be noted that the theory predicts a non-monotonic relationship between country size differences and FDI. The theory predicts that vertical MNEs dominate when size differences are large if the small country is relatively skilled labor abundant and the differences are not too large. In this case, we would expect that investment liberalization would lead to increased vertical FDI and increased trade. However, if the skilled labor abundant country is too small it may not be able to support any plants there. If the two countries were the same in terms of relative skill abundance but differed in size then national firms would dominate. In this case, we would expect that an increase in investment costs should reduce FDI and increase the number of national firms, but what happens to exports will depend on what type of FDI was reduced. We will try to capture some of these effects by splitting the interactive country size variable into different categories to indicate the differences in relative skill abundance.

The last line in equation (1) captures the idea that trade flows from *i* to *j* are not only affected by IC_j but also should be affected by IC_i.[10] For example, if a reduction in investment costs in country *i* stimulates vertical FDI from country *j*, then this should lead to increased exports from *i* to *j* since vertical FDI involves splitting up the production stages and possibly re-exporting final goods back to the host country. So line 3 of equation (1) could be thought of as explaining how investment costs affect trade flows from *i* to *j* when we think of that trade

flow as an export from *i* to *j*; and the last line can be thought of as explaining how investment costs affect trade flows from *i* to *j* when we think of trade flows from *i* to *j* as an import to country *j*.

Alternatively, we could estimate a value of trade (exports plus imports) equation to take account of investment costs affecting both exports and imports. But this would involve a more restricted formulation as it would constrain the parameters on the *i* and *j* variables to be equivalent. This would not be problematic in a two-country world but could be overly restrictive in a multi-country world. As discussed above, vertical FDI may not generate exports back to the host country in a multi-country world. Hence, *Hypothesis 1 and 2* are more likely to hold for exports than imports. We will explore this below.

Despite these limitations, the theory does provide a rich set of predictions that can be taken to the data. Although we do not take the theory 'literally', we do base our analyses closely to the theory.

4. Model Estimation

Data

The data set includes bilateral trade flows between 36 countries for the period from 1986 to 1994 inclusive. The data are not balanced in that the number of years and/or partner countries differs across reporting countries. Both OECD and developing countries are included in the sample. (The Appendix sets out details of the countries covered, data definitions and sources.) The trade data are from the World Bank, which uses data collected by the United Nations, reported in $US. The dependent variable in equation (1), X_{ij}, is free on board (fob) nominal value of all manufactured exports from country *i* to country *j*.[11]

Country size is measured by real GDP in US$, obtained from International Financial Statistics. Real GDP figures in local currencies were converted into dollars using the market exchange rate. Data on skilled workers are from the International Labor Office. The difference in country size is the absolute difference in real GDP of country *i* and *j* (DY_{ij}). Skilled workers are defined as those working in managerial and professional occupations. This is included as the absolute difference between the ratio of skilled labor to total employment in country *i* and *j* ($DSKILL_{ij}$).

The trade cost index, TC_j , is a simple average of several indices of impediments to trade taken from the World Competitiveness Report, as in Carr *et al*., (2001). This index ranges from 0 to 100, with higher values reflecting higher trade barriers. It is constructed from a survey where companies are asked whether national protectionism prevents foreign goods from being imported, hence it is likely to capture the incidence of both tariff and non-tariff barriers. [12] The distance variable measures the great circle distance in kilometers between each country's capital cities.

Three different types of dummies are included: (i) a border dummy, which takes on the value of one if countries share a border; (ii) there are four preferential trading agreement dummies included, taking the value of one if both countries *i* and *j* belong to the same PTA – the Atlantic Free Trade Agreement (AFTA), the European Union (EU), the Association of South East Asian Nation (ASEAN) and CER. The AFTA dummy takes a value of one for trade between Canada and US after 1989. The EU dummy equals one for trade between Belgium, Denmark, France, Germany, Greece, Italy, Netherlands, Ireland, Portugal, Spain and UK. The ASEAN dummy takes on a value of one for trade between Indonesia, Malaysia, Philippines, Singapore and Thailand. The CER takes on the value of one for trade between Australia and New Zealand; (iii) the language dummy takes a value of one if both country *i* and *j* share the same main language.

The cost of investing in the affiliate country is a simple average of several indices of impediments to investment. These include factors such as government restrictions on foreign companies acquiring domestic control, immigration rules covering hiring and firing practices, restrictions on raising capital and anti-trust laws reported in the World Competitiveness Report of the World Economic Forum. These indices are computed on a scale of 0 to 100, with a higher number indicating higher investment costs. The index is calculated as a simple average of scores given to ten different questions. Details of the questions asked in calculating this index are provided in the Appendix. The survey is an extensive one: it is sent to top and middle executives in 47 countries. In 1999, it was reported that 4,160 executives completed and returned their questionnaires (see World Economic Forum, 1999).

Results

We estimate equation (1) for each year in the sample (1986 to 1994) separately using OLS. For completeness and to check robustness we present the results for each year in Table 1, however we will mainly focus our discussion of the results for the most recent year in the sample, 1994.

In Table 1, the first column of 1a and the second-last column of 1b, headed 1986g and 1994g respectively, present the results for the gravity equations without investment costs; and the columns in-between headed 1986 to 1994 present the results of the gravity equation augmented with investment costs, equation (1). We test the null hypothesis that $H_o : \delta_i = \gamma_i = 0$ in equation (1). The F-tests reject the null hypothesis, indicating that the investment cost variables with the interactions are statistically significant, with $F^{1986} = 29.73 > F_{0.05}(8,\infty) = 1.94$ and $F^{1994} = 13.77 > F_{0.05}(8,\infty) = 1.94$.

[Tables 1a and 1b here]

For most years, the standard gravity variables have the expected signs. Exports from country *i* to *j* are increasing in the size of country *i* and *j*. The coefficients on $\ln Y_i$ and $\ln Y_j$ are both positive and significant for all years. The coefficient on $\ln PC_i$ is positive and significant for all years but $\ln PC_j$ is insignificant for most years. The coefficient on distance is negative and significant with an elasticity ranging from 0.7 to 0.9. The trade cost index is also negative and significant for most years. Out of the preferential trading agreement dummies, ASEAN is the only one that is positive and significant indicating that the agreement is trade enhancing. The other PTA dummies may be insignificant due to the small number of observations, for example the CER dummy only takes a value of one for two observations each year. The border dummy is positive and significant for most years and the language dummy for all years.

Of particular interest to this study are the signs on the interactive investment cost terms. First, consider the interactive $\ln IC_j$ terms, which estimate the effect of exports from *i* to *j*, when country *j* reduces its exports. All have the hypothesized signs, except country size differences. Investment liberalization stimulates exports when countries differ in relative skill labor endowments (the coefficient on $\ln IC_j * \ln DSKILL_{ij}$ is negative), whereas investment liberalization reduces exports when trade costs are high (the coefficient on $\ln IC_j * \ln TC_j$ is positive).

Second, consider the interactive $\ln IC_i$ terms, which estimate the effect of exports from *i* to *j* (or imports to *j*) when country *i* reduces its investment costs. We see from Table 1 that the relative skill endowment variable is insignificant for most years. This probably reflects the third country effects discussed above. Even if investment liberalization stimulates trade creating vertical FDI it may not show up in re-exports back to the host country. The trade cost variable switches signs from being negative in the early years to being insignificant or

positive in the later years. As the model does not predict any re-exports from the source to the host country in the case of horizontal FDI, it is not clear from the model what sign we should expect.

Alternatively, if we estimate a value of trade equation with $\ln VT_{ij}$ as the dependent variable

$$\ln(X_{ij} + X_{ji}) = \alpha_0 + \alpha_1(\ln Y_i * \ln Y_j) + \alpha_2(\ln PC_i * \ln PC_j) + ... + \lambda_1(\ln IC_i * \ln IC_j) + \lambda_2(\ln IC_i * \ln IC_j * DSKILL_{ij}) + ... \quad (3)$$

a lot of this information would be hidden because the coefficients on the *i* and *j* variables are constrained to be the same. For example, the coefficient on the interactive $DSKILL_{ij}$ is constrained to equal λ_2 for both countries. From the last column in Table 1b, we see that this is insignificant whereas the $\ln X_{ij}$ equation headed 1994 in Table 1b indicates the effect of $DSKILL_{ij}$ is significant when interacted with $\ln IC_j$ but insignificant when interacted with $\ln IC_i$. (Similarly, the coefficient on per capita income, α_2, is also insignificant when $\ln PC_i$ and $\ln PC_j$ are constrained to have the same effect).

The coefficient on the interactive country size term ($\ln DY_{ij} * \ln IC$) has an unexpected positive coefficient when interacted with IC_i and with IC_j. We hypothesized that investment liberalization between countries that differ in size would promote vertical FDI and hence increase trade. However, recall that the theory predicted a more complicated relationship than this. For example, the theory predicts that country size difference would promote vertical FDI only between countries that also differed in relative factor endowments, and particularly if the small country is the skill abundant country. To test this, we split the interactive country size term into four categories: (i) the source country is skill labor abundant and large; (ii) the source country is skill labor abundant and small; (iii) the destination country is skill labor abundant and large; and (iv) the destination country is skill labor abundant and small. It turns out that the coefficients on all these categories are positive. One possible explanation for this

positive coefficient relates to the presence of national firms in the Markusen (1997, 2002) model where differences in country size can give rise to comparative advantage. Hence, the bigger the country size differences the more national firms relative to MNEs - a fall in investment costs stimulates FDI, which replaces these national firms that may have been big exporters.

Sensitivity Analysis

Given that the investment cost and trade cost variables are based on survey data, we check the robustness of the results by re-estimating equation (1) with a dichotomous investment cost variable which takes the value of one for values greater than the median and zero for values less than median, reported in Table 2 below in column 1 for 1994.[13] Similarly, for the trade cost index, we construct a variable that takes a value of one for all values greater than the median and zero for less than the median, reported in column 2. Column 3 reports the results of estimating equation (1) with both the investment cost variable and the trade cost variable dichotomous. Finally, we re-estimate equation (1) omitting trade with the US to ensure that it is not driving the results. It is clear from Table 2 that the results are robust across all these specifications.

[Table 2 here]

Interpretation of results

The relationship of most interest to us is that between investment costs and trade flows. We can explore this further by taking the partial derivative of exports with respect to investment costs. Using the results for 1994, the cross-price elasticity can be calculated as follows:

$$\left(\frac{\partial \ln X_{ij}}{\partial \ln IC_j}\right)^{1994} = -5.15 + 0.13 \ln DY_{ij} - 0.27 \ln DSKILL_{ij} + 0.81 \ln TC_{jt} \qquad (4)$$

The results support our hypotheses. In *Hypothesis 1*, we stated that investment costs reduce exports if countries are similar in size and relative factor endowments, and trade costs are

medium to high. Evaluating equation (4) for the case where countries are similar, for small values of DY_{ij} and $DSKILL_{ij}$ the cross-price elasticity is likely to be positive as hypothesized since the coefficients on the trade cost variable is positive.

In *Hypothesis 2* we stated that investment liberalization promotes trade if countries differ in terms of relative factor endowments and trade costs are low. Evaluating equation (4) for low levels of trade costs, we see that the cross-price elasticity is likely to be negative as hypothesized since the coefficient on the difference in relative skill endowments is negative. However, this effect would have to outweigh the positive effect of country size difference. This is consistent with the Markusen model, which predicts that differences in relative factor endowments generate vertical FDI and trade provided that the country size differences are not too large. When country size differences are too large, the small country cannot support any plants there.

Using data from 1994, we can evaluate equation (4) with the mean values of the data to see if the cross-price elasticity is positive or negative. We find a small negative cross-price elasticity equal to –0.15, which is lower than that in 1986 of –0.53. This average effect across the sample masks much interesting information. In fact, evaluating equation (4) at the actual values for each observation indicates that 70 percent of the observations generate a negative elasticity and 30 percent a positive elasticity in 1994. The number of observations with negative elasticities has fallen from 87 percent in 1986. The fall in trade cost over this period should encourage more vertical FDI but this has been offset by the increase in similarities in relative skill endowments and increasing differences in country size.

The overall effect of investment costs on exports is conditional on the country characteristics and trade costs. To provide more insight into these relations, we hold the values of all the variables in equation (4) for 1994 fixed at their means and vary one variable at a time to find

the critical value that changes the sign of the elasticity. For example, to find the critical value of *DY* we estimate equation (4) at the mean values of all the variables (denoted by bars) in equation (5) and let *DY* vary. The critical value of *DY* at which this derivative equals zero is US$2.54 billion. This partial derivative is positive for all values of *DY* above this critical value, for which there are 11% observations, and negative for all values below.

$$\frac{\partial \ln X_{ijt}}{\partial \ln IC_{jt}} = -5.15 + 0.13 \ln DY_{ij} - 0.27 \ln \overline{DSKILL}_{ij} + 0.8 \ln \overline{TC}_{j} > 0 \quad if \quad DY_{ij} = 2.54 bil. \qquad \textbf{(5)}$$

We repeat this exercise for the other variables and summaries the results in Table 3 below. The results indicate that there are observations that fall above and below the critical values for all of the variables.

[Table 3 here]

Varying the trade cost variable, whilst holding the other variables constant at their means, we find that around 28 percent of the observations give positive cross-price elasticities. The countries with trade cost indices above the critical value are Korea, Japan, India, Indonesia, Brazil, Venezuela, Philippines, Switzerland, Israel, Norway (in descending order). For the skill difference variable, around 65% of the observations give negative cross price elasticities. Examples of countries with the largest skill differences include Indonesia and India relative to UK, Sweden and Norway. Table 4 lists the cross-price elasticities by country *j*, indicating for each country *j* the country *i* with the highest and the lowest elasticities i.e. the country whose exports are most affected by the investment liberalization.

[Table 4 here]

These results indicate that there is a great deal of variation in the cross-price elasticities for each country pair, ranging from a high positive elasticity of 2.3 percent for exports from Korea to Philippines to a high negative elasticity of –2.46 for exports from New Zealand to Columbia. We highlight in bold all of the countries with elasticities above one in absolute

value. The country pairs with negative elasticities above one clearly differ significantly in relative skill endowments, for example, Columbia and NZ, Indonesia and Denmark, Argentina and Belgium, Australia and Korea, Chile and NZ, Greece and Indonesia. In contrast, investment liberalization substitutes for trade between countries with similar factor endowments, like France and Switzerland, and UK and Sweden.

5. Conclusions

This paper estimates the effects of investment liberalization on trade flows between 36 countries. Whether investment liberalization stimulates exports depends on the type of FDI that it generates. For example, vertical FDI is expected to stimulate trade whereas horizontal FDI is expected to substitute for trade. We develop an approach based on a theoretical model by Markusen (1997, 2002), which links country characteristics and trade costs to whether horizontal or vertical FDI would dominate. This model is used to generate testable hypotheses of the relationship between trade and foreign direct investment costs.

We generate new findings, showing that the impact of investment costs on trade does depend on country characteristics and trade costs as predicted by theory. The results show that investment liberalization stimulates exports when countries differ in relative skill endowments provided trade costs are low. In this case the theory predicts vertical FDI is likely to dominate with MNEs geographically splitting stages of production and engaging in intra-firm trade. In contrast, we find that investment liberalization reduces exports when countries are similar in relative skill endowments, and trade costs are high. In this case the theory predicts horizontal FDI is likely to dominate with MNEs serving foreign markets by producing abroad instead of exporting.

Both types of relationship are prevalent in our sample. In 1994 investment liberalization reduces exports in 70 percent of the observations; and in the remaining 30 percent of the

observations investment liberalization promotes exports. Furthermore, the relationship is not static over time. As country characteristics and trade costs change over time so too does the impact of investment liberalization on trade. This is evident from comparing the annual cross-price elasticities: with a negative cross price elasticity in 1986 equal to –0.53 (with 87 percent of the observations having a negative elasticities) to –0.15 in 1994 (with 70 percent negative elasticities).

These results are also useful in providing a framework for understanding why previous studies on the effects of FDI on trade that constrained the relationship to be the same across all countries gave conflicting results. The sample years and countries under study will influence whether the relationship is positive or negative. For example, investment liberalization is likely to stimulate trade between countries that differ significantly in factor endowments such as Columbia and New Zealand, but substitute for trade between countries like UK and Sweden. Studies that constrain the relationship to be the same across all countries mask much interesting information. Our study shows that these heterogeneous relationships are not *ad hoc* - they depend on country characteristics and trade costs in a systematic way.

This finding is also interesting from a policy perspective as the results show that the impact of investment liberalization on trade is not uniform across all countries. The results imply that further investment liberalization between countries that are similar in relative factor endowments, such as OECD countries, is likely to lead to higher FDI, with this substituting for trade. However, if investment liberalization is coupled with trade liberalization then both FDI and trade may be stimulated. When investment liberalization takes place between countries that differ substantially in relative factor endowments, such as developed and developing countries, this is likely to promote both FDI and trade provided trade costs are not too high. Of course, reducing trade costs as well as investment costs enhances this result.

Appendix: Data Sources and Definitions

Name of Variable	Definition	Source
$\mathbf{X_{ij}}$	Exports f.o.b. (i.e. without freight costs) for all trade in manufacturing goods – an aggregation of ISIC 311 to 390.	World Bank based on UN Comtrade database www.worldbank.org/research/trade
$\mathbf{Y_j}$, $\mathbf{Y_i}$	Real GDP is measured in billions of 1990 US $. Real GDP figures in local currencies were converted into dollars using the market exchange rate.	International Financial Statistics (IFS).
Population		Global Development Finance and World Development Indicators
$\mathbf{DSKILL_{ij}}$	Absolute differences in relative skill labor endowments between country *i* and *j*. The skilled labor category includes employment in occupational categories 0/1 and 2 i.e. professional, technical and related workers and administrative and managerial workers, over total employment.	Yearbook of Labor Statistics, International Labor Office.
$\mathbf{IC_j}$	Index ranging from 0 to 100	World Economic Forum
$\mathbf{TC_j}$	Index ranging from 0 to 100.	World Economic Forum
Distance	Distance between capital cities in 1000 kilometers	http://www.eiit.org/
language and border dummies		http://www.eiit.org/

Partner Countries:

Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Colombia, Denmark, Finland, France, Germany, Greece, Hong Kong, India, Indonesia, Ireland, Israel, Italy, Japan, South Korea, Malaysia, Mexico, Netherlands, New Zealand, Norway, Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, Turkey, United Kingdom and Venezuela. Note that bilateral trade flows reported by Belgium, Brazil and Israel were unavailable but trade flows from the other countries to these countries are in the sample.

Table A1: Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
$\mathbf{X_{ij}}$ (US$'000)	1.65E+09	5.90E+09	521	1.16E+11
Y ($'mil)	509,841.1	1,038,976	23,430	6,183,600
DY ($'mil)	773,659.9	1,324,948	20	6,144,500
PC	12,988.91	9,298	301.73	34,028.61
DSKILL	0.10	0.08	6.53E-06	0.45
IC INDEX	38.69	11.20	15.3	79.43
TC INDEX	34.89	15.03	6	85.08
DISTANCE (km)	8,204.25	5,159.07	174.024	19,868.12

Table A2: Correlation Matrix

	X_{ij}	Y_{jj}	DY_{ij}	$PC_{\underline{1}}$	$DSKILL_{ij}$	IC_j	TC_j
Y_{jj}	0.33	1					
DY_{ij}	0.31	0.64	1				
PC_j	0.16	0.33	0.19	1			
$DSKILL_{ij}$	-0.07	0.00	-0.01	0.05	1		
IC_j	-0.14	-0.20	-0.14	-0.57	0.02	1	
TC_j	-0.07	-0.01	-0.02	-0.31	0.07	0.71	1
$DIST_{ij}$	-0.21	-0.02	-0.01	-0.22	-0.01	0.08	0.07

Construction of IC index

The World Economic Forum conducts extensive surveys, in which it asks participants to give a score between 0 and 100 in response to a number of questions. The IC index is a simple average of the following scores:

1. FIC: Foreign investor controls: "Foreign investors may not acquire control in a domestic company or are free to acquire control in a domestic company".
2. IMM: "Immigration laws prevent your company from employing foreign skills or do not prevent your company from employing foreign skills".
3. CBV: "Cross-border ventures cannot be negotiated with foreign partners without government imposed restraint or can be negotiated freely"
4. HFP: "Hiring and Firing Practices are too restricted by government or are flexible enough".
5. ATL: "Anti-trust laws do not prevent unfair competition in your country or do prevent unfair competition in your country".
6. JUS: Justice. "There is no confidence in the fair administration of justice in the society or there is full confidence in the fair administration of justice in society"
7. SCE: "State Control of Enterprise distorts fair competition in your country or does not distort fair competition in your country.
8. LCM: "Local capital markets are not accessible to foreign companies or are equally accessible to domestic and foreign companies".
9. FCM: Foreign capital markets. "Access to foreign capital markets is restricted for domestic companies or is not restricted for domestic companies"
10. IPR: "Intellectual property rights are inadequately protected in your country or is adequately protected in your country"

Table A3: Mean by country

Country j	X_{ij}	Y_j	DY_{ij}	PC_j	$DSKILL_{ij}$	TC_j	IC_j	$DIST_{ij}$
Argentina	4.24E+09	198,650	533843	5791	0.08	21.80	36.94	11851
Australia	9.10E+09	326,650	561175	18303	0.10	20.50	28.06	13035
Austria	1.26E+09	171,930	532119	21418	0.08	23.80	24.82	6136
Belgium	1.02E+10	203,900	517817	20157	0.10	10.60	29.19	5922
Brazil	7.42E+09	487,120	621001	3099	0.08	39.60	47.67	10438
Canada	1.06E+11	604,100	707409	20649	0.14	22.80	28.37	8251
Chile	2.57E+09	40,110	575081	2866	0.09	15.80	31.33	12070
Colombia	3.79E+09	47,670	568286	1261	0.08	20.80	40.64	10408
Denmark	1.09E+09	138,810	533823	26669	0.07	10.80	17.55	6057
Finland	9.16E+08	124,670	537087	24498	0.14	21.70	27.72	6193
France	1.23E+10	1,236,530	1136588	21346	0.08	28.10	35.24	6179
Germany	1.76E+10	1,768,890	1583084	21700	0.07	17.40	21.54	6087
Greece	6.68E+08	86,620	549361	8308	0.08	14.10	37.56	6530
Hong Kong	9.90E+09	39,100	576058	6519	0.09	6.80	19.26	9104
India	2.21E+09	365,280	578148	400	0.16	51.60	47.81	7959
Indonesia	2.59E+09	138,410	548792	725	0.17	44.70	48.84	10699
Ireland	3.24E+09	52,670	564776	14751	0.07	9.30	23.51	6296
Israel	4.47E+09	65,480	574384	12128	0.12	36.06	30.32	6644
Italy	6.25E+09	1,123,700	1049236	19673	0.07	28.40	44.10	6328
Japan	4.48E+10	3,144,240	2825335	25162	0.08	52.80	35.75	9135
Korea	1.64E+10	333,980	564013	7513	0.13	61.60	61.83	8796
Malaysia	6.70E+09	59,270	561213	2948	0.09	25.10	38.88	9690
Mexico	4.62E+10	284,080	548772	3172	0.10	19.80	36.68	10097
Netherlands	1.21E+10	304,680	554088	19809	0.11	13.90	25.15	6088
NZ	1.35E+09	47,690	568271	13434	0.09	7.90	19.01	14066
Norway	1.10E+09	133,240	534875	30725	0.15	34.20	31.13	6122
Philippines	3.42E+09	47,150	568722	687	0.13	38.20	48.46	9626
Portugal	8.42E+08	78,880	552357	7966	0.08	14.50	36.29	6812
Singapore	1.25E+10	52,060	565169	17767	0.07	18.70	23.65	9848
Spain	3.76E+09	511,120	653420	13058	0.07	22.90	39.28	6610
Sweden	2.23E+09	223,540	537055	25458	0.17	18.20	26.29	6117
Switzerland	3.64E+09	226,250	520780	32349	0.07	36.60	25.98	5989
Turkey	2.59E+09	165,220	532119	2767	0.12	21.70	37.28	6579
UK	2.33E+10	1,021,380	976622	17491	0.17	12.70	20.84	6173
USA	2.35E+09	6,183,600	5766652	23756	0.13	27.20	23.51	8563
Venezuela	3.67E+09	55,090	563371	2577	0.08	38.70	46.76	9845

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References

Baldwin, Richard E. and Gianmarco I.P. Ottaviano, 2001, Multiproduct multinationals and reciprocal FDI dumping, Journal of International Economics 54(2), 429-448.

Belderbos, René and Leo Sleuwaegen, 1998, Tariff Jumping DFI and export substitution: Japanese electronics firms in Europe, International Journal of Industrial Organization 16, 601-638.

Blomström, M., R.E. Lipsey, and K. Kulchycky, 1988, US and Swedish Direct Investment and Exports, in: Richard Baldwin, ed., Trade Policy Issues and Empirical Analysis, University of Chicago Press, 259-297.

Blonigen, Bruce A., 2001, In Search of Substitution Between Foreign Production and Exports, Journal of International Economics 53(1). 81-104.

Braconier, Henrik and Karolina Ekholm 2000, Swedish Multinationals and Competition from High and Low-Wage Locations, Review of International Economics 8(3), 448-61.

Brainard, S. Lael. 1997, An Empirical Assessment of the Proximity-Concentration Trade-off Between Multinational Sales and Trade, American Economic Review 87(4), 520-544.

Brainard, S. Lael, 1993, An Empirical Assessment of the Factor Proportions Explanation of Multinational Sales, NBER Working Paper No. 4583.

Brainard, S. Lael and D.A. Riker 1997, Are Multinationals Exporting US Jobs?, NBER Working Paper 5958.

Carr, David L., James R. Markusen, and Keith E. Maskus, 2001, Estimating the knowledge-capital model of the multinational enterprise, American Economic Review 91(3), 693-708.

Clausing, Kimberly A., 2000, Does Multinational Activity Displace Trade?, Economic Inquiry, 38(2), 190-205.

Ekholm, Karolina, 1995, Multinational Production and Trade in Technological Knowledge, Lund Economic Studies No. 58.

Feenstra, Robert C. and Gordon H. Hanson, 1997, Foreign Direct Investment and Relative Wages: Evidence from Mexico's Maquiladoras, Journal of International Economics 42, 371-393.

Frankel, Jeffrey A., Ernesto Stein and Shang-jin Wei 1995, Trading Blocs and the Americas: The natural, the unnatural, and the super-natural, Journal of Development Economics 47, 61-95.

Grubert, Harry and John Mutti, 1991, Taxes, Tariffs, and Transfer Pricing n Multinational Corporate Decision Making, Review of Economics and Statistics, 285-293.

Harrigan, James 1993, OECD Imports and Trade Barriers in 1983, Journal of International Economics, 35 (1-2), 91-111.

Head, Keith and John Ries, 2001, Overseas Investment and Firm Exports, Review of International Economics 9, 108-122.

Helpman, Elhanan 1984, A simple theory of international trade with multinational corporations, Journal of Political Economy 92, 451-472.

Helpman, Elhanan and Paul R. Krugman, 1995, Market Structure and Foreign Trade, MIT.

Lipsey, R.E. and M.Y. Weiss, 1984, Foreign Production and Exports of Individual firms, Review of Economics and Statistics 66, 304-308.

Lipsey, R.E. and M.Y. Weiss, 1981, Foreign production and exports in manufacturing industries, Review of Economics and Statistics 63, 488-494.

Markusen, James R., 2002, Multinational Firms and the Theory of International Trade, Cambridge: MIT Press, forthcoming.

Markusen, James R., 1997, Trade versus Investment Liberalization, NBER Working Paper No. 6231.

Markusen, James R., 1995, The Boundaries of Multinational Enterprises and the Theory of International Trade, Journal of Economic Perspectives 9(2), 169-189.

Markusen, James R., 1984, Multinationals, multi-plant economies, and the gains from trade, Journal of International Economics 16, 205-226.

Markusen, James R. and Keith E. Maskus 2002, General-Equilibrium Approaches to the Multinational Firm: A Review of Theory and Evidence, in: James Harrigan ed., Handbook of Empirical International Trade, London: Blackwell, forthcoming, also NBER working paper 8334.

Markusen, James R. and Anthony J. Venables, 2000, The Theory of Endowment, Intra-industry and Multinational Trade, Journal of International Economics 52(2), 209-234.

Markusen, James R. and Anthony J. Venables, 1998, Multinational Firms and New Trade Theory, Journal of International Economics 46(2), 183-203.

Pain, Nigel and Katharine Wakelin, 1998, Export Performance and the Role of Foreign Direct Investment, The Manchester School 66, 62-88.

Pfaffermayr, Michael, 1996, Foreign Outward Direct Investment and exports in Austrian Manufacturing: Substitutes or Complements? Welwirtschaftliches 132(3), 501-522.

Svensson, Roger, 1996, Effects of overseas production on home country exports: evidence based on Swedish multinationals, Weltwirtscaftliches Archiv, 132(2), 304-329.

Swedenborg, Birgitta, 1979, The Multinational operations of Swedish firms. Stockholm: Industriens Utredningsinstitut.

World Economic Forum, 1999, World Competitiveness Yearbook, Lausanne, Switzerland: International Institute for Management Development.

World Investment Report 1997, Transnational Corporations, Market Structure and Competition Policy, United Nations Conference on Trade and Development.

Table 1a: Results 1986-1990

	1986g	*1986*	*1987*	*1988*	*1989*	*1990*
$\ln Y_i$	0.54	0.74	0.75	0.76	0.74	0.76
	(12.35)	(17.26)	(17.12)	(17.05)	(17.24)	(17.26)
$\ln Y_j$	0.64	0.68	0.67	0.66	0.67	0.77
	(13.93)	(15.40)	(15.05)	(14.35)	(15.38)	(17.10)
$\ln PC_i$	0.51	0.11	0.15	0.13	0.13	0.12
	(12.59)	(2.20)	(2.88)	(2.54)	(2.68)	(2.60)
$\ln PC_j$	-0.05	-0.06	-0.06	0.02	-0.05	-0.15
	(-1.01)	(-1.11)	(-1.08)	(0.35)	(-0.84)	(-2.60)
$\ln DY_{ij}$	0.30	-2.56	-2.72	-2.91	-2.71	-2.80
	(8.11)	(-6.50)	(-6.27)	(-6.33)	(-5.86)	(-6.48)
$\ln DSKILL_{ij}$	0.12	0.39	0.88	1.98	2.12	0.89
	(2.98)	(0.64)	(1.25)	(2.77)	(3.22)	(1.36)
$\ln TC_j$	-0.85	-5.20	-6.14	-8.11	-11.20	-1.51
	(-6.81)	(-4.63)	(-4.69)	(-4.53)	(-5.96)	(-1.32)
$\ln DIST_{ij}$	-0.92	-0.87	-0.90	-0.87	-0.84	-0.89
	(-14.93)	(-15.20)	(-15.67)	(-15.02)	(-15.32)	(-16.53)
EU_{ij}	-0.04	0.06	0.01	-0.10	-0.05	-0.28
	(-0.21)	(0.39)	(0.06)	(-0.57)	(-0.30)	(-1.76)
$AFTA_{ij}$						-0.31
						(-0.34)
CER_{ij}	0.94	1.38	1.35	1.45	1.57	1.13
	(0.93)	(1.51)	(1.46)	(1.53)	(1.74)	(1.28)
$ASEAN_{ij}$	2.60	2.71	2.54	2.41	1.96	2.08
	(5.78)	(6.48)	(6.02)	(5.62)	(4.82)	(5.27)
BD_{ij}	0.08	0.26	0.35	0.36	0.37	0.42
	(0.33)	(1.18)	(1.55)	(1.56)	(1.67)	(1.94)
LD_{ij}	1.10	1.00	0.87	0.89	0.83	0.63
	(7.60)	(7.37)	(6.31)	(6.29)	(6.11)	(4.77)
$\ln IC_j$		-9.13	-10.66	-12.90	-16.39	-5.75
		(-6.23)	(-6.51)	(-6.67)	(-8.41)	(-3.95)
$\ln IC_j * \ln DY_{ij}$		0.24	0.24	0.24	0.23	0.29
		(3.05)	(2.98)	(2.68)	(2.63)	(3.59)
$\ln IC_j * \ln DSKILL_{ij}$		-0.31	-0.36	-0.46	-0.50	-0.33
		(-2.45)	(-2.52)	(-3.20)	(-3.76)	(-2.44)
$\ln IC_j * \ln TC_j$		1.29	1.55	2.07	2.92	0.17
		(4.28)	(4.45)	(4.34)	(5.83)	(0.51)
$\ln IC_i$		-6.48	-8.13	-9.37	-8.60	-7.04
		(-5.95)	(-6.95)	(-7.69)	(-7.37)	(-5.92)
$\ln IC_i * DY_{ij}$		0.53	0.55	0.60	0.55	0.52
		(6.99)	(6.76)	(6.98)	(6.52)	(6.60)
$\ln IC_i * \ln DSKILL_{ij}$		0.24	0.16	-0.06	-0.06	0.10
		(1.91)	(1.14)	(-0.38)	(-0.47)	(0.72)
$\ln IC_i * \ln TC_i$		-0.18	-0.03	-0.06	-0.11	-0.14
		(-4.26)	(-0.73)	(-1.46)	(-2.92)	(-3.83)
β_0	13.89	67.26	78.44	92.25	102.76	57.44
	(14.67)	(10.41)	(10.77)	(11.05)	(12.24)	(8.44)
N	1107	1107	1108	1106	1113	1117
Adjusted R-squared	0.72	0.77	0.76	0.75	0.77	0.77
RSS	2134.3	1740.7	1790.4	1856.7	1690.3	1622.6

Table 1b: Results 1991 to 1994

	1991	*1992*	*1993*	*1994*	*1994g*	*1994* VT
$\ln Y_i$	0.68	0.72	0.68	0.64	0.60	0.64
	(15.40)	(16.27)	(13.27)	(13.00)	(13.74)	(12.32)
$\ln Y_j$	0.71	0.73	0.73	0.67	0.67	
	(16.09)	(16.27)	(14.94)	(14.11)	(13.58)	
$\ln PC_i$	0.21	0.08	0.10	0.10	0.36	0.05
	(4.73)	(1.58)	(1.80)	(1.90)	(9.15)	(1.13)
$\ln PC_j$	0.11	-0.03	-0.18	-0.03	-0.01	
	(2.29)	(-0.45)	(-2.90)	(-0.61)	(-0.26)	
$\ln DY_{ij}$	-1.97	-1.81	-1.72	-1.62	0.20	1.01
	(-3.92)	(-4.77)	(-4.66)	(-4.39)	(5.86)	(1.53)
$\ln DSKILL_{ij}$	-0.81	0.31	0.46	1.05	-0.02	-1.42
	(0.94)	(0.50)	(0.79)	(1.93)	(-0.47)	(-3.16)
$\ln TC_j$	-10.15	-1.38	-0.27	-3.09	-0.46	-3.65
	(-6.09)	(-1.33)	(-0.35)	(-4.02)	(-4.81)	(-3.84)
$\ln DIST_{ij}$	-0.85	-0.76	-0.79	-0.77	-0.79	-0.69
	(-15.31)	(-13.87)	(-13.89)	(-13.36)	(-13.27)	(-9.37)
EU_{ij}	0.05	-0.06	-0.05	0.04	-0.18	0.03
	(0.33)	(-0.37)	(-0.28)	(0.22)	(-0.97)	(0.11)
$AFTA_{ij}$	-0.99	-0.61	-0.62	-0.23	-0.43	-0.05
	(-1.07)	(-0.66)	(-0.66)	(-0.24)	(-0.43)	(-0.04)
CER_{ij}	1.08	1.03	0.98	1.10	0.96	0.93
	(1.19)	(1.14)	(1.06)	(1.15)	(0.97)	(0.83)
$ASEAN_{ij}$	2.16	2.37	2.21	2.63	2.52	2.52
	(5.30)	(5.87)	(5.31)	(6.23)	(5.78)	(4.82)
BD_{ij}	0.41	0.55	0.52	0.51	0.37	0.57
	(1.86)	(2.49)	(2.30)	(2.19)	(1.54)	(1.88)
LD_{ij}	0.69	0.78	0.72	0.68	0.83	0.64
	(5.18)	(5.94)	(5.23)	(4.87)	(5.81)	(3.77)
$\ln IC_j$	-12.59	-2.76	-3.45	-5.15		-7.52
	(-6.00)	(-2.33)	(-3.18)	(-4.55)		(-6.92)
$\ln IC_j * \ln DY_{ij}$	0.12	0.14	0.17	0.13		0.23
	(1.15)	(1.86)	(2.32)	(1.77)		(3.56)
$\ln IC_j * \ln DSKILL_{ij}$	-0.18	-0.20	-0.17	-0.27		-0.15
	(-1.03)	(-1.62)	(-1.42)	(-2.26)		(-1.62)
$\ln IC_j * \ln TC_j$	2.78	0.14	-0.02	0.81		0.54
	(5.97)	(0.48)	(-0.08)	(3.69)		(4.02)
$\ln IC_i$	-8.29	-7.01	-6.94	-7.47		
	(-5.75)	(-6.86)	(-7.00)	(-7.27)		
$\ln IC_i * DY_{ij}$	0.49	0.42	0.38	0.40		
	(4.97)	(6.04)	(5.39)	(5.82)		
$\ln IC_i * \ln DSKILL_{ij}$	0.41	0.11	0.03	-0.04		
	(2.49)	(0.89)	(0.27)	(0.34)		
$\ln IC_i * \ln TC_i$	0.26	0.08	0.13	0.16		
	(5.47)	(2.08)	(3.38)	(3.73)		
β_0	80.82	43.03	41.59	50.19	11.07	60.00
	(9.17)	(7.65)	(8.18)	(9.60)	(11.89)	(8.23)
N	1117	1117	1117	1117	1117	495
Adjusted R-squared	0.74	0.73	0.71	0.69	0.67	0.74
RSS	1703.1	1698.6	1790.7	1855.70	2042.6	

Table 2: Sensitivity

	IC dummy	TC dummy	IC&TC dummy	without US
$\ln Y_i$	0.59	0.70	0.62	0.65
	(12.39)	(15.3)	(14.25)	(12.21)
$\ln Y_j$	0.63	0.67	0.63	0.64
	(13.20)	(14.67)	(14.08)	(12.27)
$\ln PC_i$	0.19	0.10	0.11	0.10
	(3.27)	(1.87)	(2.29)	(1.82)
$\ln PC_j$	-0.06	-0.01	-0.06	0.00
	(-1.09)	(-0.24)	(-12.8)	(-0.05)
$\ln DY_{ij}$	0.09	-1.62	0.07	-1.64
	(1.90)	(-4.42)	(1.41)	(-4.03)
$\ln DSKILL_{ij}$	0.11	0.97	0.15	0.85
	(1.64)	(1.80)	(2.18)	(1.53)
$\ln TC_j$	-0.58	-4.96	-0.81	-3.47
	(-4.57)	(-4.50)	(-6.65)	(-4.36)
$\ln DIST_{ij}$	-0.76	-0.79	-0.78	-0.81
	(-13.24)	(-13.71)	(-14.02)	(-13.70)
EU_{ij}	0.09	-0.17	-0.09	-0.02
	(0.48)	(-0.96)	(-0.52)	(-0.08)
$AFTA_{ij}$	0.08	-0.04	0.37	
	(0.08)	(-0.04)	(0.39)	
CER_{ij}	1.16	1.01	1.04	0.98
	(1.23)	(1.06)	(1.12)	(1.02)
$ASEAN_{ij}$	2.42	2.59	2.21	2.55
	(5.80)	(6.17)	(5.40)	(5.98)
BD_{ij}	0.52	0.49	0.50	0.38
	(2.26)	(2.14)	(2.23)	(1.59)
LD_{ij}	0.68	0.69	0.63	0.68
	(4.81)	(4.97)	(4.65)	(4.48)
$\ln IC_j$	-3.16	-3.44	-2.00	-5.25
	(-4.27)	(-3.55)	(-3.38)	(-4.42)
$\ln IC_j * \ln DY_{ij}$	0.03	0.13	0.05	0.13
	(0.78)	(1.91)	(1.03)	(1.74)
$\ln IC_j * \ln DSKILL_{ij}$	-0.25	-0.31	-0.28	-0.24
	(-3.23)	(-2.60)	(-3.64)	(-1.92)
$\ln IC_j * \ln TC_j$	0.56	1.30	0.71	0.90
	(3.12)	(4.07)	(4.12)	(3.97)
$\ln IC_i$	-6.00	-6.26	-4.70	-7.28
	(-8.61)	(-6.55)	(-7.88)	(-6.77)
$\ln IC_i * DY_{ij}$	0.21	0.40	0.25	0.40
	(4.49)	(5.74)	(5.58)	(5.23)
$\ln IC_i * \ln DSKILL_{ij}$	-0.10	0.02	-0.12	-0.03
	(-1.21)	(0.18)	(-1.56)	(-0.21)
$\ln IC_i * \ln TC_i$	0.75	0.06	0.68	0.15
	(5.32)	(2.08)	(5.59)	(3.5)
β_0	12.79	40.69	11.66	50.91
	(11.79)	(8.53)	(11.89)	(90.4)
N	1117	1117	1117	1117
Adjusted R-squared	0.70	0.70	0.71	0.67

Table 3: Critical values

Variable	Mean value	Critical value	Proportion of observations above critical value
DY ($mil)	839,753	2,540,140	11%
DSKILL	0.103	0.06	65%
TC	38.70	28.4	28%

Table 4: Cross price elasticities - $\frac{\partial \ln X_{ij}}{\partial \ln IC_j}$ by country

Country *j*	min country *i*	min elasticity	max country *i*	max elasticity
Argentina	Sweden	-0.89	Japan	0.84
Australia	**Korea**	**-1.09**	NZ	0.38
Austria	Turkey	-0.91	France	0.27
Belgium	**Argentina**	**-1.53**	USA	-0.32
Brazil	India	-0.18	**Greece**	**1.03**
Canada	India	-0.67	Finland	0.59
Chile	**NZ**	**-1.19**	Malaysia	-0.07
Colombia	**NZ**	**-1.68**	Japan	0.50
Denmark	**Indonesia**	**-1.94**	Germany	-0.17
Finland	Indonesia	-1.09	Canada	0.55
France	UK	-0.34	Ireland	0.92
Germany	UK	-0.57	Ireland	0.74
Greece	**Indonesia**	**-1.13**	France	0.15
Hong Kong	**NZ**	**-1.82**	Japan	-0.61
India	Australia	-0.16	Indonesia	0.92
Indonesia	Denmark	-0.79	India	0.80
Ireland	Philippines	-1.68	Italy	0.63
Israel	Philippines	-0.58	**USA**	**1.43**
Italy	UK	-0.43	**Ireland**	**1.54**
Japan	UK	0.40	**Venezuela**	**1.58**
Korea	Australia	-0.20	**Philippines**	**2.31**
Malaysia	NZ	-0.76	Japan	0.32
Mexico	Netherlands	-0.97	Chile	0.03
Netherlands	**Korea**	**-1.26**	USA	0.01
NZ	**Colombia**	**-2.46**	Australia	-0.39
Norway	Indonesia	-0.85	Canada	0.78
Philippines	NZ	-0.92	**Korea**	**1.93**
Portugal	Finland	-1.09	Japan	0.38
Singapore	**Philippines**	**-1.06**	Japan	0.28
Spain	Canada	-0.61	Singapore	0.42
Sweden	Argentina	-1.04	**UK**	**1.23**
Switzerland	Sweden	-0.68	**France**	**1.03**
Turkey	Austria	-0.98	Korea	0.03
UK	**Italy**	**-1.08**	Sweden	0.94
Venezuela	NZ	-0.39	**Japan**	**1.33**
USA	Indonesia	-0.10	Finland	0.68

[1] Carr, Markusen and Maskus (2001) estimated that a fall in investment costs of one percent increases FDI by one percent.

[2] For example, see Braconier and Ekholm (2000), Brainard (1993,1997), Brainard and Riker (1997), Ekholm (1995) and Feenstra and Hanson (1997). Also, see Markusen (1995) for a survey of the literature.

[3] The index is based on extensive surveys conducted by the World Economic Forum (1999). The indices can take values between 0 and 100, with higher values indicating higher investment costs. It is the same measure of investment costs that is used in the Carr *et al* study which estimates an FDI equation. An additional advantage of using this measure is that it makes our estimate of the cross-price elasticity (i.e. the effect of investment costs on exports) directly comparable to the Carr *et al* estimate of own-price elasticity (i.e. the effect of investment costs on FDI).

[4] This contrasts with previous models that predicted either horizontal FDI (Markusen, 1984) or vertical FDI (Helpman, 1984). In the horizontal FDI models, it was assumed that there was only one factor of production so there was no factor price motivation for FDI. In the vertical FDI models, trade costs were assumed to be zero so there was no tariff-jumping motive to set up a plant abroad. Related models where national firms and horizontal MNEs arise endogenously (but not vertical MNEs) are developed by Markusen and Venables (1998, 2001) in an oligopoly model and in a monopolistic competition setting, respectively.

[5] Note that in a differentiated product model Baldwin-Ottaviano (2001) show that FDI between identical countries has a trade enhancing effect, as the variety is re-imported into the Home country; and a trade displacing effect, as the foreign market is served by foreign affiliate instead of exports. However, the trade displacing effect always dominates, hence trade and FDI are net substitutes in their model.

[6] The inclusion of intermediate inputs is particularly problematic for predicting trade in a horizontal model, however if a country *i* firm invests in country *j* to avoid trade costs, it is unlikely to increase its exports of intermediate inputs. Markusen and Maskus (2002) state that "...substitution is the expected relationship under horizontal investment as firms economize on transport costs and trade barriers in servicing markets of similar size and endowments. The relationship would be complementary in

vertical investments, particularly if fragmentation results in production of both intermediates and final goods within the firm" p22.

[7] The model has 47 equations and inequalities and the questions involve comparative statics on inequalities. See Markusen (1997).

[8] Carr *et al* (2002) use interaction terms to capture the non-monotonic relationships predicted in Markusen (1997) to estimate an FDI equation.

[9] Note that some gravity equations include population instead of per capita incomes –both versions are mathematically equivalent in the gravity equation.

[10] We are grateful to an anonymous referee for pointing this out.

[11] The World Bank data set provides bilateral trade flows of manufactured goods, which we aggregate up to get total manufacturing trade. Agriculture and raw materials are not included in the dependent variable, as there are other important factors driving such trade – for example, the availability of natural resources –that are not included in the model we estimate.

[12] Brainard (1997) also uses a trade cost index compiled from the World Competitiveness Report. We were unable to include freight costs as an explanatory variable because data from the same reporting country for trade flows f.o.b and c.i.f are unavailable, except for the US. Constructing freight measures using data from different reporting countries produces unrealistic figures (see Harrigan 1993).

[13] We only report 1994 results to save space but find the results are robust to the sensitivity analysis for all years.