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Investment Liberalisation and International Trade

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Abstract

This paper estimates the cross-price elasticity of exports with respect to investment costs for bilateral relations between the US and 35 partner countries. We show that the relationship depends on country characteristics as predicted by the Markusen *et al*. (1996) model. When countries differ in relative factor endowments and trade costs are low, investment liberalisation stimulates exports, whereas when countries are similar in terms of relative factor endowments and size, and trade costs are moderate to high, investment liberalisation reduces exports.

Outline

1. Introduction
2. Empirical Literature
3. Theory of FDI
4. Model Estimation
5. Conclusions

Non-Technical Summary

The rapid growth in foreign direct investment (FDI) over the last few decades, from 5% of world GDP in 1980 to 10% 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 liberalisation stimulates FDI. The effects of FDI can be wide reaching, with evidence suggesting that FDI impacts significantly on trade, employment and factor prices. 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 problem of which causes which – FDI causes trade, or trade FDI – 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 different motives underlying FDI and the different types of FDI.

In this paper we focus on the trade relationship but from a quite different perspective, taking into account the fact that reduced barriers to investment can stimulate different types of FDI in different circumstances. According to theory, the impact on trade depends on the type of FDI it stimulates (see Markusen (1997) and Markusen, Venables, Konan and Zhang (1996)). 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, such as differences in relative skilled labour endowments and country size differences, and to the level of trade costs.

By providing a theoretical framework to link country characteristics to the type of FDI, the Markusen, Venables, Konan and Zhang (1996) model enables us to hypothesise the likely impact of investment liberalisation on exports. Based on this model, we postulate a relationship between investment costs and exports that depends on these country characteristics, and regress exports on country characteristics, trade costs, and investment cost using bilateral country level data for the US and 35 partner countries from 1986 to 1994. Our measure of investment costs is a comprehensive one, which improves on measures used in earlier studies. It is an index that includes 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.

Our study also contributes to the literature in a number of other respects. First, we avoid any causation problem by including investment costs instead of FDI as our explanatory variable. Second, we do not

constrain the relationship between trade and investment costs to be the same across all countries. We allow the relationship to depend on differences in country size, relative factor endowments and trade costs. Third, we use a combination of different measures of trade costs in an attempt to capture its different forms. For example, we include a trade cost index from the World Economic Forum that gives an indication of how protective firms view a country to be, as well as freight, tariff and distance measures.

Our results show that investment costs do have a significant impact on trade, and this effect depends on country characteristics in a meaningful way. The results indicate that investment liberalisation stimulates exports when countries differ in relative factor endowments and trade costs are not too high; yet reduces exports when countries differ in size and trade costs are high, providing some support for the theory. These results are also interesting from a policy perspective, given that governments directly influence investment costs. A clear understanding of all the implications of investment liberalisation will also facilitate successful progress of WTO negotiations on the General Agreement on Trade in Services (GATS), affecting FDI restrictions.

I. Introduction

The rapid growth in foreign direct investment (FDI) over the last few decades, from 5% of world GDP in 1980 to 10% 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 liberalisation 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 different motives underlying FDI and the different types of FDI.

In this paper we focus on the trade relationship but from a quite different perspective, taking into account the fact that reduced barriers to investment can stimulate different types of FDI in different circumstances. According to theory, the impact on trade depends on the type of FDI it stimulates (see Markusen (1997) and Markusen, Venables, Konan and Zhang (1996)). 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, such as differences in relative skilled labour endowments and country size differences, and to the level of trade costs.

By providing a theoretical framework to link country characteristics to the type of FDI, the Markusen, Venables, Konan and Zhang (1996) model enables us to hypothesise the likely impact of investment liberalisation on exports. Based on this model, we postulate a relationship between investment costs and exports that depends on these country

[1] For example, Carr, Markusen and Maskus (1998) have 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 for a survey of the empirical literature.

characteristics, and regress exports on country characteristics, trade costs, and investment cost using bilateral country level data for the US and 35 partner countries from 1986 to 1994. Our measure of investment costs is a comprehensive one[3]. It is an index that includes 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.

Our study also contributes to the literature in a number of other respects. First, we avoid any endogeneity problems by including investment costs instead of FDI as our explanatory variable. Second, we do not constrain the relationship between trade and investment costs to be the same across all countries. We allow the relationship to depend on differences in country size, relative factor endowments and trade costs. Third, we use a combination of different measures of trade costs in an attempt to capture its different forms. For example, we include a trade cost index from the World Economic Forum that gives an indication of how protective firms view a country, as well as freight, tariff and distance measures.

Our results show that investment costs do have a significant impact on trade, and this effect depends on country characteristics in a meaningful way. The results indicate that investment liberalisation stimulates exports when countries differ in relative factor endowments and trade costs are not too high; yet reduces exports when countries differ in size and trade costs are high, providing some support for the theory.

These results are also interesting from a policy perspective, given that governments directly influence investment costs. A clear understanding of all the implications of investment liberalisation will also facilitate successful progress of WTO negotiations on the General Agreement on Trade in Services (GATS), affecting FDI restrictions.

The remainder of this paper is set out as follows: Section II provides an overview of the empirical literature; Section III describes the theoretical framework and develops the hypotheses; Section IV contains details of the data and discusses the results; Section V presents a summary and conclusions.

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[3] The index is based on extensive surveys conducted by the World Economic Forum. It is the same measure of investment costs that is used in the Carr *et al* study which estimates an FDI equation, however it has not been included in a trade equation before. 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).

II. Empirical Literature

There are numerous studies that examine the relationship between FDI and trade, and their results have been extremely mixed. Typically, they regress exports on FDI and a host of other explanatory variables. Many earlier 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 (forthcoming) 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, as in our study, Clausing (2000) finds a positive coefficient on affiliate sales indicating complementarity between exports and FDI.

A common problem across all these studies is simultaneity since both exports and FDI are endogenous. Some studies have tried to overcome the endogeneity of FDI by using different econometric techniques such as two-stage least squares and three-stage least squares. There are two main problems with these approaches. First, it is difficult to find a suitable instrument. For example, if lagged FDI is used as an instrument and is correlated with current FDI it is questionable whether the endogeneity issue is properly addressed. Second there is a conceptual difficulty in interpreting results obtained from regressing one endogenous variable on another.

The issue of endogeneity is addressed in Clausing (2000) 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. There is some doubt whether these measures do accurately reflect investment costs. For instance, Markusen (1995, p.171) reports that there is little evidence for the idea that tax avoidance is an important motive for FDI. It seems that firms first choose foreign production locations and then minimise taxes. In addition, average compensation could be picking up factors such as differences in human capital and/or differences in productivity, which would also stimulate FDI, rather than measuring investment costs.

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 and found that there was significant country heterogeneity. 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. This finding should not be too surprising given the diverse motives that underlie FDI activities. We draw on Markusen *et al* (1996) to explain this heterogeneity in analysing the effect of investment costs in trade.

III. Theory of FDI

We link our empirical analysis to a theoretical framework developed by Markusen *et al* (1996), which allows horizontal and vertical FDI to arise endogenously, depending on country characteristics and the level of trade costs. The model has two countries, two factors of production (skilled and unskilled labour) 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 are assumed to use skilled labour intensive technology; and the final goods assembly stage, which uses an unskilled labour intensive technology. International trade is subject to trade costs.

Three types of firms may emerge: (i) vertical multinational firms (MNEs),[4] 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 headquarter services, which produce blueprints, formulas and managerial services, are the most skilled labour intensive operations. Furthermore, the fixed cost of setting up two plants is assumed to be 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. The headquarter services can be supplied at low marginal costs to additional plants. Firms have to choose whether to supply the foreign country by exporting or by setting up a local plant. Their choice will depend 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. 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 hence horizontal FDI was ruled out by assumption.

Whether FDI is horizontal or vertical is relevant for this study as it affects the relationship predicted between trade and investment costs[5]. In general, a fall in investment costs stimulates FDI. However, whether it also stimulates trade depends on whether the increase in FDI is of the horizontal or vertical type.

[4] We use FDI and MNEs interchangeably.
[5] Note that the Markusen *et al* model does not explicitly consider gradual changes in investment costs. In the model FDI is either banned or allowed.

Markusen *et al* 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. Whereas 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.

If the two countries differed in relative endowments, one country has an advantage over the other in terms of factor prices, favouring vertical MNEs. Markusen *et al* shows that vertical MNEs are likely to dominate when factor prices 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-labour abundant country and its final production stage in the unskilled-labour 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 labour abundant and the host country is large and unskilled labour 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 favoured to avoid costly capacity in the small market.

This framework can be used to generate the following hypotheses:

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).*

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).*

These hypotheses can be tested by estimating the following equation:

$$X_{ijt} = \beta_o + \beta_1 Y_{jt} + \beta_2 DY_{ijt} + \beta_3 DSKILL_{ijt} + \beta_4 DCAP_{ijt} + \beta_5 TC_{jt} + \beta_6 IC_{jt} + \beta_7 DY_{ijt} * IC_{jt} + \beta_8 DSKILL_{ijt} * IC_{jt} + \beta_9 DCAP_{ijt} * IC_{jt} + \beta_{10} TC_{jt} * IC_{jt} + \varepsilon_{jt} \quad (1)$$

The dependant variable in equation (1), X_{ijt}, is the real value of exports from country *i* to country *j* at time *t*. The first four variables represent country characteristics: Y_{jt} is real gross domestic product in country *j*, to capture the idea that exports depend on the size of the market to which a country exports. Standard trade theory would suggest that exports would be higher the larger the market ($\beta_1>0$). DY_{ijt} is the absolute difference in GDP between country *i* and *j*. We hypothesise that an increase in the difference in GDP reduces exports, that is, intra-industry trade is maximised when countries are of equal size ($\beta_2<0$) (see Helpman and Krugman 1995). $DSKILL_{ijt}$ is the absolute difference in the relative skilled labour endowments between countries *i* and *j* at time *t*. $DCAP_{ijt}$ is the absolute difference in relative capital endowments between countries *i* and *j* at time *t*. According to traditional trade models, larger relative factor endowment differences lead to increased volumes of inter-industry trade (β_3, $\beta_4>0$).

The variable TC_{jt} measures the trade costs of country *i* exporting to country *j* at time *t*. We would expect that an increase in trade costs should reduce exports ($\beta_5<0$). We include four different measures of trade costs.

The main relationship we are interested in is how investment costs affect exports, where IC_{jt} measures the cost of a firm from country *i* locating a plant in country *j*. We hypothesise that the effect of investment costs on exports depends on whether FDI is horizontal or vertical, which in turn depends on country characteristics. Hence, we interact investment costs with country characteristics and trade costs in equation (1). The overall effect of investment costs on exports can be examined by taking the partial derivative of exports with respect to investment costs, as given below in equation (2).

$$\frac{\partial X_{ijt}}{\partial IC_{jt}} = \beta_6 + \beta_7 DY_{ijt} + \beta_8 DSKILL_{ijt} + \beta_9 DCAP_{ijt} + \beta_{10} TC_{jt} \quad (2)$$

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

We expect investment liberalisation 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*, *DSKILL* and *DCAP* are small, (or close to zero indicating that countries are identical) and trade costs are positive, we hypothesise that $\beta_{10}>0$, and $\frac{\partial X_{ijt}}{\partial IC_{jt}}$ to be positive.

If countries differ in relative factor endowments, and trade costs are low, we expect investment liberalisation to stimulate vertical FDI (*Hypothesis 2*), and hence $\frac{\partial X_{ijt}}{\partial IC_{jt}}$ to be negative. Therefore we hypothesise that $\beta_7<0$, $\beta_8<0$ and $\beta_9<0$. Although the Markusen *et al* model only has two factors of production, skilled and unskilled labour, we also include differences in relative capital endowments to avoid biased estimates due to an omitted variable.

One difficulty of taking the theory to the data is 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 labour abundant and the differences are not too large. In this case, we would expect that investment liberalisation would lead to increased vertical FDI and increased trade. However, if the skilled labour 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.

Another difficulty is that the model only has two production stages and two countries. If we extend the model to more than two production stages and/or more countries, then vertical FDI may not always promote exports between the two countries. So vertical FDI may occur between countries that differ substantially in relative factor endowments, as predicted by the theory, and lead to increased multilateral trade, however this may not show up as an increase in bilateral trade.

We also include the investment cost variable separately to allow for the possibility that other factors outside this model may affect the relationship between investment costs and trade. If all countries were identical in relative factor endowments and trade costs were zero there would be no motive for FDI in the Markusen *et al* model, therefore changing investment costs would not have any effect on FDI hence β_6 would be zero. But of course one model cannot be expected to capture every aspect of the real world so we will allow β_6 to be non-zero. Whether it is positive or negative will depend on what these other factors outside the model are likely to be. For example, when a multinational firm sets up a plant abroad it is likely to raise the profile of its home country and improve international links, leading to increased trade, irrespective of whether it is horizontal or vertical FDI. In this case, investment liberalisation should stimulate FDI and trade, hence β_6 will be less than zero.

IV. Model Estimation

Data

The US is the world's largest exporter of goods and services and is also the largest source of FDI. It is therefore the natural reference point for testing our hypotheses.

Our data set is an extensive one. It covers US bilateral relationships with 35 countries for the period from 1986 to 1994 inclusive. (The Appendix sets out details of the countries covered, data definitions and sources.) Both OECD and developing countries are included in the sample. The dependant variable in equation (1), X_{ijt}, is the real value of exports of non-agricultural goods from country *i* to country *j* at time *t*. Note that since all our observations are bilateral relations with the US, half the sample will represent exports from the US (country *i*) to each country *j* and the other half will be exports from each country *i* to

the US (country *j*). The export data are free on board (f.o.b.) i.e. they do not include freight costs.[6]

The key country characteristics included are differences in country size and differences in relative factor endowments. The difference in country size is the absolute difference between the real GDP of country *i* and country *j* (DY). Skills are defined according to employment categories, with skilled employees taken as those working in managerial and professional occupations. This is included as the absolute difference between the ratio of skilled labour to total employment in country *i* and country *j* (DSKILL). Capital is defined as the real gross fixed capital stock[7]. It is included as the absolute difference in the ratio of capital stock to total employment in country *i* and country *j* (DCAP).

We include four different measures of trade costs, to reflect different aspects such as natural barriers and man-made barriers[8]. One is a measure of freight costs, which is calculated by taking the ratio of bilateral imports with freight costs (c.i.f) to bilateral imports without freight costs (f.o.b) (FREIGHT). Previous attempts to construct a similar variable using OECD trade data have produced unrealistic estimates. For example, Harrigan (1993) calculated the ratio of OECD import values on a c.i.f. basis over the corresponding f.o.b. basis for exports from the exporting country. This resulted in estimates of freight costs in excess of 500 percent, partly due to inconsistent reporting procedures between countries. Using the US bilateral trade data collected by the NBER and described in Feenstra (1996) gives more credible estimates as they are based on two US data series. The mean value of the ratio is 1.05 indicating that transport costs are on average five percent of import values. The highest value is 12 percent and the lowest 0.03 percent. Moreover, the variable is also systematically higher for countries a long distance from the US, and is generally decreasing over time.[9] Data are only available for freight costs on imports into the US on a bilateral

[6] Trade in agriculture is excluded from the dependent variable, as there are other important factors driving it – such as the availability of natural resources – not included in the model we estimate.

[7] The capital stock data were kindly provided by Keith Maskus. They are calculated as follows: figures for gross fixed capital formation (from IMF, International Financial Statistics) for a 15-year period (e.g. 1970-84), are deflated using local deflators and are then converted to US dollars using PPP exchange rates (from Penn World Tables). This resulted in the 1984 capital stock data. Mohan later updated this procedure to calculate capital stocks for 1985-94. Details of construction are in Maskus, 1991.

[8] Note this is an improvement on previous studies such as Clausing (2000) that measures trade costs as the residuals from a regression of the ratio of imports to GDP on population and population squared.

[9] Brainard (1993) uses freight charges relative to import values from the same source as a proxy for transport costs.

basis. As a result, we have assumed that costs are symmetric, i.e. that freight costs from the US to country *j* are the same as freight costs from country *j* to the US.

Our second variable reflects the incidence of tariffs. It is defined as the ratio of import duties paid in the US to total imports from country *j* to the US (DUTYSH). Since it is calculated from tariff revenues, it represents collected tariffs and thus reflects the actual incidence of tariff barriers. Unfortunately, it is not available for tariffs paid in country *j* from the US, so again we have had to assume that this incidence is symmetric. Another drawback of this measure is that it does not capture non-tariff barriers such as quotas. To address these shortcomings, we include a third measure, which is a simple average of several indices of impediments to trade taken from the World Competitiveness Report, as in Carr *et al.*, 1998. This index ranges from 0 to 100, with higher values reflecting higher trade barriers[10]. Our fourth measure is distance, which is measured as the number of miles from each country's capital city to Washington DC.

A dummy variable for the North Atlantic Free Trade Agreements (NAFTA) is also included, taking a value of one for Canada after 1989 and for Mexico from 1994. This captures the possibility that the level of integration among the three countries may have been affected by these agreements over and above that picked up by our import duty share variable[11]. We would expect the coefficient on NAFTA to be positive, reflecting the greater trade among these countries as a result of integration. We also include a dummy variable for countries that are members of the European Union (EU). As there may have been trade diversion from the US (and trade creation among EU countries) we expect the EU dummy to be negative.

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, as in Carr *et al*. 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.

[10] It comes from a survey where companies are asked whether national protectionism prevents foreign products and services from being imported.

[11] The duty share variable indicates a fall over the period from 0.9% to 0.3% and 3.1% to 1.3% for Canada and Mexico respectively from 1986 to 1994.

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 (World Competitiveness Yearbook, 1999).

Results

The results from estimating equation (1) are summarised in Table 1. To exploit the panel dimension of the data, we experimented with fixed and random effects estimations. In the fixed effects model, we include fixed effects for each bilateral country pairing, thus allowing us to control for factors that vary by bilateral relationship, and may influence trade but have not been explicitly included in the model; for instance natural resources, language and technology differences. Given these variables are likely to be correlated with the regressors, we prefer the fixed effects to the random effects model.[12] The Hausman test also favours the fixed-effects model. However, given the general weakness of the Hausman test we report the results for both models. Furthermore, when estimating the fixed-effects model some variables need to be dropped (distance and the EU dummy) as they have no variation within bilateral relationships. The NAFTA dummy can remain as it has some variation over time. The results indicate that the signs on the coefficients are the same in both models and the significance levels do not alter substantially.

[12] For example, the fixed effects may pick up how technically advanced a country is and this is likely to be correlated with the capital to labour ratio. The F-test for the joint insignificance of the fixed effects was rejected (F 35,570=31.81), indicating they should be included in the model.

Table 1: Results

	Fixed effects model		***Random effects model***	
	Coefficient	**t-statistic**	**Coefficient**	**z-statistic**
Y	0.05	4.49**	0.04	3.35**
DY	-2.13	-4.82**	-4.12	-20.85**
DSKILL	64.11	2.90**	59.79	3.03**
DCAP	16.08	2.01**	15.66	1.80*
TC INDEX	-0.49	-5.97**	-0.48	-5.16**
FREIGHT	-147.25	-3.00**	-283.84	-6.01**
DUTYSH	-148.53	-2.71**	-102.47	-1.92*
DISTANCE			0.39	1.25
EU			-8.61	-5.95**
NAFTA	12.02	5.73**	23.23	10.82**
IC	-9.59	-8.78**	-9.74	-7.83**
*DY * IC*	0.09	18.36**	0.08	15.13**
*DSKILL * IC*	-2.63	-5.40**	-2.22	-4.01**
*DCAP * IC*	-0.46	-2.24**	-0.42	-1.83*
*TC * IC*	0.01	6.71**	0.01	5.71**
*FREIGHT*IC*	4.61	4.40**	4.98	4.16**
*DUTYSH*IC*	4.16	3.29**	4.37	3.04**
*DISTANCE*IC*	-0.03	-4.56**	-0.03	-3.99**
Time dummies	*Yes*		*Yes*	
α	287.60	5.25**	527.33	10.82**
N	621		621	
R-squared within	0.47		0.42	
Adjusted R-squared	0.91			

** Significant at 1%; * significant at 5%.

In general, the results support the model's predictions, with all of the variables having the expected sign except the interactive country size variable (*DY*IC)*. First, let us look at the linear terms. The results confirm the predicted relationship between exports and country characteristics and trade costs. Exports are increasing in the size of the destination country; countries that are more similar in size have higher bilateral exports (shown by the negative coefficient on DY, the difference in GDP) probably as a result of higher intra-industry trade. As traditional trade theory predicts, differences in relative factor endowments – in this case the difference in the skilled labour to unskilled labour ratios and capital to labour

ratios – increase the volume of trade. As predicted, increases in trade costs reduce exports. The three trade-cost variables included in the fixed effects model – the trade cost index, freight costs and the proportion of duties paid are all negative and significant. As expected, membership of NAFTA increases trade with the US. For the effects of EU membership and distance we need to refer to the random effects model, which indicates that membership of the EU leads to a fall in trade between EU countries and the US, possibly because of trade diversion. The distance variable is insignificant.

All the interactive terms have the hypothesised sign, except country size differences. Investment liberalisation stimulates trade when countries differ in relative skill labour endowments and relative capital endowments (the coefficients on *DSKILL*IC* and *DCAP*IC* are negative); whereas investment liberalisation reduces exports when trade costs are high (the coefficients on *TC*IC*, *FREIGHT*IC*, *DUTYSH*IC* are all positive). Note that the coefficient on the interactive distance term (*IC*DISTANCE*) is negative. The theory does not give clear predictions on this as it could reflect trade costs or an investment cost, with the cost of monitoring foreign affiliates expected to rise with distance.

The coefficient on the interactive country size term (*DY*IC*) has an unexpected positive coefficient. We hypothesised that investment liberalisation between countries that differed 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 was the skill abundant country. To test this, we split the interactive country size term into three categories: (i) the source country is skill labour abundant; (ii) the two countries are similar in relative skill labour abundance; and (iii) the host country is skill labour abundant. It turns out that the coefficients on all these categories were positive and of a similar magnitude. One possible explanation for this positive coefficient is that the third country effect is not picked up in these bilateral relationships. That is, vertical FDI may result in a fall in exports from country *i* to *j* but an overall increase in trade between country *i*, *j* and *h*.

Note that the coefficient on investment cost (*IC*) is significantly different from zero, indicating that there are other factors outside the Markusen *et al* model affecting the relationship. The negative coefficient on this indicates that investment liberalisation stimulates exports. These factors could include trade in differentiated goods, or multi-

product plants making contacts and increasing the foreign demand for goods produced in their home countries.

The relationship of most interest to us is that between investment costs and exports. We can explore this further by taking the partial derivative of exports with respect to investment costs:

$$\frac{\partial X_{ijt}}{\partial IC_{jt}} = -9.59 + 0.99\,DY_{ijt} - 2.63DSKILL_{ijt} - 0.46DCAP_{ijt} + 0.01TC_{jt} + 4.61FREIGHT_{ijt} + 4.16DUTYSH_{ijt} - 0.03DISTANCE_{ij} \quad (3)$$

The results support our hypotheses. In *Hypothesis 1*, we stated that investment costs will reduce exports if countries are similar in size and relative factor endowments, and trade costs are medium to high. If we evaluate equation (3) for the case where countries are similar, by setting *DY*, *DSKILL* and *DCAP* to zero, we see that the cross-price elasticity, $\frac{\partial X_{ijt}}{\partial IC_{jt}}\frac{IC_{jt}}{X_{ijt}}$, is likely to be positive as hypothesised since the coefficients on all the trade cost variables (except distance) are positive.

In *Hypothesis 2* we stated that investment liberalisation would promote trade if countries differed in terms relative factor endowments and trade costs are low. If we evaluate equation (3) for low levels of trade costs the cross-price elasticity is likely to be negative as hypothesised since the coefficients on the relative factor endowments are negative. However, these effects would have to outweigh the positive effect of country size difference.

Using data from the sample, we can evaluate equation (3) with the mean values of the data to see if the cross price elasticity is positive or negative. We find a small positive cross price elasticity of 0.2 for US exports to all the countries in the sample. Hence, a one percent decrease in investment costs in the partner countries will decrease the demand for US exports in those countries by just over 0.2 percent, indicating that FDI substitutes for trade. In contrast, a one percent fall in investment costs in the US will increase US imports from the 35 partner countries on average by around 0.04 percent. However, this average effect across the sample masks much interesting information.

More information is gained by evaluating equation (3) at the annual mean values. We see from Table 2 that there has been a positive trend, beginning with a negative cross price elasticity in 1986 to a positive one in 1994[13]. The data indicate that the mean difference in country sizes between the US and the partner countries has increased over time, which would promote a positive relationship between investment costs and exports. Offsetting this is the increase in the differences in relative skill and capital abundance, and the fall in trade costs, promoting vertical FDI and hence a negative relationship, however these are dominated by size difference effects.

Table 2: Cross price elasticities - $\frac{\partial X_{ijt}}{\partial IC_{ijt}}\frac{\overline{IC}_t}{\overline{X}_t}$ by year

Year	From US to country *i*	From country *i* to US
1986	-3.07	-1.36
1987	-1.47	-0.82
1988	-0.01	-0.20
1989	0.71	0.23
1990	0.52	0.03
1991	0.22	-0.10
1992	0.57	0.13
1993	0.87	0.66
1994	1.21	0.65

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 (3) fixed at their means and vary one variable at a time to find the critical value that changes the sign of the derivative. For example, to find the critical value of DY^* we estimate equation (3) at the mean values of all the variables (denoted by bars) in equation (4) and let *DY* vary. The critical value of *DY* at which this derivative equals zero is 53.35. This partial derivative is positive for all values of *DY* above this critical value, for which there are 62% observations, and negative for all values below.

$$\frac{\partial X_{ijt}}{\partial IC_{jt}} = -9.59 + 0.99\, DY_{ijt} - 2.63\overline{DSKILL} - 0.46\overline{DCAP} + 0.01\overline{TC} + 4.61\overline{FREIGHT} + 4.16\overline{DUTYSH} - 0.03\overline{DISTANCE} > 0 \;\; if \;\; DY > 53.35. \quad (4)$$

[13] Svensson (1996) also finds the relationship between trade and FDI becomes more one of substitution over time using Swedish data.

We repeat this exercise for all the other variables and summarise them in Table 3 below.

Table 3: Critical values

Variable	**Mean value**	**Critical value**	**Proportion of observations above**
DY ($'000m)	53.45	53.35	62%
DSKILL	0.115	0.118	53%
DCAP	0.178	0.197	40%
TC	33.15	32.48	44%
FREIGHT	1.047	1.049	48%
DUTYSH	0.037	0.035	41%
DISTANCE ('000miles)	8.505	8.79	32%

As can be seen from Table 4, there are observations that fall above and below all the critical values. For example, it is not the case that when we vary, say, distance holding all other variables constant at their means, that the cross-price elasticity is always negative. In 32 per cent of the cases the cross price elasticity is negative and in 68 percent it is positive. This implies that there is not one single dominant characteristic that is driving the results. In fact, evaluating equation (3) at the actual values for each observation, we found that 60 percent of the observations indicate a positive elasticity.

In Table 4 below, we see that there is a great deal of variation in the cross-price elasticities for each country pair. These are calculated from evaluating equation (3) using the mean values of variables for each country pair (which are listed in the Appendix).

Table 4: Cross price elasticities - $\frac{\partial X_{ijt}}{\partial IC_{ijt}}\frac{\overline{IC}_{ij}}{\overline{X}_{ij}}$ by country

Country *i*	From US to Country *I*	From country *i* to US	Country *I*	From US to Country *i*	From country *i* to US
Chile	-5.38	-3.41	Greece	44.61	38.62
India	5.16	-2.84	NZ	9.38	27.05
Indonesia	6.41	-1.98	Finland	39.71	15.23
Brazil	0.43	-1.72	Denmark	10.15	12.81
Malaysia	-1.83	-1.35	Norway	26.18	9.41
France	-2.15	-1.29	Portugal	22.19	9.09
Philippines	9.05	-1.14	Austria	14.91	8.88
Germany	-2.66	-1.13	Argentina	7.12	7.99
Japan	-3.88	-0.80	Turkey	6.44	6.53
UK	-0.87	-0.71	Ireland	4.45	5.76
Italy	-1.55	-0.54	Colombia	5.53	3.44
Singapore	-1.31	-0.42	Netherlands	0.83	2.70
Korea	0.46	-0.27	Sweden	4.71	2.17
Mexico	-0.38	-0.26	Israel	5.37	2.15
Australia	0.48	-0.26	Venezuela	2.69	1.03
Canada	0.04	0.00			
Switzerland	0.76	0.24			
HK	0.22	0.81			

It is difficult to identify a common trend in Table 4 that would pinpoint a single country characteristic that drives the overall sign of the cross-price elasticity to be positive or negative, given the complex relationship between trade and investment costs as seen in equation (3). However it is still interesting to see just how much variation there is across different countries. The largest positive elasticity is found for US exports to Greece – a one percent increase in investment costs in Greece will increase exports to Greece by over 40 percent. The largest negative value is for US exports to Chile, where a one percent increase in investment costs reduces US exports by over five percent.

In general the elasticities are larger for countries that have little trade with the US. For example, small European countries such as Greece, Finland, Denmark and Norway have large positive elasticities indicating that a small reduction in investment costs has a large negative impact on trade. In contrast, very small effects are noticeable with countries like Canada that trade a lot with the US. This indicates that the elasticity is not constant - the absolute value of the elasticity is lower for higher levels of exports.

V. Conclusions

This paper estimates the effects of investment liberalisation on exports for the US and 35 partner countries over the period 1986 to 1994. Whether investment liberalisation 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 developed by Markusen *et al*, 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.

Our results lend support to the theory, showing that investment liberalisation stimulates exports when countries differ in relative factor endowments (skilled labour and capital) and trade costs are low. Whereas investment liberalisation reduces exports when countries are similar in relative factor endowments and trade costs are high.

These results provide 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. Whether the relationship is positive or negative will be influenced by the sample years and countries under study. For example, in our sample 60 per cent of the observations indicated a positive cross-price elasticity of exports with respect to investment costs and the remaining 40 percent a negative one. We have shown that these heterogeneous relationships are not *ad hoc* - they depend on country characteristics and trade costs in a systematic way.

Appendix: Data Sources and Definitions

Name of Variable		Definition	Source
$\mathbf{X_{ij}}$		Real exports f.o.b. (i.e. without freight costs) for all trade in goods, excluding agriculture. The US $ series were deflated using the US GDP deflator. They are in 1987 US $.	NBER Trade Database Disk 1: U.S. Imports 1972-1994 and Disk 3: U.S. Exports, 1972-1994.
$\mathbf{Y_j}$		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).
$\mathbf{DY_{ij}}$		Difference in real GDP at market prices: between country *i* and country *j*	World Development Indicators on CD-ROM from the World Bank.
$\mathbf{DSKILL_{ij}}$		Absolute differences in relative skill endowments between country *i* and country *j*. Skills are defined as 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 Labour Statistics, International Labour Office, various years.
$\mathbf{DCAP_{ij}}$		Absolute differences in relative capital endowments between country *i* and country *j*, defined as the ratio of gross fixed capital stock relative to total employment.	Penn World Tables
$\mathbf{TC_{ij}}$	**DUTYSH**	Duties paid on imports in $ country j over imports.	NBER Trade Database Disk 1: U.S. Imports 1972-1994 and Disk 3: U.S. Exports, 1972-1994.
	FREIGHT	The ratio of imports c.i.f. (i.e. including freight costs) to imports f.o.b. (excluding freight costs) for the US and for country j in US $ and excluding agriculture.	NBER Trade Database Disk 1: U.S. Imports 1972-1994 and Disk 3: U.S. Exports, 1972-1994.
	TC index	Index ranging from 0 to 100.	World Economic Forum
	Distance	Distance between capital cities in 1000 miles	http://www.eiit.org/
$\mathbf{IC_{ij}}$		Index ranging from 0 to 100	World Economic Forum

Notes:

- For the trade data see NBER working paper series number 5515 and 5990 by Robert C. Feenstra for a detailed explanation of the data.
- The skill data: for Brazil and Sweden skills category 2 is included along with 3 (clerical and related staff). As a result only skills category 0/1 over total employment is used as the skills variable. This is an underestimate relative to the other countries, but should capture the variation over time. In the cases when some years are missing for some countries the data have been filled in with the skills variable for the nearest year.
- Data were not available on skills for France from the same source. As a result the percentage of the workforce in professional and intermediate professions was used from 'Étude sur la marché du travail' 1997, European Commission.

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, the Netherlands, New Zealand, Norway, Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, Turkey, United Kingdom and Venezuela.

Descriptive Statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
X ($'000m)	7.77	15.03	0.17	93.97
Y ($'000m)	30.15	27.10	0.23	61.84
DY ($'000m)	53.45	6.10	26.05	61.45
DSKILL	0.12	0.08	0.001	0.28
DCAP	0.18	0.14	0.001	0.56
TC INDEX	33.15	11.09	6.00	85.08
FREIGHT	1.05	0.02	1.00	1.11
DUTYSH	0.04	0.02	0.0003	0.10
DISTANCE (miles '000)	8.51	3.91	0.73	16.37
IC INDEX	32.81	10.03	15.30	79.43

Correlation Matrix

	X	Y	DY	DSKILL	DCAP	TC INDEX	FREIGHT	DUTYSH	DISTANCE
Y	0.13	1.00							
DY	-0.51	-0.07	1.00						
DSKILL	-0.11	-0.01	0.12	1.00					
DCAP	-0.004	-0.01	0.20	0.71	1.00				
TC INDEX	-0.03	-0.16	-0.12	0.27	0.25	1.00			
FREIGHT	-0.40	-0.03	0.11	0.35	0.30	0.22	1.00		
DUTYSH	-0.20	-0.01	0.03	0.54	0.29	0.13	0.43	1.00	
DISTANCE	-0.24	-0.01	0.08	0.39	0.12	0.15	0.29	0.37	1.00
IC INDEX	-0.14	-0.63	-0.06	0.29	0.26	0.64	0.26	0.14	0.02

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”

Mean by country

Country	DY	DSKILL	DCAP	TC	FREIGHT	DUTYSH	DISTANCE	X (US to *i*)	X (*i* to US)	IC
Argentina	55.29	0.13	0.13	33.05	1.08	0.03	8.40	0.76	1.62	45.64
Australia	54.00	0.05	0.07	39.23	1.06	0.02	15.96	1.42	6.34	33.87
Austria	55.35	0.09	0.03	29.93	1.04	0.04	7.13	1.01	0.73	33.68
Belgium	55.01	0.04	0.06	20.28	1.04	0.02	6.22	4.08	5.60	32.43
Brazil	52.40	0.22	0.40	60.03	1.07	0.04	6.80	5.27	4.15	54.89
Canada	51.27	0.01	0.16	37.36	1.02	0.01	0.73	71.11	60.19	29.95
Chile	56.60	0.17	0.34	22.36	1.04	0.02	8.08	0.53	1.33	38.99
Colombia	56.51	0.15	0.29	31.53	1.05	0.02	3.83	1.53	1.79	48.83
Denmark	55.61	0.02	0.07	21.24	1.04	0.04	6.52	1.03	0.85	23.32
Finland	55.66	0.01	0.11	32.93	1.07	0.03	6.94	1.04	0.58	37.16
France	45.29	0.03	0.05	36.59	1.03	0.03	6.17	10.62	9.21	44.36
Germany	41.21	0.11	0.02	20.50	1.03	0.04	6.41	24.64	11.07	24.88
Greece	56.08	0.13	0.26	34.54	1.09	0.05	8.26	0.28	0.47	47.07
Hong Kong	56.57	0.17	0.14	14.60	1.05	0.10	13.13	8.49	4.64	23.50
India	53.92	0.25	0.21	64.12	1.07	0.05	12.05	2.68	1.57	57.91
Indonesia	55.83	0.26	0.45	57.32	1.09	0.07	16.37	2.77	1.16	56.40
Ireland	56.47	0.10	0.10	28.86	1.02	0.04	5.45	1.41	1.91	30.97
Israel	56.38	0.01	0.11	41.44	1.02	0.00	9.45	3.03	2.33	33.04
Italy	46.22	0.01	0.05	35.15	1.05	0.06	7.22	10.19	4.91	48.05
Japan	28.05	0.14	0.19	42.86	1.03	0.03	10.91	83.58	22.97	37.38
Korea	54.37	0.21	0.20	48.65	1.05	0.07	11.17	15.48	7.90	52.80
Malaysia	56.47	0.19	0.25	41.95	1.04	0.03	15.35	5.25	2.89	40.85
Mexico	54.43	0.18	0.36	35.20	1.01	0.03	3.04	23.20	22.01	47.41
Neth	54.12	0.01	0.04	21.90	1.04	0.03	6.20	3.60	7.81	26.49
NZ	55.73	0.05	0.09	29.36	1.07	0.02	14.10	0.32	0.89	27.89
Norway	56.47	0.01	0.08	39.42	1.06	0.01	6.24	1.40	0.87	37.62
Phil	56.48	0.22	0.47	63.84	1.06	0.07	13.79	2.74	1.70	50.12
Portugal	56.24	0.17	0.33	32.92	1.06	0.07	7.98	0.57	0.44	45.28
Singapore	56.53	0.15	0.05	16.52	1.02	0.03	15.56	8.35	6.20	25.09
Spain	52.16	0.16	0.06	40.60	1.07	0.05	6.10	2.33	2.71	47.26
Sweden	54.69	0.04	0.04	26.70	1.04	0.03	6.64	4.07	2.07	35.51
Switz	54.72	0.11	0.11	34.37	1.02	0.04	6.61	4.58	3.34	30.75
Turkey	55.42	0.21	0.36	35.34	1.09	0.08	8.73	0.68	1.40	40.69
UK	47.32	0.05	0.14	25.42	1.03	0.03	5.90	16.26	15.93	27.09
Venezuela	56.40	0.13	0.32	26.41	1.06	0.01	3.32	5.88	2.97	48.65
USA				31.26						26.49

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