The Geographic Distribution of Economic Activities of the USA Multinational Enterprises*

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Abstract

This paper examines empirically a range of theoretical hypotheses about the determinants of FDI location in a panel data regression framework. The results of the estimation of a gravity model lend support to the proximity-concentration and internalisation hypotheses. Also, the fact that FDI has been found to be decreasing in the competition posed by alternative locations is suggestive of the superiority of the share version of the gravity model over its classical formulation. A panel data cointegration-type analysis between FDI and GDP, and per capita income differential suggests that GDP has a positive impact on FDI, but provide mixed evidence as to whether per capita income differential reflects demand or supply determinants of FDI. Causality tests between income, income differential and FDI points to FDI playing a positive role on economic growth and convergence.

JEL Classification: C23; F21; F23

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1 Introduction

As globalisation reaches the remotest economies in the world, an increasing number of firms engage in foreign direct investment (FDI) for an increasing number of reasons, in a widening array of locations, in order to take advantage of the spawning business opportunities and also to better accommodate the blistering pace of technological change. From the host countries standpoint, FDI is generally reckoned as “good news” because, abstaining from the controversy of whether it constitutes a relevant source of aggregate capital, FDI is perceived as fostering sustained long term growth and promoting convergence between the developing economies that manage to lure large flows of FDI on a sustained basis and the developed countries. In the sense that the ability of countries in attracting sustained flows of FDI hinges decisively on certain country-specific characteristics, trying to pin down empirically the general determinants of the locational choice of FDI is a crucial task that, although with few notable exceptions, has received scarce attention in the literature. Thus, in this paper we evaluate empirically a range

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of theoretical hypotheses about the determinants of the location of multinational activity in a panel data regression framework.

The international economics literature has proposed several theories for the emergence of multinational enterprises (MNE). Of these, three stand out: the "proximity-concentration" hypothesis, the "factor-proportions" hypothesis and the "internalisation" hypothesis.

The proximity-concentration hypothesis explains the firm's choice between the two alternatives modes of foreign penetration, exporting and overseas expansion, as depending on the trade-off between the advantages related to proximity to the foreign market and the economies of scale that might result from the concentration of production (Krugman, 1983, Horstmann and Markusen, 1992, Brainard, 1993*b*, 1997). The models that underlie this hypothesis assume that each firm operate within a differentiated goods sectors. This sector is characterised by increasing returns at the firm level due to some input that can be easily spread among different production facilities, scale economies at the plant level, such that unit costs are decreasing with the plant size, and a variable transport cost. In this setup, and ignoring factor-proportions discrepancies, the proximity-concentration hypothesis predicts that FDI will tend to prevail relative to exporting the more difficult is the access to the foreign market, i.e. the higher are transport costs and trade barriers, and the lower are the economies of scale at the plant level relative to those at the firm level. Since the market-size hypothesis holds that if there are economies of scale firms will tend to invest in the larger foreign markets and export to the smaller ones in order to reap scale advantages and minimise transport costs, it can be said that the proximity-concentration hypothesis nests the market-size hypothesis of FDI location.

The factor-proportions hypothesis (Helpman, 1984, Markusen, 1984, Helpman and Krugman, 1985, Ethier and Horn, 1990) explains FDI location in terms of the combination of relative factor endowments with the characteristics of the production technology. In this context, if the production technology is such that different production stages have different factor-intensities, FDI may emerge as a viable way of exploiting lower factor costs. In the simplest case, where headquarters activities are capital-intensive and plant activities are labour-intensive, a single-plant MNE might emerge in order to exploit different factor costs. In particular, the firm will place its headquarters in the capital-abundant market and concentrate production in the labour-abundant location, exporting back to the headquarters market. In spite of assigning some opposite roles to some variables (e.g. regarding transport costs), these two hypothesis are not necessarily mutually exclusive (Brainard, 1997), since the proximity-concentration hypothesis is essentially tailored to explain horizontal FDI whereas the factor-proportions hypothesis is more suitable to account for the emergence of vertical FDI. In empirical terms, we would expect the proximity-concentration hypothesis to hold better for aggregate FDI flows, since horizontal FDI (especially among developed economies) accounts for the bulk of global FDI.

The "internalisation" hypothesis (Ethier, 1986, Horstmann and Markusen, 1987, Dunning, 1988, 1993, Ethier and Markusen, 1996) assumes that MNEs have firm-specific advantages that are better explored internally, rather than licensed or sold to a local firm because of the risk of assets dissipation, which gives rise to overseas expansion. It accrues that, if the firm's products require a local presence in order to maintain quality control, brand reputation or even to adapt to local tastes, then FDI will prevail as the mode of foreign market penetration.

Linder (1961) argued that countries with similar per capita incomes tend to have similar demand structures and so to consume similar consumption bundles. In spite of having been thought to characterise international trade flows, the Linder hypothesis can also be applied to FDI in which case intra-industry FDI between two countries with similar per capita incomes would emerge in order to exploit the two countries similar "tastes". Therefore, to the extent that per capita income differentials constitutes a good proxy for factor-proportions differences, the Linder and the factor-proportions hypotheses of FDI yield opposite predictions, since the former implies that FDI reacts negatively to per capita income differentials and the latter, positively.

The theory has identified other factors capable of conditioning the geographical distribution of FDI. The location of FDI should be sensible to cost-related variables, such as corporate taxes and labour costs. In what concerns corporate taxes, there is an extensive literature evaluating the effects of tax rates on FDI. Naturally, firms should prefer producing in locations where the tax rate is relatively lower (Grubbert and Mutti, 1991, Holland and Owens, 1996, Brainard, 1997, Haufler and Wooton, 1997). The economies of agglomeration have also been put forward as a relevant determinant of FDI location in the sense that existing foreign ventures in a given foreign location somehow pave the way for further overseas expansion by other MNEs (see e.g. Wheeler and Mody, 1992, Head, Ries and Swenson, 1995, Cheng and Kwan, 2000).

Processes of economic integration also seem to influence the patterns of FDI dispersion (for a recent discussion on this issue see Blomstrom and Kokko, 1997). Regional integration has typically been thought as of producing two type of effects: static and dynamic. As for the static effects, regional integration has two conflicting effects on inter-regional FDI. On the one hand tariff-hopping FDI is likely to be reduced as trade barriers are lifted. On the other hand, the elimination of investment barriers and greater openness, which supposedly stimulates cross-border investment, would bring about larger intra-regional FDI flows. In what concerns inter-regional FDI, the creation of a trade area may increase the level of protectionism relative to the rest of the word thereby generating tariff-hopping FDI. Regional integration is also likely to generate dynamic effects that will affect positively FDI inflows. That is because regional integration is bound to promote greater efficiency and economic growth, and also because a larger integrated market normally leads to firm mergers and increases the scope for economies of scale. Given the conflicting nature of the different effects of economic integration on FDI, the particular direction of the overall impact of regional integration is an empirical matter.

One central goal of the present analysis is to test empirically the above described theoretical determinants of FDI location. We will be concerned with testing those determinants jointly as to avoid as much as possible any omitted variable bias that is arguably pervasive in the empirical contributions that are concentrated in testing locational theories of FDI in isolation. Our econometric exercise is carried out using data on FDI outflows of United States (U.S.) MNEs disaggregated at industry level to a sample of several host countries. The empirical framework that we chose to test the locational determinants of U.S. FDI belongs to the family of the gravity models, which have been the workhorse of empirical applications in the international economics domain. In fact, since Linnemann (1961), gravity models have been used frequently in empirical work to assess trade flows and most recently to assess FDI (Brainard, 1997, Lipsey, 1999). The theoretical underpinnings of trade under the classical gravity model suggest that transport costs and trade barriers should discourage trade since they raise imports prices. These two variables are thought to have the opposite effect on FDI, implying that FDI and trade can be seen as alternative modes of foreign market penetration (see e.g. Horst, 1972*b*,*a*, Caves, 1974, Brainard, 1997). In this context, several empirical studies on the determinants of FDI have been criticised because, first, the exporting alternative is not endogeneised, and second, it can only relate the stock of foreign investment at a given time to tariffs rates at that time[1] (Caves, 1996, Brainard, 1997). Recognising the interdependence of FDI and exporting, the present study includes variables that proxy for transport costs and trade and FDI barriers in our gravity model.

The particular version of the gravity model that we employ is the share gravity model proposed in Mello-Sampayo (2000) and summarily described in §4.1. In short, the share version of the gravity model adds to the classical version a competition factor that captures the gravity of

[1]When FDI is subject to sunk costs it can appear unrelated to trade related determinants even if that causal relation was in force when the original investments were made. Studies that analysed flows of foreign investments have been more successful in finding a relation between FDI and trade policy (Caves, 1996).

"rival" countries candidate to the U.S. FDI. The competition factor allows to treat the U.S. FDI directed to one specific location as interdependent with the FDI decisions concerning alternative locations. In the sense that the validity of the share version of the gravity model implies that the classical version (that has been extensively used in empirical applications in international economics) is misspecified, testing the empirical validity of the share version constitutes another central goal of this paper.

To anticipate the results, the choice for the share version rather than the classical formulation of the gravity model seems to be vindicated by the data as the coefficient of the competition factor has been found to be negative and highly significant. Moreover, the econometric results suggest that FDI shares are increasing in transport costs, barriers to trade, FDI openness and market size (population), and decreasing in the scale economies at the plant level relative to the corporate level. These results provide unequivocal support to the proximity-concentration hypothesis. As expected, corporate taxes were found to have a detrimental impact on FDI. We also include a measure of each country's protection of intellectual property rights as a means of testing the internalisation hypothesis, since this hypothesis suggests that MNEs choose locations where its proprietary advantages are relatively more protected. The results seem to lend support to the internalisation hypothesis as the share of FDI has been found to be positively related to the degree of property rights protection. Finally, the location of U.S. MNEs' activities was also found to be highly persistent across destinations, suggesting the presence of agglomeration effects.

The fact that the levels of the FDI measures used in this application and the income variables, namely GDP and per capita income differential against the U.S. were found to be nonstationary implied that the impact of the income variables on FDI could not be evaluated under the share gravity model, since the GMM methodology that we use to estimate is only valid for stationary variables. Thus, a cointegration analysis in the context of panel data was employed with two further goals in mind. First, as a way of complementing the share gravity model, we test the "market size" hypothesis, this time using GDP as proxy for market size, and also whether differences in per capita income vis-à-vis the U.S. constitute demand determinants of FDI, as suggested by the Linder hypothesis, or supply determinants, as predicted by the factor-proportions hypothesis. The overall results suggest that GDP has a positive impact on FDI, thereby lending further support to the market size hypothesis, but provide mixed evidence as to whether per capita income differential reflects demand or supply determinants of FDI. Second, we conducted Granger-causality tests as a simple means of testing the long run role of FDI on economic growth and convergence. We seem to find evidence of reverse causality between the relevant income variables and FDI, suggesting that FDI plays a positive role in economic development and also in narrowing the gap between developing and developed countries.

The structure of the paper is as follows. First, the related empirical literature is briefly reviewed. Then, the data and the estimation method are described and the results of the share gravity model discussed. Finally, the estimation methods for the nonstationary data are described and the relevant results analysed.

2 Related Empirical Literature

Empirical research on the locational pattern of multinational activities has focused on a wide range of issues. Those include relative factor prices and separation factors, such as transport costs, trade and foreign investment barriers. Other explanatory variables that have been looked upon as influencing FDI are directly related to the host country's idiosyncrasies, such as market size and economies of scale, market and institutional characteristics, such as exchange rate and political stability and the income tax policy. Firm specific advantages have also featured prominently among empirical studies, since intangible assets are deemed to be much more relevant to FDI than physical capital assets (see Markusen, 1995).

With regard to the specific advantages of a foreign location, the market size brings down the average fixed cost of investing abroad. Scale factors affecting the absorptive capacity of the host country have been generally found to influence positively the locational decisions of MNEs (Grubbert and Mutti, 1991, Brainard, 1993*a*, 1997, Goldberg and Klein, 1996, Lipsey, 1999, 2000). Grubbert and Mutti (1991) found the low level of corporate taxes to be a decisive factor in attracting FDI inflows from the U.S., which contrasts with the results obtained in Lipsey (1999) and Wheeler and Mody (1992). Grubbert and Mutti (1991) also found that trade restrictions play a crucial role in attracting FDI inflows as long as the local market supports the subsidiaries' production. Brainard (1993*a*, 1997) rejects the factor-proportions hypothesis as a general explanation for the location of aggregate FDI. However, Brainard (1993*a*) finds more compelling evidence in favour of the factor-proportions hypothesis when a distinction is made between affiliate production for sale in the local market and that exported back to the affiliate's parent market, because factor proportions should be particularly relevant for vertical FDI.

Other empirical studies have focused on the industry specific characteristics that lead to foreign production rather than to exporting. In Lall (1980), economies of scale, when used as the only exogenous variable, have a greater positive effect on FDI than on exports, a somewhat puzzling result, since it would be expected that economies of scale would favour the concentration of production. This counter-intuitive outcome could be attributed to the fact that the regression used by Lall suffers from the problem of omitted variables (positive) bias arguably stemming from the positive correlation existing between economies of scale and variables such as market power and firm size, which tend to affect positively FDI. Another important finding of Lall (1980) is that "mobile" proprietary advantages such as product differentiation and R&D seem to promote FDI. In a study for Canada and the U.K., Caves (1974) found that in both countries economies of scale and ownership advantages are determinant in explaining the emergence of MNEs in industries characterised by concentration and high barriers to entry. Brainard (1997) tested and gathered favourable evidence for the proximity-concentration hypothesis by finding that affiliate sales respond positively to transport costs and trade barriers and negatively to investment barriers and production scale economies.

In sum, the empirical literature on FDI generally supports the claim that MNEs respond to a wide range of stimuli. Thus, an econometric analysis that concentrates on a reduced number of factors necessarily provides only a partial account of the determinants of FDI and incurs in a higher "risk" of omitted variables bias. In an attempt to avoid such problems, this paper pursues an eclectic approach that accommodates several variables in order to provide an overall view of the determinants that lead MNEs to choose a particular foreign production location over others and at the same time test the most prominent theories of FDI location. Looking at the related literature, our paper comes closest to Brainard (1997). As in there, we use data on U.S. MNEs to test the proximity-concentration, factor-proportions and internalisation hypotheses and arrive at similar qualitative conclusions. However, unlike Brainard (1997) who takes a cross-section approach, we carry out our estimation within a panel data framework, which arguably allows us to ge more reliable estimates and inference, and perhaps more importantly, to take avantage of the time series dimension of our data set to explore the long run relationship between FDI and income variables. Moreover, unlike Brainard (1997) who uses the classical version of the gravity model, we use the share gravity formulation, which includes a competition factor that according to Mello-Sampayo (2000) enhances the specification of the gravity model for the analysis of the location of multinational activity.

3 Data

The data set in the present application consists of outward FDI flows, broken-down by sector, emanated from the U.S. and targeted at a panel of countries. There are at least two good reasons for choosing U.S. MNEs when analysing the issues related to FDI location. First, a large share of worldwide MNEs' headquarters are located in the U.S.. Since MNEs around the world seem to be driven by broadly the same goals, the behaviour of American multinationals should give a fairly good idea of the location decisions of other countries' MNEs. Second, and most crucially, disaggregated data on FDI and on operations of foreign affiliates are extremely difficult to gather. Yet, the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce conducts compulsory outward investment surveys[2] in which the concepts and definitions are consistent, thus providing reliable data across countries and industries.

The host countries were selected as to embrace countries of the world's main economic regions, and to highlight the duality between developed and developing countries. Our sample incorporates countries with different cultures, income, organisation and infrastructures as well as with differing geographical proximity to the U.S.. The list of countries is: United Kingdom, Germany, France, Italy, Netherlands, Spain, Malaysia, Indonesia, Philippines, Thailand, Mexico and Canada. As of 1996, these countries accounted for around 60 percent of the total U.S. outward FDI. In what concerns the sectorial breakdown, the FDI data pertaining to each host country is disaggregated into 14 different industries[3].

In the specific form of the gravity model employed here, we use the share of U.S. MNEs' activities allocated to each country in the panel as the dependent variable. Since we use shares of FDI located to each country in the panel, we are controlling for the determinants of trade flows that are common to all alternative FDI locations, leaving only unaccounted the changes of the trade-off between FDI and exporting that are specific to each country. The use of panel data and of a dynamic specification of the share gravity model enables, to some extent, to control for the discrepancy between the trade policy at a time and FDI at that time.

3.1 The FDI Series (Dependent Variable)

FDI is commonly measured by the stock or flow of capital as defined by the International Monetary Fund (IMF) due to its ready availability and consistency across time and countries. This commonly used measure of MNEs' activity is a financial concept made for balance of payments purposes and does not necessarily have a one-to-one correspondence with real activities[4]. In order to overcome this limitation, four other measures of FDI are added to capital stock, namely, total assets, total sales, number of employees and employment compensation. In spite of FDI being a flow variable, some of its crucial dimensions are best conveyed by stock variables, such as the total assets or the number of employees pertaining to a foreign affiliate of a MNE. That is why the selected set of FDI measures includes both stocks and flows. In addition, the use of five different measures of MNEs' activities allows testing the robustness of the econometric results to several different measures of the same phenomenon.

Under the BEA's survey, the U.S. FDI data are presented for U.S. nonbank foreign affiliates of nonbank U.S. parents. Capital stock is equal to U.S. parents' equity in, and net outstanding loans to, their foreign affiliates. So, under this measure of FDI, the U.S. FDI may become negative when the loans from affiliates to the parents exceed the equity and loans to the affiliates. In some

[2]The survey is available on-line at `http://www.bea.doc.gov/`.

[3]The classification is based on the Standard Industrial Classification (SIC) Revision 2 Classification (Standard Industrial Classification Manual, 1987). See appendix A

[4]A good example of this mismatch is the foreign investment into "tax-havens".

cases, totalling well below one percent of the overall sample observations, the direct investment position is negative. Since the original series are to be transformed in logarithms, those cells are replaced by a positive value close to zero in the original series, such that their logarithmic transformed exist. This solution, albeit ad-hoc, prevents dropping Malaysia, Indonesia and the Philippines off the sample, which seems worthwhile given the extremely small number of such occurrences.

Foreign affiliates' total assets are equal to the sum of total owners' equity in affiliates held by both U.S. parents and all other persons and total liabilities owed by affiliates to both U.S. parents and all other persons. Total sales include sales of goods and services and are defined as gross sales minus returns, allowances, and discounts or as gross operating revenues, both exclusive of sales and consumption taxes levied directly on consumers, net value-added taxes, and excise taxes levied on manufacturers, wholesalers, and retailers. The number of employees is defined as the full-time and part-time employees on the payroll at the end of the fiscal year. The employment compensation (wages and salaries per employee) data cover the full year. Reported employee compensation data often covered only the portion of the year that the business was in the direct investment universe.

It is important to note that the data in the BEA's tables were suppressed if showing them would disclose the data for individual companies. In addition, it is often necessary to suppress other cells that, by subtraction from a common total or subtotal, could be used to derive the primary suppressed cell in the same or related table. However, this constitutes less than 5 per cent of the total and the omitted cells were filtered following ranges' approximations derived from the country and industry totals, whenever possible[5].

3.2 Competition Factor

The competition factor is a composite variable that attempts to capture the gravity of the competing destinations (see Mello-Sampayo, 2000). The competition factor (CF_{ijt}) is the sum, weighted by transport costs relative to industry j, of all other countries' characteristics (except country i) in attracting FDI from the U.S..

To proxy the country's overall characteristics in attracting U.S. FDI, GDP per capita at purchasing power parity (GDP^{PPP}) taken from *World Competitiveness Yearbook* (WCY)[6], is used. The competition factor is given by:

$$CF_{ijt}^{US} = \sum_{k \neq i}^{N} GDP_{kt}^{PPP} \cdot TC_{kjt}^{US} \qquad (1)$$

where CF_{ijt}^{US} is an index that measures the competition faced industry j of country i, and TC_{ijt}^{US} stands for transport costs. GDP^{PPP} is a prime indicator of the demand per capita as it measures the local consumers' real purchasing power, and the higher the consumers' purchasing power the more a firm will want to produce locally in order to fully exploit the market potential. Further, GDP^{PPP} is highly correlated with the variables used in this study to analyse the determinants of U.S. FDI location (e.g. labour productivity, FDI openness) and so is arguably able to capture the overall characteristics of the local market. However, in order to avoid multicollinearity problems, the GDP per capita PPP will be only used to compute the competition factor.

[5]This procedure draws on the fact that panel data is used. The gaps are approximated by distributing the remaining of the total across the correspondent industry and country. Although still arbitrary, the procedure has the advantage of bridging gaps by two criteria.

[6]The WCY is published annualy by the IMD International, Geneva, Switzerland.

3.3 Transport Costs

The gravity model emphasises the significance of transport costs in determining the pattern of the interactions flows, Masahisa Fujita and Venables (1999). Formal treatments of the gravity model, such as in Bergstrand (1989, 1990), have assumed an exogenous transport cost (*c.i.f./f.o.b.*) factor in shipping goods between countries. Hence, only a portion of a shipment arrives at its destination with the part lost in transit representing the resources exhausted to ship the output[7] (Krugman, 1980, Helpman and Krugman, 1985).

Very often in empirical applications, the physical distance between economic centers is used to proxy the separation factors in the gravity model (Linnemann, 1961, Bergstrand, 1985, 1989, 1990). Notwithstanding, Kau and Sirmans (1979) suggest that studies using physical distance as a proxy for the time cost of travel will overstate the impact of transport cost on spatial interaction. At the industry level, Brainard (1997) argues that any reasonably accurate measure of the cost of interaction between two places should reflect not only the physical distance, but also specific product characteristics. For that purpose, Brainard (1997) uses the ratio of freight and insurance charges to import values, whilst Harrigan (1993) employs the ratio of import values on a *c.i.f.* basis to the corresponding trading partner's export value on a *f.o.b.* basis. Another point has to do with the fact that, since we are trying to explain FDI decisions, our measure of transport costs should account for the trade-off faced by the multinational firm between the two alternative modes of foreign penetration: exports and FDI. That is because the higher the costs related to exports incurred by the firm the greater its incentive to expand its production capacity at the target location. Taking this issues on board and following both Brainard (1997) and Harrigan (1993), we created the following series to proxy for transport costs at the industry level, for the period 1988-1996:

$$TC_{ij}^{US} = \frac{(\text{US Other Transport Receipts})_i^{US}}{(\text{US Export Value})_i^{US}} \times (\text{US Shipped to Affiliates})_{ij}^{US} \qquad (2)$$

The variable TC_{ij}^{US} captures the transport cost of exports between the U.S. parent in industry j and its foreign affiliate in country i. Both the denominator and numerator of the ratio in (2) were obtained from the BEA's U.S. Balance-of-Payments data[8]. Other transport receipts primarily covers transactions for freight and port services for the transport of goods by ocean, air, and lorry from the U.S.. The denominator, "export value" covers the free alongside ship (*f.a.s*) value of merchandise at the U.S. port of export, based on the transaction price including inland freight, insurance and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of export.

The cost of transport per U.S. dollar exported to country i is then multiplied by U.S. exports (value) shipped to affiliates, country of affiliate by industry of affiliate, from the BEA. The merchandise trade data from BEA are reported on a "shipped"" basis, i.e., on the basis of when and to (or by) whom the goods were physically shipped. Exports of U.S. parents shipped to foreign affiliates are disaggregated into the 14 product categories (industries). The choice of computing transport costs for exports rather than for total trade is explained by the fact that, as far as transport costs are concerned, exports are the main alternative to FDI. Appendix B contains the average cost of transport per U.S. dollar exported to each country in the panel, with the highest average value for the Philippines and the lowest for Mexico and Canada. Hence, this series seems reasonable in approximating country-specific transport costs. Although not reported here, when multiplying the obtained transport costs series by the U.S. exports (value)

[7] This is known as the "iceberg" transport technology: for every unit shipped, only $1/\tau$ units arrive, for $\tau > 1$.
[8] The U.S. exports to Spain, Indonesia, Malaysia, Philippines and Thailand were drawn from the World Trade Tables.

shipped to affiliates, country of affiliate by industry of affiliate, in order to approximate industry-specific transport costs, the resulting series also seems sensible, since its highest values are for industries such as transport equipment (I9) and its lowest values for industries such as finance, insurance and real estate (I12).

3.4 Barriers

As is well known, data on tariffs and non-tariffs barriers (NTBs) are very difficult to gather and not easily comparable across countries. Yet, the WCY presents two measures of openness using survey data: the trade openness and the FDI openness indices, for the period 1990-1997. The WCY uses two types of data to capture quantitative and qualitative information separately. The hard data comprises statistical indicators obtained from supranational, international, national and regional organisations and statitics offices. The soft data is compiled from the executive opinion survey, which is an in-depth 87-item (criteria) questionnaire sent to executives in each country analysed.

We use the WCY's trade openness index to generate a trade barrier index (TRP), which aggregates information on tariffs and NTBs and is decreasing in the degree of openness to trade[9]. Hence, the trade barrier index is expected to have an overall positive impact on the share of U.S. FDI (Horst, 1972*b*, Caves, 1974, Grubbert and Mutti, 1991, Brainard, 1997). The countries more open to trade are the Netherlands and the U.K. and the least open are the "New Tiger" countries (see figure 1).

The FDI openness index (FDIO) is increasing in the degree of openness to FDI and is expected to have an overall positive impact on the share of U.S. FDI. The countries in the panel with the greater barriers to foreign investors are Indonesia, Philippines and Thailand, those with a more open stance are the Netherlands, U.K. and Germany (see figure 2).

3.5 Other Data

Data on the intellectual property right (IPR) index are taken from the WCY for the period 1990-1997. The higher the index, the more the intellectual property is adequately protected. IPR is included as a proxy for the host market's legal and regulatory framework compatibility with the operations of foreign-owned firms. As well known, firm-specific assets that confer MNEs proprietary advantages, i.e. technology, brand name, product design, managerial technique and so forth, are a necessary condition for the emergence of MNEs. Hence, MNEs will more likely invest in a country where their assets are well protected. In the sense that better intellectual property rights protection reduces the risk of the firm-specific assets dissipation, the variable IPR can be used to test the importance of the internalisation hypothesis. In regard to the sample IPR series, Germany appears on top and Thailand at the bottom of the panel (see figure 3).

GDP per employee per hour in U.S. dollars from the WCY is used to proxy for labour productivity (LP) for the period 1990-1997. Cushman (1987)[10] finds that low labour costs in itself are an insignificant advantage unless low labour costs can be matched with high productivity. Therefore, it is expected a positive relation between labour productivity and inflows of FDI. Also, to the extent that labour productivity constitutes a good measure of the factor proportions, LP can be used to test the factor-proportions hypothesis of FDI. The country with the

[9]The trade barrier index for country i in the sample was constructed by subtracting from the overall maximum value for the WCY's trade openness index series the value of the trade openness index recorded for country i. In this way we turn the trade openness index, which is increasing in the degree of openness to trade, into a measure that is decreasing in the degree of openness to trade.

[10]Cushman argues that non-U.S. productivity is the most important of the various labour-related cost variables in determining FDI over the period 1963-1981.

highest LP is France, followed closely by Germany. Indonesia has the lowest LP in the panel (see figure 4).

Another cost-related factor included in our study is the level of taxation in the host country. Data on corporate taxes (CT) on profits, income and capital gains as a percentage of GDP are taken from WCY for the period 1989-1996. The country with the highest level of taxation is Indonesia where CT represents on average 8 percent of GDP (see figure 5).

The theory distinguishes between scale economies at the corporate and plant level. Scale economies at the corporate level are typically induced by firm-specific assets that are easily spread across different plants and at a low cost. Examples of firm-specific assets are technology, management, marketing services as well as patents and trademarks. R&D, advertising and technical and scientific workers are frequently used as proxies for firm-specific assets (Markunsen, 1995). Since such data are not available for our panel, we use the number of non-production employees from the Statistical Abstract of the U.S. Census Bureau for the period 1988-1997. From figure 6, manufacturing (I3) appears at the top but with a downward trend, other industries (I14) and services (I3) follow with an upward trend. Similarly, scale economies at the plant level or economies of scale based on physical capital intensity are proxied by the number of production workers from the Statistical Abstract of the U.S. Census Bureau for the period 1988-1997. These economies of scales variables along with transport costs, barrier variables and market size will be pivotal in testing the validity of the proximity-concentration hypothesis.

Data on GDP at current prices, GDP per capita differential vis-à-vis the U.S. (GDPDIF) and population (POP) are taken from the IFS of the IMF for the period 1982-1997. GDP and POP have been widely used in the gravity models analysing trade flows[11]. GDP is used to proxy for market income-size and population to proxy for market demographic-size (see figures 7 and 8). GDP per capita differential (GDPDIF) is the absolute value of the differential in per capita GDP between the U.S. and each country in the panel. GDPDIF is included to test the factor-proportions hypothesis. The countries with higher GDPDIF are the "New Tiger" countries and Mexico (see figure 9).

We consider an additional measure of FDI, the level of U.S. outflows of capital stock, aggregated over industry, including banking, into each country in the panel. Data on aggregated capital stocks (AKS) for 1982-1998 are taken from BEA. AKS data are presented for U.S. foreign affiliates of U.S. parents. In figure 10 it is observed that, according to this measure of FDI, the U.K. is the largest recipient of U.S. FDI, followed by Canada. At the bottom of the list come the developing countries.

3.6 Unit Root Tests

Since the appropriateness of the methodology to be applied to the econometric estimation depends on the time series properties of the data, such properties must be ascertained before any estimation is carried out. There are several statistics that may be used to test for a unit root in panel data, but since we have a short-panel data set, we employ the Im, Pesaran and Shin (2003) t-bar statistic, which is based on the mean augmented Dickey-Fuller (ADF) test statistics calculated independently for each cross-section of the panel.

The unavailability of diagnosis tests for the presence of deterministic components in the ADF regressions implies that the unit root tests are carried out using several combinations of deterministic components. In the cases where the results regarding the existence of unit root differ for different models, we pick the model whose deterministic components seem more

[11] Under trade theory there is an inverse relation between volume of trade and population, as larger countries tend to be more self-sufficient. On the other hand, there is a direct relation between volume of trade and GDP as it reflects the size of demand and supply of the market.

appropriate when analysing the plot for each series (figures 1 to 10). Finally, as far as the specification of the test equations is concerned, time dummies are always included to control for common effects across cross-sections.

(Insert table 1 here)

The results of the panel unit root tests for each variable used in this paper are shown in table 1. Since we have annual data with a limited time span, we use one lag to account for autocorrelation. As we may observe in table 1, in every case the null that every variable contains a unit root for the series in logs is rejected with the exception of the five measures of FDI (in levels, not in shares), aggregated capital stocks, GDP, GDP per capita differential and population. The hypothesis of non-stationarity was not rejected against the alternative that the population series is stationary, but was rejected against the null of trend-stationary.

To test for the possibility that the variables which were found to be non-stationary are integrated of second order, $I(2)$, unit root tests on the first differences of the variables were run. Although not shown here, these tests suggest that all variables are stationary in first differences.

Having ascertained the time series properties of the data, we now select the variables that are stationary and align the time span pertaining to each variable in order to obtain a balanced panel for all stationary variables. The result is a panel comprising the share of U.S. FDI portrayed in the five measures, transport cost, competition factor, trade barriers index, FDI openness index, labour productivity, corporate taxes, population, intellectual property rights index and production and non-production workers, for the period 1990-1996. With this panel we estimated a share gravity model in order to analyse the determinants of U.S. FDI location. For the non-stationary variables we constructed a balanced panel comprising aggregated capital stock, GDP and GDP per capita differential for the period 1982-1997, which will be used in section 5 to analyse the issue of possible cointegration and causality among each GDP variable and FDI as measured by aggregate capital stock.

4 Estimation of the Share Gravity Model

4.1 The Share Gravity Model

The formulation adopted in most applications of the gravity models to the analysis of trade and FDI goes back to the contribution of Hua and Porell (1979) and can be summarised by the generalised version of the classical gravity model, as follows:

$$F_{ijt} = \Omega \cdot AG_{it}^{\alpha_1} \cdot AT_{jt}^{\alpha_2} \cdot SF_{ijt}^{\alpha_3} \tag{3}$$

where F_{ijt} is the expected interaction flow between locations i and j per unit of time, Ω is a predetermined quantity, AG_{it} measures the features of country i that generate the outflows, AT_{jt} measures the attractiveness of country j and SF_{ijt} is a spatial measure between the two countries. Hua and Porell (1979) denominate AG_{it}, AT_{jt}, SF_{ijt}, as generation, attraction (the mass terms) and the spatial term, respectively. So, the inverse of the facility, SF_{ijt}^{-1}, measures the separation factor, which in the present context certainly includes transport costs between country i and j, at time t, but also any trad and foreign investment barriers in the target destination, j. α_1, α_2 and α_3 are parameters to be estimated.

The classical gravity model applied to the international trade theory uses the "distance-decay" concept (Fotheringham, 1983, 1984), which may be described as the rate at which the volume of trade between locations decreases as the distance between them increases. Conversely, the FDI theory uses the "distance-incentive" concept, or the rate at which the volume of FDI flow increases as the transport costs between economic centres increases, since it will become preferable to produce locally than to export (Horstmann and Markusen, 1992, Brainard, 1993*b*, 1997, Markusen and Venables, 1996). Therefore, when modelling international trade flows we expect that $\alpha_1 > 0$, $\alpha_2 > 0$ and $\alpha_3 < 0$ whereas for FDI flows we should obtain $\alpha_1 > 0$, $\alpha_2 > 0$ and $\alpha_3 > 0$.

In spite of its widespread use in international economics, the classical version of the gravity model arguably contains a fundamental flaw when applied to the empirical analysis of FDI: it implies that FDI flows between two countries depend solely on factors pertaining to those countries. Most crucially it ignores the attractiveness of alternative locations. To overcome this limitation Mello-Sampayo (2000) proposes the use of the share version of the gravity model introduced in the human geography literature by Hua and Porell (1979), but virtually ignored in economic applications. Its main difference from the classical version stems from the fact that a competition factor encompassing the ability of third countries to attract FDI is included as a dampening factor to FDI flowing to any potential location. Such an alternative specification of the gravity model applied to the behaviour of FDI may be given by the following equation:

$$F_{ijt} = \Omega \cdot (AG_{jt})^{\beta_0} \cdot (AT_{it})^{\beta_1} \cdot {\frac{1}{SF_{ijt}}}^{\beta_2} \cdot \frac{1}{(CF_{ijt})^{\beta_3}} \tag{4}$$

$$CF_{ijt} = \sum_{k \neq i}^{N} AT_{kt} \cdot \frac{1}{SF_{ijt}} \tag{5}$$

where β_0, β_1, β_2 and β_3 are parameters, i stands for country, j for industry, t for time, US for United States. The variable F_{ijt}^{US} denotes United States FDI into industry j of country i at time t.

Equation (5) gives the sum, weighted by the separation term relative to industry j, of all other countries' characteristics (except country i) in attracting FDI from the United States. Equation (5) attempts to capture the gravity of the competing destinations. Otherwise, it can be seen as a composite index that yields the competition faced by industry j in country i in attracting United States FDI.

Since the aim of the present study is not to explain the amount in levels of FDI, but rather the way United States MNEs distribute their foreign activities across different countries, we need a model of shares rather than levels. That may be accomplished by substituting the parameter Ω in equation (4) by the total FDI outflow from United States in industry j into all countries in the panel, F_{*jt}, to yield the share distribution gravity model:

$$\frac{F_{ijt}}{F_{*jt}} = (AT_{it})^{\beta_1} \cdot {\frac{1}{SF_{ijt}}}^{\beta_2} \cdot \frac{1}{(CF_{ijt})^{\beta_3}} \tag{6}$$

Notice that we have not included the generation variable in equation (6) since this is an origin-specific model and so variations in the United States' aggressiveness become redundant in explaining changes in the FDI shares of destination countries[12]. What is crucial about equation (6) is the fact that since a country's advantage as a location for FDI is dependent on the weighted sum of all other countries' attractiveness, the traditional gravity model, according to which a change in the characteristics of one country would not shift flows into other countries, misses the interdependence among FDI flows. However, in a world of scarce capital resources, the interdependence of the flows seems to be a much more plausible theory of investment.

[12] If the level of flows instead of shares was to be analysed, the home country's aggressiveness would prove instrumental in accounting for variations in the interaction flows.

4.2 The Econometric Model

The following dynamic log-linear model, which we call the benchmark model, explains the share of U.S. FDI allocated to each industry in each country of the panel as a function of a set of regressors:

$$\begin{aligned} LFSH^{US}_{ijt} &= \beta_0 LFSH^{US}_{ijt-1} + \beta_1 LTC_{ijt} + \beta_2 LCF_{ijt} + \beta_3 LTRP_{it} + \beta_4 LFDIO_{it} + \\ &\quad \beta_5 LLP_{it} + \beta_6 LCT_{it} + \beta_7 LPOP_{it} + u_{ijt} \end{aligned} \quad (7)$$

where $\begin{cases} i = 1, 2, \ldots, 12, \text{ denotes countries;} \\ j = 1, 2, \ldots, 14, \text{ denotes industries;} \\ t = 2, \ldots, 7, \text{ denotes periods (years).} \end{cases}$

The dependent variable, $LFSH_{ijt}$, is the log of the U.S. FDI into industry j of country i over the total FDI outflow from the U.S. into industry j of all countries in the panel at time t. LTC_{ijt} is the log of the transport costs for industry j between the U.S. parent and its foreign affiliate in country i at time t. LCF_{ijt} is the log of the index that yields the competition factor faced by industry j in country i at time t. $LTRP_{it}$ and $LFDIO_{it}$ are the logs of the survey measures of protection to trade and openness to FDI in country i at time t, respectively. LLP_{it} is the log of labour productivity in country i at time t. LCT_{it} is the log of corporate taxes on profits, income and capital gains as a percentage of GDP, and $LPOP_{it}$ is the log of population in country i, at time t.

The number of observations for each measure of FDI is given by: $\sum_{i=1}^{12}\sum_{j=1}^{14}(T_{ij} - 1) = 1008$, where $T_{ij} = T = 7$, since we have a balanced panel data. The two-way error component term of equation (7) is given by:

$$u_{ijt} = \lambda_t + \eta_i + \varphi_j + \varepsilon_{ijt} \quad (8)$$

where η_i accounts for unobservable country-specific effects, φ_j accounts for unobservable industry-specific effects and λ_t accounts for time-specific effects. The term ε_{ijt} is the random disturbance in the regression, varying across time, country and industry cells. As regards the model of equation (7), we assume sequential exogeneity of the regressors, which amounts to postulating that the dynamics of the model are entirely captured by the one-period lagged dependent variable. Thus, the ε_{ijt} can be assumed to be independently distributed across individuals with zero mean. But arbitrary forms of heteroskedasticity across units and time are allowed.

The benchmark model, given by equation (7), will be used primarily to test the validity of the share gravity model as a relevant empirical framework for FDI. The way we think equation (7) provides a suitable testing ground for the share gravity model can be seen by grouping the variables in (7) so as to match the terms of equation (6). In fact, we can think of transport costs, trade barriers and FDI openness in (7) as accounting for the separation term between the source and the target locations, in the same way as population, labour productivity and corporate taxes can be seen as factors determining the attractiveness of the target location. The remaining two variables in equation (7), competition factor and the lagged dependent variable account for the competition exerted by alternative destinations and the dynamics of the model, respectively. Further ahead, we will add to equation (7) the intellectual property rights index to test the internalisation hypothesis and after the number of production and non-production workers to fully test the proximity-concentration hypothesis.

In picking the econometric technique to estimate equation (7) we have to carefully consider the characteristics of this specific panel data. As regards the choice of the estimation procedure, our econometric problem exhibits two defining features. First, we have a typical short-panel, since the number of time periods is limited and the number of units large. This implies that the fixed effects least squares model suggested by Mátyás (1998) for the estimation of the gravity model, which explicitly estimates the time and individual effects in (8), would result in a large loss of degrees of freedom and quite possibly in multicollinearity problems, since we are estimating extra parameters for the individual and time effects. Second, the presence of the lagged dependent variable in the right-hand side of the regression equation means that the lagged dependent variable is correlated with the unobservable country and industry-specific effects. That is because both $LFSH^{US}_{ijt}$ and $LFSH^{US}_{ijt-1}$ depend on η_i, φ_j, which are imbedded in the error term. This fact rules out the pooled OLS and the random effects estimators as both estimators would come out inconsistent.

The problem of the correlation between $LFSH^{US}_{ijt-1}$ and η_i and φ_j could be overcome by applying a transformation to the model in equation (7) that would eliminate the unobservable fixed country and industry effects. There two natural such transformations: the within transformation and first-differencing. For the within transformation the $\left[LFSH^{US}_{ijt-1} - \overline{LFSH}^{US}_{ij.-1}\right]$ will be correlated with $[\varepsilon_{ijt} - \bar{\varepsilon}_{ij.}]$ even if the random disturbances ε_{ijt} are not serially correlated, because $LFSH_{ijt-1}$ is correlated with $\bar{\varepsilon}_{ij.}$ by construction. For the first-differences transformation the $\left[LFSH^{US}_{ijt-1} - LFSH^{US}_{ijt-2}\right]$ will be correlated with $[\varepsilon_{ijt} - \varepsilon_{ijt-1}]$ even if the random disturbances ε_{ijt} are not serially correlated, because $LFSH_{ijt}$ is correlated with $\bar{\varepsilon}_{ijt+1}$ by construction. In these two cases, the assumption of strict exogeneity is violated, causing both the within and first-differences estimators to be inconsistent.

Under these conditions, especially when estimating dynamic models under short-panel data, Arellano and Bond (1991) suggest exploiting the orthogonality conditions between the explanatory variables (the lagged dependent variable and the exogenous variables) and the random term that exists in equation (7) in order to instrument the regressors that are correlated with the two-way error component term. Following Arellano and Bond (1991) and several other related contributions thereafter, a GMM estimation procedure is applied to our dynamic panel data model. The standard GMM estimator proposed by Arellano and Bond (1991), which eliminates unobserved specific effects by applying first differences or orthogonal deviations and taking lagged levels of the regressors as instruments is not suitable for our panel data because the five measures of FDI are found to be highly persistent[13]. Thus, lagged levels are only weakly correlated with subsequent first-differences and as shown in Blundell and Bond (1998, 1999) in this particular setting, weak instruments can result in large finite-sample biases and imprecision[14]. If the instruments used in the first-differences estimator are weak, then the first-differences GMM results are expected to be biased downwards, as with the within groups (see Arellano and Bond, 1991, Blundell and Bond, 1998, 1999). Blundell and Bond (1998, 1999) also showed that biases resulting from using weak instruments could be considerably reduced by incorporating more informative moment conditions. These moments conditions result from using changes in the lags of the regressors as instruments for the equations in levels (Arellano and Bover, 1995). Blundell and Bond (1998) suggest stacking the moments conditions relative to the equations in first-differences and in levels to form what they call the GMM-system estimator. These authors employ Monte Carlo simulations to show that the GMM-system estimator brings about a dramatic improvement in the small-sample bias and precision relative to the standard (Arellano and Bond, 1991) estimator, particularly when the dependent variable is highly persistent (though stationary), which seems to be an essential feature of our data. In view of its superiority in terms of unbiasedness and efficiency, we use the GMM-system estimator in all estimations of

[13]The results of fitting a AR(1) to all variables considered is available from the authors upon request.

[14]Blundell and Bond (1998, 1999) demonstrate that the instruments used in the first-difference GMM estimator become less informative in two important cases: as the value of the autoregressive parameter tends towards unity and as the variance of the fixed effects increases relative to the variance of the random shocks.

the share gravity model.

In the context of our share gravity model, the precise set of instruments that give rise to the moments conditions depends on the degree of exogeneity we are prepared to assume for the regressors other than the lagged dependent variable. As we do not expect all regressors to be strictly exogenous, we assume sequential exogeneity as we did for the lagged dependent variable. This leads to moments conditions that imply that the residuals of the estimated equations are uncorrelated with contemporaneous and past observations of all the regressors. Therefore, the matrix of instruments is composed of lagged levels of the dependent variable dated $t-2$ and earlier and lagged levels of the remaining regressors dated $t-1$ and earlier in the first difference equations and of lagged first-differences of the dependent variable dated $t-2$ with lagged first-differences of the remaining regressors dated $t-1$ as instruments in the levels equations.

4.3 Estimation Results

The results pertaining to the estimation of the benchmark share gravity model in (7) as well as some extensions to it are reported in tables 2, 3 and 4. In table 2 we report the results found for each of the five measures of FDI. Moreover, since the various measures of FDI are likely to be highly correlated, we used the principal component analysis (PCA) to analyse the underlying dimensionality of the five measures. The five eigenvalues were 4.636, 0.306, 0.034, 0.019 and 0.006. Since the largest eigenvalue accounts for 92.7 per cent of the total variation and the corresponding eigenvector suggests that all variables have nearly the same weight, we may conclude that any of the five measures of FDI may be used to picture the FDI phenomenon, or that the effective dimensionality of the FDI data is one. In other words, the estimation results should be almost identical for each of the five measures. A new series, PCV, was created using the first principal component. As patent in table 2, the econometric results seem to be consistent with the PCA predictions. Thus, in tables 3 and 4 we report only the results for the PCV variable.

In all tables 2, 3 and 4 we report the results for both the one-step and two-step GMM-system estimators. The one-step estimator uses a weighting matrix that is independent of estimated parameters, while the (asymptotically) more efficient two-step estimator uses a weighting matrix that corresponds to the variance matrix of the estimated residuals of the one-step estimator. In spite of its asymptotic higher efficiency relative to the one-step estimator, the two-step estimator produces downward biased variance estimates in small samples due to the extra variation introduced by the presence of estimated parameters rather than the true ones, resulting in oversized individual and joint significance tests. In this context, it has been advocated the use of the one-step estimator for inference, since this estimator reports a dispersion around the point estimate that is closer to the asymptotic one in finite samples. In any case, the trade-off between the higher asymptotic efficiency and the downward biasedness of the variance estimates pertaining to the two-step GMM-system estimator hinges, in a rather complex way, on the specific model in hand, the number of cross-section and time periods, the specific instruments used, and the number of moments. Therefore, the choice between the one-step and the two-step GMM estimators for the analysis of the results is not straightforward.

Along with the estimated coefficients of the share gravity model and the respective p-values, we report several specification tests. The Wald test evaluates the overall significance of the model under the null hypothesis that all coefficients are jointly zero. We also report a first-order and second-order autocorrelation tests for the residuals of the equations in first-differences. The rationale for this is that the presence of serial correlation in the residuals of the original model (in levels) constitutes evidence that sequential exogeneity of the regressors cannot hold, which in turn implies the invalidity of moment conditions that rely on the levels (or changes) of lags of the dependent variable as instruments, as it is the case with the GMM-system estimator we are using. Since we are testing for autocorrelation of the residuals in the differenced equations, we should expect to find first-order serial correlation but no evidence of second-order autocorrelation if the model is well specified, i.e. if our specification fully captures the dynamics of the underlying true model[15]. Finally, we report a Sargan test for the overidentifying restrictions under the null of the validity of the moment conditions.

In table 2, for both one-step and two-step GMM-system estimators we reject the null of the Wald test and so accept the overall significance of the regressors. We fail to reject first-order but not second-order autocorrelation of the residuals in the equations in first-differences, which constitutes evidence in favour of the validity of the assumption of sequential exogeneity. Even though there is a strong tendency for the Sargan test to over-reject the null hypothesis under the presence of heteroskedastic errors, the validity of the over-identifying restrictions are not rejected for TA, KS and PCV. A model with an intercept was estimated and, as expected, the intercept turned out to be statistically insignificant, since the dependent variable is expressed in shares, not levels. It turns out that the model in equation (7) seems to be well specified and to explain the share of FDI reasonably well. Moreover, the estimated individual coefficients for the various measures of FDI were generally found to have the correct sign and to be statistically significant (at least for the two-step GMM estimator). Adding to all this the fact that the competition factor, which is absent from the classical version, has been estimated to have a detrimental effect on the share of FDI, not only vindicates the share gravity model as a suitable framework for the analysis of the locational determinants of FDI, but is also suggestive of its superiority over the classical version.

The results of the estimation of equation (7) suggest that the share of FDI exhibits a high persistence as the coefficient on the lagged dependent variable was found to be relatively close to one and quite significant. As often contended in the literature, this can be regarded as evidence in favour of the presence of agglomeration effects in FDI.

(Insert table 2 here)

The inclusion of an adjacency dummy and of intellectual property rights (IPR) variable is assessed in the share gravity model by using the PCV measure of FDI (see table 3). The adjacency dummy takes the value of one for Mexico and Canada and zero otherwise. The effects of adjacency are generally analysed in light of the impact of the geographical proximity on FDI decisions. However, in the particular case of the U.S., the two adjacent countries form with the U.S. a trade zone (NAFTA), which leads us also to consider the effects of regional integration on FDI when looking at the estimated effects of adjacency.

According to the "distance-incentive" concept, which assumes higher relevance for horizontal FDI, the adjacency parameter estimate should be negative as low transport costs should render exporting more advantageous than FDI. However, adjacency also exerts some positive effects on the potential to attract FDI, as it may encourage local production destined to be exported back to the parent firm's home market or MNEs' vertical integration across borders (Brainard, 1993*a*) and also reduce the cost of supervision of foreign affiliates (Ethier and Horn, 1990, Lipsey, 1999, 2000). The results are presented in table 3. It appears that, if anything, adjacency plays an overall negative role in the location of FDI (see columns PCV(2) for both the one-step and two-step estimators in table 3). The lack of statistical significance of the estimated coefficient on adjacency might be reflecting the fact that we would expect the FDI flowing to Mexico to be predominantly of the vertical type and that flowing to Canada to be predominantly of the horizontal type. Therefore, since these two types of FDI are affected by distance in

[15]If a series u_t are *iid* it can be easily shown that $corr(\Delta u_t, \Delta u_{t-1}) = -0.5$ and $corr(\Delta u_t, \Delta u_{t-2}) = 0$.

opposite ways, the positive effect of adjacency pertaining to Mexico might be cancelling out the negative effect pertaining to Canada. These conflicting effects will further interact with the also potentially contradictory effects of NAFTA on American FDI (see section 1). Overall, the lack of a discernible impact of adjacency on U.S. FDI is perfectly compatible with the predictions of the FDI theory.

The columns PCV(3) for both the one-step and two-step estimators in table 3 show the results of the share gravity model with the inclusion of the IPR variable. The estimated coefficient of IPR measures how keen MNEs are in protecting their proprietary advantages. The coefficient on IPR appears positive as expected, though not significant under the one-step estimator. This implies that MNEs will, *ceteris paribus*, invest in the locations that better guarantee that their know-how cannot be improperly exploited by local competitors, which conforms with the "internalisation" hypothesis.

(Insert table 3 here)

Finally, we test the "proximity-concentration" hypothesis using the share gravity model. Since we use shares of FDI allocated to each country in the panel, we are controlling for the determinants of trade flows that are common to all alternative locations in the panel thereby mitigating the potential problems associated with the joint determinacy of exports and FDI. The results of including the scale-economies variables in the original share gravity model (equation 7) are reported in the columns PCV(1) for both the one-step and two-step estimators in table 4. All the coefficients have the predicted sign. Specifically, in regard to the scale variables, the coefficient on production workers (PW) is negative and significant at 10 percent under the two-step estimator but not significant under the one-step estimator. The non-production workers' (NPW) coefficient is positive and significant. Hence, scale economies at the plant level, by which the concentration of production lowers unit costs, affect negatively the share of FDI allocated to each country in the panel. On the other hand, scale economies at the corporate level, which imply that the firm has an input that can be spread among any number of factories with undiminished value, affects positively the share of FDI. This combined with the positive effect of transport costs, trade barriers and of market size, indicates that the share of FDI allocated to each country in the panel is an increasing function of proximity advantages but decreasing in the advantages from concentrating production in one location.

Comparing these results with the ones of the column PCV(1) of the two-step estimator displayed in table 3, the elasticities given by the coefficients of CF and FDIO are significantly higher under the "proximity-concentration" hypothesis. Thus, the weight of competition of potential competing countries and the host market investment climate comes stronger in equations where the firm is assumed to be confronted with the trade-off between proximity to consumers and concentration of production. In sum, the "proximity-concentration" hypothesis is not rejected when explaining the share of FDI allocated to each country in the panel. All relevant variables appear with the correct sign, namely corporate scale economies and production scale economies are positive and negatively, respectively, related to the share allocated to a specific location. Again adjacency and IPR have the predicted signs.

(Insert table 4 here)

5 Long Run Relation, Short Run Dynamics and Causality Between Output and FDI

In this section we look at the relation between aggregate FDI as measured by aggregate capital stocks (AKS) and output. Throughout this section we drop the industry observational category.

In this way, our data set collapses into a panel of countries from 1982 to 1997. Two different hypotheses concerning the determinants of FDI are tested. The first is that the host market size, measured by GDP, exerts an important influence on FDI location. In particular, we would expect a positive relation between GDP and FDI, since the higher the income of the host country the more demand for certain goods has gone potentially unfulfilled and so a local presence may be required. Moreover, we may also have the "home market effect", by which in the presence of transport costs and economies of scale, larger markets attract firms to produce to the internal market and export to smaller countries (Krugman, 1980, Helpman and Krugman, 1985).

The second hypothesis tests whether per capita income differential ($GDPDIF$) reflects demand or supply determinants of FDI. On the one hand, the Linder hypothesis implies that countries with similar per capita income will tend to enjoy each others' differentiated products. Thus, a negative relation between $GDPDIF$ and U.S. FDI is expected, since the richer a country is, the likelier are U.S. MNEs to find a market for their (differentiated) products. Therefore, an estimated negative relation between $GDPDIF$ and FDI constitutes evidence of per capita income differentials reflecting demand determinants of FDI. On the other hand, to the extent that per capita income differential constitute a reasonable proxy for capital-labour ratios or factor-proportions differences as assumed in Bergstrand (1989), Bergstrand (1990), Hummels and Levinsohn (1995), Brainard (1997), the factor-proportions hypothesis predicts a positive relation between $GDPDIF$ and FDI, since MNEs tend to locate their activities in order to take advantage of different factor costs stemming from factor-proportions differences.

Given that FDI, GDP and $GDPDIF$ have all been found to contain a unit root in §3.6, we conduct a cointegration-type analysis in order to disclose not only the long run co-properties of the data, but also their dynamic behaviour and causality. Since at this stage we are only interested in testing the above mentioned hypotheses, we use a bivariate framework that besides being simpler to handle allows to test the long-run direct effect of GDP and income differential on FDI as well as the effect of FDI on long-run economic growth and convergence without specifying a full structural model.

We test for cointegration using a panel data equivalent to the single equation methodology. The main motivation for using the panel data cointegration test is to increase the power of the test by increasing the sample size that results from pooling the data from different cross section units. This procedure has been often claimed in the literature to be superior to the alternative of widening the span of the time series because problems associated with structural changes are likely to arise in long time series[16].

We estimate the cointegration relationships and the error-correction mechanism (ECM) equations separately for each country, and test hypotheses regarding panel-average effects by averaging only the relevant parameters across countries. The advantage of this method is that instead of assuming parameters to be common across countries, which might lead to bias and possible inconsistency when estimating the panel-average effects (Pesaran and Smith, 1995), we allow for heterogeneity among the key parameters across countries. Thus, we are also able to analyse and compare individual country results.

5.1 Panel Data Cointegration Tests

To test for cointegration we can use the panel data equivalent to the Engle and Granger (1987) two-step procedure, which basically consists of firstly estimating a cointegrating regression and secondly testing for the presence of unit roots in the cointegration regression's residuals. Thus, the null-hypothesis is in fact a hypothesis of no-cointegration.

[16]However, as remarked in Maddala and Kim (1998), it is not clear that structural change is less problematic than the cross-sectional heterogeneity associated with panel data.

Given the possibility of reverse causality between the variables we use Pedroni (2003) panel cointegration technique, which is robust to causality running in both directions and allows for both heterogeneous cointegrating vectors and short-run dynamics across countries. The cointegration equations for each of the mentioned hypotheses are given by:

$$FDI_{it}^{US} = \alpha_i + b_t + \beta_i GDP_{it} + e_{it} \text{ (first hypothesis)} \quad (9)$$

$$FDI_{it}^{US} = \alpha_i + b_t + \beta_i GDPDIF_{it} + e_{it} \text{ (second hypothesis)} \quad (10)$$

where all variables are in logs. The term e_{it} represents a stationary error term. In this section the subscript i indexes countries for the hypotheses tested ($i = 1, \ldots, N$). Notice that equations (9) and (10) can allow for fixed effects (α_i), time-specific effects (b_t)[17], and the slope of the cointegrating relationship (β_i) to vary across countries.

Running a unit root test on the residuals retrieved from equations (9) and (10), the null-hypothesis of no-cointegration is tested. Since such residuals consist of a panel, we use as before the Im et al. (2003) ADF unit root t-bar tests. However, since we are testing residuals from an estimated relationship ($\hat{e}_{it}$) rather than a true relationship (e_{it}), in order to construct the test statistic from the average of all countries' ADF t-statistics we employ the adjustment terms provided by Pedroni (1999, 2003) rather than the ones in Im et al. (2003).

In table 5 we report the average over countries of the ADF t-test calculated from the residuals from equations (9) and (10) with a lag length of up to 3 years. As the results make clear, we reject the null of no-cointegration for each of the two hypotheses. Consequently, we may assume that there is cointegration between and FDI^{US} and GDP, and between FDI^{US} and $GDPDIF$.

(Insert table 5 here)

5.2 Error-Correction and Short-Run Dynamics

Given the evidence in favour of cointegration between FDI^{US} and both GDP and $GDPDIF$, we proceed with the estimation of both long–run relationships and ECMs, for which we need to choose a procedure among the available in the literature.

The Engle-Granger two-step procedure has been criticised on the grounds of small-sample bias present in the OLS estimation of the cointegration equation. This bias carries over to the estimates of the short-run parameters obtained in the ECM equations. Another issue is that of normalisation. The results from the single equation methods depend on what variable is used for normalisation of the cointegrating relationship[18], while with the Johansen (1988, 1991) maximum likelihood procedure the problem of normalisation does not appear.

Thus, in estimating the error-correction model we follow a two-step procedure. The first step consists of demeaning the data relative to the panel mean for each period to accommodate the presence of common time effects[19], and then use the Johansen procedure to estimate equation (9) and (10) for each cross-section individually[20]. With the normalised estimated coefficients

[17] In this context, the time effects are aimed at capturing any secular movements in FDI flows and/or business cycle fluctuations.

[18] Ng and Perron (1997) show that the least squares estimator can have poor finite sample properties when normalised in one direction but can be well-behaved when normalised in the other. Since the single equation method is associated with least squares estimation, it suffers from normalisation problems.

[19] For each period we subtract the sample averages, given by $\overline{FDI}_t^{US} = N^{-1}\sum_{i=1}^{N} FDI_{it}^{US}$, taken over the N countries in the panel. Note that we work with the demeaned data throughout this section.

[20] The selection of the lag length (k), for the estimation of the cointegrating vector under the Johansen methodology, consists of choosing the value of k that minimises first, the log-likelihood and then the Akaike Information Criterion (AIC). However, note that the AIC, although consistent, is known to underfit in small samples.

we are able to construct the disequilibrium term, $\hat{e}_{it} = FDI^{US}_{it} - \hat{\alpha}_i - \hat{b}_t - \hat{\beta}_i X_{it}$, where X_{it} may denote GDP_{it} or $GDPDIF_{it}$ depending on the hypothesis under analysis. In the second step, we use the estimated disequilibrium term, $\hat{e}_{it}$, to estimate the ECM independently for each country in the panel through OLS:

$$\Delta FDI^{US}_{it} = a_{1i} + \lambda_{1i}\hat{e}_{i,t-1} + \sum_{j=1}^{k}\phi_{11ij}\Delta FDI_{i,t-j} + \sum_{j=1}^{k}\phi_{12ij}\Delta X_{i,t-j} + \varepsilon_{1it} \quad (11)$$

$$\Delta X_{it} = a_{2i} + \lambda_{2i}\hat{e}_{i,t-1} + \sum_{j=1}^{k}\phi_{21ij}\Delta FDI_{i,t-j} + \sum_{j=1}^{k}\phi_{22ij}\Delta X_{i,t-j} + \varepsilon_{2it} \quad (12)$$

The variable $\hat{e}_{it}$ represents deviations from the long-run equilibrium and the ECM estimates how these disequilibria propel the cointegrating variables to adjust in order to keep the long-run equilibrium relationship unaltered. In the spirit of the Granger representation theorem, if FDI^{US} and X are cointegrated then λ_{1i} and λ_{2i} cannot both be zero. Finally, note that k is chosen by a "general-to-specific" procedure[21].

To analyse the adjustments to deviations from equilibrium and also the short-run transitional dynamics implicit in each of the hypotheses being tested we estimate equation (11) and analyse the significance and sign of the elements of the vectors: $\lambda_1 = [\lambda_{11}, \lambda_{12}, \ldots, \lambda_{1N}]$; $\phi_{11} = [\phi_{111}, \phi_{112}, \ldots, \phi_{11N}]$; $\phi_{12} = [\phi_{121}, \phi_{122}, \ldots, \phi_{12N}]$.

Tables 6 and 7 present the results for equation (11) under the first and second hypothesis, respectively. In table 6, it is clear that all countries converge to the long–run equilibrium with the exception of Philippines, although the elements of the vector λ_1 corresponding to Canada, France, Germany and Spain are not significant at 10 percent significance level. Moreover, a test of the joint hypothesis that the adjustment parameter λ_1 is zero in every country is also reported in table 6. This Likelihood ratio (LR) test provides strong evidence against the long–run effect being uniformly zero among all countries, and since it clearly rejects the null of no long–run effect at the 1 percent significance level in each case, it corroborates the Engle-Granger cointegration test ran previously.

(Insert table 6 here)

According to the first hypothesis, by which positive shocks to market size have a persistent, positive impact on FDI^{US}_{it}, we expect that $\sum_{j=1}^{k}\phi_{12} > 0$ for each i. The U.K. and Italy seem to contradict the market size (first) hypothesis as, though not significant, the relevant ϕ_{12} coefficients are negative for the U.K. and Italy. For the remaining countries, the "market size" hypothesis holds.

Now, by the second hypothesis, shocks to $GDPDIF$ may have a persistent, positive impact on FDI^{US} if the factor-proportions hypothesis prevail, but may as well have a persistent, negative effect on FDI^{US} if the Linder hypothesis holds. Hence, under the "factor-proportions" hypothesis we expect $\sum_{j=1}^{k}\phi_{12} > 0$ but under the Linder hypothesis we expect $\sum_{j=1}^{k}\phi_{12} < 0$. The evidence presented in table 7 on the relative relevance of the two hypothesis in explaining FDI coming from the estimates of the ϕ_{12} coefficients in equation (11) is rather mixed. Only for Italy were we able to find a negative and significant at 10 percent level estimates on the relevant

[21]Two different procedures are employed and then combined: one is to pick the smallest k that gives residuals that pass the LM-test for serial correlation at 5 percent significance level, the other consist of choosing the value of k that minimises the Bayesian information criterion (BIC).

ϕ_{12} coefficients. On the other hand, we found a positive and significant estimate of the relevant ϕ_{12} coefficients for Mexico and Thailand. Though not very robust, these results are compatible with the standard predictions of the modern FDI literature that demand determinants are more relevant for FDI among developed countries, and supply determinants for FDI more important for developing countries.

(Insert table 7 here)

5.3 Testing for Granger-Causality

So far we have established that FDI^{US} is cointegrated with X. These hypotheses would then presuppose that Granger-causality would run from the relevant real output variable to FDI, since those hypotheses are aimed at explaining the determinants of FDI^{US} location. However, this does not preclude the existence of reverse causality, that is, it would be interesting to test whether GDP, $GDPDIF$ Granger causes FDI^{US}, but also if FDI^{US} Granger causes the income variables.

(Insert tables 8 and 9 here)

The results of the individual Granger-causality tests are reported in tables 8 and 9. In those tables it is clear that Granger-causality between FDI^{US} and the output variables has been estimated to be bi-directional for some countries, unidirectional for some other, and in some instances the non-causality hypothesis has simply not been rejected. According to Canning and Pedroni (1999) this type of mixed results can be given two alternative interpretations. One is that causality might occur in some countries but not in others. Another interpretation is purely statistical and follows from the inevitable sampling variation associated with any testing procedure. In fact, when testing the null of non-causality, say at the 10 percent significance level, we would be prepared to reject the null for 10 percent of the countries in a situation in which the null is true. In this context, a number of rejections well above 10 percent of the cases can be taken as evidence against the hypothesis that there is no causality in every country. Therefore, in order to complement the causality tests run individually for each country, in table 10 we report the percentage of countries that reject the F-test for the hypothesis of non-causality at the 10 percent significance level. Using this criterion, we have evidence in favour of causality running in both directions when the income variable used is GDP, since we find rejections of non-causality in more than 10 percent of countries (see table 10)[22]. However, when we use $GDPDIF$ we fail to reject reject that $GDPDIF$ does not Granger-cause FDI^{US}.

(Insert table 10 here)

We also test the joint hypothesis of non-causality in all countries. This is given by a likelihood ratio test of the hypothesis that all relevant parameters are jointly zero in every country. Under the null hypothesis of non-causality the test statistic is established as a Chi-square with degrees of freedom equal to the number of restrictions imposed. Again, evidence supports two-way causality between FDI and the GDP variables. The fact that non-causality is rejected in a significant number of countries supports the idea that the results for the likelihood ratio (LR) test of non-causality in all countries are not being driven by a small number of extreme estimates

[22]Under the null hypothesis of a parameter value of zero in every country, in the present case the number of countries rejecting at the 10% significance level has a Binomial distribution with mean 1.2 and variance 1.08. Note that for a large sample (N large) we could approximate to a Normal distribution with mean 10 (measured in percentage of rejections of the null) and standard deviation $30N^{-1/2}$ (see e.g. Freund, 1992).

in a few countries. However, we find evidence that extreme estimates may be influencing the value of the LR test-statistic in the case of Granger-causality running from $GDPDIF$ to FDI^{US}, since only Italy and Malaysia support causality between these two variables. If that is the case, then it implies that even though these two variables are cointegrated, it is $GDPDIF$ that adjusts in the short run to disequilibrium shocks and variations in FDI, not the other way round.

The bi-directional causality detected from FDI^{US} to GDP supports the by now standard argument that FDI has the potential to promote economic development of the host country. Sidestepping the controversial issue of whether FDI produces a net contribution to a country's capital formation, it nevertheless entails the transfer of technology, new ideas, knowledge (on markets and on products) and human skills to the host country[23]. In this sense, FDI is nowadays reckoned as "good news" by countries whose policies (e.g. income tax, trade policies, and subsidies to foreign firms) clearly reflect the increased concern of governments towards attracting FDI inflows. In what concerns the sign of the effect of past realisations of FDI^{US} on GDP, the results of the estimation of equation (12) depicted in table 11 show that FDI has a positive impact on GDP growth for all countries in the panel but the Philippines.

(Insert table 11 here)

The bottom-left quadrant of table 10 indicates that $GDPDIF$ is Granger caused by FDI^{US}, implying that past realisations of FDI^{US} contributes to the present level of the GDP per capita differential of the countries in the panel. Having already established that FDI has a positive impact on GDP growth, we must test whether that impact is strong enough to promote absolute or conditional convergence across countries[24] (de Mello, 1997). Since we have a mixed panel of countries reflecting differentiated stages of development, we expect FDI to affect the countries' steady states differently. In particular, we are interested in knowing whether the estimated coefficient of lagged values of FDI^{US}_{it} on $GDPDIF_{it}$ (the ϕ_{21} coefficients) in the developing countries are negative, as it would imply that per capita income differentials tend to disappear over time. This is precisely the overall pattern of results described in table 12, in which it is clear that for all developing countries (except for Mexico and Thailand), plus Italy and U.K., FDI concurs to economic convergence since the estimated ϕ_{21}'s are negative for this set of countries.

(Insert table 12 here)

5.4 Testing for Long run Effects of FDI on Output Growth and Convergence

The above discussed Granger-causality tests results are aimed at ascertaining the feedbacks existing between FDI^{US} and GDP and FDI^{US} and $GDPDIF$. However, the causality detected may be temporary due for example to the multiplier effects of FDI, so that innovations to FDI^{US} may affect GDP and $GDPDIF$ in the short-run but eventually die out as the system converges towards the long-run. Therefore, it would be important to investigate whether FDI affects output in the long-run. For that purpose, since the variables are cointegrated, we use a result demonstrated in Canning and Pedroni (1999) that in our case would read: "provided that some conditions in the long-run behaviour of GDP ($GDPDIF$) hold[25], the coefficient λ_2 in equation (12) is equal to zero if, and only if, innovations to FDI^{US} have no long-run effect on GDP ($GDPDIF$)".

[23]For a survey on the potential benefits of inward FDI, see Blomstrom and Kokko (1996).

[24]Under the neoclassical growth theory, the conditional convergence holds that low income countries will tend to grow faster than the rich ones, leading to a progressive reduction in the income differential. On the other hand, the absolute convergence hypothesis states that economies will have the same speed of convergence.

[25]These conditions follow from the moving average representation of the stationary vector $\Delta Z_t = (\Delta FDI_t, \Delta X_t)' = F(L)\varepsilon_t$, where X denotes either GDP or GDPDIF and $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t})$ is a vector of innovations.

It turns out that by simply testing the significance of the coefficients λ_{2i} in the regression (12) we are testing for long-run causality from FDI^{US} to GDP or from FDI^{US} to $GDPDIF$ separately from any short-run causal effect. We test the joint null-hypothesis $H_0 : \lambda_{2i} = 0$ for all i. This again is a likelihood-ratio test, whose test statistic under the null hypothesis is distributed as a Chi-square with degrees of freedom equal to the number of restrictions, in this case the number of countries in the panel.

The outcome of the tests displayed in tables 11 and 12 show unequivocally that the λ_{2i} are statistically significant, meaning that there must be long-run causality running from FDI^{US} to GDP and equally from FDI^{US} to $GDPDIF$.

6 Conclusion

The effect of several factors on the location of FDI is tested under the share gravity model using panel data on U.S. MNEs disaggregated at the industry level. The share of U.S. FDI, portrayed by five different measures, is increasing in lagged FDI shares, transport costs, trade barriers, FDI openness, labour productivity and population, and decreasing in competition posed by other countries and corporate taxes. This evidence suggests that country-specific locational factors are very important determinants of the U.S. FDI. These results combined with the fact that the factor capturing the gravity of the competing destinations emerges very significant and with the correct sign across the different measures of FDI vindicates the use of the share formulation of the gravity model to the analysis of the location of MNEs' activities.

The share of U.S. FDI is also increasing in the level of protection of intellectual property rights (IPR) in the host country. Thus, when there are intellectual property advantages, as assumed by the imperfect competition models of multinationals, which are easily transferred across borders, MNEs will choose the countries that better protect those advantages. The "proximity-concentration" hypothesis is not rejected when explaining the share of FDI allocated to each country in the panel. All relevant variables appear with the correct sign, namely corporate scale economies and production scale economies are respectively, positive and negatively related to the share allocated to a specific location.

The fact that the variables, aggregated capital stocks, GDP and per capita income differential have been found to contain a unit root implies that the impact of each of these variables on FDI has to be evaluated using econometric techniques suitable for non-stationary data. The overall results suggest that GDP has a positive impact on FDI, thereby lending support to the "market size" hypothesis. The results provide mixed evidence on whether per capita income differential reflects demand or supply determinants of FDI. By rejecting that per capita income differential helps forecast present values of FDI, we could not claim that our results support the pure "factor-proportions" explanation for FDI, even though we found evidence that income per capita differential affects the long-run growth of FDI. Further, causality tests suggest that FDI plays a positive role on economic growth and on narrowing the gap between developed and developing countries.

Now, let $F(L) = \begin{bmatrix} F(1)_{11} & F(1)_{12} \\ F(1)_{21} & F(1)_{22} \end{bmatrix}$ represent the matrix of long run responses of the levels Z_t to realisations of ε_t. The condition according to which the proposition outlined in the test holds is that $F(1)_{22} > 0$, which means that innovations to the income variables X have a permanent impact on the levels of X. In turn, this implies that the income variables contain a unit root, which conforms with the results of our unit root tests for these variables. For the proof see the mathematical appendix of Canning and Pedroni (1999).

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Appendix

A List of Industries

I1 - All industries

I2 - Petroleum
Oil and gas extraction
Crude petroleum extraction (no refining) and natural gas
Oil and gas field services
Petroleum and coal products
Integrated petroleum refining and extraction
Petroleum refining without extraction
Petroleum and coal products, nec
Petroleum wholesale trade
Other

I3 - Manufacturing

I4 - Food and kindred products
Grain mill and bakery products
Beverages
Other

I5 - Chemicals and allied products
Industrial chemicals and synthetics
Drugs
Soap, cleaners, and toilet goods
Agricultural chemicals
Chemical products, nec

I6 - Primary and fabricated metals
Primary metal industries
Ferrous
Nonferrous
Fabricated metal products

I7 - Machinery, except electrical
Farm and garden machinery
Construction, mining, and materials handling machinery
Office and computing machines
Other

I8 - Electric and electronic equipment
Household appliances
Radio, television, and communication equipment
Electronic components and accessories
Electrical machinery, nec

I9 - Transport equipment
Motor vehicles and equipment
Other

I10 - Other manufacturing
Tobacco products
Textile products and apparel
Lumber, wood, furniture, and fixtures
Paper and allied products
Printing and publishing
Rubber products
Miscellaneous plastics products
Glass products
Stone, clay, and other nonmetallic mineral products
Instruments and related products
Other

I11 - Wholesale trade
Durable goods
Nondurable goods

I12 - Finance (except banking) , insurance, and real estate
Finance, except banking
Insurance
Real estate
Holding companies

I13 - Services
Hotels and other lodging places
Business services
Advertising
Equipment rental (ex automotive and computers)
Computer and data processing services
Business services, nec
Automotive rental and leasing
Motion pictures, including television tape and film
Health services
Engineering, architectural, and surveying services
Management and public relations services
Other

I14 - Other industries
Agriculture, forestry, and fishing
Mining
Metal mining
Nonmetallic minerals
Construction
Transport
Communication and public utilities
Retail trade

B Transport Costs

Transport costs by Country										
Country	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**Average**
Canada	0.017	0.019	0.022	0.024	0.020	0.018	0.017	0.018	0.018	0.02
France	0.049	0.045	0.040	0.038	0.039	0.037	0.029	0.029	0.029	0.03
Germany	0.055	0.054	0.050	0.040	0.051	0.053	0.063	0.054	0.037	0.05
Italy	0.043	0.057	0.064	0.052	0.066	0.069	0.070	0.052	0.039	0.06
Netherlands	0.058	0.059	0.051	0.048	0.053	0.058	0.059	0.056	0.054	0.06
Spain	0.040	0.036	0.035	0.035	0.049	0.044	0.045	0.031	0.036	0.04
United Kingdom	0.050	0.055	0.053	0.047	0.039	0.043	0.041	0.044	0.045	0.04
Mexico	0.017	0.014	0.014	0.014	0.011	0.012	0.011	0.009	0.010	0.01
Indonesia	0.056	0.050	0.036	0.037	0.028	0.033	0.012	0.019	0.022	0.02
Malaysia	0.047	0.037	0.034	0.030	0.021	0.016	0.017	0.015	0.020	0.02
Philippines	0.122	0.107	0.103	0.115	0.107	0.085	0.082	0.051	0.037	0.07
Thailand	0.067	0.052	0.043	0.035	0.036	0.037	0.030	0.024	0.018	0.03
Average										**0.04**

Note: Transport costs as a percentage of total value of export shipment.

Figures

Figure 1: Trade Protection

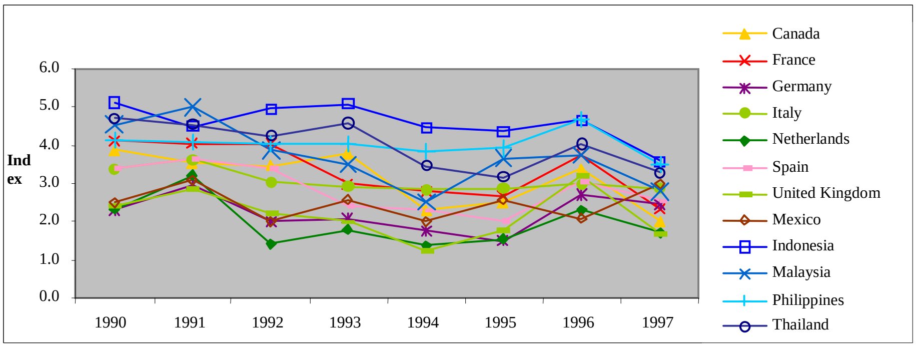


Figure 2: FDI Openness

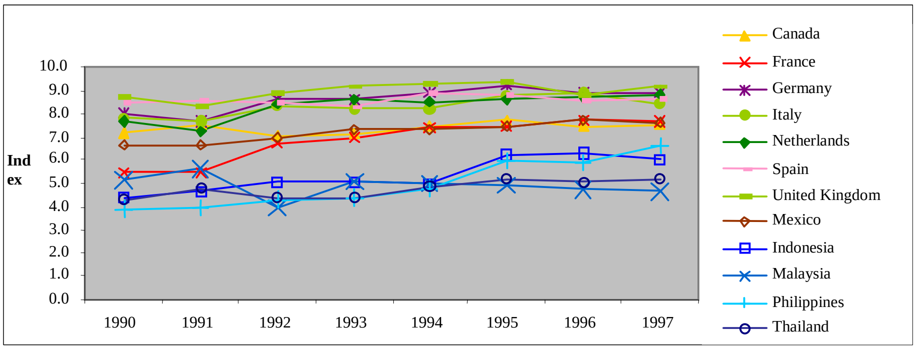


Figure 3: Intellectual Property Rights

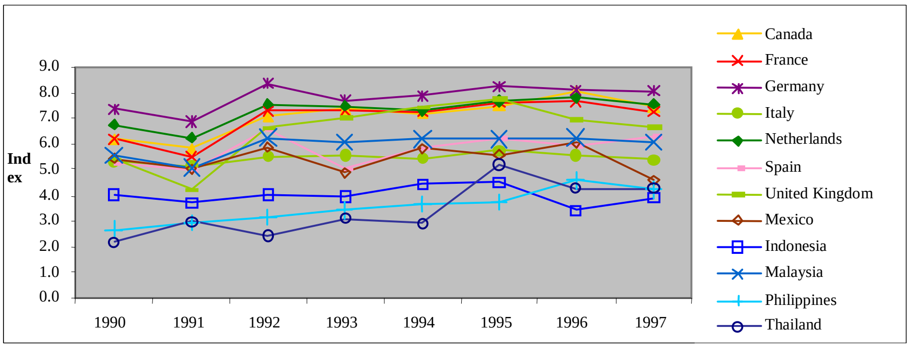


Figure 4: Labour Productivity

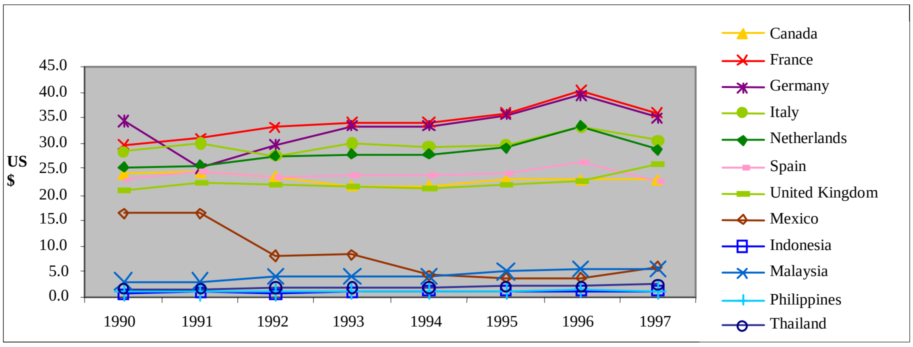


Figure 5: Corporate Taxes

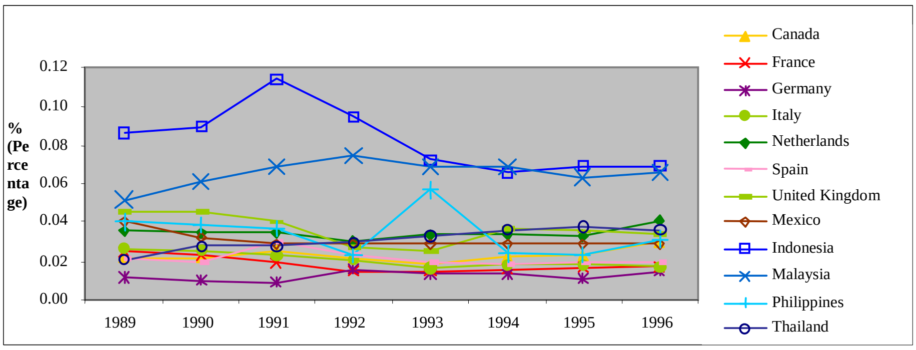


Figure 6: Production & Non-Production Workers

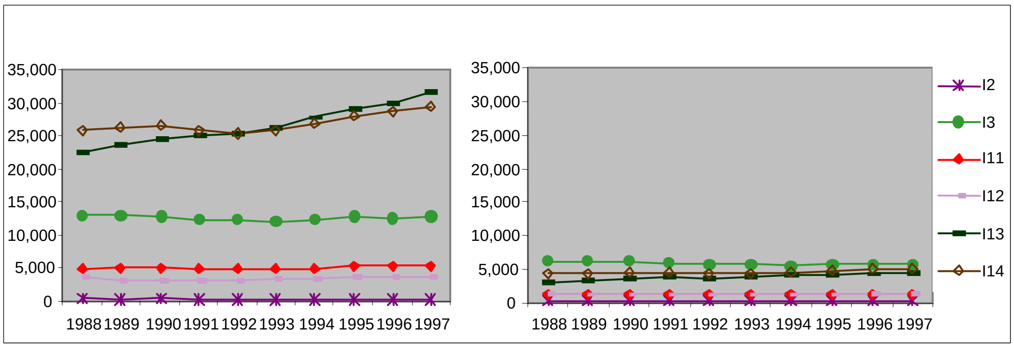


Figure 7: Population

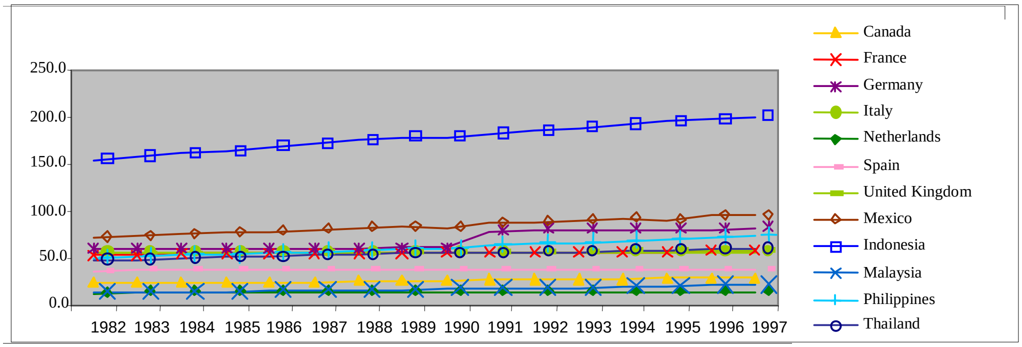


Figure 8: GDP

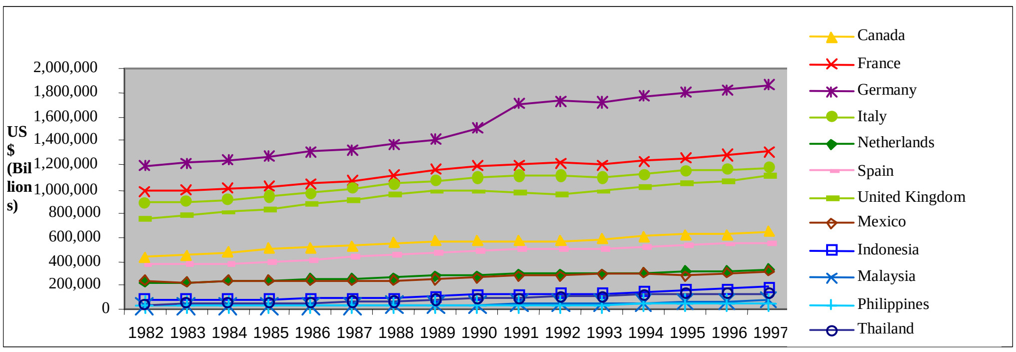


Figure 9: GDP Differential per Capita

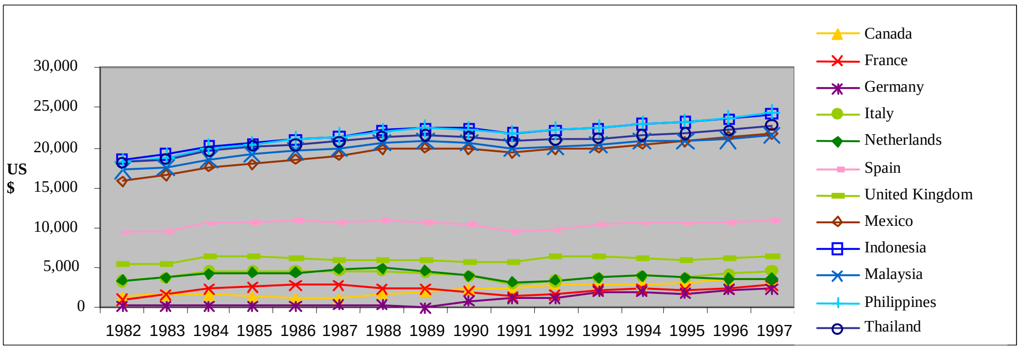
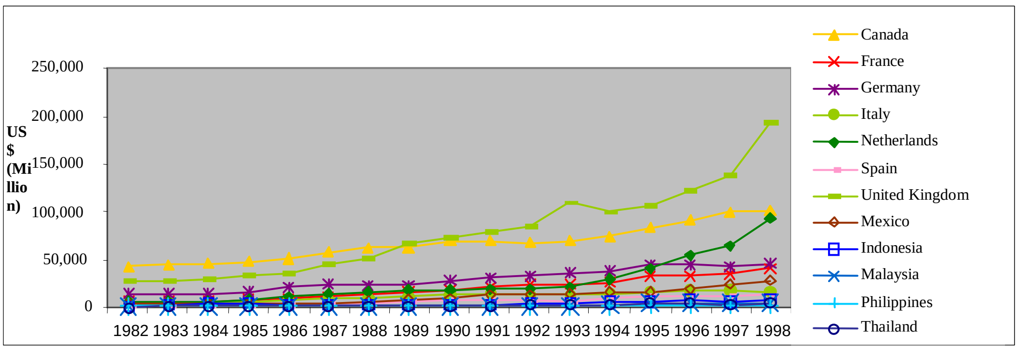


Figure 10: Aggregated Capital Stock



Tables

Table 1: Panel Unit Root Tests

Variables in Log-Levels	Period	N	Adjustment Factors Mean	Adjustment Factors Variance	Average ADF	Group Test Statistic
Total assets	1988-98	168	-2.172	1.354	-2.18	-0.04
Total Assets All Countries†	1988-98	14	-2.172	1.354	-1.90	0.88
Capital Stocks†	1988-98	168	-2.172	1.354	-2.17	0.08
Capital Stocks All Countries†	1988-98	14	-2.172	1.354	-2.09	0.26
Total Sales†	1988-98	168	-2.172	1.354	-2.01	1.84
Total Sales All Countries†	1988-98	14	-2.172	1.354	-1.98	0.61
Number of Employees†	1988-98	168	-2.172	1.354	-2.11	0.74
Number of Employees All Countries†	1988-98	14	-2.172	1.354	-1.83	1.09
Employment Compensation†	1988-98	168	-2.172	1.354	-2.06	1.28
Employment Compensation All Countries†	1988-98	14	-2.172	1.354	-2.10	0.23
Share Total assets	1988-98	168	-1.491	1.206	-1.79	-3.52***
Share Capital Stocks	1988-98	168	-1.491	1.206	-1.74	-2.91***
Share Total Sales	1988-98	168	-1.491	1.206	-1.84	-4.07***
Share Number of Employees	1988-98	168	-1.491	1.206	-1.88	-4.54***
Share Employment Compensation	1988-98	168	-1.491	1.206	-1.96	-5.58***
Transport Costs	1988-96	168	-1.485	1.304	-2.36	-9.95***
Competition Factor	1988-96	168	-1.485	1.304	-1.68	-2.26***
Trade Protection	1990-97	12	-1.482	1.353	-2.62	-3.39***
FDI Openness	1990-97	12	-1.482	1.353	-2.89	-4.19***
Labour Productivity	1990-97	12	-1.482	1.353	-2.22	-2.20**
Corporate Taxes	1989-96	12	-1.482	1.353	-2.41	-2.78***
Intellectual Property Rights	1990-97	12	-1.482	1.353	-2.35	-2.59***
Population	1982-97	12	-2.170	0.935	-0.82	2.37
De-trended Population	1982-97	12	-1.506	0.999	-2.55	-3.60***
Production Workers	1988-97	14	-1.488	1.255	-2.50	-3.38***
Non-production Workers	1988-97	14	-2.170	1.056	-3.96	-5.54***
Aggregated Capital Stocks †	1982-98	12	-2.170	0.912	-1.82	1.26
GDP†	1982-97	12	-2.170	0.935	-2.59	-1.49
Differential GDP per Capita	1982-97	12	-1.506	0.999	-1.05	1.57

[a)] The tests statistics are distributed as $N(0,1)$ under the null of non-stationary. The statistics are constructed using small sample adjustment factors from Im et al. (2003).
† Includes a trend.
* Rejects the null at the 10% level.
** Rejects the null at the 5% level.
*** Rejects the null at the 1% level.

Table 2: Benchmark Share Gravity Model

	TA	KS	SL	EC	EM	PCV
1-Step System-GMM Estimator						
Dependent Variable Lag 1	0.703	0.673	0.773	0.773	0.779	0.819
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transport Costs (TC)	0.123	0.291	0.093	0.102	0.095	0.156
	(0.071)	(0.020)	(0.089)	(0.082)	(0.066)	(0.088)
Competition Factor (CF)	-0.237	-0.558	-0.185	-0.214	-0.187	-0.293
	(0.088)	(0.021)	(0.089)	(0.084)	(0.081)	(0.098)
Trade Barriers (TRP)	0.509	1.140	0.144	0.355	0.219	0.601
	(0.263)	(0.025)	(0.608)	(0.217)	(0.654)	(0.306)
FDI Openness (FDIO)	0.732	1.251	0.515	0.597	0.213	0.861
	(0.352)	(0.320)	(0.367)	(0.309)	(0.758)	(0.492)
Labour Productivity (LP)	0.016	0.028	-0.017	0.017	-0.029	0.057
	(0.877)	(0.916)	(0.882)	(0.862)	(0.718)	(0.708)
Corporate taxes (CT)	-0.051	0.127	-0.056	-0.076	-0.025	-0.008
	(0.858)	(0.777)	(0.848)	(0.693)	(0.859)	(0.988)
Population (POP)	3.816	1.775	1.267	1.990	1.003	2.103
	(0.064)	(0.612)	(0.528)	(0.256)	(0.614)	(0.516)
Wald Test	0.000	0.000	0.000	0.000	0.000	0.000
FOSC Test	0.029	0.036	0.054	0.057	0.042	0.076
SOSC Test	0.827	0.394	0.351	0.309	0.339	0.424
2-Step System-GMM Estimator						
	TA	**KS**	**SL**	**EC**	**EM**	**PCV**
Dependent Variable Lag 1	0.699	0.773	0.769	0.770	0.783	0.827
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transport Costs (TC)	0.127	0.142	0.100	0.105	0.093	0.146
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Competition Factor (CF)	-0.203	-0.221	-0.193	-0.196	-0.156	-0.247
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade Barriers (TRP)	0.103	0.301	0.131	0.191	0.128	0.225
	(0.138)	(0.011)	(0.001)	(0.000)	(0.000)	(0.002)
FDI Openness (FDIO)	0.303	0.315	0.269	0.270	0.254	0.317
	(0.030)	(0.413)	(0.008)	(0.026)	(0.006)	(0.085)
Labour Productivity (LP)	0.032	0.012	0.023	0.049	-0.057	0.064
	(0.232)	(0.838)	(0.193)	(0.020)	(0.004)	(0.066)
Corporate taxes (CT)	-0.043	-0.013	-0.028	-0.091	-0.064	-0.074
	(0.448)	(0.895)	(0.464)	(0.023)	(0.155)	(0.339)
Population (POP)	2.653	2.842	1.543	0.941	0.629	3.065
	(0.000)	(0.012)	(0.001)	(0.099)	(0.218)	(0.000)
Wald Test	0.000	0.000	0.000	0.000	0.000	0.000
FOSC Test	0.063	0.015	0.079	0.077	0.066	0.062
SOSC Test	0.868	0.360	0.381	0.340	0.357	0.401
Sargan Test (ST)	0.084	0.817	0.024	0.000	0.000	0.060

The benchmark model is estimated for all six measures of FDI: Total assets (TA), capital stocks (KS), total sales (SL), employment compensation (EC), number of employees (EM), first principal component (PCV). P-values corresponding to asymptotic standard errors robust to general heteroskedasticity are reported in parentheses. The Wald, the Sargan, the First Order Serial Correlation (FOSC) and Second Order Serial Correlation (SOSC) tests are asymptotically robust to general heteroskedasticity (p-values reported). The number of observations for all the estimated equations under the benchmark model is 1008.

Table 3: Benchmark Model with Adjacency & IPR

	1-Step System-GMM			2-Step System-GMM		
	PCV(1)	**PCV(2)**	**PCV(3)**	**PCV(1)**	**PCV(2)**	**PCV(3)**
Dependent Variable Lag 1	0.819	0.838	0.831	0.827	0.842	0.835
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transport Costs (TC)	0.156	0.119	0.122	0.146	0.112	0.113
	(0.088)	(0.030)	(0.015)	(0.000)	(0.000)	(0.000)
Competition Factor (CF)	-0.293	-0.176	-0.271	-0.247	-0.153	-0.200
	(0.098)	(0.052)	(0.008)	(0.000)	(0.000)	(0.000)
Trade Barriers (TRP)	0.601	0.031	0.205	0.225	0.028	0.092
	(0.306)	(0.894)	(0.557)	(0.002)	(0.424)	(0.039)
FDI Openness (FDIO)	0.861	0.313	0.296	0.317	0.402	0.513
	(0.492)	(0.484)	(0.783)	(0.085)	(0.000)	(0.000)
Labour Productivity (LP)	0.057	0.043	-0.072	0.064	0.072	0.028
	(0.708)	(0.838)	(0.714)	(0.066)	(0.008)	(0.354)
Corporate taxes (CT)	-0.008	-0.179	-0.070	-0.074	-0.023	-0.027
	(0.988)	(0.474)	(0.793)	(0.339)	(0.647)	(0.640)
Population (POP)	2.103	0.426	2.522	3.065	2.792	3.801
	(0.516)	(0.870)	(0.360)	(0.000)	(0.001)	(0.000)
Adjacency-dummy (ADJ)	-	-0.277	-	-	-0.070	-
	-	(0.324)	-	-	(0.477)	
Int. Property Rights (IPR)	-	-	1.011	-	-	0.244
	-	-	(0.420)	-	-	(0.082)
Wald Test	0.000	0.000	0.000	0.000	0.000	0.000
FOSC Test	0.076	0.072	0.063	0.062	0.068	0.066
SOSC Test	0.424	0.412	0.399	0.401	0.404	0.401
Sargan Test	-	-	-	0.060	0.069	0.038

The results reported for this extended model refer to the estimation with the first principal component (PCV) measure of FDI. P-values corresponding to asymptotic standard errors robust to general heteroskedasticity are reported in parentheses. The Wald, the Sargan, the First Order Serial Correlation (FOSC) and Second Order Serial Correlation (SOSC) tests are asymptotically robust to general heteroskedasticity (p-values reported). The number of observations for all the estimated equations this extended version of the benchmark model is 1008.

Table 4: Share Gravity Model Under the Proximity-Concentration Hypothesis

	1-Step System-GMM			2-Step System-GMM		
	PCV(1)	**PCV(2)**	**PCV(3)**	**PCV(1)**	**PCV(2)**	**PCV(3)**
Dependent Variable Lag 1	0.797	0.812	0.808	0.800	0.813	0.811
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transport Costs (TC)	0.165	0.149	0.155	0.159	0.149	0.150
	(0.067)	(0.002)	(0.066)	(0.000)	(0.000)	(0.000)
Competition Factor (CF)	-0.385	-0.348	-0.369	-0.349	-0.321	-0.320
	(0.067)	(0.003)	(0.047)	(0.000)	(0.000)	(0.000)
Trade Barriers (TRP)	0.192	0.127	0.053	0.121	0.119	0.078
	(0.711)	(0.506)	(0.880)	(0.001)	(0.001)	(0.016)
FDI Openness (FDIO)	0.845	0.645	0.296	0.756	0.744	0.516
	(0.363)	(0.255)	(0.811)	(0.000)	(0.000)	(0.000)
Labour Productivity (LP)	0.095	0.002	0.010	0.088	0.018	0.037
	(0.546)	(0.993)	(0.956)	(0.000)	(0.458)	(0.208)
Corporate taxes (CT)	-0.081	-0.208	-0.236	-0.068	-0.087	-0.120
	(0.775)	(0.519)	(0.259)	(0.147)	(0.111)	(0.014)
Population (POP)	1.003	3.962	-1.542	2.275	4.950	1.489
	(0.771)	(0.343)	(0.676)	(0.000)	(0.000)	(0.111)
Production Worker (PW)	-0.125	-0.093	-0.146	-0.106	-0.071	-0.094
	(0.408)	(0.448)	(0.274)	(0.089)	(0.257)	(0.153)
Non-Production Worker (NPW)	0.379	0.316	0.411	0.332	0.273	0.306
	(0.212)	(0.110)	(0.135)	(0.000)	(0.001)	(0.000)
Adjacency-dummy (ADJ)	-	-0.139	-	-	-0.122	-
	-	(0.904)	-	-	(0.331)	-
Int. Property Rights (IPR)	-	-	0.372	-	-	0.131
	-	-	(0.797)	-	-	(0.357)
Wald Test	0.000	0.000	0.000	0.000	0.000	0.000
FOSC Test	0.047	0.062	0.050	0.066	0.068	0.068
SOSC Test	0.406	0.416	0.400	0.419	0.417	0.416
Sargan Test	-	-	-	0.004	0.001	0.020

The results reported for this extended model refer to the estimation with the first principal component (PCV) measure of FDI. P-values corresponding to asymptotic standard errors robust to general heteroskedasticity are reported in parentheses. The Wald, the Sargan, the First Order Serial Correlation (FOSC) and Second Order Serial Correlation (SOSC) tests are asymptotically robust to general heteroskedasticity (p-values reported). The number of observations for all the estimated equations under this extended version of the benchmark model is 1008.

Table 5: Panel Cointegration Tests

	Period	Countries	Average ADF	Test Statistic
FDI and GDP	1982-1997	12	-2.79	-3.24***
FDI and GDPDIF	1982-1997	12	-2.81	-3.34***

Countries Tests:

	FDI and GDP		**FDI and GDPDIF**	
	ADF	lags	ADF	lags
Canada	-3.87	1	-1.99	0
France	-2.78	3	-2.38	3
Germany	-1.11	0	-2.82	1
Italy	-2.12	1	-1.85	1
Netherlands	-4.04	3	-8.17	3
Spain	-2.50	2	-1.51	0
United Kingdom	-2.10	0	-2.20	0
Mexico	-1.79	3	-2.40	0
Indonesia	-3.70	3	-3.90	3
Malaysia	-2.22	3	-1.65	0
Philippines	-3.39	2	-2.01	0
Thailand	-3.88	3	-2.87	3

The tests statistics are distributed as $N(0,1)$ under the null of no-cointegration. The test statistics are constructed using small sample adjustment factors from Pedroni (2003).

*** Rejects the null at the 1% level.

Table 6: Error Correction and Short Term Dynamics [Equation (11)]

[FDI on GDP]	λ_1	ϕ_{11i1}	ϕ_{11i2}	ϕ_{11i3}	ϕ_{12i1}	ϕ_{12i2}	ϕ_{12i3}
Canada	-0.036	-0.017	–	–	0.376	–	–
	(0.823)	(0.968)			(0.635)		
France	-0.263	0.310	–	–	0.305	–	–
	(0.312)	(0.509)			(0.945)		
Germany	-0.015	-0.075	–	–	0.761	–	–
	(0.882)	(0.822)			(0.463)		
Italy	-0.570	0.467	-0.156	–	-3.023	0.097	–
	(0.008)	(0.093)	(0.557)		(0.263)	(0.966)	
Netherlands	-1.277	0.901	0.483	0.857	4.323	3.787	-0.670
	(0.001)	(0.002)	(0.031)	(0.003)	(0.086)	(0.090)	(0.712)
Spain	-0.149	-0.164	–	–	4.689	–	–
	(0.469)	(0.693)			(0.273)		
United Kingdom	-0.759	0.260	–	–	-2.529	–	–
	(0.036)	(0.419)			(0.137)		
Mexico	-0.532	0.472	–	–	0.371	–	–
	(0.016)	(0.162)			(0.745)		
Indonesia	-0.312	0.244	-0.276	–	10.686	2.634	–
	(0.002)	(0.010)	(0.006)		(0.000)	(0.078)	
Malaysia	-0.294	0.026	–	–	2.512	–	–
	(0.059)	(0.912)			(0.107)		
Philippines	0.135	-0.389	–	–	0.669	–	–
	(0.156)	(0.242)			(0.571)		
Thailand	-0.549	-0.060	0.186	1.015	6.563	-1.354	3.739
	(0.073)	(0.868)	(0.448)	(0.007)	(0.015)	(0.470)	(0.143)

Likelihood Ratio Tests[a)]

	All Countries
Full Sample Test of λ_1	106.608
	(0.000)
Full Sample Test of all ϕ_{11}	91.844
	(0.000)
Full Sample Test of all ϕ_{12}	97.681
	(0.000)

[a)] Under the null of a parameter zero in every country, the likelihood ratio test is distributed as a Chi-squared with degrees of freedom equal to the number of restrictions. Figures in parentheses are p-values.

Table 7: Error Correction and Short Term Dynamics [Equation (11)]

[FDI on GDPDIF]	λ_1	ϕ_{11i1}	ϕ_{11i2}	ϕ_{11i3}	ϕ_{12i1}	ϕ_{12i2}	ϕ_{12i3}
Canada	-0.299	-0.045	0.411	–	0.020	– 0.030	–
	(0.044)	(0.892)	(0.181)		(0.818)	(0.762)	
France	-0.500	0.309	0.810	0.719	0.123	0.180	0.356
	(0.139)	(0.385)	(0.073)	(0.081)	(0.473)	(0.237)	(0.031)
Germany	-0.433	0.212	–	–	0.037	–	–
	(0.066)	(0.466)			(0.310)		
Italy	-0.765	-0.333	-0.243	-0.445	-0.919	-0.357	-0.392
	(0.012)	(0.269)	(0.124)	(0.051)	(0.058)	(0.069)	(0.033)
Netherlands	-0.309	0.645	–	–	-0.269	–	–
	(0.178)	(0.112)			(0.600)		
Spain	-0.236	0.161	–	–	– 0.203	–	–
	(0.384)	(0.658)			(0.768)		
United Kingdom	-0.215	-0.008	–	–	0.383	–	–
	(0.460)	(0.984)			(0.495)		
Mexico	-1.865	2.534	-0.025	1.426	1.257	0.338	-1.019
	(0.068)	(0.017)	(0.959)	(0.036)	(0.075)	(0.485)	(0.130)
Indonesia	-0.268	0.467	-0.034	–	0.370	0.817	–
	(0.040)	(0.193)	(0.897)		(0.679)	(0.262)	
Malaysia	-0.300	0.327	–	–	-0.673	–	–
	(0.078)	(0.151)			(0.217)		
Philippines	0.045	-0.129	–	–	0.920	–	–
	(0.519)	(0.727)			(0.252)		
Thailand	-1.302	1.012	–	–	2.275	–	–
	(0.047)	(0.063)			(0.040)		

Likelihood Ratio Tests[a)]

	All Countries
Full Sample Test of λ_1	76.352
	(0.000)
Full Sample Test of all ϕ_{11}	75.073
	(0.000)
Full Sample Test of all ϕ_{12}	70.964
	(0.000)

a) Under the null of a parameter zero in every country, the likelihood ratio test is distributed as a Chi-squared with degrees of freedom equal to the number of restrictions. Figures in parentheses are p-values.

Table 8: Granger Causality Tests (FDI & GDP)

Null Hypothesis:	Period	Lag	F-Statistic	p-value
FDI Does Not Granger Cause GDP				
Canada	1982-97	2	4.620	0.042
France	1982-97	1	11.398	0.006
Germany	1982-97	2	0.239	0.792
Italy	1982-97	3	14.178	0.004
Netherlands	1982-97	1	2.343	0.152
Spain	1982-97	1	5.830	0.033
United Kingdom	1982-97	2	1.564	0.261
Mexico	1982-97	1	0.040	0.845
Indonesia	1982-97	1	0.405	0.537
Malaysia	1982-97	3	28.522	0.001
Philippines	1982-97	2	9.223	0.007
Thailand	1982-97	2	0.031	0.970
GDP Does Not Granger Cause FDI				
Canada	1982-97	1	0.029	0.867
France	1982-97	1	0.030	0.866
Germany	1982-97	1	0.419	0.529
Italy	1982-97	1	8.342	0.014
Netherlands	1982-97	2	1.269	0.327
Spain	1982-97	1	0.407	0.536
United Kingdom	1982-97	1	0.031	0.863
Mexico	1982-97	1	9.020	0.011
Indonesia	1982-97	3	25.953	0.001
Malaysia	1982-97	1	9.754	0.009
Philippines	1982-97	3	3.492	0.090
Thailand	1982-97	1	6.267	0.028

Table 9: Granger Causality Tests (FDI & GDPDIF)

Null Hypothesis:	Period	Lag	F-Statistic	p-value
FDI Does Not Granger Cause GDPDIF				
Canada	1982-97	1	2.188	0.165
France	1982-97	1	12.725	0.004
Germany	1982-97	1	1.430	0.255
Italy	1982-97	2	1.285	0.323
Netherlands	1982-97	1	4.112	0.065
Spain	1982-97	1	3.541	0.084
United Kingdom	1982-97	1	1.313	0.274
Mexico	1982-97	3	8.032	0.016
Indonesia	1982-97	1	2.308	0.155
Malaysia	1982-97	1	0.074	0.791
Philippines	1982-97	1	1.482	0.247
Thailand	1982-97	2	6.463	0.018
GDPDIF Does Not Granger Cause FDI				
Canada	1982-97	1	1.379	0.263
France	1982-97	3	1.924	0.227
Germany	1982-97	1	2.615	0.132
Italy	1982-97	3	23.083	0.001
Netherlands	1982-97	1	0.716	0.414
Spain	1982-97	1	0.391	0.543
United Kingdom	1982-97	1	0.141	0.714
Mexico	1982-97	2	0.655	0.543
Indonesia	1982-97	2	1.315	0.316
Malaysia	1982-97	1	13.783	0.003
Philippines	1982-97	1	0.052	0.823
Thailand	1982-97	1	0.034	0.856

Table 10: Panel Granger Causality Tests

Null Hypothesis: FDI Does Not Granger Cause GDP		**Null Hypothesis:** GDP Does Not Granger Cause FDI	
Number of Countries Rejecting Null at the 10% Significance Level[a]	6	Number of Countries Rejecting Null at the 10% Significance Level[a]	6
Percentage	50.0%	Percentage	50.0%
	(0.000)		(0.000)
Full Sample Likelihood Ratio Test[b]	112.281	Full Sample Likelihood Ratio Test[b]	79.469
	(0.000)		(0.000)
Null Hypothesis: FDI Does Not Granger Cause GDPDIF		**Null Hypothesis:** GDPDIF Does Not Granger Cause FDI	
Number of Countries Rejecting Null at the 10% Significance Level[a]	5	Number of Countries Rejecting Null at the 10% Significance Level[a]	2
Percentage	41.7%	Percentage	16.7%
	(0.004)		(0.230)
Full Sample Likelihood Ratio Test[b]	66.325	Full Sample Likelihood Ratio Test[b]	64.823
	(0.000)		(0.000)

[a] The percentage of countries rejecting the null hypothesis of the Granger causality tests at the 10% level is distributed as a binomial with critical values of 38.7% at 1%, 26.9% at 5%, 24.2% at 10%. Figures in parentheses are p-values.

[b] The likelihood ratio test is distributed as a Chi-squared with degrees of freedom equal to the number of restrictions. Figures in parentheses are p-values.

Table 11: Error Correction and Short Term Dynamics [Equation (12)]

[FDI on GDP]	λ_1	ϕ_{11i1}	ϕ_{11i2}	ϕ_{11i3}	ϕ_{12i1}	ϕ_{12i2}	ϕ_{12i3}
Canada	0.121	0.012	–	–	0.736	–	–
	(0.005)	(0.897)			(0.001)		
France	-0.069	0.050	–	–	-0.407	–	–
	(0.006)	(0.191)			(0.261)		
Germany	0.068	0.008	–	–	0.582	–	–
	(0.042)	(0.934)			(0.084)		
Italy	-0.092	0.081	0.046	–	-0.671	-0.582	–
	(0.002)	(0.022)	(0.159)		(0.053)	(0.055)	
Netherlands	-0.025	0.029	-0.008	0.054	0.356	-0.196	-0.331
	(0.296)	(0.191)	(0.724)	(0.047)	(0.270)	(0.474)	(0.250)
Spain	-0.037	0.041	–	–	0.240	–	–
	(0.020)	(0.162)			(0.397)		
United Kingdom	-0.073	0.038	–	–	0.444	–	–
	(0.169)	(0.451)			(0.102)		
Mexico	-0.008	0.208	–	–	-0.504	–	–
	(0.915)	(0.132)			(0.289)		
Indonesia	-0.005	0.023	–	–	0.144	–	–
	(0.769)	(0.356)			(0.715)		
Malaysia	-0.121	0.069	0.071	–	-0.109	-0.279	–
	(0.000)	(0.006)	(0.002)		(0.366)	(0.039)	
Philippines	0.074	-0.109	–	–	0.489	–	–
	(0.000)	(0.002)			(0.000)		
Thailand	-0.085	0.044	–	–	0.790	–	–
	(0.181)	(0.503)			(0.093)		

Likelihood Ratio Tests[a)]

	All Countries
Full Sample Test of λ_1	135.777
	(0.000)
Full Sample Test of all ϕ_{11}	75.435
	(0.000)
Full Sample Test of all ϕ_{12}	89.482
	(0.000)

[a)] Under the null of a parameter zero in every country, the likelihood ratio test is distributed as a Chi-squared with degrees of freedom equal to the number of restrictions. Figures in parentheses are p-values.

Table 12: Error Correction and Short Term Dynamics [Equation (12)]

[FDI on GDPDIF]	λ_1	ϕ_{11i1}	ϕ_{11i2}	ϕ_{11i3}	ϕ_{12i1}	ϕ_{12i2}	ϕ_{12i3}
Canada	-0.672	0.107	–	–	0.339	–	–
	(0.058)	(0.914)			(0.267)		
France	-0.902	0.532	–	–	0.260	–	–
	(0.008)	(0.339)			(0.184)		
Germany	-2.665	3.774	–	–	-0.130	–	–
	(0.148)	(0.128)			(0.652)		
Italy	-0.121	-0.667	–	–	-0.128	–	–
	(0.512)	(0.204)			(0.794)		
Netherlands	-0.773	0.899	0.437	0.807	-0.519	-0.311	-0.784
	(0.012)	(0.039)	(0.081)	(0.037)	(0.205)	(0.265)	(0.073)
Spain	-0.327	0.194	0.113	–	-0.723	-0.665	–
	(0.008)	(0.115)	(0.287)		(0.011)	(0.018)	
United Kingdom	-0.038	-0.012	-0.005	–	-0.750	-0.616	–
	(0.860)	(0.964)	(0.982)		(0.073)	(0.076)	
Mexico	-0.782	0.259	0.445	–	-0.451	-0.653	–
	(0.003)	(0.085)	(0.038)		(0.022)	(0.004)	
Indonesia	0.037	-0.035	–	–	-0.539	–	–
	(0.514)	(0.771)			(0.117)		
Malaysia	0.363	0.136	-0.263	-0.210	-1.217	-0.297	-0.250
	(0.031)	(0.340)	(0.157)	(0.206)	(0.059)	(0.345)	(0.394)
Philippines	0.040	-0.199	–	–	-0.445	–	–
	(0.154)	(0.178)			(0.154)		
Thailand	-0.913	0.226	0.350	–	1.388	0.631	–
	(0.001)	(0.118)	(0.005)		(0.010)	(0.016)	

Likelihood Ratio Tests[a)]

	All Countries
Full Sample Test of λ_1	111.802
	(0.000)
Full Sample Test of all ϕ_{11}	78.622
	(0.000)
Full Sample Test of all ϕ_{12}	94.715
	(0.000)

[a)] Under the null of a parameter zero in every country, the likelihood ratio test is distributed as a Chi-squared with degrees of freedom equal to the number of restrictions. Figures in parentheses are p-values.