Regional Economic Integration and Geographic Concentration of U.S. Multinational Firms*

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March 2007

Abstract

A volume of theoretical studies emphasizes that regional economic integration, by improving intra-bloc market accessibility, prompts multinationals to restructure their activities geographically within the bloc and improve the economies of scale. However, little has been done to test this prediction. This paper thus examines theoretically and empirically the divergent impact of economic integration on U.S. multinational firms' affiliate sales across host countries. It is found that economic integration does lead to an increase in multinationals' activities especially in countries that are integrated with a large size of markets, because the benefit of a lower trade cost is exclusive to inside firms. However, this effect is significantly asymmetric both across and within the integrated regions, as multinationals are now motivated to serve the less attractive production locations via exports. In particular, countries with a comparative advantage gain multinationals at the expense of others, including their Preferential Trade Agreement (PTA) partners. Accounting for the potential issues of omitted variables and the endogeneity of PTA does not lead to any significant change in the results.

Key words: regional economic integration, multinational firms, concentration, market potential, comparative advantage

JEL code: F15, F23

*I would like to thank Keith Maskus, Jim Markusen, Mike Moore, Pravin Krishna and seminar participants at George Washington University, Georgetown University, SAIS of Johns Hopkins University, and US International Trade Commission for their helpful comments and suggestions. Research funding from George Washington University Center for International Business Education and Research (CIBER) is also gratefully acknowledged.

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1 Introduction

The proliferation of regional economic integration, granting firms located in the region preferential market access to all the member countries, is reshaping the flow of Foreign Direct Investment (FDI). Opel, the German based subsidiary of General Motors, for example, recently shut down its plant in the north of Lisbon, Portugal, not long after its aggressive job cuts in Germany and in parallel to its investment in a new production facility in Poland, a new member of the EU.[1] The Dutch-based electronics group Philips closed the operations of its Novalux subsidiary in Spain in 2004 and transferred the research and development (R&D) section to France and the rest also to Poland.[2] These firms are just two of the many multinational firms that are shifting their manufacturing activities to countries with not only a lower production cost but also preferably a lower trade cost to access large markets. As documented in the World Investment Report (2005), while the total inflow of FDI to the European Union rose in 2004, United Kingdom is one of the few EU-15 countries that experienced an increase. Countries such as Ireland and Spain, which were able to successfully attract a large volume of FDI prior to 2004 because of their relative advantage at the labor cost and corporate tax in the EU-15, are now threatened by some of the more competitive new members. This observation is hardly surprising. On the one hand, because the benefit of freer market access is exclusive to inside firms, outside firms are motivated to move their production to the bloc rather than exporting from, for example, their home country outside the bloc. However, not every member would gain multinationals equally; some may even lose FDI, because multinationals may find it less costly to export to these markets from their other plant in the region than to maintain the local production.

This paper thus examines the asymmetric impact of regional economic integration on countries' ability to attract multinationals. In particular, it seeks to answer: Does regional economic integration increase foreign direct investment in the participating countries? Which countries gain multinational firms at the expense of others? And do multinationals indeed adopt some integrated countries as export platforms to serve third countries? While the existing theoretical work yields clear predictions on the above questions, little has been done to test them empirically.[3] In fact, very few empirical studies, with the exceptions of Barrel and Pain (1999), Feinberg and Keane (2001), and Ekholm, Forslid, and Markusen (forthcoming), have analyzed

[1] European Industrial Relations Observatory, October 30, 2006.

[2] European Industrial Relations Observatory, March 3, 2004.

[3] Examples of the many classic theoretical work include Motta and Norman (1996), Krugman and Venables (1996), Puga and Venables (1997), and Ekholm, Forslid, and Markusen (forthcoming). Motta and Norman (1996), in a game theoretical model of FDI, find that the integration of a region causes outside firms to invest in the region and particularly leads to export-platform FDI with the investing firm supplying the majority of the countries in the regional bloc by intra-regional exports. In a two-country two-industry model, Krugman and Venables (1996) show that at lower trade barriers agglomeration force dominates and each industry concentrates in a single location. Puga and Venables (1997) extend the analysis of preferential trade agreement and industrial location to a more complicated trading system, and also find that a fall in trade barriers may lead to agglomeration with some member countries gaining industry at the expense of others. Ekholm, Forslid, and Markusen (forthcoming) similarly show that the formation of a free trade area leads to a rise of export-platform FDI from both inside and outside firms.

FDI in the context of regional economic integration. Barrel and Pain (1999) are one of the first that explore the effect on FDI of the Single Market Programme implemented in the European Union (EU), and find that the removal of trade barriers within the EU has changed the permeability of national borders and raised FDI in all the four major European economies. Feinberg and Keane (2001) consider the trade liberalization between the United States and Canada, and show that a lower U.S. tariff raises the exports of Canada-based U.S. multinationals back to their home country. Ekholm, Forslid, and Markusen (forthcoming) formally test their theoretical prediction on the export-platform FDI and find that multinationals located in a free trade area do tend to concentrate on their exports to third countries.

This paper contributes to this literature in two dimensions. First, instead of estimating the effect of one PTA, it examines how economic integration may exert a different impact on FDI *across the PTA regions*. Figure 1, constructed based on the U.S. multinational affiliate sales data in 2002 from the Bureau Economic Analysis, illustrates how asymmetrically U.S. multinationals are distributed across regions. This paper seeks to explain this geographic asymmetry by introducing the role of regional economic integration. Because of their varied size (e.g., the European Union versus the MERCOSUR), PTAs raise their members' ability of attracting multinationals to different extents. A member state of a bigger integrated bloc has preferential access to a larger integrated market, and hence offers a stronger incentive for outside firms to replace exports to this country with FDI. Furthermore, some countries, such as Mexico and Chile, often belong to more than one preferential trade agreement, which gives rise to a phenomenon referred to as the hub-and-spoke arrangement. Firms located in a hub country (.e.g., Mexico) are entitled with a lower tariff to access all the spoke countries (e.g., Colombia and Japan which respectively have a bilateral Free Trade Agreement with Mexico) whereas the benefit of the lower tariff does not necessarily apply between the the spokes. Thus, one goal of this paper is to address how a country's ability to attract multinational firms depends on the number and size of its PTA partners, an issue that has not been considered in the literature.

[Figure 1 about here]

Second, this paper also examines how economic integration motivates multinational firms to concentrate their activities *within the PTA region*. As shown in Figure 1, U.S. multinational firms are asymmetrically distributed even within a region such as the European Union and South America. While economic integration may raise the total foreign direct investment in the region, multinationals' incentive to maintain local production and avoid trade costs are weakened in some members of the region. The lower tariff between integrated countries offers firms an opportunity to concentrate their production geographically and improve the economies of scale. Firms thus become more selective in their location choices. Within an integrated bloc, host countries with desirable characteristics, such as a lower labor cost or a lower corporate tax, may gain multinational firms at the expense of the others. And such a contrast in the effect of integration rises with the heterogeneity of countries belonging to the same bloc. Hence, this paper investigates how the difference in integrated countries' characteristics, such as comparative advantage, may result in the divergent impact of economic integration, which has been overlooked so far in the empirical literature.

The paper is also built on the broader literature that examines the causes of FDI. Two main motives have been addressed in the past studies. First, firms may choose to supply each market through local production to avoid trade cost, which is referred to as the market access or tariff jumping motive. If the advantage of local access to the market outweighs the advantage of scale production, firms expand horizontally across countries of similar factor abundance. Markusen and Venables (2000), for example, offer a model of horizontal FDI. Second, when the production process consists of various separable stages which require different factor intensities, firms may choose to locate each stage in a country where the factor used intensively in that stage is abundant. This is referred to as the comparative advantage motive. Krugman and Venables (1996), for instance, consider the vertical case of FDI. The voluminous empirical work in this area includes representative studies such as Brainard (1997), Markusen and Maskus (1999), Carr, Markusen, and Maskus (2001), Markusen and Maskus (2001), and Yeaple (2003). In light of this literature, this paper considers how a decline in trade costs within a bloc, through influencing the above two motives, may lead multinationals to relocate. First, firms from outside the bloc are motivated to move their production to the bloc, because the benefit of preferential market access to the entire bloc is exclusive to insiders. However, the market access motive which led multinationals to expand their production horizontally in the bloc prior to the integration is now weakened. Not only would multinationals become more geographically concentrated in the bloc, but their choice of such locations would be dominated by the comparative advantage factor.

To explicitly formulate the role of regional economic integration in multinationals' location decision, this paper first builds a model which establishes a link among PTA, a country's market potential, and multinationals' affiliate sales. It considers the formation of a preferential trade agreement improves a country's market access to its PTA partners and thus the size of its potential export markets. Similar to Harris (1954), Krugman (1992), and Hanson (2005), a country's market potential is defined as the sum of domestic market size and the market size of other countries discounted by trade costs, such as distance. The recent study by Head and Mayer (2004) considers the role of market potential (without distinguishing the PTA partners from the rest of the world) in multinationals' location decision and provides strong evidence that the market size of other countries also matter in explaining a country's receipt of FDI.

Taking the model directly to the data, this paper finds in both linear and nonlinear estimations that integrated countries with preferential access to a large size of markets are especially favored by multinationals, thanks to their distinguished market potential. Hub countries, in particular, see a greater increase in multinationals' affiliate sales than spoke countries. However, the impact of regional economic integration is significantly asymmetric and even contrary within the integrated region dependent on countries' comparative advantage. In particular, labor abundant members tend to become the locations in which labor-intensive multinationals concentrate their production, whereas the capital abundant members may even lose FDI after economic integration in labor intensive industries. As it becomes less costly to supply some markets by exports than local production, multinationals are indeed found to switch from a dispersed-FDI strategy to export-platform FDI. Export-platform FDI rises in PTA members with preferential market access to a large number of countries or countries with a great market size.

To account for the potential issue of omitted variables, this paper adopts a novel approach introduced by Head and Mayer (2004) and constructs a more generalized measure of market potential. By taking into account market factors such as the degree of competition and additional trade costs such as the national border, this alternative measure serves as a better indicator of export demand. However, the adoption of this approach does not change the results qualitatively. The demand in the PTA partner countries is still shown to exert a significant and positive effect on the affiliate sales. This paper also addresses the potential endogeneity of two countries' preferential trade relationship by first investigating the economic and political determinants of the PTAs. Using the two-stage instrumental variable method, the paper shows the estimated effect of economic integration on both total and export sales remains robust.

The rest of the paper is organized as follows. Section 2 builds a simple model to examine firms' location decision before and after integration and lists the main hypotheses. Sections 3 and 4 describe respectively the econometric framework and data of the paper. Section 5 presents the empirical results, and section 6 deals with the issue of omitted variables and endogeneity of the preferential trade agreements. Section 7 concludes the paper.

2 The Model

Following Motta and Norman (1996), this paper builds a model to examine firms' location decision. Consider the world consists of three countries, H, A, and B. A representative consumer located in country $j = H$, A, and B, allocates her expenditure in a representative industry, denoted by Y_j, across differentiated varieties. Within each industry, the consumer's utility function exhibits constant elasticity of substitution. Maximizing the CES utility function subject to the expenditure and the prices from all three possible product origins yields the demand equation for the representative variety i as

$$q_{ij} = \frac{p_{ij}^{-\sigma}}{\sum_r n_r p_{rj}^{1-\sigma}} Y_j, \tag{1}$$

where q_{ij} is the quantity a firm producing in country i would sell to each destination country j, p_{ij} is the price of products from country i faced by consumers in country j, n_r denotes the number of firms producing in country r, where $r = H, A$, and B, and σ is the constant elasticity of substitution. Further, $p_{ij} = \phi_{ij} \cdot p_i$, where p_i is the market price in the origin country i and ϕ_{ij} is the trade cost between countries i and j. Trade cost is assumed to include transport cost between countries i and j, denoted by d_{ij}, and tariff, denoted by τ_{ij}. To be specific, trade cost is defined as $\phi_{ij} \equiv d_{ij}^{\gamma} \tau_{ij}^{\lambda}$, where $d_{ij}, \tau_{ij} \geqslant 1$ (with equality holding for $i = j$), and $\gamma, \lambda > 0$.

There is one firm in each country, denoted by h, a, and b, which sells to all three markets. Firms take into account the consumer's demand and set their prices to maximize profits. Following Dixit and Stiglitz (1977), the profit-maximizing price is a constant mark-up over marginal cost, denoted as c_i: $p_i = [\sigma/(\sigma - 1)]c_i$. Taken the price function into account, the quantity a firm producing in country i would sell to each destination country j, defined in equation (1), becomes:

$$q_{ij} = \frac{(\sigma - 1)}{\sigma} \frac{(c_i \phi_{ij})^{-\sigma}}{Z_j} Y_j, \tag{2}$$

where $Z_j \equiv \sum_r n_r (c_r \phi_{rj})^{-\sigma}$ captures the number of firms selling in country j with each firm weighted inversely by its production cost and trade cost. The gross profit a firm earns by producing in country i and selling in destination country j is

$$\pi_{ij} = \frac{c_i^{1-\sigma} {\phi_{ij}}^{-\sigma}}{\sigma Z_j} Y_j, \tag{3}$$

which is an increasing function of the expenditure of country j (i.e., Y_j) and a decreasing function of marginal production cost (i.e., c_i). Further, a fall in the trade cost, ϕ_{ij}, improves country i's market access to country j. Even though it also raises the competition in country j reflected by Z_j, its net effect is to increase the profit country i's exporters earn in country j.

Since this paper examines the impact of economic integration on the location decision of U.S. multinational firms, the model focuses on the firm of one parent country, say country H. Firm h may choose where to locate in the three countries and how to supply each of the markets, whereas the firms of the other countries are assumed to supply foreign markets only through exports. Denote l_i as firm h's location decision in country i, where $i = H, A$, and B. $l_i = 1$ if firm h establishes a local production facility in country i and 0 otherwise. Firm h can produce in more than one location, and thus $\sum_i l_i \geqslant 1$. If $l_i = 1$ for $i \neq H$, firm h has a plant in countries A or B and is considered as a multinational firm. For the locations in which $l_i = 1$, firm h also determines q_{ij}, i.e., its sales to local market ($j = i$) and exports to foreign markets where firm h does not have production facility ($l_j = 0$).[4] In addition to the variable cost of production,

[4] It is assumed that firm h would supply a market from only one production location. If firm h has a local plant in a country, it supplies this country's consumers through local production. If firm h does not have a local plant in a country, it exports to this country from a location that maximizes its gross profit.

production at each plant is assumed to require a fixed cost, denoted as F, and therefore the total fixed cost incurred by firm h is $(\sum_i l_i) \cdot F$. Since firm h may locate its production in any of the three countries, the number of firms producing in each country, i.e., n_r, and thus the market structure factor in each market, i.e., Z_j, is conditional on firm h's location choice.

There is a total of 7 possible location configurations for firm h, denoted by $[l_H, l_A, l_B]$. These possible configurations $[l_H, l_A, l_B]$, assuming firm h produces in at least one location, i.e., $\max l_i > 0$, can be divided to three categories: (1) $\sum_i l_i = 1$, (2) $\sum_i l_i = 2$, and (3) $\sum_i l_i = 3$.[5] First, when firm h only produces in one location i, i.e., $l_i = 1$ and $l_j = 0$ for $j \neq i$, its gross profit is

$$\Pi\left(\sum_r l_r = 1\right) = \pi_i - F = \sum_j \pi_{ij} - F = \frac{c_i^{1-\sigma}}{\sigma} \sum_j \frac{\phi_{ij}{}^{-\sigma}}{Z_j^i} Y_j - F. \tag{4}$$

In the above equation, $\Pi\left(\sum_r l_r = 1\right)$ is an increasing function of the term $\sum_j \frac{\phi_{ij}{}^{-\sigma}}{Z_j^i} Y_j$, which is the sum of all three countries' market size weighted by their respective trade cost with country i, ϕ_{ij}, and the degree of competition in their markets, Z_j^i (in which the added superscript denotes the location of firm h and the subscript denotes the sales market). Following Krugman (1992) and Head and Mayer (2004), I refer to this term, i.e., $M_i(\sum_r l_r = 1) \equiv \sum_j \frac{\phi_{ij}{}^{-\sigma}}{Z_j^i} Y_j$, as the market potential faced by the firms in country i. Note if $i = H$, i.e., firm h produces at home and exports to both foreign countries A and B, the number of firms producing in each location is 1 ($n_r = 1$, for all r), $Z_j^H = \sum_r (c_r \phi_{rj})^{-\sigma}$, and thus $M_i(\sum_r l_r = 1) = \sum_j \left(\phi_{ij}{}^{-\sigma} / \sum_r (c_r \phi_{rj})^{-\sigma}\right) Y_j$. But if $i \neq H$, i.e., firm h does not produce at home but a foreign country i, then the number of production firms in each country is respectively $n_i = 2$, $n_j = 1$, and $n_H = 0$, where $l_i = 1$, $l_j = l_H = 0$, and $i, j \neq H$. The degree of competition in each market, which determines country i's market potential M_i, is hence $Z_i^i = (c_j \phi_{ji})^{-\sigma} + 2c_i^{-\sigma}$, $Z_j^i = 2(c_i \phi_{ij})^{-\sigma} + c_j^{-\sigma}$, and $Z_H^i = 2(c_i \phi_{iH})^{-\sigma} + (c_j \phi_{jH})^{-\sigma}$. Comparing equation (4) for all three locations, firm h, when operating only one plant, would choose the location that maximizes its profit.

Similarly, when firm h chooses to produce in two locations, say countries i and j (i.e., $l_i = l_j = 1$) and export to the third country k where $l_k = 0$ ($k \neq i, j$) from country i, its gross profit is

$$\Pi\left(\sum_r l_r = 2\right) = \pi_i + \pi_j - 2F = \sum_{r \neq j} \pi_{ir} + \pi_{jj} - 2F = \frac{c_i^{1-\sigma}}{\sigma} \sum_{r \neq j} \frac{\phi_{ir}{}^{-\sigma}}{Z_r^i} Y_r + \frac{c_j{}^{1-\sigma}}{\sigma Z_j^j} Y_j - 2F. \tag{5}$$

Here it is assumed that $c_i^{1-\sigma} \phi_{ik}^{-\sigma} / Z_k^i \leqslant c_j^{1-\sigma} \phi_{jk}^{-\sigma} / Z_k^j$, which ensures it is more profitable for firm h to export from i to k instead from j to k. Z_r^i and Z_j^j are similarly defined as above. Here,

[5] This paper focuses on firm h's location choices and supply strategies and hence assumes the parameters of the model, such as the market size of each country, Y_j, satisfy the nonnegative profit conditions such that firm h would always supply each market. The decision faced by firm h is therefore to choose the optimal strategy to serve each market, i.e., by local production or exports, and the optimal locations for production (including the production of exported good).

$M_i(\sum_r l_r = 2) \equiv \sum_{r \neq j} \frac{\phi_{ir}{}^{-\sigma}}{Z_r^i} Y_r$, indicating that the market potential of country i is the weighted sum of its domestic market size and the size of the country to which firm h exports to from i. The market potential of country j, i.e., the other country in which firm h is located, is simply its domestic market size discounted by the degree of competition, Y_j / Z_j^j. To select the optimal pair of locations, firm h ranks the above profit function for each pair of countries and chooses the pair that yields the maximum.

When firm h decides to supply each country through local production, i.e., $l_r = 1$ for all r, its gross profit becomes

$$\Pi \left(\sum_r l_r = 3 \right) = \sum_i \pi_i - 3F = \sum_i \frac{c_i{}^{1-\sigma}}{\sigma Z_i^i} Y_i - 3F. \tag{6}$$

The market potential of each host country is simply its competition-adjusted domestic market size.

Provided all the above possible location choices, firm h picks its optimal location configuration $[l_H^*, l_A^*, l_B^*]$ such that

$$\Pi \left(l_H^*, l_A^*, l_B^* \right) \geqslant \Pi \left(l_H, l_A, l_B \right), \ \forall \left[l_H, l_A, l_B \right], \tag{7}$$

where the right hand side of the inequality is defined by equations (4), (5), and (6). The optimal number of plants, $\sum_r l_r^*$, is thus equal to $l_H^* + l_A^* + l_B^*$.

Note that this paper does not intend to identify explicitly the conditions associated with each possible optimal location configuration, but instead to investigate the transition between these configurations in the context of regional economic integration. For this purpose, consider countries A and B adopt a preferential trade agreement which removes the tariff between each other. In other words, the tariff rate between A and B, i.e., τ_{ij} where $i, j = A, B$ and $i \neq j$, falls to 1 reducing the trade cost between the two countries from ϕ_{ij} to d_{ij}^{γ}. Such a decline in the trade cost alters the profit associated with each of the 7 location configurations.

To see this, first of all, Z_j^i, where $j = A, B$, rises regardless of the location of firm h (i), representing an increase in competition in A and B due to the lower trade cost. Then it follows directly that, if firm h does not derive a direct benefit from the tariff reduction by exporting from A to B or vice versa, firm h's profit falls due to the greater competition. In other words, $\Pi \left(l_H, l_A, l_B \right)$ decreases when $[l_H, l_A, l_B] = [1, 0, 0]$, $[0, 1, 1]$, or $[1, 1, 1]$ and when $[l_H, l_A, l_B] = [1, 1, 0]$ (and symmetrically $[1, 0, 1]$) but firm h serves the market with $l = 0$ by exports from H. Hence, this group of location configurations and supply strategies becomes less desirable. In contrast, the reduction in τ_{ij} ($i, j = A, B$ and $i \neq j$) has a positive effect on firm h's profit in all other cases—when firm h has one plant in either A or B (but not both), i.e., $[0, 1, 0]$, $[0, 0, 1]$, $[1, 1, 0]$, or $[1, 0, 1]$, and supply the other country via exports from its plant in the region. Thus, as established in Appendix A, if the initial equilibrium is one of the former configurations a PTA between countries A and B will trigger firm h to switch its location choices or at least its choice of export platform to supply countries A and B. For example, if the initial equilibrium is $[1, 0, 0]$, i.e., firm h would produce only at home and export to A and B, a fall in the tariff between A and B would motivate firm h to build a new plant in either A or B and supply the rest of the region from the new plant. This is especially possible when the production cost in A or B is sufficiently low or when the trade cost between the region and country H, i.e., ϕ_{Hj} with $j = A, B$, is sufficiently high. Furthermore, firm h is motivated to concentrate its production in the country (between A and B) that offers a greater gross profit, i.e., a greater value of $c_i^{1-\sigma} \sum_j (\phi_{ij}^{-\sigma} Y_j / Z_j^i)$, through either a lower production cost, c_i, or a greater market potential, $M_i \equiv \sum_j (\phi_{ij}^{-\sigma} Y_j / Z_j^i)$. Table 1 summarizes the predictions discussed in Appendix A.

[Table 1 about here]

Three hypotheses immediately follow:

A.1 A fall in the trade cost between A and B raises the production of firm h in the integrated region, especially when c_j $(j = A, B)$ is low or ϕ_{Hj} $(j = A, B)$ is high.

A.2 Within the integrated region, while the country with a lower production cost or a greater market potential likely sees an increase in firm h's production, its regional partner may experience a decline;

A.3 Within the integrated region, the country with a lower production cost or a greater market potential also likely sees an increase in its exports by firm h.

At the optimal location configuration, the profit firm h would earn from its production in country $i = A$ or B is

$$\pi_i^* = \frac{c_i^{1-\sigma}}{\sigma} \sum_{j \in \{k |\ q_{ik}^* > 0\}} \frac{\phi_{ij}{}^{-\sigma}}{Z_j^i} Y_j - F, \tag{8}$$

in which the profit is based on firm h's sales in both the domestic market and export market (if any), i.e., q_{ik}^*. Similarly, the profit firm h would earn from its exports from its production in country $i = A$ or B, denoted as π_i^e, is

$$\pi_i^e \equiv \sum_{j \in \{k |\ q_{ik}^* > 0\}} \pi_{ij}^* = \frac{c_i^{1-\sigma}}{\sigma} \sum_{j \in \{k |\ l_k^* = 0\}} \frac{\phi_{ij}{}^{-\sigma}}{Z_j^i} Y_j. \tag{9}$$

Taking the natural log of equation (8) without the constant F yields:

$$\ln \pi_i^* = -(\sigma - 1) \ln c_i + \ln M_i, \tag{10}$$

where $M_i \equiv \sum_{j\in\{\, i,k\neq i|\ l_k^*=0\}} \phi_{ij}{}^{-\sigma} Y_j/Z_j^i$. Similarly, taking the natural log of equation (9) yields:

$$\ln \pi_i^e = -(\sigma-1)\ln c_i + \ln M_i^e, \tag{11}$$

where $M_i^e \equiv \sum_{j\in\{\, k|\ l_k^*=0\}} \phi_{ij}{}^{-\sigma} Y_j/Z_j^i$ is country i's export market potential, and $M_i^e = M_i - Y_i$, i.e., country i's export market potential is equal to its aggregate market potential net of its domestic market size.

3 Econometric Framework

To derive estimation equations, three assumptions are made about equations (10) and (11). First, the tariff is assumed to be uniformly set by all importer countries on all exporters, i.e., $\tau_{ij} = \tau$, unless the two countries are integrated.[6] Second, it is assumed $\gamma = 1/\sigma$ to simplify the computation of market potential. Third, while the market potential of a country faced by firm h is defined in the model as the total size of the markets which are supplied by firm h's production in this country, it is infeasible to identify these markets with the industry-level data. Hence, this paper calculates market potential based on all the potential markets. To be specific, the paper constructs a new binary variable, PTA_{ij}, that is equal to 1 for $i, j = A, B$ when A and B form a preferential trade agreement and 0 otherwise. By normalizing the weight of a country's domestic market size in its market potential to 1 and denoting the weights of PTA partners and the rest of the world respectively as ω_1 and ω_2 (note that ω_1/ω_2 would equal to $\tau^{\lambda\sigma} > 1$), the formula of market potential is then rewritten as:

$$\text{market potential:} \qquad M_i = \frac{Y_i}{Z_i^i} + \sum_{j\neq i}\left[\omega_1 PTA_{ij}\cdot\frac{Y_j}{d_{ij}Z_j^i} + \omega_2(1-PTA_{ij})\cdot\frac{Y_j}{d_{ij}Z_j^i}\right]. \tag{12}$$

Similarly, the export market potential becomes:

$$\text{export-market potential:} \qquad M_i^e = \sum_{j\neq i}\left[\omega_1 PTA_{ij}\cdot\frac{Y_j}{d_{ij}Z_j^i} + \omega_2(1-PTA_{ij})\cdot\frac{Y_j}{d_{ij}Z_j^i}\right]. \tag{13}$$

The goal is thus to estimate equations (10) and (11), taking into account equations (12) and (13), and identify $-(\sigma-1)$, the effect of production cost, ω_1 and ω_2, the importance of PTA partners's market size and that of the unintegrated countries.

[6] A main reason this assumption is adopted is that the tariff data is not always available for all the included countries for the sample period.

GDP is adopted as a proxy for Y_j and distance between the multinational firm's host country and another country j as a proxy for d_{ij}. However, Z_j^i, which not only takes into account the number of firms selling in a market but also weighs these firms differently with their respective production cost and trade cost, is difficult to control for and is thus not included in the equation. Note that with the omission of Z_j^i, equations (12) and (13) become very similar to the market potential that was first introduced by Harris (1954), i.e., the sum of all countries' market size divided by their distance to a given country. The exception is that this paper distinguishes countries that have preferential trade relationship with the host from the rest. Section 6 addresses the issue of omitted variables and adopts a more comprehensive measure of market potential, which is first introduced in Krugman (1992) and considered in Head and Mayer (2004).[7]

The variable cost of production is another explanatory variable that determines multinationals' affiliate sales (and exports). Since the actual production cost in the host country is often not observed, a country's capital-labor ratio is adopted as a proxy for its comparative advantage and production cost. A relatively capital abundant country should attract capital intensive multinational firms, whereas a relatively capital scarce country should receive labor-intensive multinational firms. Hence, an industry's capital intensity is also included in the estimation both independently and by being interacted with a country's capital labor ratio. A host country's corporate tax rate is also a cost factor to multinationals and expected to be negatively correlated with the affiliate sales of multinationals.

The role of freight cost in affiliate sales is more complex. On the one hand, freight cost is part of the trade costs associated with the shipment of final goods and thus may motivate firms to supply foreign markets through local production instead of exports. On the other hand, when multinationals have a vertical production structure and need to ship the intermediate inputs from home to the host country for assembly production, the freight cost between their home and host country would be negatively associated with multinationals' affiliate sales. As a result, the net effect of freight cost is ambiguous. A similar variable that exerts simultaneously a positive and negative impact on multinationals' affiliate sales is the tariff the host country imposes on the parent country of the multinationals. While it offers a tariff-jumping motive for multinationals to replace exports with FDI, it discourages those multinationals which need to export their intermediate inputs to the host country for their production. Moreover, multinational firms may seek to export their products back to their home country, and in this case the freight cost and the tariff rate the U.S. imposes on the host countries would exert an adverse impact on the affiliate sales. Thus, the latter variable is also included in the estimation.

However, despite the control of the above explanatory variables, there may still exist a wide range of omitted variables, such as the different investment environment across host countries,

[7] In the previous empirical studies that examine the effect of PTAs on multinationals' affiliate sales, it is common to use just the dummy variable to reflect the host country's status of regional economic integration. This measure will be considered in this paper as well to provide comparative results.

which may be correlated with the existing explanatory variables. Therefore, a host country-industry fixed effect is included to control for all time-invariant factors of the host country and time fixed effect to control for time specific factors.[8]

4 Data

The data employs a sample of 40 countries for the period of 1986 to 1999.[9] The data of multinational affiliate sales and exports is taken from the datasets collected by the Bureau of Economic Analysis from U.S. majority owned affiliates abroad. It consists of SIC 2-digit level manufacturing industries.[10]

Table 2 takes a brief glance at the distribution of U.S. multinationals' affiliate sales in several geographic regions (15 western European countries, North America, South America, South-Eastern Asia, and Australia-New Zealand) and across sales destinations (local sales, exports back to the U.S., and exports to third countries). All of these geographic regions have reached at least one Preferential Trade Agreement by 1999.

[Table 2 about here]

A few observations are noteworthy. First, the volume of total affiliate sales has been growing at an annual rate of 13% between 1986 and 1998. Similar growth is observed in the volume of affiliate sales in each of the regions. Second, it appears that the percentage of sales by affiliates located in Canada and Mexico has slightly declined from 18% to 15% from 1986 to 1998, while the percentage by the affiliates located in South America has increased from 3% to 6%.

Then, the affiliate sales are categorized by their destinations. The first category is the percentage of local sales by U.S. multinational affiliates, capturing mainly the horizontal type of FDI that is intended to seek markets and avoid trade costs. As shown, this dimension of multinationals' activities is dominant in all regions perhaps with the exception of South-Eastern Asia. However, U.S. multinationals have become less local-market oriented over time also except South-Eastern Asia. The second category, the percentage of exports back to the U.S., reflects mainly U.S. multinationals' comparative advantage motive which leads them to move their production abroad and make the vertical type of foreign direct investment. It is shown that this percentage grows significantly in Canada and Mexico especially since 1994 when the NAFTA was formed, but falls in South America and South-Eastern Asia. Last, the share of affiliate sales exported to third countries (excluding the host country and the U.S.), defined as

[8] Note that by including both the cross-section and time fixed effects this paper essentially employs a difference-in-difference estimator to analyze the effect of regional economic integration.

[9] Table A.1 lists the included countries.

[10] Because the Bureau of Economic Analysis switched from the SIC industry classification to the NAICE code in 1999 when collecting data on U.S. multinationals' activities, the data of affiliate sales at the SIC 2-digit industry level is only available until 1999, and cannot be corresponded to the NAICE code because of the 2-digit level of classification. As a result, this paper's sample covers the period of 1986 and 1999.

export-platform FDI (and often viewed as a combination of horizontal and vertical FDI), is not only highest in Western Europe and South-Eastern Asia but also steadily growing in Western Europe, South America, and Australia-New Zealand. In sum, the data seems to imply that, even though the volume of multinational affiliate sales grows in each region, the targeted markets vary across regions and over time.

Now consider the explanatory variables included in the estimation. This paper takes into account all the Preferential Trade Agreements that were implemented before 1999 and involved the countries included in the sample.[11] PTA_{ijt} is constructed as a dummy variable that takes the value of 1 if the host country i has a preferential trade agreement with another country j at year t and 0 otherwise. The data of real GDP at the 1995 U.S. dollars of host country as well as its potential export destinations is obtained from the World Bank's World Development Indicators. The distance between the host and another country, employed as a weight of the latter country's GDP, is the straight-line distance between nation's capitals in thousand kilometers and taken from the City Distance Calculator provided by VulcanSoft. K/L ratio measures the country's comparative advantage and hence production cost, and is the ratio of capital stock relative to the size of labor force. The data of gross fixed capital formation (investment) is available from the World Development Indicators. A country's capital stock is then obtained by the perpetual inventory method as outlined in Leamer (1984). Assuming a depreciation rate (δ) of 7%, the annual capital stocks are computed as $K_t = (1-\delta)K_{t-1} + I_t$. The initial value of capital stocks is taken from far enough in the past so that the impact of the initial value on the estimated time series is small. A country's labor endowment, i.e., the size of the labor force, is also from the World Development Indicators. An industry's capital intensity is measured by the share of capital expenditure in value added, with the data from the NBER-CES manufacturing industry database and the U.S. Annual Survey of Manufacturers. The average corporate tax rate of a host country is calculated following the methodology discussed in Hines and Rice (1994). An ad valorem measure of the freight and insurance cost is constructed from the U.S. import data as discussed in Feenstra (1996). To measure the tariff rate the host country imposes on the U.S. for a particular industry, the average tariff of the disaggregate sub-industries is calculated using the import value as the weight of each sub-industry. Both tariff and import data are taken from the COMTRADE database. The tariff rate the U.S. imposes on the host country is also included based on the datasets described in Feenstra (1996).

Table 3 provides a simple comparison of the level of affiliate sales, exports and the share of exported affiliate sales between the sample countries that have at least one PTA (i.e., $PTA_{ij} = 1$ $\forall j$) and those that don't belong to any PTA (i.e., $PTA_{ij} = 0$ for all j) for six manufacturing industries. As shown, the level of total affiliate sales appears always higher in the integrated countries, especially in the industries of machinery and transport. The same observation holds for the level of exports by affiliates, while the difference between integrated and unintegrated

[11] Table A.2 lists the Preferential Trade Agreements included in the paper.

countries is widened. Further, the share of affiliates' exports in each of these industries is also unambiguously greater in integrated countries, which is consistent with the theory that regional economic integration raises multinationals' incentive to serve third countries via exports and concentrate their production in export platforms.

[Table 3 about here]

5 Empirical Results

5.1 The effect of regional economic integration on multinationals

The estimation sets out by including either a dummy variable to represent a host country's status of economic integration or a simple count of countries with which the host has a PTA. The results are reported in the second and third columns of Table 4. In the rest of the table, the paper adopts a country's market potential, i.e., equation (12), to reflect economic integration. It proceeds with two variant measures. In the fourth column, it first only considers the domestic market size and the size of integrated countries (i.e., assuming $\omega_1 = 1$ and $\omega_2 = 0$ in equation (12)), and estimates the effect of integrated market size on affiliate sales. The paper then releases these assumptions in the last column, and directly estimates the importance of integrated markets relative to the rest of the world (i.e., estimating ω_1 and ω_2).

As shown throughout the table, a country's relative capital abundance is negatively associated with the level of affiliate sales, suggesting labor abundant countries tend to see a greater level of affiliate sales. This effect is especially stronger in labor intensive industries as suggested by the statistically significant and positive parameter of the interaction term. The parameter of capital intensity, though statistically insignificant, suggests a negative correlation between an industry's capital intensity and multinationals' activities abroad. The parameter of corporate tax rate is shown statistically insignificant, which may be due to the use of country-industry fixed effect. A 1% increase in the freight cost between the U.S. and the host country reduces multinationals' affiliate sales by about 0.13%. This result seems in accordance with a vertical FDI model: first, when a multinational firm exports intermediate inputs from its home headquarter to its affiliates abroad for assembly multinationals' activity may be discouraged by transport cost, second, when the final goods are exported back to the home country of multinationals, transport cost may again adversely affect affiliate sales. Further, multinational firms' tariff-jumping motive is confirmed in the table. A 1% increase in the tariff imposed by the host country raises multinationals' affiliate sales by about 0.8%. The tariff the U.S. imposes on the host country, in contrast, has an adverse impact on the U.S. multinationals, perhaps because some multinational firms export their goods back to the U.S. Since the first two columns of results do not consider the role of another country's market size, the host country's GDP is included and shown to be positively associated with multinational affiliate sales.

[Table 4 about here]

The estimated impact of regional economic integration, when first captured by either the dummy variable or the total number of countries granting preferential market access to the host country, not only is statistically significant but also suggests that a country sees more multinational affiliate sales the greater number of PTA partners it has. In particular, having an additional PTA partner of equivalent market size increases affiliate sales by 11%. Two implications are derived: first, a member's ability to attract multinationals on average increases with the total number of members in the PTA; second, countries which belong to more than one PTA are more likely to be where multinationals choose to concentrate their activities, because they essentially become the hub countries with better market access to all the spoke nations.[12]

When a country's market potential in integrated markets is instead considered, it is found that a 1% increase in a host country's market potential in integrated markets leads to a 1.04% increase in multinational affiliate sales. It suggests that having preferential trade relationship with both a large number of countries and countries of a great market size raises the host countries' ability to attract multinational firms.

In the last column of Table 4, instead of only considering the market size of integrated countries, the estimation takes into account all the other countries. Hence, a country's market potential now consists of: (a) its domestic market size, (b) the market size of its PTA partners discounted by distance, and (c) the market size of the rest of the world (similarly discounted by distance).[13] Normalizing the weight of domestic market size in the calculation of market potential to 1, the paper estimates the respective weights of PTA partners and third countries using a Nonlinear Least Square model. First, the estimated effect of aggregate market potential is 6.3, suggesting a 1% increase in a host country's market potential leads to a 6.3% increase

[12] Since the paper includes both customs union and FTA in the consideration of regional economic integration, it is reasonable to suspect they may extert different impacts on FDI. The cause of different impacts could be that the former requires all the members to impose a uniform external tariff system (against outside countries including the U.S.) while the latter does not. However, since the level of the host country's tariff against the U.S. is included in the estimation, the difference between the two types of PTAs is at least partially captured. In the next section, the paper examines the effect on the affiliate sales of a host country's tariff (against the U.S.) relative to its PTA partners, and essentially separates Customs Union from Free Trade Agreement.

Another worthy distinguishment would be to divide the PTAs to two groups: the PTAs that involve the parent country of multinationals (in this case, the U.S.) and the others. In other words, consider the host countries which receive preferential tariffs from the U.S. separately from the rest which receive MFN tariffs. This would be especially important when examining the part of multinational affiliate sales exported back to home. To address this, the paper includes the tariff rate the U.S. imposes on the host country, which would be equal to zero to countries that have a PTA with the U.S., i.e., Canada and Mexico, since the PTA was adopted. Alternatively, the paper separated the NAFTA from the other PTAs, and found that the NAFTA does not significantly raise U.S. multinationals' affiliate sales while the other PTAs exert a significant and positive impact. A possible explanation is that the adoption of a PTA between the multinationals' home country and a host country offers firms a stronger incentive to export than to move production abroad.

[13] For the host countries which do not have any PTA, their market potential is the sum of (a) their domestic market size and (c) the market size of the rest of the world, with the value of (b) equal to zero. For the host countries which adopt PTA at a certain year, (b) becomes positive in that year while (c) decreases, but the unweighted sum of (b) and (c) remains the same.

in its affiliate sales. Second, within the aggregate market potential, the weight of the PTA partners' GDP discounted by their distance to the host is 0.57 while the weight of the rest of the world is 0.47. The significant difference between the two groups' weights suggests that the market size of countries that have preferential trade relationships with the host plays a more important role in attracting multinationals than that of unintegrated countries.

5.2 Integration and geographic concentration of multinationals

While regional economic integration is shown to increase multinationals' affiliate sales especially in countries that have preferential trade relationships with a large number of countries or countries with a great market size, the theory suggests that such an effect also diverges across countries because of their varied cost of production. Given multinationals' increased incentive to geographically concentrate their production, some countries are likely to gain multinationals at the expense of others, including their PTA partners. Hence, this section proceeds to address the asymmetric impact of regional economic integration on countries because of their difference in characteristics such as comparative advantage. Do multinationals indeed become more geographically concentrated in their production within integrated countries? What types of host countries are more attractive? Who gains and who loses? To answer these question, the dummy variable of PTA is interacted with countries' characteristics; the results are reported in Table 5.

[Table 5 about here]

As seen in the upper part of Table 5, labor abundant countries receive a greater increase in multinationals' affiliate sales after regional economic integration, especially in labor intensive industries. In other words, comparative advantage is an important factor in firms' location decision especially when a regional bloc is integrated. Integrated countries with a lower corporate tax rate also see a greater increase in affiliate sales. Moreover, the positive effect of a PTA on stimulating multinationals' activities is particularly stronger in host countries which require a higher shipping cost for the goods to be exported from the U.S.[14] These findings are broadly consistent with hypothesis A.1 in section 2.

Hence, it appears that the effect of regional economic integration does vary across host countries. While some countries—thanks to their comparative advantage or tax policy—become more attractive production location after joining PTAs, other countries could very likely lose multinationals even as a member of PTA and be now served by U.S. multinationals via exports. This contrast in the effect of regional economic integration should also be seen among countries in the same integrated bloc. As multinationals located in an integrated country can access all the PTA partners at zero tariff, their incentive to concentrate their production within the bloc rises. As a result, attractive host countries may gain multinationals at the loss of their PTA

[14] Table 5 reports a selected list of estimates, but the complete table is available upon request.

partners. To test this hypothesis, the difference between a host country's characteristics and the average of its PTA partners' is measured, i.e., $\Delta X_{ikt} \equiv X_{ikt} - mean\,(X_{jkt})\,\big|_{PTA_{ijt}=1}$, which captures the host country's advantage or disadvantage in their ability to attract multinationals relative to their PTA partners. The lower part of Table 5 reports the estimated parameters of the terms that interact ΔX_{ikt} with the PTA dummy variable. As expected in hypothesis A.2, countries that are relatively labor abundant compared to their PTA partners receive a greater increase in multinationals' affiliate sales in labor intensive industries. Also, multinationals are more likely to increase their activities in integrated countries that require a higher transport cost.

Next, the estimated marginal effect of an additional PTA partner on affiliate sales is depicted for each individual country and a particular industry in Figures 2-4.[15] There exists a statistically significant correlation between the country-specific estimates and countries' capital-labor endowment ratio in three industries: food, chemicals, and electrical appliances. It is clear that not every integrated country gains multinationals and, furthermore, countries do not gain (or lose) multinationals in all industries. In the food industry, labor abundant countries, such as Thailand, Malaysia, Peru and Chile, experience a greater increase in multinationals' activities, while capital abundant countries such as most of the European countries see a decline. This contrast is not surprising given that the food manufacturing is a labor intensive industry. In contrast, the correlation between the country estimates and countries' capital-labor ratio is found positive in the chemical industry (for the European countries) and in the electrical appliance industry. Similarly, this finding is in accordance with these two industries' relatively high capital intensity. In particular, as shown in Figure 4, the positive impact of regional integration is almost exclusive to industrial countries in the electrical appliance industry, such as Ireland, Switzerland and Denmark. However, not every industrial country sees an increase of multinationals' activities; almost half of the EU members, such as Belgium and Greece, actually experience a decline in multinationals' affiliate sales which is replaced by the imports from their EU partners.

[Figures 2-4 about here]

5.3 Export-platform FDI

As established in the theoretical literature, such as Motta and Norman (1996), Krugman and Venables (1996), Puga and Venables (1997), and Ekholm, Forslid, and Markusen (forthcoming), a phenomenon that shall be stimulated by regional trade liberalization is export-platform FDI. With the decline in trade costs, it becomes less costly for multinationals to supply some markets

[15] Because the paper includes a country-industry fixed effect, it could not estimate country specific effects of the PTA dummy variable, which would be perfectly correlated with the fixed effect for countries that have a PTA throughout the entire sample period. Hence, the paper instead estimates country specific effects of an additional PTA partner.

by exporting than establishing a separate production plant. This section hence adopts the exports of multinational affiliates to third countries as a dependent variable[16] and examine how regional economic integration may lead to the rise of export-platform FDI (hypothesis A.3 in section 2).[17]

As shown in Table 6, regional economic integration exerts a significant and positive impact on multinationals' exports to third countries.[18] In particular, the second column finds the parameter of a host country's PTA status statistically significant and positive and suggests signing a preferential trade agreement raises the exports of multinational affiliates located in this country. This positive effect rises with both the number of preferential trading partners as suggested in the third column and the total market size of these partner countries as indicated by the parameter of integrated export market potential. In the nonlinear Least Square model, it is shown that not only is the aggregate export market potential crucial in determining affiliates' exports but also the weight of PTA partners relative to the rest of the world is significantly higher than 1, implying improved market accessibility to integrated markets raises a country's attractiveness as the location of concentrated production and export platform. In addition, multinationals' comparative advantage motive is another determinant in their export behavior. Host countries with relative labor abundance see a larger amount of exports by multinational affiliates.

[Table 6 about here]

6 Robustness analysis

6.1 Omitted variables

However, there may exist omitted variables in the above specifications despite the controls of both country-industry and time fixed effects. In particular, while the market size of countries that share a PTA with the host country are found to affect the host country's ability to attract multinationals, the estimated effect of PTA may have captured some other factors these countries share with the host, such as border and language. Moreover, the measure of a host country's market potential has so far only taken into account the other markets' total market

[16] One drawback of the exports data is that it cannot be divided between exports to the integrated countries and those to the rest of the world. As a result, the paper estimates the effect of economic integration on the exports of U.S. multinational affiliates to all third countries (countries other than the host and the U.S.).

[17] Explanatory variables are correspondingly adjusted to estimate multinationals' exports. First, the host country's GDP is no longer included on the right hand side, including in the measure of market potential. Second, United States is also excluded in the measure of market potential, because the dependent variable, i.e., multinationals' exports to third countries, excludes the exports back to the U.S. For the same reason, the tariff the U.S. imposes on the host country is dropped from the estimation. As an additional check, the paper also kept the host country's GDP and found it does not have a significant effect.

[18] The size of the sample is significantly reduced because of the missing values of the export data reported by the BEA.

size (discounted by the distance), and ignored factors such as the degree of competition existing in these markets which may significantly affect the market demand faced by an individual host country's exporters. Hence, to account for these omitted characteristics, the approach considered in Head and Mayer (2004) is adopted to construct a more generalized measure of a country's (export) market potential in two stages.

First, a standard trade equation is estimated, in which the dependent variable is the natural log of imports of a country, say country j, from its trading partner, say country i, denoted as $\ln Q_{ijt}$. The trade equation is characterized as:

$$\ln Q_{ijt} = EX_{it} + IM_{jt} + \beta_1 \ln d_{ij} + \beta_2 B_{ij} + \beta_3 B_{ij} \times L_{ij} + \beta_4 PTA_{ijt} + \varepsilon_{ijt}. \tag{14}$$

In this equation, EX_{it} is the exporter fixed effect that varies by time, IM_{jt} is the time-variant importer fixed effect, $\ln d_{ij}$ is the natural log of distance between the capital cities of the importer and exporter countries, B_{ij} is a dummy variable that is equal to 1 if the trading countries share a border and 0 otherwise, and L_{ij} is a dummy variable that is equal to 1 when the two countries share a common language. Equation (14) follows Head and Mayer (2004) and allows the border effect to differ by importing country dependent on whether it speaks the same language as the exporting country, a hypothesis largely supported by the empirical literature (see, e.g., Chen, 2004). A dataset that covers the trade flow between 80 countries is used to estimate the above equation and obtain the estimates of $\widehat{IM}_{it}$ for each importer country and the parameters of bilateral market access variables, i.e., $\hat{\beta}$. The results are reported in Table 7. The estimated effect of bilateral market access, including, distance, border, language and PTA, is consistent with the vast literature on the estimation of trade flows using gravity equation.[19]

[Table 7 about here]

In the second stage, following Head and Mayer (2004), for every country j, $\exp(\widehat{IM}_{jt})$ generated from the first stage is used as a proxy for Y_j/Z_j^i, i.e., a country's market size weighted by factors including the degree of competition, and $\exp[\hat{\beta}_1 \ln d_{ij} + B_{ij}(\hat{\beta}_2 + \hat{\beta}_3 L_{ij})]$ as a proxy for $d_{ij}^{-\gamma\sigma}$, i.e., the bilateral transport cost. However, this paper departs from Head and Mayer (2004) by distinguishing the countries that share a PTA with the host from the rest because of their varied tariff. In other words, for every host country i, its export market potential is based on two groups, integrated versus unintegrated markets, and measured by $\widetilde{M_{it}^e} = \sum_{j \neq i,H} [\omega_1 PTA_{ij} \cdot \hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}} + \omega_2 (1 - PTA_{ij}) \cdot \hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}}]$. Its aggregate market potential is $\widetilde{M_{it}} = Y_{it} + \widetilde{M_{it}^e}$. Similar to the previous section, the goal is to estimate parameters including ω_1 and ω_2, the importance of PTA partners' import demand and that of the rest of the world to a country's ability to attract multinationals.

As shown in Table 8, a country's aggregate market potential constructed in the above formula is positively correlated to its total affiliate sales. In particular, its market potential in integrated

[19] For a comprehensive review in this area, see, for example, Anderson and van Wincoop (2003).

countries is a significant and positive stimulus to multinationals. However, in contrast to the previous results, a country's market potential in markets that do not share a PTA is shown to reduce multinationals' affiliate sales. This finding is plausible in that, in the absence of preferential market access, multinational firms may find it more profitable to set up separate production facilities in these markets than export from its other affiliates. Hence, the sales of multinational affiliates in a host country are diluted by the multinationals' production elsewhere. A country's export market potential constructed using the method above is also positively correlated with multinationals' exports to third countries. While the market size of PTA partners contributes significantly to a country's export-platform FDI, the effect of unintegrated markets is insignificant.

[Table 8 about here]

6.2 Endogeneity of economic integration

The concern of endogeneity of PTA may also arise in the context of this paper. There are two potential sources of endogeneity. First, a host country's PTA status or market potential in its PTA partners could be correlated with unobserved factors in the residual term. The approach adopted in the previous section, to a certain extent, accounted for this issue, especially the correlation between PTA and integrated countries' characteristics. However, the causality between a country's PTA status and its receipt of FDI may still be questionable. It may be argued that countries' adoption of preferential trade agreements is an effort to attract multinationals. Thus, to correct the potential endogeneity of PTA and establish its causal effect on multinationals' affiliate sales, the method of instrument variable is considered in this section.

While the theoretical literature on the economics of PTAs is well established (for example, the seminal work by Krugman (1991a,b), Frankel (1997), Frankel et. al (1995, 1996, 1998) among many others), the empirical literature on this topic is recently built by studies including Magee (2003) and Baier and Bergstrand (2004). Following the theoretical and econometric framework in Baier and Bergstrand (2004), this section estimates two countries' status in sharing a preferential trade agreements, PTA_{ijt}. It is considered that two countries will form a PTA only if such a PTA leads to a positive net welfare gain for both countries, which in turn depends on the trade creation versus trade diversion. As in Baier and Bergstrand (2004), three categories of economic determinants are considered. First, the trade creation is greater when two countries are larger and similar in market size. The second category of economic factors concerns the countries' comparative advantage. Trade creation rises with the difference in the two countries' relative factor endowment. Trade diversion, on the other hand, increases with the difference between the relative factor endowment of the pair and that of the rest of the world. The third hypothesis is that welfare gain of forming a PTA is greater between natural trading partners. Specifically, trade creation is greater between countries that are closer geographically and trade diversion is smaller when the two countries are remote from the rest of the world.

In addition to the economic determinants of PTA, a political variable is included, which also serves as an instrument variable. A large political science literature argues that preferential trade agreements generate a "security" externality; see, for example, Gowa and Mansfield (1993). Nations often choose to internalize this externality by forming a PTA with an ally. To measure the degree of political alliance between two countries, this paper adopts the "affinity" index described in Gartzke, Jo and Tucker (1999), which reflects the similarity of each pair of countries in their votes at the United Nations' General Assembly. This variable may also affect countries' likelihood of signing a PTA through influencing negotiation costs. Baier and Bergstrand (forthcoming) similarly consider the "affinity" index as a measure of political alliance and find it plays a significant role in determining two countries' probability of having a PTA. The above considerations are summarized in the following equation:

$$\begin{aligned} PTA_{ijt} &= \theta_1 \left[\frac{1}{2}(\ln Y_i + \ln Y_j)\right] + \theta_2 \left|\ln Y_i - \ln Y_j\right| + \theta_3 \left|\ln \frac{K_i}{L_i} - \ln \frac{K_j}{L_j}\right| \qquad (15) \\ &\quad + \theta_4 \cdot \frac{1}{2} \sum_{k=i,j} \left|\ln \frac{K_k}{L_k} - \ln \frac{K_{ROW}}{L_{ROW}}\right| + \theta_3 \ln d_{ij} + \theta_4 remote_{ij} + \theta_5 alliance_{ijt} + \varepsilon_{ijt}. \end{aligned}$$

In this equation, $1/2(\ln Y_i + \ln Y_j)$ is the mean of two countries' GDP in natural log, $|\ln Y_i - \ln Y_j|$ measures their dissimilarity in GDP, the third term on the right hand side captures the difference of two countries' factor endowment,[20] and the fourth term is their difference in factor endowment from the rest of the world. $\ln d_{ij}$ is included to test the natural trading partner hypothesis, whereas

$$remote_{ij} \equiv continent_{ij} \cdot \frac{1}{2}\left[\ln \sum_{l \neq i,j} d_{il}/(N-1) + \ln \sum_{l \neq i,j} d_{jl}/(N-1)\right] \qquad (16)$$

measures the natural log of average distance of two countries' to the rest of the world if the two countries are located in the same continent ($continent_{ij} = 1$) and is equal to 0 otherwise. $alliance_{ijt}$ is an index of affinity between two countries and values between -1 and 1. The index is computed based on the United Nations General Assembly votes. A higher value of the affinity index represents a greater similarity between two countries' votes.

An additional econometric issue concerning the above estimation needs to be addressed. To avoid the endogeneity of the explanatory variables, such as the participating countries' GDP, the explanatory variables are lagged by 10 years such that the data are taken from far enough in the past for most countries.[21] An alternative is to estimate the decision to form a PTA, i.e., $\Delta PTA_{ijt} \equiv PTA_{ijt} - PTA_{ijt-1}$.[22] The estimation results of both specifications based on a

[20] The square of this variable is also included in the estimation to examine if the correlation between countries' factor endowment difference and probability of having a PTA is monotonic.

[21] However, for the countries that formed a PTA before 1986, i.e., the initial EU members, the endogeneity of the explanatory variables may still exist. Hence, as addressed next, an alternative approach is adopted to estimate the decision to form a PTA instead of the status of sharing a PTA.

[22] For those pairs which formed a PTA at year T, the value of ΔPTA_{ijt} would be considered missing for $t > T$.

balanced dataset of 65 countries are reported in Table 9.[23]

[Table 9 about here]

As shown, countries with a greater GDP are more likely to have a preferential trade agreement, and this probability, however, declines with their dissimilarity in GDP. As expected, the probability of a PTA is higher the larger the difference in relative factor endowment between two countries. But this effect diminishes when the factor endowment difference exceeds a certain threshold value. Natural trading partners are indeed more likely to have a PTA with each other, and remoteness from the rest of the world also enhances the probability. The degree of political alliance between two countries is found to be positively associated with the probability of economic integration, suggesting that countries have a greater incentive to form a PTA with their political allies. One surprising finding, however, is that countries' probability of sharing a PTA rises with their difference in relative factor endowment from the rest the world, which is predicted to lead to trade diversion. Most of the findings remain robust when a country pair fixed effect is included in a linear probability model.[24] In the estimation of countries' decision to form a PTA, it is shown that all the characteristics play a qualitatively similar role as before but the magnitude of the effects declines. Based on the estimates reported in the third (fifth) columns of Table 9, the predicted probability of sharing (signing) a PTA is calculated for each pair.

In the second stage of the endogeneity analysis, the fitted probability of sharing a PTA is used to calculate the fitted value of a country's market potential in its PTA partners and other countries, i.e., $\sum_{j=1}^{N} P(PTA_{ijt} = 1)Y_{jt}/d_{ij}$ and $\sum_{j=1}^{N} P(PTA_{ijt} = 0)Y_{jt}/d_{ij}$.[25] Its effects on affiliate sales and exports are estimated using the nonlinear Least Squares method. The results are summarized in Table 10. As shown in the second column of Table 10, the instrumented aggregate market potential still exerts a significant and positive effect on the level of affiliate sales. A 1% increase in the instrumented aggregate market potential leads to a 0.78% increase in multinationals' affiliate sales. This positive effect rises with the country's probability of forming PTAs with others, as suggested by the positive parameter of $P(PTA_{ijt} = 1)$ and the negative parameter of $P(PTA_{ijt} = 0)$. A similar finding applies to the level of exports by multinationals. A country that is more likely to form a PTA with other markets sees a greater export-platform FDI.

[Table 10 about here]

[23] The sample countries are mainly determined by the availability of the capital formation data.

[24] A linear probability model is adopted when the fixed effect is included in the estimation. The reason to do so is to avoid the incidental parameter problem that arises in probit models in the presence of fixed effect.

[25] The fitted value of market potential was also calculated based on the predicted probability of signing a PTA within each pair, i.e., $P(\Delta PTA_{ijt} = 1)$, and found to exert a qualitatively similar effect on the affiliate sales.

7 Conclusion

This paper examines theoretically and empirically how regional economic integration exerts an asymmetric impact on multinationals' affiliate sales across countries. It is shown that improved market accessibility, through intra-bloc tariff reduction, leads to an average increase in multinationals' affiliate sales in the bloc. This positive effect is particularly stronger for countries that have preferential access to a large size of markets by either belonging to a large bloc or signing multiple preferential trade agreements. Furthermore, this impact is significantly asymmetric—or even contrary—within the integrated bloc. Countries with a lower labor cost see a greater increase in multinationals' affiliate sales especially in labor-intensive industries, whereas capital abundant countries may experience a reduction. Regional economic integration also leads to a rise of export-platform FDI. Countries that gain preferential access to a large size of export markets are more likely to become export platforms from which multinationals supply third countries. Accounting for the potential concerns of omitted variables and the endogeneity of PTAs finds that not only does the size of integrated markets remain to have a positive effect on multinationals' sales but the size of unintegrated markets adversely affects a country's ability to attract multinationals.

The evidence presented in this paper lends empirical support to an important hypothesis established in the theoretical literature: not every country benefits from economic integration in their ability to attract foreign direct investment. Some gain at the expense of others. Countries with comparative advantage and favorable tax policy would not only become the location in which multinationals concentrate their production but also rise to be the export platforms. While these countries may enjoy the benefit of increased foreign direct investment, such as the technology spillover to the domestic industry, their preferential trade partners may be challenged to deal with the impact of losing foreign direct investment, such as an increase in the unemployment. As countries increasingly rely on preferential trade agreements as the approach to free trade, understanding firms' location preferences is crucial to the optimal choice of preferential trade partners.

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Appendix A

The analysis below demonstrates that, when countries A and B form a preferential trade agreement, four pre-integration equilibria are likely to be replaced by the other location configurations (or supply strategies) in which firm h produces in its plant in A or B and concentrates its production within the integrating region.

(i) First, consider firm h's initial location decision is $[1,0,0]$, in which case firm h chooses to supply A and B by exporting from home. As a necessary condition for this to be an optimum, $\Pi(1,0,0) \geqslant \max[\Pi(0,1,0), \Pi(0,0,1)]$, which is equivalent to

$$c_i/c_H \geqslant \left[\sum_j \left(\phi_{ij}^{-\sigma} Y_j / Z_j^i\right) / \sum_j \left(\phi_{Hj}^{-\sigma} Y_j / Z_j^H\right)\right]^{1/(\sigma-1)}, \tag{a.1}$$

where $i, j = A, B$. When ϕ_{ij} falls because of a fall in τ_{ij}, the right hand side of the inequality rises and the inequality may be reversed. The underlying reason is that, holding Z_j^i constant, $M_i(\sum_r l_r = 1)$ rises for countries A and B but remains the same for country H after the formation of the PTA. This is especially possible when the production cost in A or B, i.e., c_i, is relatively small or the trade cost facing country H when exporting to A and B, i.e., ϕ_{Hj}, is sufficiently high. Hence, economic integration motivates firm h to relocate its only plant from home country H to foreign country i and export to both home and the third country from i. In other words, the equilibrium switches from $[1,0,0]$ to $[0,1,0]$ or $[0,0,1]$. The choice of the new host country would offer the maximum of $c_i^{1-\sigma} \sum_j \left(\phi_{ij}^{-\sigma} Y_j / Z_j^i\right)$.

(ii) Again suppose the initial equilibrium is $[1,0,0]$. As a necessary condition, it must also be true that $\Pi(1,0,0) \geqslant \max[\Pi(1,1,0), \Pi(1,0,1)]$, which is equivalent to:

$$F > 1/\sigma \left[\left(c_i^{1-\sigma}/Z_i^i - c_H^{1-\sigma} \phi_{Hi}^{-\sigma}/Z_i^H\right) Y_i + \left(c_i^{1-\sigma} \phi_{ij}^{-\sigma}/Z_j^i - c_H^{1-\sigma} \phi_{Hj}^{-\sigma}/Z_j^H\right) Y_j\right], \tag{a.2}$$

where $i, j = A, B$. When ϕ_{ij} falls, the right hand side of the above inequality rises and firm h may find it more profitable to establish an additional plant in A or B from which it exports to the third country. In other words, the equilibrium may switch from $[1,0,0]$ to $[1,1,0]$ or $[1,0,1]$. This probability is especially high when F is sufficiently small or ϕ_{Hj} is sufficiently high.

(iii) Now consider firm h's initially produces in both country H and one of the other two countries, i.e., the initial equilibrium is $[1,1,0]$ (or $[1,0,1]$). In this case, firm h would export to the third country from home if and only if

$$c_i/c_H > \left[(\phi_{Hj}/\phi_{ij})^{\sigma} (Z_j^H/Z_j^i)\right]^{1/(\sigma-1)}, \tag{a.3}$$

where $i, j = A, B$. However, given a decline in ϕ_{ij} firm h is likely to increase its share of production in country i and export to country j from i instead of H.
(iv) Another equilibrium in which firm h operates two plants is $[0, 1, 1]$. As a sufficient condition for this to be an equilibrium, $\Pi(0,1,1) \geqslant \max\left[\Pi(0,1,0), \Pi(0,0,1)\right]$, which is equivalent to

$$F < 1/\sigma \left(c_j^{1-\sigma}/Z_j^j - c_i^{1-\sigma}\phi_{ij}^{-\sigma}/Z_j^i \right) Y_j. \tag{a.4}$$

A decline in ϕ_{ij} may reverse the inequality, suggesting that firm h chooses instead to concentrate all of its production in only one plant and shut down the other. In other words, the equilibrium may switch from $[0, 1, 1]$ to $[0, 1, 0]$ or $[0, 0, 1]$. This is especially possible when c_j is sufficiently large relative to c_i or F is large.
(v) Last, consider an initial equilibrium in which firm h has a plant in each country, i.e., $[1, 1, 1]$. Inequality (7) implies that $\Pi(1,1,1) \geqslant \max\left[\Pi(1,1,0), \Pi(1,0,1)\right]$. Similarly, a decline in ϕ_{ij} may cause the initial equilibrium to be unstable and lead firm h to shut down at least one plant in the region of A or B at the new equilibrium, i.e., $[1, 1, 0]$ or $[1, 0, 1]$.

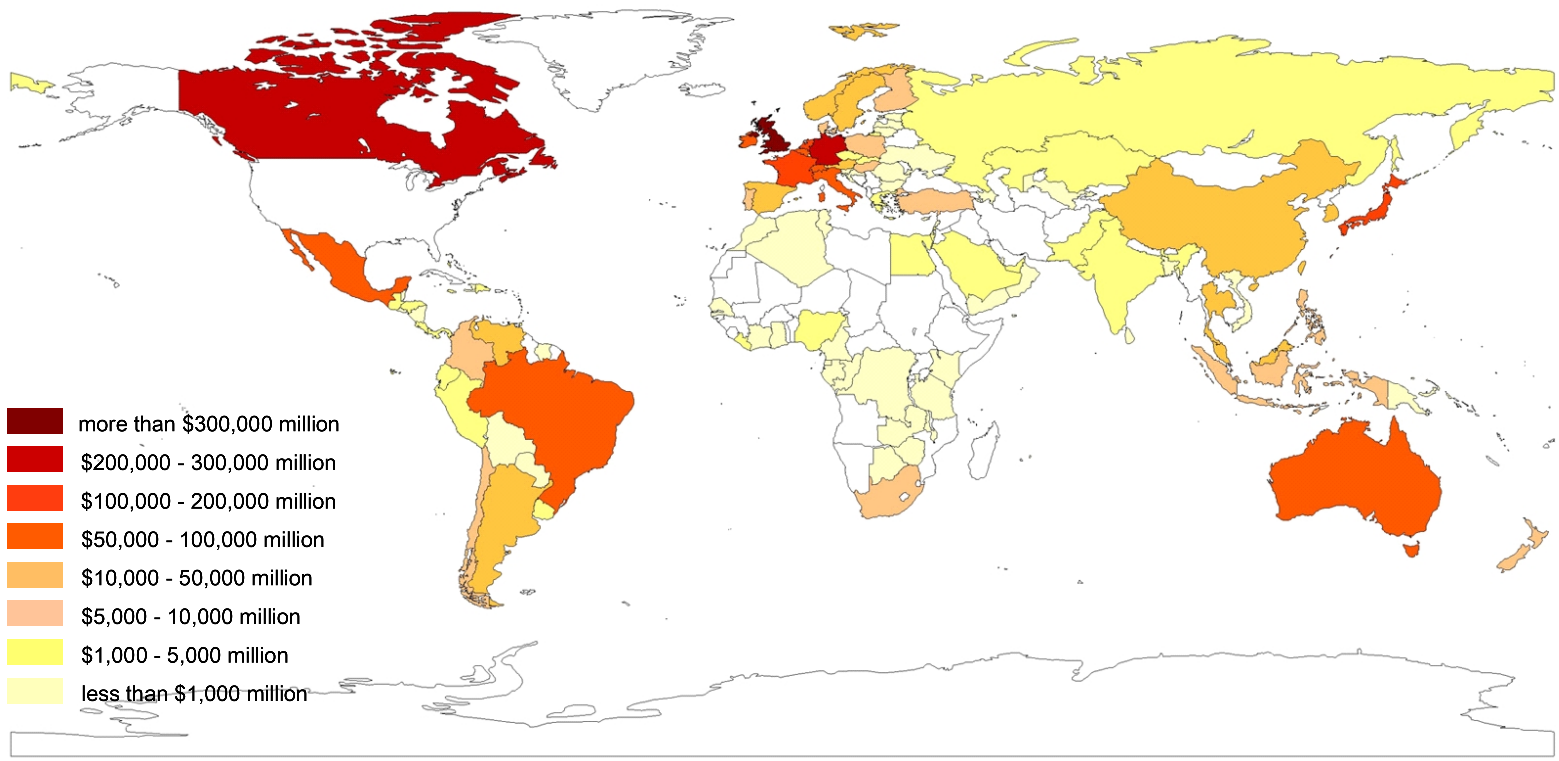

Figure 1: The geographical distribution of U.S. multinationals by affiliate sales in 2002

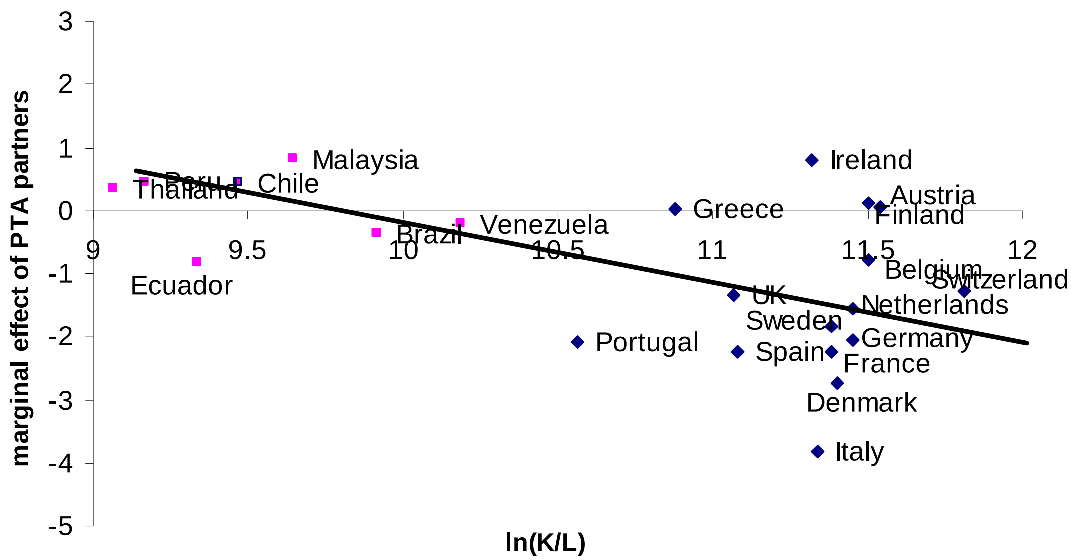

Figure 2: The correlation between country-specific marginal effect of PTA partners and relative factor endowment—the food industry: the slope is -0.71 with a p-value of 0.01 (only statistically significant estimates are included)

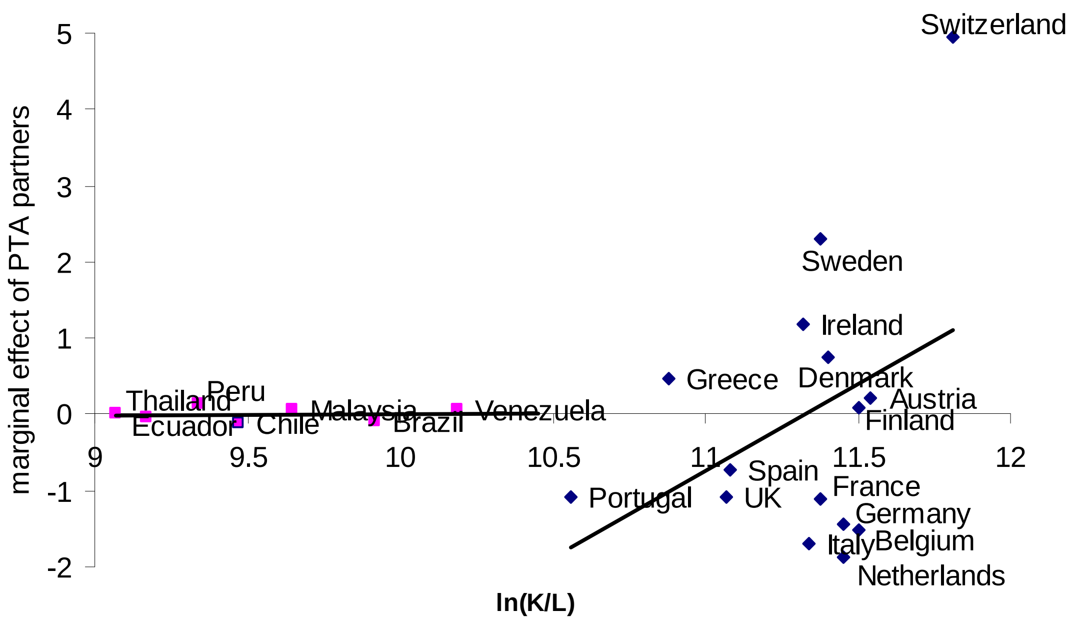

Figure 3: The correlation between country-specific marginal effect of PTA partners and relative factor endowment—the chemicals industry: the slope is 2.37 for the European countries with a p-value of 0.10 and insignificant for the others (only statistically significant estimates are included)

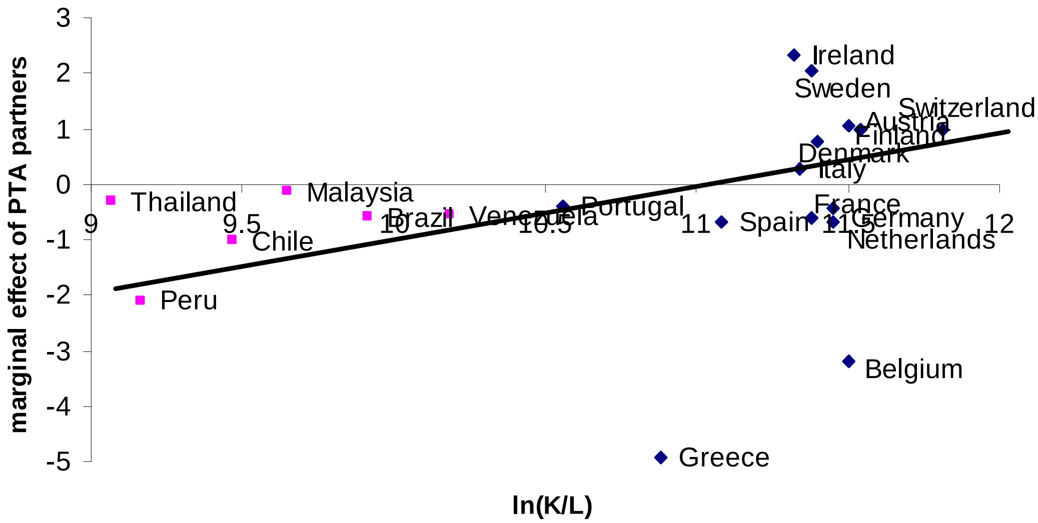

Figure 4: The correlation between country-specific marginal effect of PTA partners and relative factor endowment—the electrical appliances industry: the slope is 1.05 with a p-value of 0.09 (only statistically significant estimates are included)

Table 1: The predicted impact of economic integration on firms' location decision, affiliate sales, and exports

Pre-integration	Post-integration	Entry/Exit		Affiliate sales		Exports to a third country	
Equilibrium	Equilibrium	country A	country B	country A	country B	country A	country B
[1, 0, 0]	[0, 1, 0]	$\uparrow$	–	$\uparrow$	–	$\uparrow$	–
[1, 0, 0]	[1, 1, 0]	$\uparrow$	–	$\uparrow$	–	$\uparrow$	–
[0, 1, 1]	[0, 1, 0]	–	$\downarrow$	$\uparrow$	$\downarrow$	$\uparrow$	–
[1, 1, 0]	[1, 1, 0]	–	–	$\uparrow$	–	$\uparrow$	–
[1, 1, 1]	[1, 1, 0]	–	$\downarrow$	$\uparrow$	$\downarrow$	$\uparrow$	–

Note: It is assumed here that $c_A^{1-\sigma} \sum_j \left(\phi_{Aj}^{-\sigma} Y_j / Z_j^i \right) > c_B^{1-\sigma} \sum_j \left(\phi_{Bj}^{-\sigma} Y_j / Z_j^i \right)$. The outcome is symmetric if the reverse holds.

Table 2: The distribution of U.S. multinational affiliate sales across geographic regions and sales destinations (in millions of U.S. dollars)

Host regions/Sales destinations	1986	1990	1994	1998
World	720,069 (100%)	1,208,349 (100%)	1,435,901 (100%)	1,971,909 (100%)
Western Europe (15 countries)	359,438 (49%)	647,098 (53%)	725,336 (50%)	1,000,725 (50%)
Local sales	66%	68%	67%	63%
Exports back to the U.S.	3%	3%	3%	5%
Exports to third countries	29%	28%	29%	31%
North America	133,950 (18%)	197,997 (16%)	233,245 (16%)	303,019 (15%)
Local sales	72%	73%	69%	66%
Exports back to the U.S.	24%	23%	28%	30%
Exports to third countries	3%	3%	2%	3%
South America	37,622 (5%)	53,755 (4%)	65,466 (4%)	122,075 (6%)
Local sales	85%	86%	85%	82%
Exports back to the U.S.	8%	6%	5%	4%
Exports to third countries	6%	7%	9%	12%
South Eastern Asia	23,377 (3%)	51,260 (4%)	85,580 (6%)	118,091 (6%)
Local sales	35%	47%	49%	43%
Exports back to the U.S.	29%	22%	19%	22%
Exports to third countries	35%	30%	31%	34%
Australia-New Zealand	25,258 (3%)	43,809 (3%)	64,346 (4%)	58,308 (3%)
Local sales	88%	85%	86%	84%
Exports back to the U.S.	2%	4%	3%	3%
Exports to third countries	8%	10%	10%	13%

Table 3: A comparison of affiliate sales and exports between integrated and unintegrated countries

	Food	Chemicals	Metals	Machinery	Electrical	Transport
affiliate sales						
$PTA_{ij} = 1$ $(\forall j)$	6.77	7.23	5.47	6.15	6.38	5.29
$PTA_{ij} = 0$ (for all j)	5.47	6.21	4.37	4.07	5.93	2.95
t statistic	6.90	6.78	5.50	6.91	2.19	6.08
affiliate exports						
$PTA_{ij} = 1$ $(\forall j)$	4.69	5.75	4.13	5.27	5.19	3.79
$PTA_{ij} = 0$ (for all j)	2.03	3.63	2.33	2.21	4.09	1.09
t statistic	8.94	9.69	6.61	8.54	3.86	7.40
share of exports in affiliate sales						
$PTA_{ij} = 1$ $(\forall j)$	0.23	0.29	0.30	0.56	0.32	0.36
$PTA_{ij} = 0$ (for all j)	0.09	0.14	0.16	0.26	0.14	0.03
t statistic	3.59	5.18	4.27	1.23	7.26	8.60

Note: All variables are measured in natural log.

Table 4: The impact of regional economic integration on multinational affiliate sales

Dependent variable: affiliate sales	OLS	OLS	OLS	Nonlinear LS
KL endowment ratio	-0.653***	-0.674***	-0.832***	-0.798***
	(0.305)	(0.304)	(0.307)	(0.288)
KL endowment ratio×capital intensity	3.684*	3.692*	3.923*	6.625***
	(2.253)	(2.222)	(2.219)	(2.295)
capital intensity	-33.855	-33.824	-36.441	-66.028
	(25.103)	(24.755)	(24.732)	(25.443)
corporate tax	0.072	0.067	0.055	0.082
	(0.051)	(0.051)	(0.041)	(0.060)
freight	-0.130***	-0.135***	-0.122**	-0.143**
	(0.057)	(0.057)	(0.057)	(0.056)
host country's tariff on the U.S.	0.078	0.089*	0.083*	0.115*
	(0.052)	(0.053)	(0.052)	(0.052)
U.S. tariff on the host country	-0.095	-0.094	-0.103*	-0.134**
	(0.066)	(0.066)	(0.066)	(0.066)
domestic market size	0.573**	0.537**		
	(0.279)	(0.276)		
PTA dummy	0.088*			
	(0.055)			
number of integrated countries		0.115***		
		(0.051)		
integrated market potential			1.041***	
			(0.290)	
aggregate market potential				6.293***
				(1.279)
weight of PTA partners (ω_1)				0.576**
				(0.322)
weight of ROW (ω_2)				0.472*
				(0.270)
Country-industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
number of observations	1450	1450	1450	1450
R square	0.97	0.97	0.97	0.97
Root MSE	0.49	0.49	0.49	0.49

Notes: (i) integrated market potential $\equiv GDP_{it} + \sum_{j\neq i}(PTA_{ijt} \cdot GDP_{jt}/d_{ij})$
aggregate market potential $\equiv GDP_{it} + \sum_{j\neq i}[\omega_1 PTA_{ijt}\,(GDP_{jt}/d_{ij}) + \omega_2(1 - PTA_{ijt})\,(GDP_{jt}/d_{ij})]$.
(ii) all variables are measured in natural log except capital intensity and PTA dummy;
(iii) standard errors are reported in the parentheses;
(iv) ***, **, and * represent significance at 1%, 5%, and 10% level respectively.

Table 5: The divergent impact of regional economic integration

Dependent variable: affiliate sales	(1)
PTA×	
KL endowment ratio	-0.780***
	(0.282)
KL endowment ratio×capital intensity	10.632***
	(3.400)
capital intensity	-122.072***
	(36.174)
corporate tax	-0.170*
	(0.104)
freight	0.241***
	(0.084)
host country's tariff on the U.S.	-0.150
	(0.119)
U.S. tariff on the host country	0.053
	(0.067)
number of observations	1450
R square	0.97
Root MSE	0.49
Dependent variable: affiliate sales	**(2)**
PTA×	
ΔKL endowment ratio	0.007
	(0.092)
ΔKL endowment ratio×capital intensity	2.795***
	(1.184)
capital intensity	-39.569***
	(13.172)
Δcorporate tax	0.094
	(0.075)
Δfreight	0.181***
	(0.057)
Δhost country's tariff on the U.S.	-0.057
	(0.063)
ΔU.S. tariff on the host country	-0.073
	(0.094)
number of observations	1450
Root MSE	0.49
R square	0.97

Notes: (i) all variables are measured in natural log except capital intensity and PTA; (ii) the rest of the estimates are not reported but available upon request; (iii) standard errors are reported in the parentheses; (iv) ***, **, and * represent significance at 1%, 5%, and 10% level respectively.

Table 6: The impact of regional economic integration on export-platform FDI

Dependent variable: affiliate sales	OLS	OLS	OLS	Nonlinear LS
KL endowment ratio	-0.494*	-0.707*	-0.465*	-0.797*
	(0.296)	(0.395)	(0.265)	(0.506)
KL endowment ratio×capital intensity	2.201	1.988	2.321	3.695
	(3.897)	(3.885)	(3.892)	(3.889)
capital intensity	-15.384	-14.611	-18.796	-34.092
	(44.183)	(44.032)	(44.130)	(44.080)
corporate tax	-0.009	-0.031	-0.004	0.001
	(0.066)	(0.065)	(0.066)	(0.066)
freight	-0.136*	-0.145*	-0.145*	-0.122
	(0.081)	(0.081)	(0.081)	(0.100)
host country's tariff on the U.S.	0.220***	0.244***	0.225***	0.240***
	(0.070)	(0.071)	(0.070)	(0.069)
PTA dummy	0.392***			
	(0.115)			
number of integrated countries		0.359***		
		(0.095)		
integrated export market potential			0.024***	
			(0.006)	
aggregate export market potential				0.571*
				(0.349)
weight of PTA partners (ω_1)				0.923**
				(0.500)
weight of ROW (ω_2)				0.025
				(0.029)
Country-industry fixed effect	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
number of observations	830	830	830	830
R square	0.96	0.96	0.96	0.96
Root MSE	0.49	0.49	0.49	0.49

Notes: (i) integrated export market potential $\equiv \sum_{j \neq i} (PTA_{ijt} \cdot GDP_{jt}/d_{ij})$
agg. export market potential $\equiv \sum_{j \neq i}[\omega_1 PTA_{ijt}\,(GDP_{jt}/d_{ij}) + \omega_2(1 - PTA_{ijt})\,(GDP_{jt}/d_{ij})]$;
(ii) all variables are measured in natural log except capital intensity and PTA dummy;
(iii) standard errors are reported in the parentheses;
(iv) ***, **, and * represent significance at 1%, 5%, and 10% level respectively.

Table 7: The trade equation

Dependent variable: imports	OLS
distance	-1.346***
	(0.042)
border	0.636***
	(0.058)
border $\times$ language	0.919***
	(0.029)
PTA dummy	0.298***
	(0.039)
exporter-year fixed effect	Yes
importer-year fixed effect	Yes
number of observations	56044
R square	0.60
Root MSE	1.86

Notes: (i) standards errors are reported in the parentheses; (ii) ***, **, and * represent significant at 1%, 5%, and 10% respectively.

Table 8: The Nonlinear Least Squre estimations with a generalized measure of market potential

Dependent variable:	affiliate sales	exports
KL endowment ratio	-0.990***	-0.635*
	(0.316)	(0.359)
KL endowment ratio×capital intensity	4.619**	1.156
	(2.245)	(3.997)
capital intensity	-44.167**	-5.801
	(25.010)	(45.333)
corporate tax	0.058	-0.056
	(0.042)	(0.066)
freight	-0.130***	-0.126
	(0.057)	(0.107)
host country's tariff on the U.S.	0.095*	0.212***
	(0.052)	(0.071)
aggregate market potential	0.874***	
	(0.272)	
aggregate export market potential		0.165*
		(0.104)
weight of PTA partners (ω_1)	0.351**	0.160*
	(0.182)	(0.092)
weight of ROW (ω_2)	-1.060***	0.107
	(0.298)	(0.169)
Country-industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
number of observations	1450	830
R square	0.97	0.96
Root MSE	0.49	0.49

Notes: (i)

agg. market potential $\equiv GDP_{it} + \sum_{j \neq i} \left[\omega_1 PTA_{ijt} \left(\hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}} \right) + \omega_2 (1 - PTA_{ijt}) \left(\hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}} \right) \right]$

agg. export market potential $\equiv \sum_{j \neq i} \left[\omega_1 PTA_{ijt} \left(\hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}} \right) + \omega_2 (1 - PTA_{ijt}) \left(\hat{d}_{ij}^{-\gamma\sigma} \widehat{\frac{Y_j}{Z_j^i}} \right) \right]$;

(ii) all variables are measured in natural logs except capital intensity;

(iii) standard errors are reported in the parentheses;

(iv) ***, **, and * represent significance at 1%, 5%, and 10% level respectively.

Table 9: The first-stage estimation of the probability of PTA

Dependent variable:	PTA		PTA decision	
	Probit	FE Linear Prob	Probit	FE Linear Prob
GDP average	0.317***	0.222***	0.145***	0.058***
	(0.009)	(0.015)	(0.022)	(0.004)
difference in GDP	-0.111***	0.016	-0.117***	-0.005
	(0.009)	(0.014)	(0.020)	(0.004)
difference in KL endowment ratio	0.904***	0.074***	0.837***	0.034***
	(0.049)	(0.029)	(0.117)	(0.008)
squared difference in KL endowment ratio	-0.306***	-0.008	-0.282***	-0.003**
	(0.014)	(0.005)	(0.039)	(0.002)
difference in KL endowment ratio from the ROW	0.266***	0.112***	0.088*	0.027***
	(0.023)	(0.043)	(0.049)	(0.010)
distance	-0.976***	—	-0.567***	—
	(0.022)		(0.037)	
remoteness	0.078***	—	0.034***	—
	(0.004)		(0.008)	
affinity	0.419***	0.114***	0.352***	0.013**
	(0.055)	(0.033)	(0.118)	(0.007)
Pair fixed effect	No	Yes	No	Yes
number of observations	29120	29120	25727	25727
(Pseudo) R square	0.55	0.77	0.25	0.15
Log likelihood	-5704.3	—	-1185.4	—

Notes: (i) standards errors are reported in the parentheses; (ii) ***, **, and * represent significant at 1%, 5%, and 10% respectively.

Table 10: The instrumented Nonlinear Least Square estimation

Dependent variable:	affiliate sales	exports
KL endowment ratio	-0.702***	-0.692*
	(0.308)	(0.405)
KL endowment ratio×capital intensity	2.734	2.663
	(2.186)	(3.875)
capital intensity	-22.906	-21.867
	(24.365)	(43.918)
corporate tax	0.047	0.003
	(0.043)	(0.066)
freight	-0.102**	-0.117
	(0.057)	(0.100)
host country's tariff on the U.S.	0.102**	0.242***
	(0.052)	(0.070)
instrumented market potential	0.786***	
	(0.269)	
instrumented export market potential		0.192***
		(0.063)
weight of P(PTA=1) (ω_1)	216.47*	400.16**
	(125.72)	(220.10)
weight of P(PTA=0) (ω_2)	-3.088***	1.867
	(0.257)	(2.084)
Country-industry fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
number of observations	1450	830
R square	0.97	0.96
Root MSE	0.49	0.48

Notes: (i)
instrumented market potential $\equiv$

$$GDP_{it} + \sum_{j\neq i} [\omega_1 (GDP_{jt}/d_{ij} \cdot P(PTA_{ijt} = 1) + \omega_2 (GDP_{jt}/d_{ij} \cdot P(PTA_{ijt} = 0))]$$

instrumented export market potential $\equiv$

$$\sum_{j\neq i} [\omega_1 (GDP_{jt}/d_{ij} \cdot P(PTA_{ijt} = 1) + \omega_2 (GDP_{jt}/d_{ij} \cdot P(PTA_{ijt} = 0))]$$

(ii) all variables are measured in natural log except capital intensity;
(iii) standard errors are reported in the parentheses;
(iv) ***, **, and * represent significance at 1%, 5%, and 10% level respectively.

Table A.1: The list of countries in the sample

Argentina	Finland	Malaysia	Spain
Australia	France	Mexico	Sweden
Austria	Germany	Netherlands	Switzerland
Belgium	Greece	New Zealand	Taiwan
Brazil	Hong Kong	Norway	Thailand
Canada	Indonesia	Peru	Turkey
Chile	Ireland	Philippines	United Kingdom
Colombia	Israel	Portugal	Venezuela
Costa Rica	Italy	Singapore	
Denmark	Japan	South Africa	
Ecuador	Luxembourg	South Korea	

Table A.2: The list of included Preferential Trade Agreements

EC	EC-Romania
EFTA	EFTA-Romania
EC-Switzerland and Liechtenstein	EFTA-Bulgaria
EC-Iceland	EC-Bulgaria
EC-Norway	NAFTA
EC-Algeria	Costa Rica-Mexico
EC-Syria	Canada-Israel
CER	Turkey-Israel
United States-Israel	Canada-Chile
EC-Andorra	Turkey-Romania
MERCOSUR	EC-Tunisia
EFTA-Turkey	Mexico-Nicaragua
EFTA-Israel	Turkey-Bulgaria