Export-Platform Foreign Direct Investment

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Abstract

An interesting empirical phenomenon is export-platform foreign-direct investment, particularly affiliate production for sale in third countries rather than in the parent or host countries. This is rather poorly understood because our theoretical understanding of multinationals is largely derived from two-county models. We show how affiliate production solely for third countries can occur when a firm in each of two large, high-income countries has a domestic plant to serve its own market, and uses a plant in a small, low-wage country to serve the other high-income country. Third-country export-platform FDI can also occur when the host and third countries are inside a free-trade area and the parent is outside. An empirical exercise shows that US affiliates located inside a free-trade area concentrate their exports to other free-trade member countries, consistent with a restricted range of parameterizations of our model. Affiliates located outside of free-trade areas such as those in Southeast Asia show a balance between exports to the parent and exports to third countries, consistent with parameterizations that generate "global export-platform" production.

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1. Introduction

In 2000, 64 percent of total sales of foreign affiliates of US multinationals were sold domestically, while 36 percent were exported. Out of the latter figure, about a third were exported back to the US and about two thirds were exported to third countries (see Table 1). The literature on FDI provides a good theoretical and empirical understanding of the phenomenon of affiliate production for local sale, often referred to as horizontal FDI. It also provides an understanding of affiliate production for export to the parent country, a phenomenon often associated with vertical FDI. However, we know little about affiliate production for export to third countries, which we will refer to as third-country export-platform FDI. This is likely due to the fact that most of our theoretical understanding is largely derived from two-country models, which by definition cannot address third-country exports.

The importance of export platform FDI is documented in a study by Hanson, Mataloni, and Slaughter (2001). Using data on the foreign operations of U.S. multinationals, they report that although the average share of exports in affiliate sales has remained constant at about one third, there has been a substantial increase in Mexico and Canada after the formation of NAFTA. Their econometric analysis suggests that export platform FDI is promoted by low host-country trade barriers and discouraged by large host-country markets.[1]

Table 1 presents some summary statistics that motivate the analysis. The data are sales

[1]Note that according to this definition of export platform FDI, situations where the foreign affiliate exports back to the home country are included. We will need to use more precise terminology, and use "third-country export-platform" FDI to refer to production solely for export to third countries, "global export-platform" FDI for balanced exports to both parent and third countries, and "home-country export-platform" FDI for exports only back to the parent (this last is traditionally called vertical FDI, but all of these cases have elements of vertical FDI).

by foreign affiliates of US multinationals, broken down into local sales in the host market, export sales back to the US, and export sales to third markets (data compiled and analyzed in Markusen and Maskus 2001, 2002). The first line of data presents average figures for all 47 host countries in the data set, and subsequent lines present three groups of countries where there is some common feature of the group data.

The first group of countries, Ireland, Belgium and Holland has the highest proportion of affiliate sales going to third countries of all countries in the sample, and very low proportions of their sales going back to the US. The countries which display third-country export-platform sales most clearly are not developing countries, but smaller countries inside the EU.

The second group of countries, Singapore, Malaysia, Phillipines and Hong Kong display a concentration of their sales in exports relative to local sales, but there is a balance between exports back to the US and exports to third countries. These countries do not make up an integrated regional market, and we interpret the data as meaning that affiliates are used in industries such as electronics to serve global markets, Europe and Japan as well as the US itself.

The third group of countries in Table 1 are the US's NAFTA partners, Canada and Mexico. Local sales in these countries are close to the proportions for the total sample, in part reflecting the fact that both countries are big markets and likely reflecting the fact that these numbers for Mexico reflect import-substituting horizontal production prior to NAFTA. The interesting thing about these data is that the shares of export going to the US and to third countries are more or less the reverse of those for the first group of countries. But they share the characteristic that the affiliates' exports are largely to the geographically close, integrated market.

As indicated above, we have a good understanding of the division of affiliate production into local sales and total export sales in Table 1, but the *composition* of export sales remains both a theoretical and empirical puzzle. The purpose of this paper is to present a simple model showing the conditions under which export–platform FDI is likely to arise and the conditions under which sales to third countries dominates the affiliate's production. We present a three-region model in which two regions are identical, large markets.[2] These regions and their firms are denoted W (west) and E (east) and collectively these two regions are referred to as N (north). We are thinking here of the US-Canada market and the EU. The third country is a small, low-wage country, denoted S (south).

We assume that the world has two firms in the multinationalized sector, one headquartered in each of the large, high-wage markets. We also assume that there is no domestic demand in the small, low-wage country, so that all output of affiliate plants (if any) in that country is exported. These two assumptions alone greatly reduce the number of cases that must be considered and allow us to focus on the *composition* of affiliate exports.

The first case we consider involves symmetric trade costs on all links, so that the two firms will each adopt the same number of plants, and either both or neither will have a plant in S and, when they do, the export patterns of those plants will be symmetric. Third-country export-platform production arises when low production costs in S lead a firm to use S to serve the other N country, but the savings on fixed costs from closing the home plant do not offset the costs of

[2]Other theoretical treatments of export-platform production are Yeaple (2003), Neary (2002) and Motta and Norman (1996). All these models and ours make different assumptions for the common objective of limiting the range of possible outcomes. In Neary and Motta-Norman, exporting back to the parent is ruled out by assumption, something we very much want to endogenize. Our model is closer to Yeaple, but our production structure on and trade costs for final and intermediate goods is rather different from his, and he maintains a symmetry assumption throughout. Our asymmetric versus symmetric cases generates predictions that are useful for taking to the data.

shipping components to S and final output back home.

The second case we present is motivated by the discussion of free-trade areas above and by the data in Table 1. We assume that W and S form a free trade area. Firm E must pay a trade cost to ship components to a plant in S (if there is one) and a cost to ship final output back to E, but enjoys costless shipping of final output to W from its plant in S. The cost to firm E of shipping components to a plant in S puts that firm at a strategic disadvantage relative to firm W. On the other hand, firm E enjoys the advantage of shipping final output duty free to W from its plant in S, while firm W must pay trade costs to ship final output from a plant in S to E.

The paper ends with an empirical exercise. We show that US affiliate exports to third countries are especially high when the host country is a member of a geographically concentrated and integrated economic block, and the parent country is outside the block (the EU). Conversely, exports are concentrated in shipments back to the parent when the parent is an inside country (NAFTA). These results are consistent with a restricted range of parameters in our model. US affiliates located in the non-integrated Southeast Asian region on the other hand, show evidence of global export-platform FDI, consistent with a certain parameterization of our symmetric model.

2. A Symmetric, Three-Region Model

We adopt a partial-equilibrium framework which is very familiar from the strategic trade-policy literature. Elements of the model are as follows.

There are three countries: E (east), W (west), and S (south).
E and W are identical; together they can be referred to as the north (N).

S is a small, low-cost country, with no demand for X.
There is one final good (X) and one intermediate good (Z) referred to as components.
Constant marginal costs in Z and X activities
One unit of Z is needed to produce one unit of X.
A fixed cost F for components and the first plant, and a fixed cost G for a second assembly plant.
There are trade costs for X and Z that are specific to each link, some of these may be zero.

Assume that there are two firms producing X, one headquartered in W and one in E, and these can be referred to as firms W and E respectively. Assume that each firm must produce its intermediate good Z in its home country. Production of X, or "assembly" as we shall sometimes refer to it, may be done in any or all countries. A firm can ship components to a foreign assembly plant and that plant may in turn serve only the local market or export to one or both of the other countries. If a firm wants only one plant in the north, it will choose its home country (e.g., firm W will not have a single plant in E).

The term regime will denote the number and location of plants. Regimes will be denoted by a two or three-letter code, with the first letter referring to the firm, and the second and third (if any) letters referring to its plant locations. WW, for example, means that firm W has an assembly plant in W and WWS means that firm W has assembly plants in W and S. In the latter case, it must be true that the plant in S only serves E, since S has no demand, and the firm would not have a plant in S to serve its home market (W) when it has a plant there as well and would not serve E from both W and S given the existence of constant marginal costs and plant-specific fixed costs.

Let superscript W or E refer to the identity of the firm. A double subscript is used on X quantities along with the firm-identifier superscript. The first subscript is the country of production and the second is the country of sale. X_{ij}^{k} is then production by firm k in country i which is sold in country j. Sales of X in each region can come from five possible sources (firms and countries). Sales in W can come from local production of its own firm, imports from E's production in E, imports of its own firm's production in S, imports of E's production in S and from E's production in a plant in W. Let p denote the price of X in a region. Inverse demand functions are given by:

(1) $$p_w = \alpha - \beta(X_{ww}^{w} + X_{ew}^{e} + X_{sw}^{w} + X_{sw}^{e} + X_{ww}^{e})$$

(2) $$p_e = \alpha - \beta(X_{we}^{w} + X_{ee}^{e} + X_{se}^{w} + X_{se}^{e} + X_{ee}^{w})$$

All intermediate production of Z occurs in a firm's home region by assumption, and the unit cost will be denoted c_z, identical in W and E. A subscript 'n' denotes the common value for W and E. c_{xn} denotes the cost of assembly in the north and c_{xs} the cost in the south. Notation for the unit cost of X assembled in each of the three regions is then:

(3) $$c_n = c_{xn} + c_z \qquad c_s = c_{xs} + c_z$$

The per-unit specific trade costs for the final (assembled) good will be denoted τ, and the specific trade cost for a unit of Z will be denoted σ. In this section, we will restrict ourselves to symmetry between W and E, so the common values of these trade costs will be denoted τ_n and σ_n. On N-S links, components only flow from north to south (if at all) and X flows only from south to north (if at all). In our symmetric case, these costs are then given by

(4) $$\tau_n = \tau_{sw} = \tau_{se}, \quad \sigma_n = \sigma_{ws} = \sigma_{es}$$

Equilibrium is found as the sub-game perfect solution to a two-stage game in which firms first select the number and location of their plants, and then play a Cournot-Nash game in outputs. Solving the second stage problem first, we then have a normal-form representation in which a payoff matrix gives the profits to the firms for the first-stage choices by both firms.

Candidate regimes in the symmetric case are as follows:[3]

WW EE	national firm regime: each firm serves its rival's market by exports
WWE, EEW	horizontal firm regime: each firm serves its rival's market with a local plant
WWS, EES	third-country export-platform regime: each firm serves its rival's market from a plant in S
WS ES	global export-platform regime: each firm serves its rival's market and its own market from a single plant in S

Consider the second stage first and assume that the regime is the national firm outcome, WW EE. This duopoly problem and algebraic results are quite familiar from the strategic-trade-policy literature and so the derivations are omitted. Equilibrium quantities are:

(5) $$X_{ww}^{w} = X_{ee}^{e} = \frac{\alpha - c_n + \tau_n}{3\beta}$$

(6) $$X_{we}^{w} = X_{ew}^{e} = \frac{\alpha - c_n - 2\tau_n}{3\beta}$$

As we will note later, this regime can occur when G and the cost of trading components are relatively high (or low for final goods and S's cost advantage is relatively small. Consider

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[3] Asymmetric outcomes (different equilibrium strategies by the two firms) are nevertheless possible in this type of model, as noted in Markusen (2002, chapter 3). However, these are generally associated with high fixed costs so that, for example, only one firm can survive in equilibrium. In this section, we will ignore asymmetric outcomes in the analytical derivations, but our numerical simulation program finds all pure-strategy outcomes (and no asymmetric outcomes are found).

next the the horizontal outcome WWE EEW. Equilibrium quantities are:

(7) $$X^w_{ww} = X^e_{ee} = \frac{\alpha - c_n + \sigma_n}{3\beta}$$

(8) $$X^w_{ee} = X^e_{ww} = \frac{\alpha - c_n - 2\sigma_n}{3\beta}$$

As we will note later, this regime can occur when the cost of trading components is small (relative to τ), G is small and S's cost advantage is relatively small. Now consider the third-country export-platform case in which each firm maintains a plant in its home country to serve its own market and a plant in S to serve its rival: WWS EES. Equilibrium quantities are now:

(9) $$X^w_{ww} = \frac{\alpha - (2c_n - c_s) + \sigma_{es} + \tau_{sw}}{3\beta} \qquad X^w_{se} = \frac{\alpha - (2c_s - c_n) - 2\sigma_{ws} - 2\tau_{se}}{3\beta}$$

(10) $$X^e_{ee} = \frac{\alpha - (2c_n - c_s) + \sigma_{ws} + \tau_{se}}{3\beta} \qquad X^e_{sw} = \frac{\alpha - (2c_s - c_n) - 2\sigma_{es} - 2\tau_{sw}}{3\beta}$$

Suppose finally that each firm produces only from a plant in S: global export-platform regime WS ES, incurring trade costs on components and costs to ship X back home. Outputs are:

(11) $$X^w_{sw} = \frac{\alpha - c_s - \sigma_{ws} - \tau_{sw}}{3\beta} \qquad X^w_{se} = \frac{\alpha - c_s - \sigma_{ws} - \tau_{se}}{3\beta}$$

(12) $$X^e_{se} = \frac{\alpha - c_s - \sigma_{es} - \tau_{se}}{3\beta} \qquad X^e_{sw} = \frac{\alpha - c_s - \sigma_{es} - \tau_{sw}}{3\beta}$$

Let π^w_{ij} denote the profits for firm W when it has plants in i and j. It is also reasonably well known that in this familiar model, profits are just the sum of β times the squared outputs sold in each market minus fixed costs. Profits in the four regimes are given by the following formulae, with identical expressions for firm E.

(13) $\pi^w_w = \beta(X^w_{ww})^2 + \beta(X^w_{we})^2 - F$ (WW EE)

(14) $\pi^w_{we} = \beta(X^w_{ww})^2 + \beta(X^w_{ee})^2 - F - G$ (WWE EEW)

(15) $\pi^w_{ws} = \beta(X^w_{ww})^2 + \beta(X^w_{se})^2 - F - G$ (WWS EES)

(16) $\pi^w_s = \beta(X^w_{sw})^2 + \beta(X^w_{se})^2 - F$ (WS ES)

In order to get some intuition behind the results to follow, consider a simple non-strategic experiment in which the firm wants to supply a fixed and equal amount of output to each market. Then we can simply add the (unit) cost of supplying each market together to get total costs, with the caution that the low-cost option is not necessarily the Nash equilibrium regime (the usual prisoner's dilemma phenomenon). Let g be the unit plant fixed costs for this fixed quantity (G divided by this reference quantity), and assume that τ takes the same value on all links as does σ. Let $\Delta c = c_n - c_s > 0$, the cost *disadvantage* of the north. Then our three conditions for the firms to *prefer* third-country export-platform FDI on a cost basis are

$\Delta c > \tau$ (WWS cheaper than WWE)

(17) $\Delta c < \sigma + \tau - g$ (WWS cheaper than WS)

$\Delta c > \sigma + g$ (WWS cheaper than WW)

The first inequality says that, for the firm to prefer third-country export-platform production to horizontal production it must be that the cost disadvantage of producing in the (other) northern market is greater than the cost of shipping X from S (the cost of shipping components is the same in either case). The second inequality says that, for the firm to prefer third-country export-platform production to a single plant in S, the cost disadvantage of continuing to produce at home for the home market is less than the cost of shipping components to S and shipping X back home, minus the added cost of having two plants. The third inequality says that, for the firm to prefer third-country export-platform production to a single home plant serving the other country by exports, the cost disadvantage must exceed the cost of shipping components to S plus the fixed costs of a second plant.

We now turn to the analytical conditions for a Nash equilibrium. These are closely related to, but not identical with the inituitive cost conditions just discussed. The difficulty is that when each firm has four strategies, there are a large number of possible deviations to check in order to establish Nash equilibria. Furthermore, which strategies are equilibria depend very much on parameter values. For example, if plant fixed costs are zero, one plant strategies will generally be ruled out while if plant fixed costs are very high, then two-plant strategies will be eliminated. Here we will just present the conditions for the third-country export-platform outcome WWS EES to exist as an equilibrium in the symmetric case. We assume the WWS EES is an equilibria, and check for profitable deviations. The algebra for establishing these conditions is not particularly informative so we relegate it to a technical appendix.

Given that firm E plays EES, firm W cannot profitably deviate from WWS if three conditions (corresponding to the three possible deviations) hold.

(18) $$\Delta c > \tau \qquad \text{(WWS to WWE unprofitable)}$$

(19) $$\Delta c < \sigma + \tau - \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n}\right]G \qquad \text{(WWS to WS unprofitable)}$$

(20) $$(\Delta c - \sigma) + \frac{(\Delta c - \sigma)^2}{\alpha - c_n - 2\tau} > \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n - 2\tau}\right]G \qquad \text{(WWS to WW unprofitable)}$$

It is fairly easy to establish the existence of parameter values that satisfy all three inequalities. Note first that, from the first two, σ *must be positive*. Transport costs for the intermediate good have to be positive or, for example, the firm will want to shut its home plant and serve markets from the south (if (18) holds, then (19) fails to hold if σ is zero). Suppose that we pick parameter values for Δc and σ (holding c_n and τ constant) such that the first two inequalities "marginally" hold, where ϵ is a small number.

(21) $$\Delta c - \tau = \epsilon \quad \text{and}$$

$$\sigma = [\Delta c - \tau] + \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n}\right]G + \epsilon = \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n}\right]G + 2\epsilon$$

The first equation uniquely determines the value of the free parameter c_s (given c_n and τ) and the second equation then determines σ. Substituting from this second expression, the third condition (20), a firm does not want to deviate to a national firm strategy) will hold if

(22) $$\Delta c > \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n}\right]G + \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n - 2\tau}\right]G - \frac{(\Delta c - \sigma)^2}{\alpha - c_n - 2\tau} + 2\epsilon$$

This inequality must hold if we make G, the plant-specific fixed cost small enough. In other words, given that the first two inequalities (18, 19) hold, the third and (22) will hold if G is sufficiently small to prevent closure of the southern plant. Alternatively, it will hold if β is small, which could be thought of equivalent to saying that the northern markets for X are big.

Consider then a diagram of equilibrium regimes in (c_s, σ) space shown in Figure 1. The transport cost σ falls moving to the right for a viewing reason which will become clearer shortly. Let (18), (19), and (20) holding with equality define three loci. Figure 1 shows these three conditions, with the solid segments of each equation giving the relevant sections as boundaries of the third-country export-platform regime. Condition (18) defines a horizontal line, (19) has a slope -1 (or +1 in Figure 1, since σ falls moving to the right). (20) is also linear with a slope -1 (or +1 in the Figure).

By transitivity, the intersection of (18) and (20) is also a condition for a firm to be indifferent between deviating to a national or horizontal strategy, and other points of indifference must occur at the same value of σ since c_s is not involved in the latter indifference condition. Thus there will be a vertical boundary separating WW EE and WWE EEW at that value of σ.

The fact that we have argued that there exists a range of parameter values that support the third-country export-platform case (WWS EES) does not prove that the regions outside of the area bounded by (18), (19), and (20) in Figure 1 are as we have labeled them, or prove that there are no areas of multiple equilibria. We never found any multiple equilibria numerically (and the simulation program finds all pure-strategy Nash equilibria), and in all cases the equilibrium regimes are as shown in Figure 1. Because we are primarily interested in the third-country export-platform case here, we will not work through all other possible deviations needed to fully characterize figure 1, and turn now to some simulations.

The lower panel of Figure 1 presents numerical simulations for the model over a grid of values of σ and c_s, with the values of $\tau = 1$ $c_n = 4$ and $G = 1.1$ held constant.[4] The profits for the two firms are calculated to form a 4x4 payoff matrix, in which each firm has four strategies: a single plant at home, plants at home and in the other northern country, a plant at home and in S, and a plant in S only. The simulation program then finds all pure-strategy Nash equilibria over this 4x4 payoff matrix. No cases of asymmetric or multiple Nash equilibria were found.

[4]Other parameter values held constant throughout are $\alpha = 12$, $\beta = 1$, and $F = 3$

The analytical results in the top panel of Figure 1 correspond to simulation equilibria for the parameters just mentioned. The bottom panel displays the (identical) profits of the two firms for a 21x21 grid of value for σ and c_s. Highest values for σ and c_s are found in the northwest corner of the top panel and the west corner of the bottom panel (this was chosen because this is the best viewing rotation in the bottom panel, and then we tried to make the top panel consistent with that). Both costs decrease along the diagonal line moving from point A to point B in the respective panels.

When the cost of trading components is high and the south has a small cost advantage, the equilibrium regime is WW EE: each firm has a single plant at home and serves the other northern country by exports. As the cost of trading components falls, each firm opens a second plant, in S if production costs in S are low, or in the other northern country if the south's advantage is small. When both component trade costs are low and the south has a big advantage, both firms just maintain a single plant in S: WS ES. The bottom panel of Figure 1 shows that both firms' profits suffer in the two-plant strategies. This is the usual prisoner's dilemma outcome: at these parameter values each firm has an incentive to switch to two plants if its rival has a single plant, but confers a negative "pecuniary externality" on its rival when doing so.

Figure 2 looks at the A-B diagonal shown in Figure 1 with high values of σ and c_s at the left and low values on the right. The drop in profits when the firms invade each others market with a branch plant (in the rival's market or in the south) is a pro-competitive effect which negatively impacts the local firm as just mentioned . In the initial WW EE national-firm strategy, the trade costs on X "insulate" the firms somewhat from competing with one another, an effect familiar from the strategic trade-policy literature. Profits rebound when the firms switch to a single plant in S, an effect similar but in a sense opposite to this insulation effect. Now each firm benefits in its rival's market, not its own market, because the rival now pays trade costs to serve its own market from S rather than locally. Consistent with our earlier discussion, the third-country export-platform outcome WWS EES occurs at moderately low values of σ and c_s, but not so low that the firms close their domestic plants.

Figures 3-5 present other statistics for the same diagonal A-B as in Figure 2. Figure 3 shows the volume of affiliate production, defined as quantities of X assembled in plants other than in the firms' home countries. In the initial national-firm regime this is zero, and rises to approximately half of world X production in the two-plant regimes. Affiliate production is 100% of world production in the WS ES global export-platform regime by definition.

Figure 4 shows the volume of X trade. In the first regime switch to horizontal production (WWE EEW), trade in X falls to zero while affiliate production in Figure 3 jumps to about half of world output. Multinational production substitutes here for trade in X and all foreign production is sold in the host-country market. When firms only have a plant in the south (WS ES), both affiliate production and trade in X are high, since all of the outputs from plants in S is exported. Multinational production then complements trade in X.

This idea that affiliate production and trade are substitutes when affiliates are horizontal and complements when affiliate production is vertical has popped up frequently in both empirical and theoretical literatures. In addition, due to the fact that data rarely allow the researcher to distinguish between horizontal and vertical motives, production for local sale is taken as a "smoking gun" for horizontal activity and export sales as a smoking gun for vertical activity. Empirical studies find that production for local sale occurs in large, high-cost, skilled-labor abundant host markets and is encouraged by high trade costs to those markets. These associations are consistent with the theory developed here and the results shown in Figures 3-4. Horizontal production substitutes for trade in X and vertical production complements it.

Figure 5 shows a statistic that we will examine in the empirical section, the share of total affiliate exports (if any) going to third countries. This statistic is 100% in the third-country export-platform region, falling to 50% in the global export-platform region.

3. An Asymmetric Case: W and S form a Free-Trade Area

Statistics in Table 1 and the associated discussion above suggest that the third-country export-platform phenomenon may be associated with and encouraged by free-trade areas formed by a large (high demand), high-cost partner and a smaller, low-cost developing country. We turn to this case in this section. Suppose that W and S form a free-trade area, so all costs between them are reduced to or toward zero. There are unfortunately a number of possibilities (see Motta and Norman (1996) who fully characterize the solution in a similar situation, but without exports back to the parent). We will look at two interesting cases, (a) when W-E and E-S trade costs are low so that the initial equilibrium without the free-trade area is the national firm strategy WW EE, or (b) these costs are high for final goods (but not components) so that the initial equilibrium is the horizontal outcome WWE EEW.

The first case is shown in Figure 6, where we assume $\sigma = \tau$. These costs are equal on all links at the left-hand edge of the diagram, and the initial equilibrium is the national-firm strategy. Let $\sigma_{ws} = \tau_{ws}$ denote the costs on the W-S link which we will reduce moving to the right in Figure 6, holding $\sigma = \tau = 1$ on the W-E and E-S links (i.e., σ and τ without subscripts in what follows indicate a common value of 1). Rather than run through all the algebra, we will just present the intuition behind the results in Figure 6 since, as will become clear shortly, there are other cases for different parameters including ones in which certain regimes do not exist as equilibria.

Consider the intuition derived from simple cost arguments as in (17) above, again letting g denote the fixed costs of a second plant per unit of output (note that g is actually a variable, depending on other costs and the strategies of both firms). Given the initial equilibrium WW EE when $\sigma_{ws} = \tau_{ws} = 1$, reductions in these values will cause firm W to want to shift its single plant to S when the cost disadvantage of the north exceed the cost of shipping components to S and shipping final output back to W (note that given the initial parameterization, W will never want to have two plants). The cost condition here involves changes in the way both markets are served.

(23) $$c_n + (c_n + \tau) > (c_s + \sigma_{ws} + \tau_{ws}) + (c_s + \sigma_{ws} + \tau) \quad \Rightarrow \quad \Delta c > \tau_{ws}/2 + \sigma_{ws}$$ (W shifts from WW to WS)

Firm E on the other hand, may wish to build a second plant in S dedicated to serving W, third-country export-platform production. The conditions to want to shift from the national strategy to third-country export-platform production relate only to the cost of serving W.

(24) $$c_n + \tau > c_s + \sigma + \tau_{ws} + g \quad \Rightarrow \quad \Delta c > \tau_{ws} + g$$ (E shifts from EE to EES)

since $\sigma = \tau$ by assumption. Finally, E may wish to have just a single plant in S to serve both markets, global export-platform production. The shift from third-country to global export-platform production is given by the cost condition for serving E.

$$c_n + g > c_s + \sigma + \tau \quad \Rightarrow \quad \Delta c > \tau + \sigma - g \tag{25}$$

(E shifts from EES to ES)

The shift from third-country to global export-platform production arises when the cost disadvantage of the north exceeds the cost of shipping components to the south, shipping the output back, minus the savings in the fixed costs of a second plant. This is an interesting condition in that it does not directly involve W-S trade costs at all. It does so indirectly since, as these costs fall, firm W becomes steadily more competitive in E and E's equilibrium output falls. Thus g rises as W-S trade costs fall, and so the right-hand side of (25) falls.

Figure 6 gives results for a parameterization such that all three regimes in (23)-(25) exist as $\sigma_{ws} = \tau_{ws}$ falls. Note that this need not be the case; for example, regime WS EES will not exist if G is sufficiently high. Figure 6 shows that firm W is the beneficiary of the W-S liberalization, since it becomes more competitive in country E and in serving its own market as well. The exception to this statement is in the neighborhood of the shift from WS EE to WS EES: firm E gains a lower marginal cost of serving W (at the expense of incurring G) which harms firm W in market W (there is no change by either firm in serving E). Then there is a discrete jump up for firm W when firm E shuts its domestic plant, incurring higher costs of serving its own market but saving a fixed cost.

Finally, it is interesting to note that, as W-S trade costs continue to fall in the WS ES region of Figure 6, firm E is still being made worse off in spite of its lower-cost access to market W. This is a competitive or "rent-shifting" effect: the cost saving to firm E is outweighed by the fact that firm W continues to enjoy lower and lower costs for shipping its components to S while firm E does not.

Figure 6a shows a statistic that we will look at in our empirical section later, the share of an affiliate's exports (if any) going to the third country, the other northern country rather than back to the parent. The difference between the two firms is most striking in the WS EES region where the insider firm W has a global strategy and outsider firm E has a third-country export-platform strategy. We will see these differences later in the data.

The second case we would like to consider is when trade costs for X are higher than in Figure 6 and higher than those for components, and plant fixed costs are moderate so that firm choose the horizontal strategies WWE EEW initially when W-S trade costs are the same as on other links. Figures 7 and 8 show outcomes for somewhat different values of c_s and G, and different relationships between τ and σ. In Figure 7, $\sigma = \tau/3$ while in Figure 8 $\sigma = 2\tau/3$.

There are two important differences between Figure 6 and Figures 7-8. One is that it is firm E now which is the first to deviate and second, it is firm E which is better off as W-S trade costs fall. Firm E will want to move its second plant from W to S (EEW to EES) when

(26) $$c_n + \sigma > c_s + \sigma + \tau_{ws} \quad \Rightarrow \quad \Delta c > \tau_{ws}$$ (E shifts from EEW to EES)

Firm W will consider two deviations. First, it is possible that firm W will now want to keep its plant in E, but serve its own market from S, which we could call "home-country" export platform production, closely related to "vertical" production in more traditional two-country models. Firm W will want to make this switch if

(27) $$c_n > c_s + \sigma_{ws} + \tau_{ws} \quad \Rightarrow \quad \Delta c > \tau_{ws} + \sigma_{ws}$$ (W shifts from WWE to WSE)

Comparing (26) and (27) it is immediately clear that firm E will want to make the shift as

W-S trade costs fall before firm W wants to switch. This does not imply that WSE is going to be an equilibrium strategy, firm W could instead close it plant in E and open a plant in S to serve E (third-country export-platform production). Firm W will want to switch from horizontal to third-country export-platform production if

(28) $$c_n + \sigma > c_s + \sigma_{ws} + \tau \quad \Rightarrow \quad \Delta c > \tau + \sigma_{ws} - \sigma$$ (W shifts from WWE to WWS)

Which of conditions (27) and (28) is satisfied first as W-S costs fall depends on the relationship between τ and σ. Let τ_{ws}* denote the value of τ_{ws} at which (27) just holds with equality (for the relevant σ_{ws}, which appears in both (27) and (28)). Firm W will prefer the home-country export-platform strategy WSE to third-country export-platform production WWS if

(29) $$\tau_{ws}^{*} < \tau - \sigma$$

This inequality must hold if τ is sufficiently large relative to σ and will be reversed if this difference is small (but τ must be greater than σ if the initial equilibrium is to be the horizontal strategies!). This is indeed the difference in the parameterizations of Figures 7 and 8: τ is large relative to σ in Figure 7 (so (29) holds) and smaller in Figure 8.

Figure 7 shows that firm E is the first to shift as W-S trade costs are reduced as suggested above. Further decreases in W-S trade costs now make firm E better off and firm W worse off in contrast to Figure 6. With $\tau_{ws} > \sigma_{ws}$, the low-cost of shipping X from S to W is worth more for firm E than the low cost of shipping components from W to S is worth for firm W. The second regime shift in Figure 7 is firm W shifting to the home-country export-platform strategy. From this point on, further reductions in W-S costs make both firms better off, and firm W's profits will exceed those of firm E as W-S free trade is approached (not shown due to the scaling).

Figure 7a shows the share of affiliates exports (if any) going to the third country for the two firms. The region WSE EES, in which firm W has a home-country export platform strategy and firm E has a third-country strategy is interesting, because it conforms closely to the data for NAFTA and the EU that we looked at in Table 1. In this region, both the affiliates of the insider and outsider firms are specialized in serving the insider northern market.

Figure 8 uses values of τ and σ that are closer together so inequality (29) is reversed. Once again, the gradual lowering of W-S trade costs causes firm E to move first, switching from a horizontal strategy to a third-country export-platform strategy. The second regime shift is to WWS EES with both countries adopting third-country export-platform strategies. In both these regions, the further lowering of W-S trade costs benefits the outside firm E and harms the inside firm W. Finally, due to the choice of different parameter values from Figure 7, firm W shift to a global export-platform strategy in Figure 8. Initially, this increases firm E's profits significantly, as firm W now has higher marginal costs of serving its own market, but this increase is eroded with further reductions in W-S costs, with profits of firm W eventually exceeding those of firm E as W-S costs go to zero (again, not shown for scaling reasons).

The pattern of affiliate exports for the insider and outsider firms in the WS EES regime is similar to the same regime region in Figure 6. The outsider firm's exports are entirely to the insider country, while the insider's exports are balanced between the two markets.

Referring back to Table 1 and anticipating the results in the next section, the data for US affiliates most closely resembles the WSE EES equilibrium of Figure 7: when the affiliate in a free-trade area has the insider country as parent, exports are highly concentrated in sales to the parent, whereas when the parent is an outsider, we will see that the affiliates exports are concentrated to third countries. While this may seem an intuitive conclusion, Figures 6-8 emphasize that it is far from an inevitable outcome.

4. An Empirical Exercise

Because of the number of possible outcomes (number of regimes that can be equilibria), it is especially valuable here to turn to the data for some insights. The previous two sections suggest that, in countries which are not members of a free-trade area, affiliates may have relatively balanced exports between sales back to the parent country and sales to third countries. For affiliates in countries which are members of free-trade areas, affiliates exports may be concentrated to other countries in the free trade area, but while this seems intuitive, we showed that it is in fact only true for certain ranges of parameters.

Ideally, we would like to have a world data set on affiliate production, sales and exports so that we could compare US and European affiliates in Mexico for example. We do not have such a data set, and the best that we have is the US BEA data which is on a bilateral basis, the US either being parent or host. Thus we can compare affiliates where the US is an insider country (e.g., Mexico) versus affiliates where the US is an outsider to a free-trade area (e.g, Ireland), but we cannot compare insider and outside affiliates in the same host country which is what we would like to do. A further weakness is that the inward data (US affiliates of foreign firms) does not break exports down into exports back to the parent versus exports to third countries. Thus for our purposes, the only useful data is on US outward investments . A weakness of the US outward data is exports to third countries are aggregated over all countries. Thus while we might reasonably conjecture that US affiliate exports from Ireland to third countries are almost exclusively to other EU countries, we cannot know this for sure.

Our dataset contains information about US manufacturing affiliates' exports to the US and exports to third countries for 47 host countries 1983-2000. It is based on publicly available data on US multinationals collected by the Bureau of Economic Analysis (BEA).

The US is an insider country with respect to the NAFTA countries, Canada and Mexico, while it is an outsider country with respect to the integrated European market. The US has far-reaching preferential trading agreements with Israel, but so has the EU. The countries in Southeast Asia are typical low-cost countries that, unlike Mexico and the countries in Southern Europe, do not belong to a regional free-trade area. We will thus use a set of Southeast Asian countries as a "control group" against which to evaluate results for NAFTA and the EU. Israel will be specified separately as well.

We regress the share of affiliate exports to third counties in total affiliate exports the following dummy variables.[5]

North American geography	= 1 for Canada and Mexico in all years
European geography	= 1 for 17 European countries in all years (EU 15 plus Norway and Switzerland)
Southeast-Asian geography	= 1 for Thailand, Hong Kong, Taiwan, Phillippines, Indonesia and Malaysia in all years
Israel	= 1 for Israel in all years
Other countries	= 1 for all countries not included in these four groups

[5]We do not include other control variables such as country size, factor endowments, and investment barriers which we do believe are very important in determining levels of affiliate activity and the composition of sales between local sales and exports (Markusen, 2002). But existing theory presents no strong case as to why these should influence the composition of exports between parent and third countries.

NAFTA	= 1 for Mexico at/after 1994, Canada at/after 1989,
EU	= 1 for an EU 15 country at/after accesssion (Portugal, Spain, Sweden, Finland, Austria enter during the sample period)

Table 2 shows the results from an OLS regression of the share of total affiliate exports going to third countries on the dummy variables just described. In this regression we have simply treated the data as a pooled cross section, allowing observations on each country to be correlated, but assuming independence across countries. We have added time dummies to take out any time effects affecting the whole sample (using 2000 as reference year).[6]

The estimated coefficients of the five dummy variables capturing different country groups give us the predicted share of affiliate exports going to third countries for host countries belonging to the respective country group.[7] Whereas affiliates in Canada and Mexico are predicted to have most of their exports back to the US (the predicted share of exports going to third countries is 0.14), affiliates located in the European countries are predicted to have most of their exports to third countries (the predicted share is 0.91). In between these two extremes we find the predicted share of exports going to third countries for affiliates located in Southeast Asia (0.50), Israel (0.39), and other countries (0.72). All these coefficients are very precisely estimated and we are able to reject the hypothesis that the coefficients of either North American geography

[6] With respect to the NAFTA and EU dummies, it should be noted that countries joining a regional free-trade area often have preferential trading agreements with membership countries prior to formal accession, so these dummies will not necessarily capture the relevant aspects of being part of a regional free-trade area. Furthermore, although countries such as Norway and Switzerland are not members of the European Union, they are still very much integrated with the rest of Europe through their membership in the European Free Trade Association (EFTA) Norway is part of the European Economic Area (EEA) since 1992. While Canada and the US formed a free-trade area in 1989, the auto sector, and important multinationalized industry, was integrated beginning in 1967.

[7] The predicted values of the dependent variable all lie within the interval between zero and one.

or European geography are the same as for any other country groups (at the one percent level).

The estimated coefficients of the two dummy variables capturing membership in NAFTA is around -0.02 and is significantly different from zero. This suggests that the predicted additional effect of being a formal member of NAFTA is a reduction of the share of exports going to third countries of about two percentage points. The estimated coefficient of the EU dummy, on the other hand, is not significantly different from zero.

The difference in the predicted share of affiliate exports going to third countries between North American geography, on the one hand, and European geography, on the other, is consistent with the predictions of the asymmetric model under the parametrization whereby the regime WSE EES arises in equilibrium. When the affiliates belong to an insider firm (affiliates located in Canada and Mexico) their exports is mainly directed to the parent country because third countries are served by local affiliates. However, when affiliates belong to an outsider firm (affiliates located in Europe), their exports are mainly directed to other countries within the regional free-trade area because the parent country is served by a local plant. This particular equilibrium regime arises when trade costs for components is significantly lower than for final goods.

The predicted shares of affiliate exports going to third countries for Southeast Asia and Israel, on the other hand, are consistent with the predictions of the symmetric model under the parameterization whereby the regime WS ES arises in equilibrium, i.e. a case with relatively low trade costs in components and a relatively large difference in production costs between the North and the South. This corresponds to the case we have termed global export-platform FDI.

The results from the OLS regression in Table 2 tell us that there are significant differences in the share of affiliate exports going to third countries between countries belonging to different country groups. However, this analysis does not address the issue of whether belonging to a particular country group is what really matters for these differences to arise. It may be that there are country-specific differences unrelated to the structure of trade costs arising from belonging to a particular country group that happen to be such that a grouping along the lines in Table 2 will lead to statistically significant differences in the predicted shares.

In order to assess whether belonging to a particular country group is crucial for the differences to arise we would ideally like to control for time-invariant country-specific differences in the share of affiliate exports going to third countries. However, using fixed effects estimation or first differencing is clearly not a feasible empirical strategy. By carrying out a regression analysis based on a random-effects specification we are however able to go some way in addressing this issue. Table 3 present the results from a random effects maximum likelihood regression of the linear equation estimated with OLS in the previous table.[8] As is evident from this table, the point estimates of the coefficients of the country group dummies differ very little from the ones obtained by OLS. There are only two substantial difference in results: the negative estimate of the coefficient of the NAFTA dummy is no longer statistically significant and we are no longer able to reject the hypothesis that the coefficient of North-American geography is the same as for Israel at standard levels of significance (the p-value of a test is 0.11). Since it is unclear whether the US should be considered an insider country or not *vis-à-vis* Israel, the latter

[8]The only difference between the two specifications is that the error term uit in the OLS regression is divided into ui + eit in the random effects regression, where ui is treated as a random variable.

change in results does not alter the main conclusion: belonging to a country group where the firm is an insider or outsider with respect to preferential trading agreements produces a pattern of affiliate exports consistent with the predictions of the model when trade costs in final goods are higher than in components.

Table 4 uses the results of the random effects estimation to summarize predicted shares for countries in NAFTA and the EU (adding the geography and free-trade coefficients together) plus all other countries in the sample. The US parent is an “insider” for affiliates located in NAFTA and an “outsider” for affiliates located in the EU. We use the term “both” for affiliates in Israel, since the parent and the affiliate are in the US-Israel free-trade area, but the affiliates are simultaneously in a country which is in the EU-Israel free-trade area where the parent is an outsider. The term “neither” is used for the Southeast Asia grouping and for all other countries. As we have already noted, the EU and NAFTA results are most closely consistent with the WSE EES equilibrium in Figure 7, where the insider country adopts a home-country export-platform strategy and the outsider country adopts a third-country export-platform strategy. Exports for the Southeast Asian, Israeli, and other affiliates on the other hand are balanced, and this is consistent with the WS ES equilibrium of the symmetric case of section 3. The results suggest that these affiliates are being used as global export platforms, serving the US and other high-income markets including Japan, Canada, and possibly Europe.

5. Summary

Export-platform direct investment is usually taken to refer to a situation where the output of a foreign subsidiary is largely sold in third markets, not in the host country or exported back to the parent country. We refer to this more precisely as "third-country export-platform" production. Our approach adopts a three-country model, with two identical large, high-cost countries and a small, low-cost country.

We consider two cases. In the first, trade costs for components are the same on all trade links as are the trade costs for assembled X. The third-country export-platform strategy is preferred on a cost basis if the cost disadvantage of the north is (a) large relative to the cost of shipping final output (so that a horizontal strategy is not preferred) and (b) large relative to the cost of shipping components and the per-unit fixed costs of a second plant (so that a national-firm strategy is not preferred), but (c) not large relative to the cost of shipping components to S, and shipping final output back to the home and incurring the added per-unit fixed costs of the second plant (so that a single plant in S is not preferred). Results of this case also complement other results in the theoretical and empirical literatures. Horizontal affiliate production substitutes for trade while vertical or export-platform production complements trade.

Our second case involves export-platform FDI arising in a situation where one (of several) high-demand, high-cost countries forms a free-trade area with a low-cost, low-demand country. If there are two high-wage countries, then firms in both those countries may have an incentive to set up a plant in the low-wage country. When trade costs for final goods are not high relative to trade costs for components, it is the "insider" firm that first moves production to S and that benefits from the free-trade area, which strikes us as an intuitive result. But when trade costs for X are high relative to those for Z, then we showed that it is the "outsider" firm that moves production first and that benefits at the expense of the insider firm. The intuition is that the outsider's ability to export X cheaply to the insider country from the plant in S is worth more than the insider's ability to export components cheaply to a plant in S.[9]

We then turn to a simple empirical exercise, examining the share of output that is exported by affiliates to third countries. Results for US affiliates in NAFTA and EU countries are most consistent with the WSE EES equilibrium of Figure 7, where the insider firm pursues a home-country export-platform strategy, serving itself from S and serving the other high-income country from a plant in that country (horizontal strategy). The outsider firm pursues a third-country export-platform strategy, serving itself with a local plant and serving the insider country from a plant in S.[10]

We also use a "control group" of Southeast Asian economies. These countries do not have significant free-trade agreements with North American, European, or Japanese countries, so US affiliates are neither insiders nor outsiders. We find that for these countries, there is a close balance between home-country and third-country exports, which is indeed consistent with parameterizations of our symmetric case that generate global export-platform production.

Returning to the NAFTA and EU empirical results that are consistent with the WSE EES equilibrium of Figure 7, these results are then also consistent with the theoretical scenario in which it is the *outsider firm* which benefits from the free-trade area at the expense of the insider. Clearly, insider firms have indeed worried about this scenario as noted in footnote 9.

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[9]In the negotiations over NAFTA, US firms were particularly concerned with raising barriers to European and Japanese firms to prevent them from or at least penalize them for using Mexico as an export platform to the US, which is consistent with this result (see Lopez-de-Silanes, Markusen and Rutherford, 1996).

[10]Again, this result is reinforced by data on Swedish affiliates in Canada and Mexico. For example, it suggests that in a three-country world of the US, the EU, and Mexico, the US and EU firms will both have plants in the EU to serve the EU and both have plants in Mexico to serve the US.

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APPENDIX: DERIVATIONS

Here we present the derivations for the boundary conditions (18)-(20).

(A) Firm W cannot profitably deviate from WWS EES to WWE EES

For the third-country export-platform case to be an equilibrium, it must not be profitable for a firm to choose to locate its second plant in the other northern country instead of in the South. Suppose that we are in the former configuration, and W considers shifting its second plant from S to E. This is very straightforward, since it does not involve changes in fixed costs, and no change by either firm in market W. Thus from (14)-(15), all that we need to check is whether or not W's equilibrium supply to E is larger under WWS or WWE. The condition for a deviation from WWS to WWE to be unprofitable is:

(A1) $$X_{ee}^{w} = \left[\alpha - 2(c_n + \sigma) + c_n\right]/(3\beta) < X_{se}^{w} = \left[\alpha - 2(c_s + \sigma + \tau) + c_n\right]/(3\beta)$$

This simplies to

(A2) $$c_n - c_s = \Delta c > \tau$$

which is the same as the second inequality in (18).

Conditions in which the number of plants change along with output are much more complicated due to the fact that variable profits are quadratic in outputs. For the third-country export-platform case to be an equilibrium, it cannot be profitable for firm W to deviate from WWS to WS, serving both markets from S given that firm E chooses EES.

(B) Firm W cannot profitably deviate from WWS EES to WS EES

There is no change in either firm's supply to market E, so we just need to compare firm W's supplies to its own market taking into account that WS involves one less G. The condition for this deviation to be unprofitable is:

(A3) $$\left[\alpha - 2(c_s + \sigma + \tau) + (c_s + \sigma + \tau)\right]^2 < \left[\alpha - 2c_n + (c_s + \sigma + \tau)\right]^2 - 9\beta G$$

(A4) $$\left[\alpha - c_s - \sigma - \tau\right]^2 < \left[\alpha - 2c_n + c_s + \sigma + \tau\right]^2 - 9\beta G$$

Add and subtract c_n from the left hand term in brackets:

(A5) $$\left[\alpha - c_n + (c_n - c_s - \sigma - \tau)\right]^2 < \left[\alpha - c_n - (c_n - c_s - \sigma - \tau)\right]^2 - 9\beta G$$

Let $(\alpha - c_n) \equiv \gamma$ *and* $(c_n - c_s - \sigma - \tau) \equiv \delta$, then (A5) can be written as:

(A6) $(\gamma + \delta)^2 < (\gamma - \delta)^2 - 9\beta G \quad \textit{or} \quad 2\gamma\delta < -2\gamma\delta - 9\beta G$

Collecting terms and dividing through by 4γ, this becomes

(A7) $c_n - c_s - \sigma - \tau = \Delta c - \sigma - \tau < -\frac{9\beta}{4\gamma}G$ or

(A8) $\Delta c < \sigma + \tau - \frac{9\beta}{4\gamma}G = \sigma + \tau - \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n}\right]G$

(C) Firm W cannot profitably deviate from WWS EES to WW EES

The procedure here is similar the deviation just considered. There is no change in either firm's supply to market W, so we just need to compare firm W's supplies to E's market taking into account that WW involves one less G. The condition for this deviation to be unprofitable is:

(A9) $\left[\alpha - 2(c_n + \tau) + c_n\right]^2 < \left[\alpha - 2(c_s + \sigma + \tau) + c_n\right]^2 - 9\beta G$

(A10) $\left[\alpha - c_n - 2\tau\right]^2 < \left[\alpha - 2c_s + c_n - 2\sigma - 2\tau\right]^2 - 9\beta G$

Add and subtract c_n from the right-hand term in brackets:

(A11) $\left[\alpha - c_n - 2\tau\right]^2 < \left[(\alpha - c_n - 2\tau) + 2(c_n - c_s - \sigma)\right]^2 - 9\beta G$

Following similar procedures, this can be reduced to:

(A12) $\Delta c > \sigma + \frac{3}{4}\left[\frac{3\beta}{\alpha - c_n - 2\tau}\right]G - \frac{(\Delta c - \sigma)^2}{\alpha - c_n - 2\tau}$

Table 1: Distribution of sales by US affiliates between local sales, exports to the US, exports to third countries

Sales of foreign affiliates of US multinationals: shares in total, 2000

	local sales	export sales to the US	export sales to third countries	share of total export sales to third countries	share of total export sales to third countries group average
All countries	0.64	0.11	0.26	0.71	
Ireland	0.13	0.16	0.71	0.82	**0.90**
Belgium	0.39	0.04	0.57	0.93	
Holland	0.37	0.03	0.60	0.95	
Hong Kong	0.33	0.36	0.32	0.47	**0.56**
Malaysia	0.20	0.33	0.47	0.59	
Phillipines	0.44	0.19	0.37	0.66	
Singapore	0.35	0.32	0.34	0.52	
Canada	0.57	0.38	0.05	0.11	**0.14**
Mexico	0.53	0.39	0.08	0.17	

Figure 1: Regimes as a function of cost of trading components, production cost in S

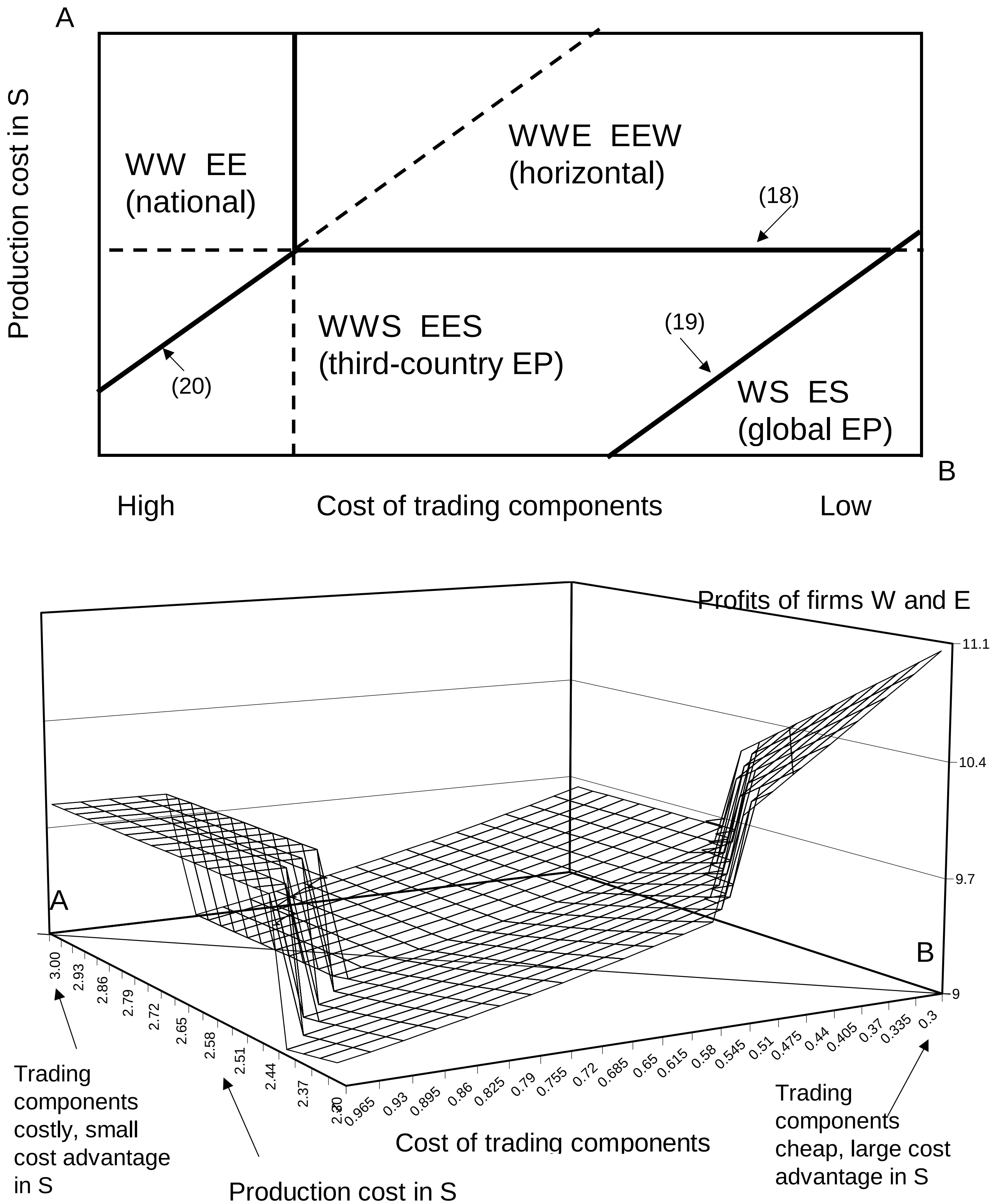


Figure 2: Symmetric model, lower cost of trading components, and production cost in South

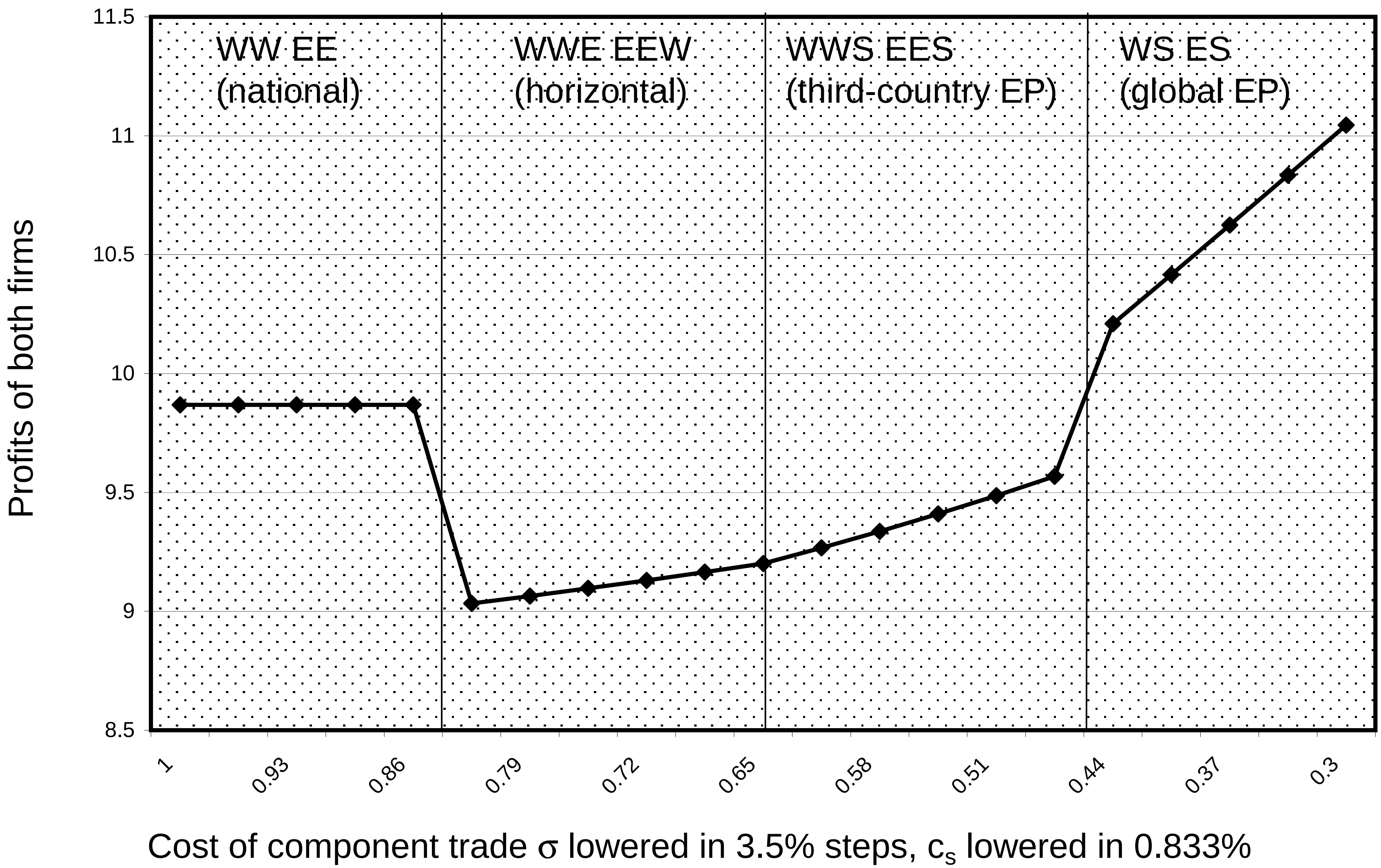


Figure 3: Volume of affiliate production

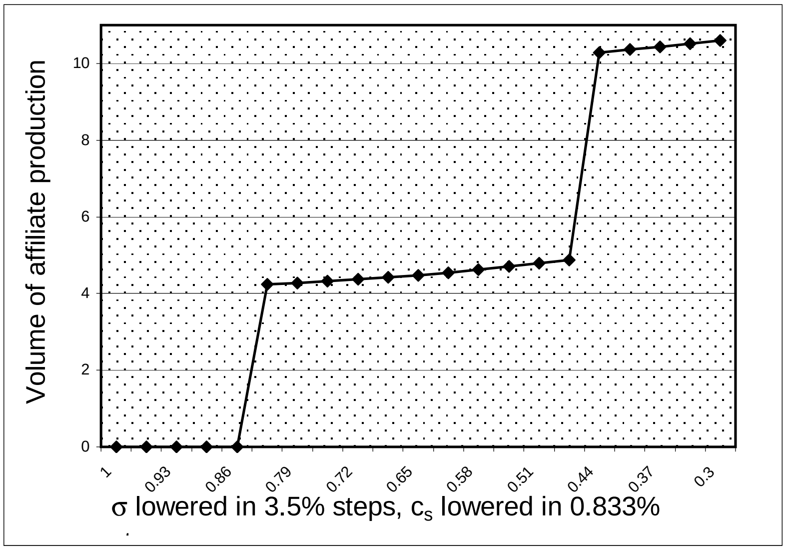


Figure 4: Volume of trade in assembled X

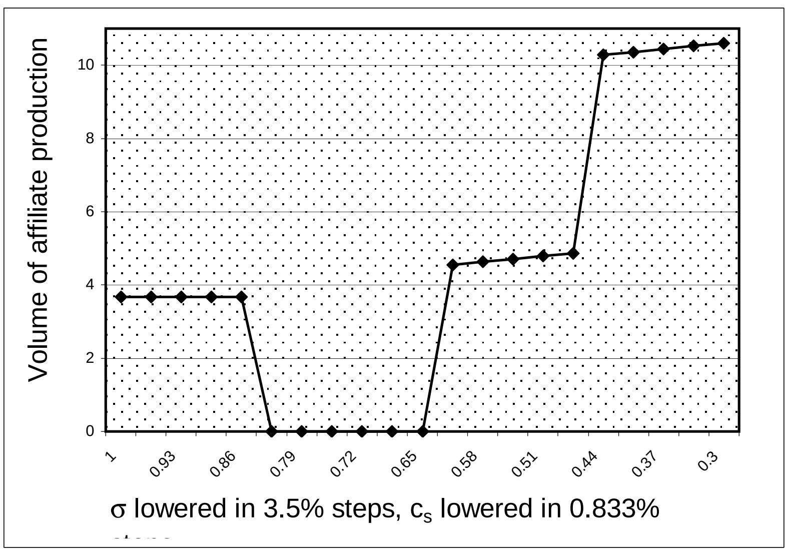
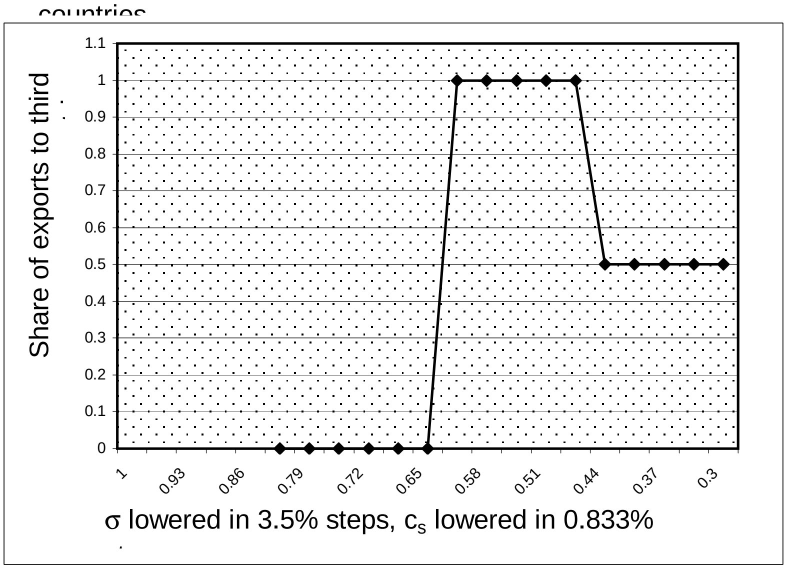


Figure 5: Share of total affiliate exports going to third countries



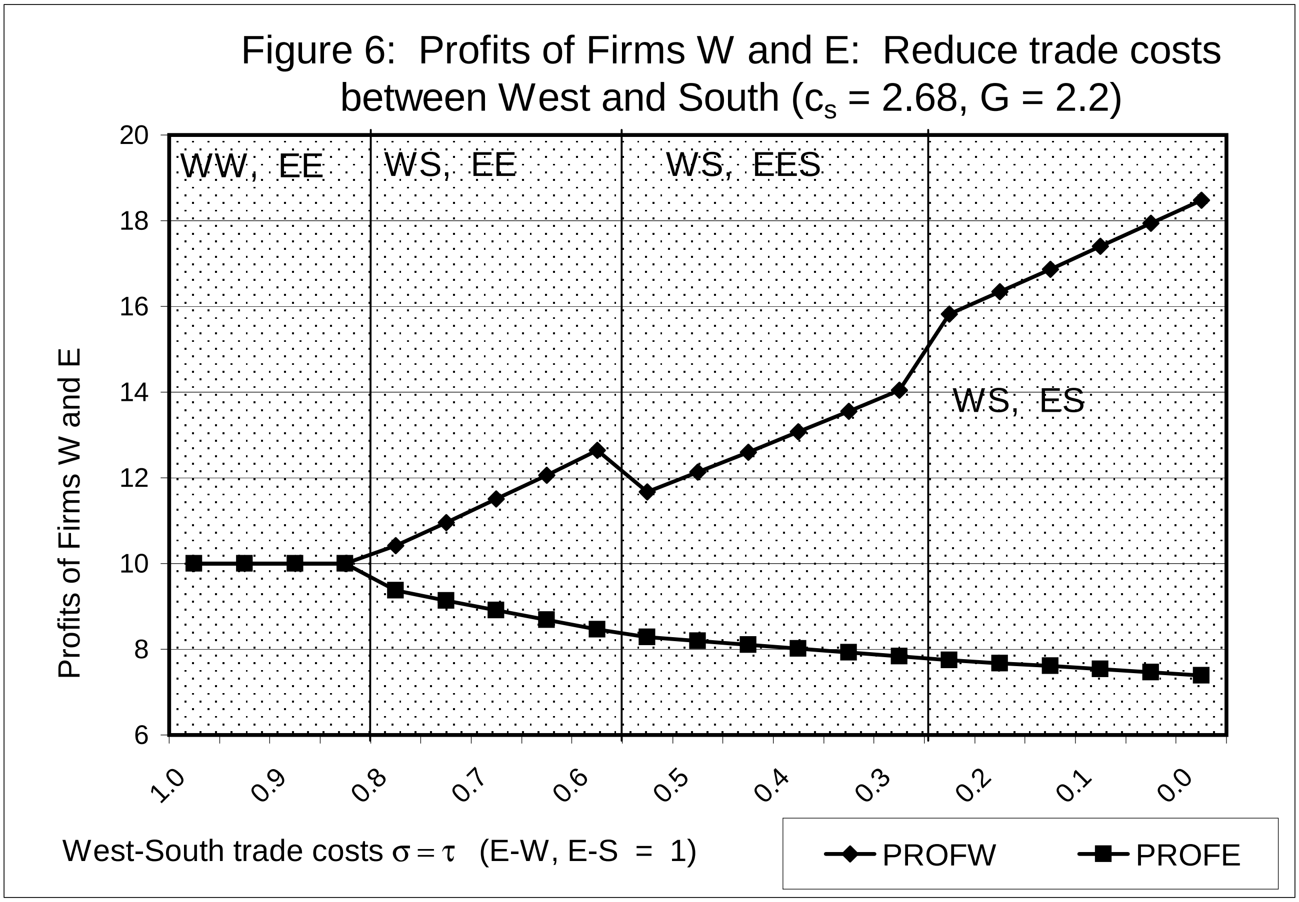


Figure 6: Profits of Firms W and E: Reduce trade costs between West and South (c_s = 2.68, G = 2.2)
20
18
16
14
12
10
8
6
Profits of Firms W and E
WW, EE
WS, EE
WS, EES
WS, ES
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
West-South trade costs $\sigma = \tau$ (E-W, E-S = 1)
PROFW
PROFE

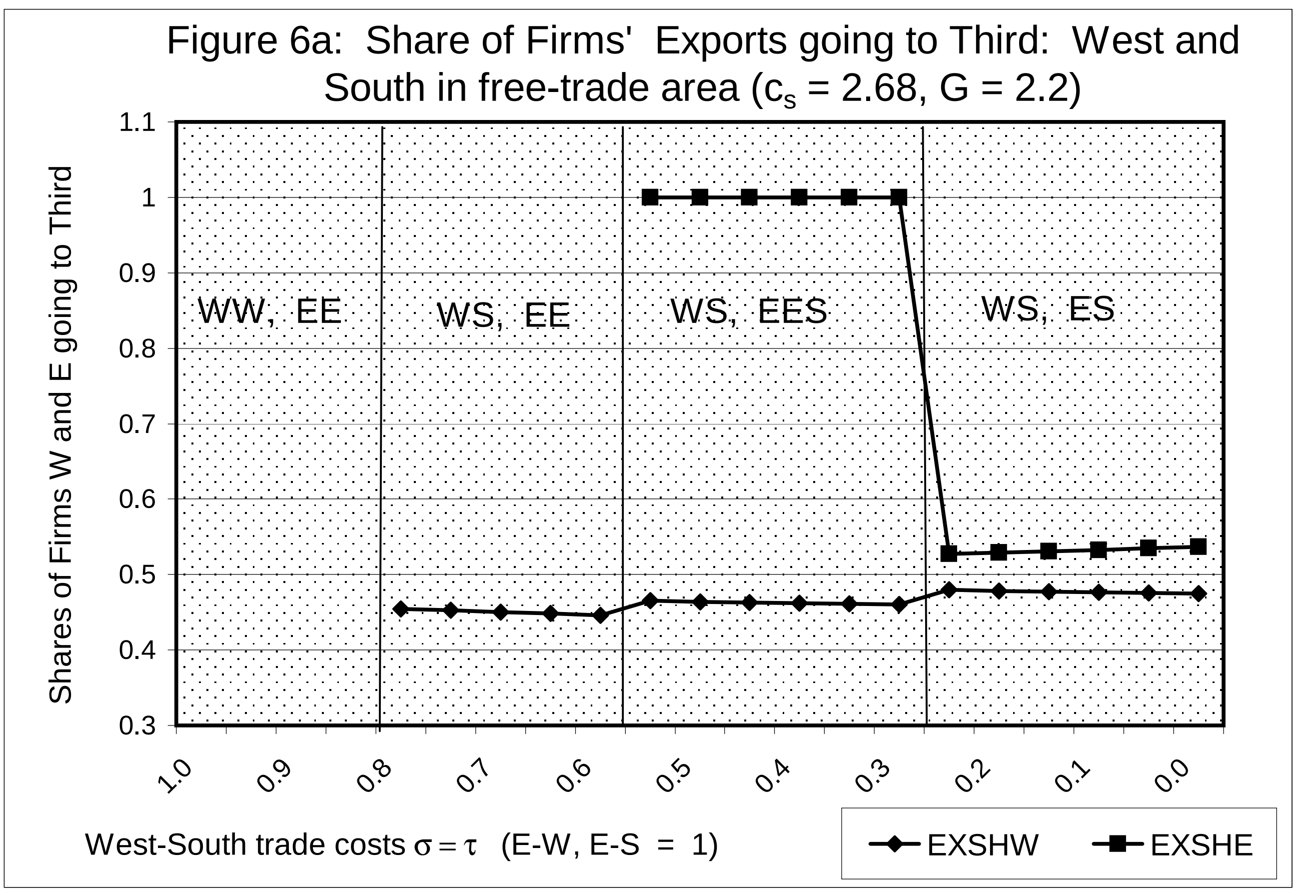


Figure 6a: Share of Firms' Exports going to Third: West and South in free-trade area (c_s = 2.68, G = 2.2)
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
Shares of Firms W and E going to Third
WW, EE
WS, EE
WS, EES
WS, ES
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
West-South trade costs $\sigma = \tau$ (E-W, E-S = 1)
EXSHW
EXSHE

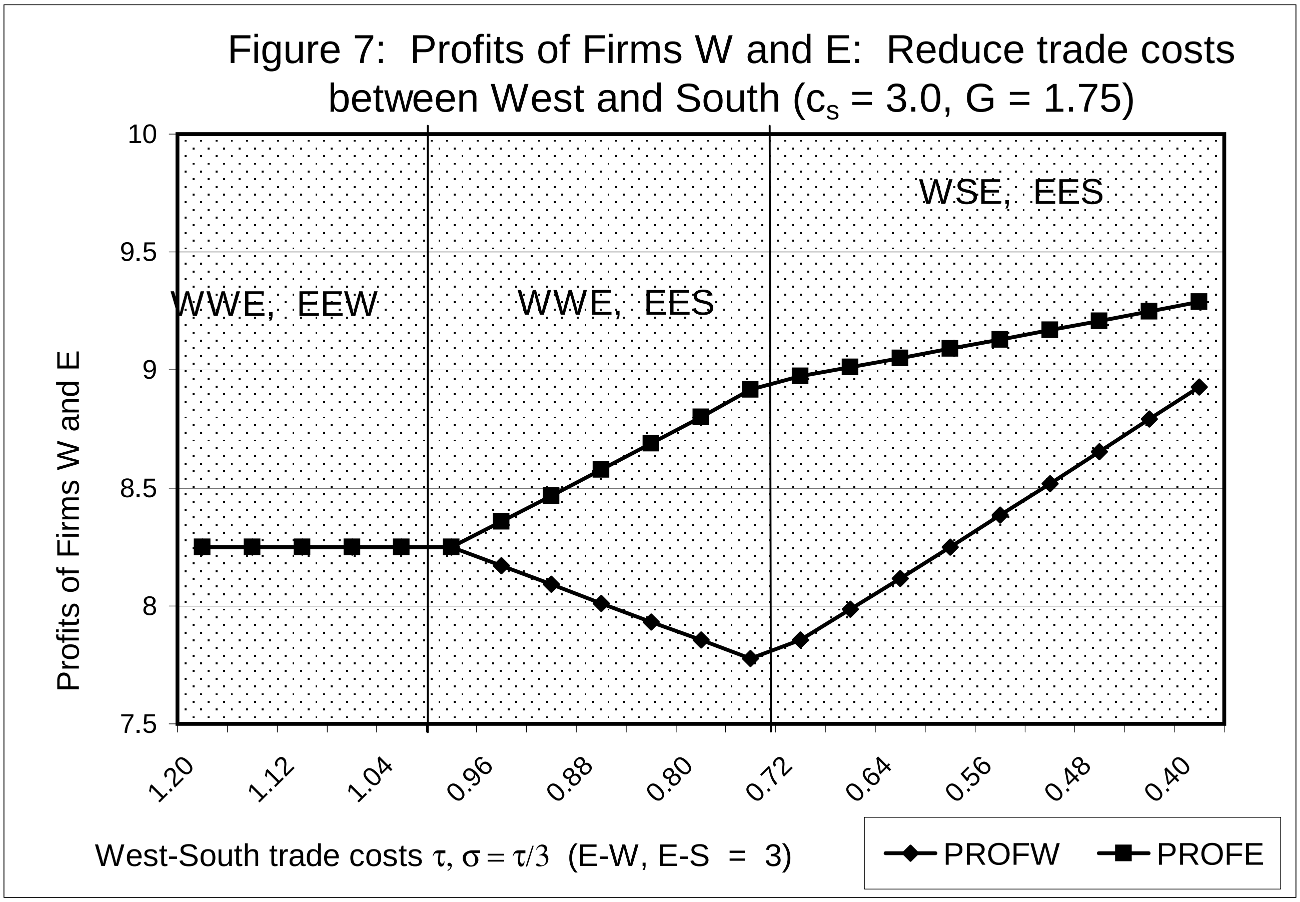


Figure 7: Profits of Firms W and E: Reduce trade costs between West and South (c_S = 3.0, G = 1.75)
Profits of Firms W and E
10
9.5
9
8.5
8
7.5
WWE, EEW
WWE, EES
WSE, EES
1.20
1.12
1.04
0.96
0.88
0.80
0.72
0.64
0.56
0.48
0.40
West-South trade costs τ, σ = τ/3 (E-W, E-S = 3)
PROFW
PROFE

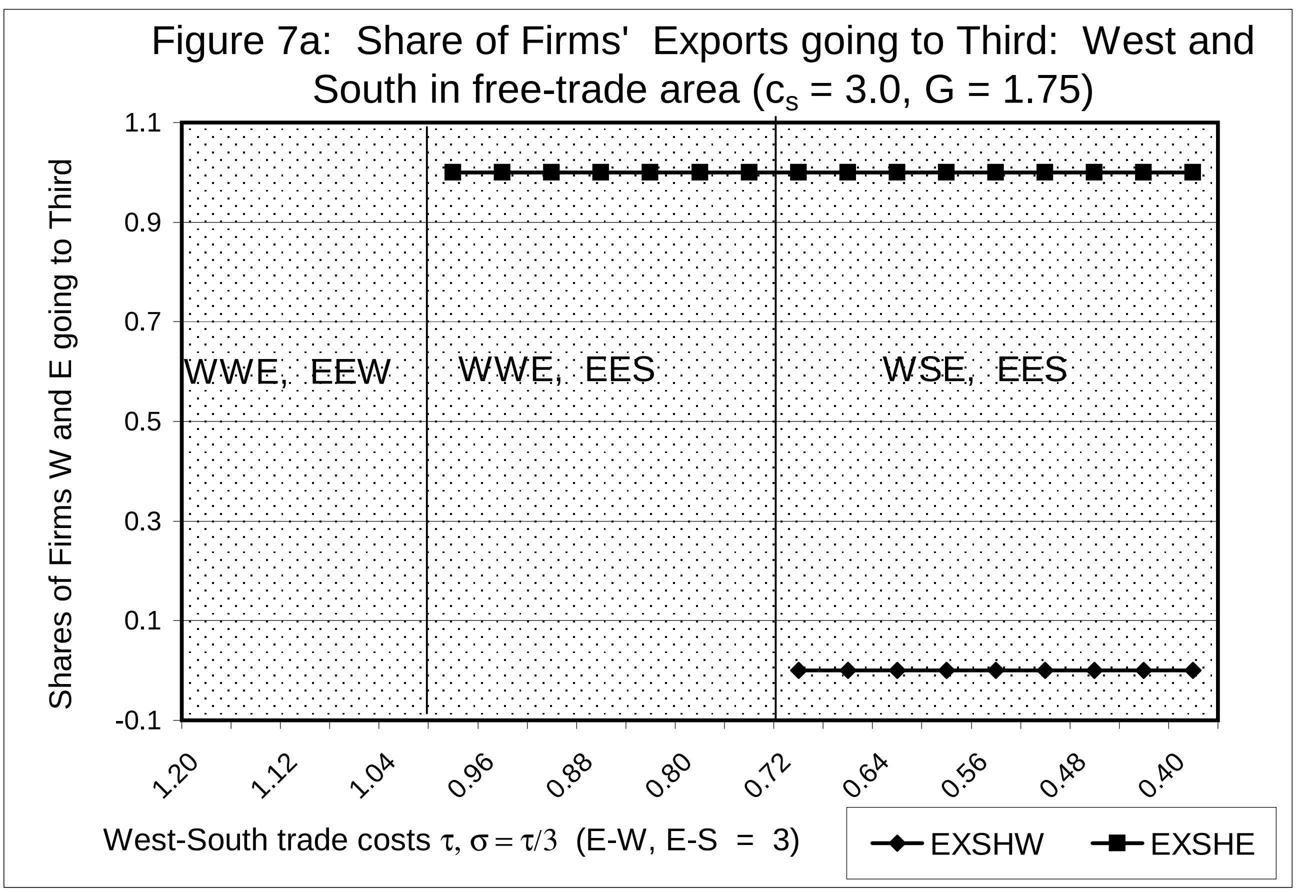


Figure 7a: Share of Firms' Exports going to Third: West and South in free-trade area (c_S = 3.0, G = 1.75)
Shares of Firms W and E going to Third
1.1
0.9
0.7
0.5
0.3
0.1
-0.1
WWE, EEW
WWE, EES
WSE, EES
1.20
1.12
1.04
0.96
0.88
0.80
0.72
0.64
0.56
0.48
0.40
West-South trade costs τ, σ = τ/3 (E-W, E-S = 3)
EXSHW
EXSHE

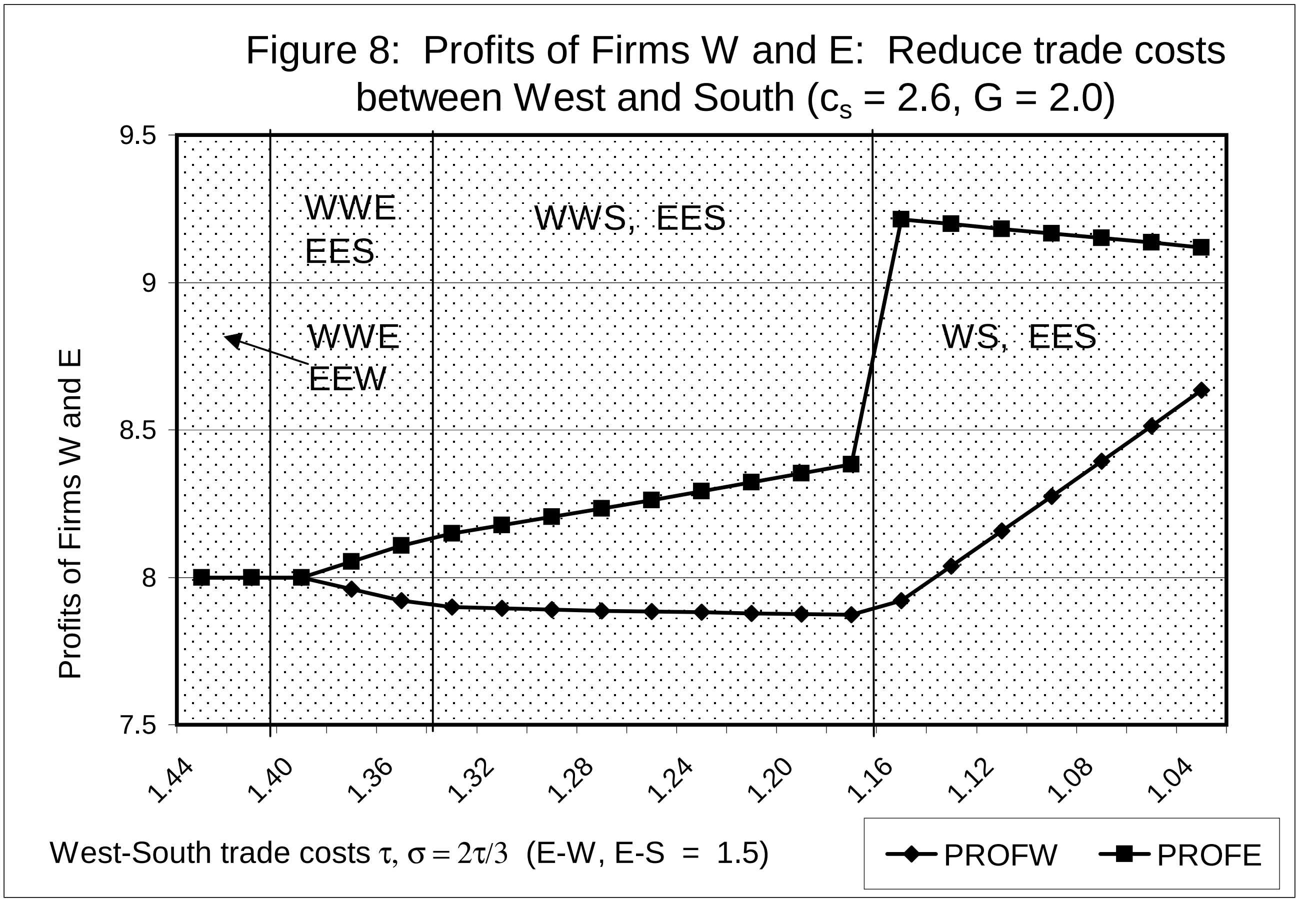


Figure 8: Profits of Firms W and E: Reduce trade costs between West and South (c_s = 2.6, G = 2.0)
Profits of Firms W and E
9.5
9
8.5
8
7.5
WWE
EES
WWS, EES
WWE
EEW
WS, EES
1.44
1.40
1.36
1.32
1.28
1.24
1.20
1.16
1.12
1.08
1.04
West-South trade costs τ, σ = 2τ/3 (E-W, E-S = 1.5)
PROFW
PROFE

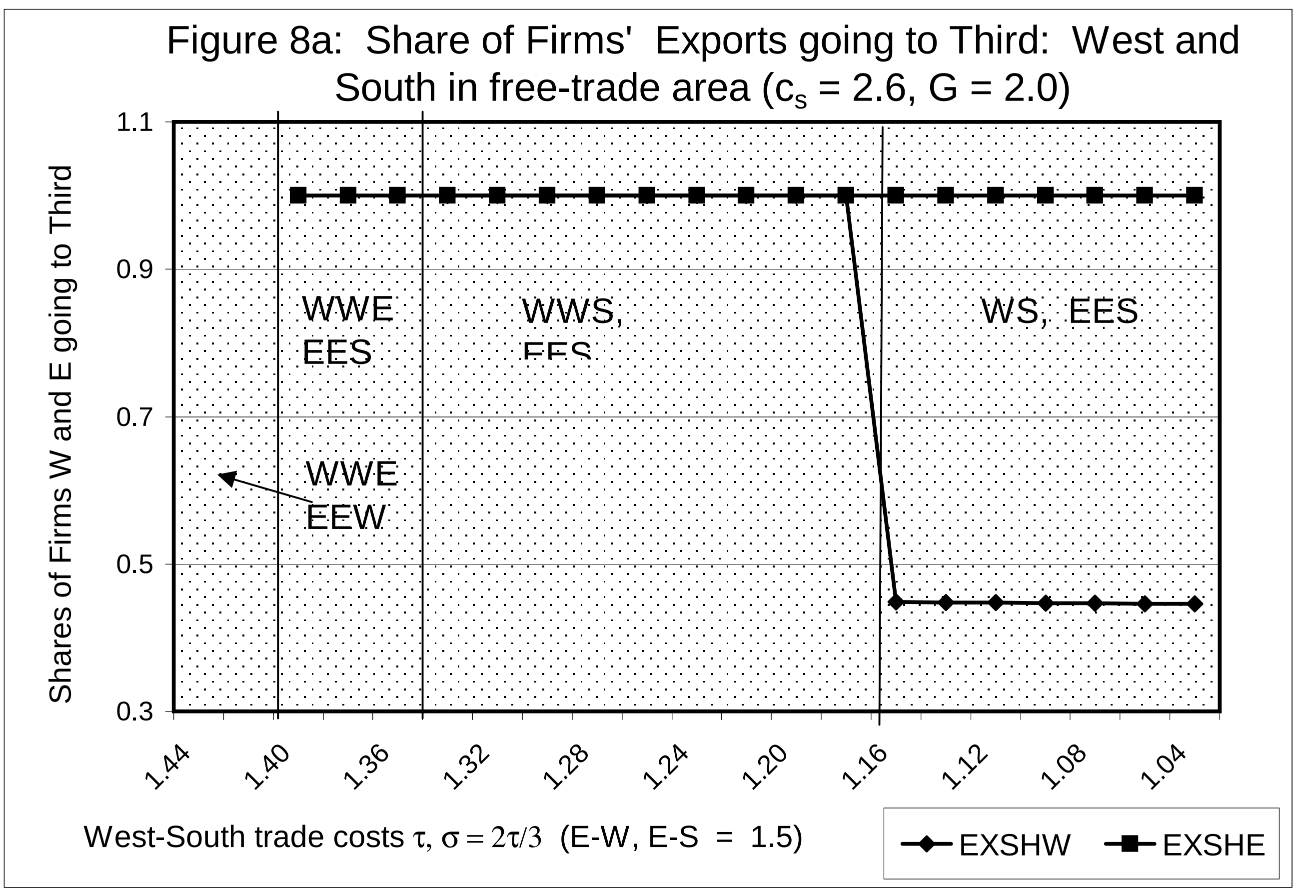


Figure 8a: Share of Firms' Exports going to Third: West and South in free-trade area (c_s = 2.6, G = 2.0)
Shares of Firms W and E going to Third
1.1
0.9
0.7
0.5
0.3
WWE
EES
WWS,
WS, EES
WWE
EEW
1.44
1.40
1.36
1.32
1.28
1.24
1.20
1.16
1.12
1.08
1.04
West-South trade costs τ, σ = 2τ/3 (E-W, E-S = 1.5)
EXSHW
EXSHE

Table 2: Results from OLS estimations

Dependent variable: share of total affiliate exports going to third countries

	coefficient	t-stat	p-value
North American geography	0.134	3.53	0.000
European geography	0.912	42.30	0.000
South-East Asia geography	0.503	31.80	0.000
Israel	0.390	6.33	0.000
Other Countries	0.719	66.80	0.000
NAFTA	-0.018	-0.35	0.723
EU	0.005	0.20	0.843
R-squared	0.961		
Observations	587		

Note: time dummies with t-values above one included (2000 being the year of reference).
Estimated coefficient of NA geo significantly different (at one percent) from all other country groups.
Estimated coefficient of Europe significantly different (at one percent) from all other country groups.

Table 3: Results from random-effects estimation

Dependent variable: share of total affiliate exports going to third countries

		coefficient	t-stat	p-value
North American geography		0.140	1.47	0.142
European geography		0.933	23.40	0.000
South-East Asia geography		0.544	10.80	0.000
Israel		0.406	2.98	0.003
Other countries		0.751	25.30	0.000
NAFTA		-0.016	-0.45	0.652
EU		-0.019	-0.62	0.535
Log likelihood		445.4		
Observations	total	587		
	groups	47		

Note: time dummies with t-values above one have been included (2000 being the year of reference).
Estimated coefficient of NA geo significantly different (at one percent) from all other groups except Israel.
Estimated coefficient of Europe significantly different (at one percent) from all other groups.

North American geography	=1 for US, Canada, Mexico in all years
European geography	= 1 for 17 European countries in all years
South-East Asia geography	= 1 for TAI, HK, SIG, THA, PHI, IND, MAL in all years
NAFTA	= 1 for Mexico at/after1994, Canada at/after 1989, Israel all years
EU	= 1 for an EU 15 country at/after accession

Table 4: Foreign affiliates of US firms: share of total exports going to the US and to third countries (random effects estimates)

Affiliate located in :	NA country in NAFTA (insider)	E country in EU (outsider)	S-E Asia group (neither)	Israel (both)	Other countries (neither)
Predicted share of exports going to the US	0.88	0.09	0.46	0.59	0.25
Predicted share of exports going to the Third	0.12	0.91	0.54	0.41	0.75

NA country in NAFTA	Expectation for a North American country in a year in which it is in NAFTA
E country in EU	Expectation for a European country in a year in which it is in the EU
"Insider"	US parent and affiliate are in the same free-trade area
"Outsider"	Affiliate is inside a free-trade area but the parent is outside
"Both"	Israel: affiliates are in both the US-Israel and EU-Israel fta's