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EXPORTING AND FDI AS ALTERNATIVE STRATEGIES

KEITH HEAD
JOHN RIES
Sauder School of Business, University of British Columbia[1]

Exports and overseas production are alternative modes for serving foreign customers. Empirical studies usually find that foreign markets are served through both modes and that countries receiving high levels of exports also host large amounts of foreign direct investment (FDI). This paper evaluates several possible ways to reconcile the facts about FDI and exports with the standard theory of multinational corporations. We argue that coexistence and correlation of FDI and exports are consistent with models where the two modes are substitutes. This substitutive relationship finds collaborative evidence in the results of several papers. Nevertheless, a significant body of evidence suggests that FDI sometimes complements exports through the mechanism of stimulating exports of intermediate goods for use by overseas affiliates.

I. INTRODUCTION

Multinational corporations (MNCs) recurrently face the same question: should we supply product *X* to customers in country *j* using our existing factory in country *i* or should we invest in a facility that can manufacture locally in country *j*? To give concrete examples, both authors of this paper drive cars manufactured by Japanese firms. One car was produced at Subaru's main plant in Gunma, Japan, while the other was produced in Georgetown, Kentucky. These examples make it clear that, at the level of an individual product, exporting and foreign direct investment (FDI) are alternative strategies for reaching an overseas customer. Much empirical work has struggled to find statistical evidence to support this proposition.

This paper outlines alternative theories of the MNC to identify the economic mechanisms linking FDI and exports. We then review the large literature on whether exporting and FDI are substitutes or complements. With few exceptions, most studies find a positive relationship between exports and FDI. Some authors interpret this as evidence of 'complementarity' between the two variables.

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Others question the econometrics, arguing that the positive relationship could be spurious. We argue that the empirical evidence does not contradict the theoretical prediction of substitution at the product level. Indeed, substitution is found in studies that focus on narrow product lines. However, manufacturing a downstream product in a foreign country may induce trade in upstream products and thereby lead to positively correlated FDI and exports. The empirical literature provides direct and indirect support for this form of economic complementarity between FDI and exports.

Why should we care whether exports and FDI are substitutes or complements? There do not appear to be any issues where the appropriate policy choice depends directly on the answer. However, governments formulating trade and foreign investment policies should benefit from a more complete understanding of how MNCs make international production decisions and the ramifications of these decisions for their home operations (including exporting). For example, would a less favourable tax treatment for income earned by overseas affiliates stimulate the manufacturing sector at home? To the extent that FDI and exports are substitutes, raising the tax cost of FDI might induce more production at home. If, instead, overseas activity tends to complement home activity, it may not actually be in domestic workers' interests to discourage overseas investment.

The paper proceeds as follows. Section II begins with a simple exposition of the standard model of the FDI versus export decision and identifies the key factors influencing the choice. The prediction of the model that firms will reach a given foreign market either through FDI *or* exporting appears to be at odds with country- and firm-level evidence illustrated by figures in section III. In the two sections that follow, we discuss extensions of the standard model of MNCs that can explain the coexistence and positive correlation of FDI and exports. In section VI, we survey the regression evidence, describing the methods used to investigate the export–FDI relationship. Section VII provides our conclusions on what lessons the theory of the MNC should draw from the empirical literature.

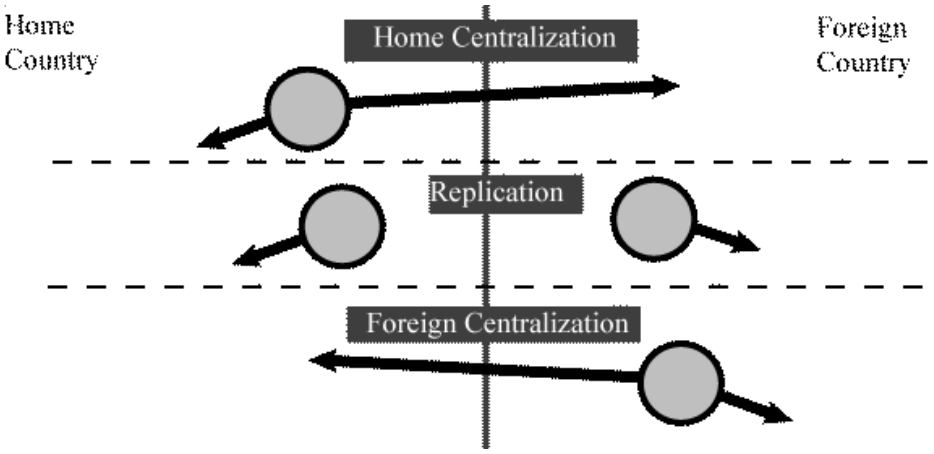
II. SINGLE-PRODUCT MNCS AND THE CASE FOR SUBSTITUTION

We begin with the simplest possible model for considering the formation of an MNC. The firm produces one product that it sells to consumers in both the home country (home, H) and the foreign country (foreign, F). Figure 1 illustrates the three options available to the firm. The default position of a firm as it first serves a foreign market is 'home centralization'. A second option is to open a plant in the foreign country to serve that market while continuing to serve the home market with the original plant. We call this 'replication' because it involves creating a replica of the home plant in the foreign country. The use of the replication form eliminates the exports associated with home centralization since the MNC now serves each market locally.

A third option is to shut down the home plant and use a new factory in the foreign country to manufacture for both markets. This 'foreign centralization' form involves importing back into the home market. Presumably some head-office activities (control) remain at home or else we would just see this as home centralization from the perspective of the foreign country. We will explicitly consider a two-stage MNC later, but for now we want to retain the focus on a single business unit.

We can use a little bit of algebra to make our analysis more precise. We take the size of each market for the firm's product as given, with there being M_H customers at home and M_F customers in the foreign country. We specify the level of demand in each country exogenously to avoid having to consider pricing decisions. The underlying assumptions would be that each consumer has demand for one unit for a price less than or equal to his or her valuation and zero units for any price above it. Therefore the firm charges a price equal to each consumer's willingness to pay. This means that aggregate revenues do not depend on the strategy the firm selects and we can focus on identifying the cost-minimizing strategy. This approach is fine for outlining the basic case for substitution. However, when we consider the case for complementarity, it will prove important to allow for downward-sloping demand curves.

Figure 1
Three Strategies for a Single-product Firm



We assume that there is a composite variable factor that we will refer to as labour and denote the composite variable factor prices as 'wages' W_H at home and W_F abroad. The individual firm possesses a unique technology allowing it transform variable inputs into final goods with productivity A that does not depend on the country in which it produces.

The total cost of home centralization, C_H, is given as

$$C_H = (w_H/A)\, M_H + (w_H/A + T_F)\, M_F + K \quad (1)$$

where w_H/A is the marginal cost of home production, T_F represents the trade costs incurred in exporting to the foreign market, M_F is the size of the foreign market, and K represents the fixed costs of the capital (land, buildings, equipment) deployed at the home factory. For simplicity, assume that this cost does not depend on which country a factory is built in. If the firm were to open another plant, it would have to incur the capital costs twice. However, it would be able to avoid trade costs by serving markets locally. Thus, the costs of replication are given by

$$C_R = (w_H/A)\, M_H + (w_F/A)\, M_F + 2K. \quad (2)$$

Shutting down the home plant and relocating it to the foreign country can lower fixed costs back to K, assuming that all the home investment K is reversible (i.e. that it can be sold at full value or relocated at zero cost). Under foreign centralization, trade becomes necessary again. The costs of importing foreign-made products into home, are denoted as T_H. Therefore the costs of foreign centralization are given by

$$C_F = (w_F/A)\, M_F + (w_F/A + T_H)\, M_H + K. \quad (3)$$

Multinational business strategy in this example just requires us to compare C_H, C_R, and C_F and select the form that yields the lowest cost.

Three-way comparisons can be complicated, so we will set aside foreign centralization and consider the relative merits of home centralization (exporting) versus replication. Home centralization is preferred when

$$C_R - C_H = K + (w_F/A)\, M_F - (w_H/A + T_F)\, M_F > 0. \quad (4)$$

Note that the costs of producing for the home market have cancelled each other out since both forms involve using the home factory for that market. Dividing by the size of the foreign market, M_F, we can see that exporting is preferable to replication when

$$w_F/A + K/M_F > w_H/A + T_F. \quad (5)$$

Figure 2 graphs the left- and right-hand sides of the inequality. It shows that replicating overseas investment can only be justified when the foreign market is large enough.

We can solve for the critical market size required to justify replicating investment. This is the M_F* that sets $C_H = C_R$:

$$M_F^* = K/[\ T_F - (\ w_F - w_H)/A]. \qquad (6)$$

Firms centralize production for both markets at home and export to the foreign market when $M_F < M_F^*$. For larger foreign markets, they engage in FDI and serve the foreign market via exports. Each term in the expression corresponds to an important concept in the theory of the multinational. In the numerator, K indicates the importance of *plant-level economies of scale*. The larger are scale economies, the larger will the foreign market have to be to justify the additional fixed costs of setting up a new factory overseas. In the denominator, we see first *trade costs*. The bigger they are, the smaller the critical size of the foreign market. In parentheses in the denominator we see the home country's *comparative advantage* (when $w_F - w_H > 0$). The larger the home comparative advantage, the bigger the foreign market will have to be to justify replicating investment.

III. THE OBSERVED RELATIONSHIP BETWEEN FDI AND EXPORTS

Straightforward intuition, supported by the algebra of section II, suggests that exports and FDI are alternative modes for serving foreign markets. Changes in trade costs, market sizes, relative production costs, or the importance of scale economies can shift relative benefits in one direction or the other, causing the firm to switch from one mode to the other. It is natural (but incorrect) to suppose that this theoretical argument implies that one should see a negative relationship between FDI and exports in the data. We shall see that this is rarely the case. In this section we use three figures to look directly at the relationship between the variables of interest.

What kinds of data could be used to investigate the relationship between exports and FDI? The most obvious sort are data on a cross-section of potential host countries. Consider a given source country. Its firms could choose to serve some of these foreign markets via exporting (the nearby, small markets with low tariffs) and some via FDI (the distant, large markets with high tariffs). What should we expect a graph of export levels versus FDI levels to look like? Taking the section II theory seriously, we would expect all the data to lie on the horizontal axis (all firms choose FDI) or the vertical axis (all firms choose exporting). The correlation between FDI and exports would necessarily be negative.

Figure 3 illustrates the actual relationship between cross-national variation in FDI and exports using data from the Appendix of Brainard (1997). Each point in Figure 3 represents a country, with two-letter International Standards Organization (ISO) codes used as labels. The measure of FDI is the sales of US-owned affiliates located in each country. Export amounts are totals (i.e. *not* limited to US parents or affiliates). The striking aspects of this figure are that FDI and exports *coexist* (both are uniformly positive) in Brainard's sample and they exhibit a pronounced positive *correlation*. The line through the data graphs the ordinary least squares (OLS) regression of log(exports) on log (affiliate sales). The corresponding elasticity of 0.63 is highly significant (t-statistic of 5.5).

A second type of cross-section variation comes from selecting a single host country and examining how sales of foreign-owned affiliates there relate to imports from a cross-section of origin countries. Figure 4 uses data on US inward FDI, relating sales of foreign-owned affiliates in the USA to total US imports from the FDI source country. The statistical relationship is positive in this case as well, although it is intriguing to note that, with an elasticity of 0.26, it is substantially weaker.

The theory of section II relates to firm-level decision making and it is, therefore, natural to examine cross-sections of firms. In prior work, Head and Ries (2001, 2003) combine export information from annual reports with a published survey of Japanese overseas investment. Figure 5 graphs exports of 26 large (domestic employment over 15,000) Japanese manufacturing firms versus employment at overseas manufacturing affiliates.

Once again we find that FDI (here measured by affiliate employment instead of affiliate sales) and exports coexist and exhibit a raw positive correlation. All Japanese manufacturing firms with more than 15,000 employees in Japan conduct FDI *and* export. Relaxing the size cut-off to the 44 firms with

Figure 2
The Critical Foreign Market Size to Justify Replicating Investment

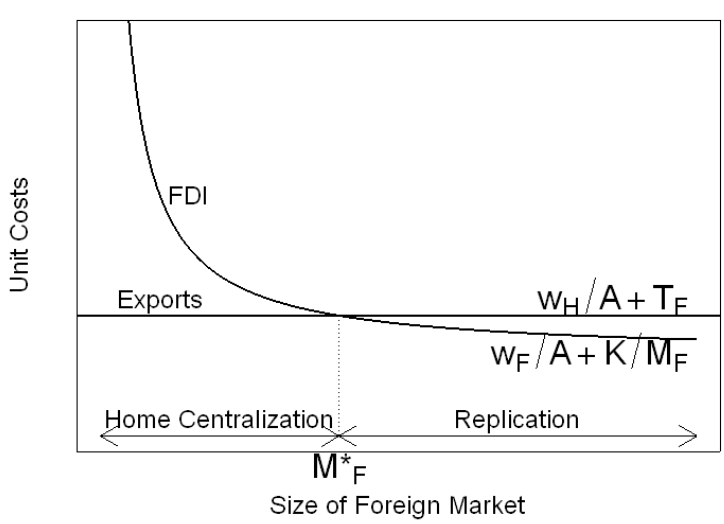
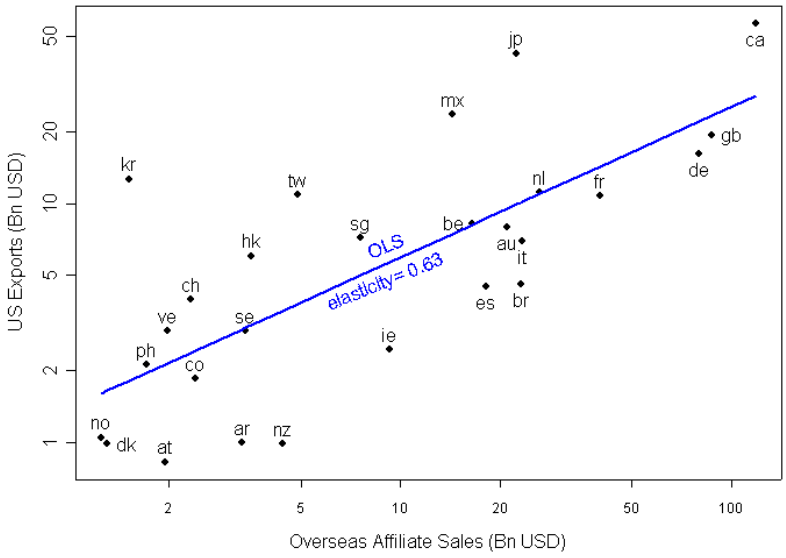


Figure 3
Overseas Sales of US-owned Affiliates and Total US Exports, 1989



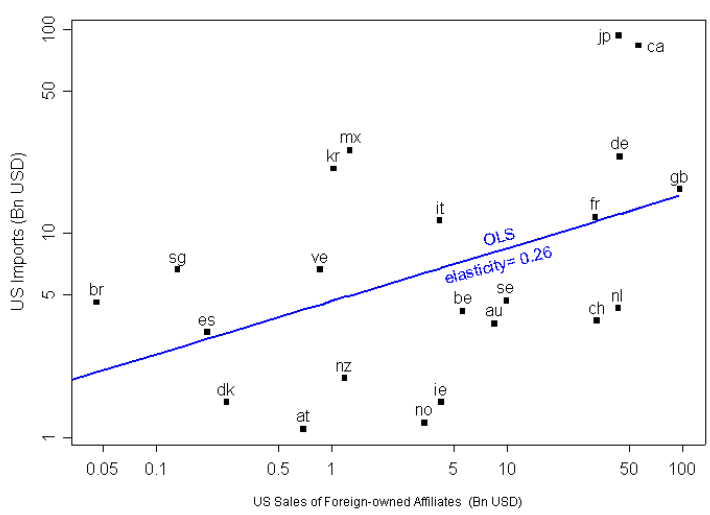
Source: Brainard (1997, Table A1).

10,000 or more domestic employees, there are just two firms with zero exports (a printing company and a baking company).

The best-known Japanese makers of cars and consumer electronics—Toyota, Nissan, Honda, Matsushita, Sony, and Toshiba—all appear in the 'north-east' section of the figure, where both overseas employment and exports are largest. The elasticity in a log–log regression is 0.45 (*t*-statistic of 3.4).

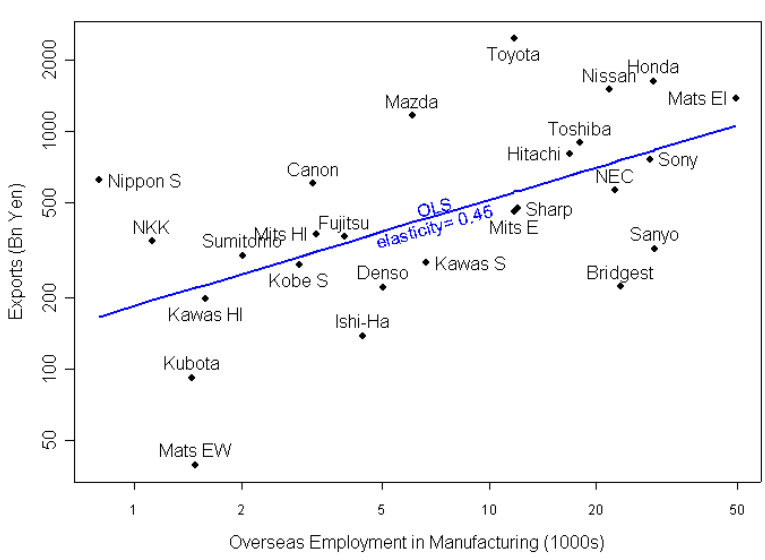
How can we account for the finding that both FDI and exports are positive across the board and highly correlated with each other? One possibility is that the basic theory is wrong in an important way: overseas production actually complements exports instead of displacing them. We consider this

Figure 4
US Sales of Foreign-owned Affiliates and Total US Imports, 1989



Source: Brainard (1997, Table A1).

Figure 5
Japanese Firm-level Overseas Employment and Exports, 1989



hypothesis later in the paper. The intuition behind a substitutive relationship is very strong and should be taken seriously. Consequently, we next investigate explanations that can reconcile core aspects of the section II theory with the empirical facts shown in Figures 3, 4, and 5.

In the next section of the paper, we extend the simple model of the export and FDI decision to explain why exports and FDI can coexist in equilibrium. The following section identifies reasons for their positive correlation.

IV. EXPLAINING THE COEXISTENCE OF FDI AND EXPORTS

The theory outlined so far assumes that FDI and exports are substitute modes through which to reach foreign markets. Yet in the data we observe both. Below we outline three situations where exporters and investors coexist in equilibrium. The first two pertain to single-product firms. We consider representative firms first and then firms that are exogenously heterogeneous. The third situation arises when firms produce more than one good.

(i) Single-product, Representative Firms

In the absence of price effects and competitor interactions, the simple theory predicts that, given a particular combination of market sizes, trade costs, wages differences, and plant-level fixed costs, all firms make the same mode decision. While useful to portray the forces that influence the FDI versus export decision, it abstracts from the effects of mode decision on price and quantity sold.

Traditional theories of horizontal FDI in the economics literature assume imperfect competition between representative firms. Important examples include Brainard (1997) and Markusen (2002). While one might expect that identical initial conditions would imply a common mode choice, this does not necessarily occur. Asymmetry in outcomes can arise from what is called the 'market-crowding' effect. When more firms produce locally overseas, the prospective profits for the next firm decline. This would not occur in the simple model of section II because demand and price are both assumed to be exogenous and, therefore, not affected by firm-location decisions. Models with downward-sloping demand can exhibit interior, or what Brainard calls 'mixed', equilibria in which otherwise identical firms divide themselves into exporters and overseas producers.

To understand the market-crowding effect, consider an initial situation where all firms export (home centralization). A fall in plant-level fixed costs then makes it more profitable for at least some firms to engage in FDI while maintaining their home plants to serve the home market (replication in Figure 1). Firms begin to switch to FDI and will continue to do so as long as the additional benefits of overseas production associated with avoiding trade costs exceed the fixed costs of operating a second plant. Define $\Pi_I(s)$ and $\Pi_X(s)$ as the variable (gross) profits of FDI and exporting expressed as a function of the share of firms that serve the foreign market through FDI, s. Firms have an incentive to become investors as long as $\Pi_I(s) - \Pi_X(s) > K$. The market-crowding effect occurs when the left-hand side of the inequality, $\Pi_I(s) - \Pi_X(s)$, falls with s. An interior solution, $0 < s < 1$, obtains when this term falls to K.

To see the market-crowding effect in a simple segmented market, Cournot setting, consider a foreign market with inverse demand $P = a - bQ$ for the goods produced by home firms. Let N denote the total number of firms serving the foreign market. A share s serve the market via FDI, producing output q_I each. There are $(1-s)N$ exporters that produce q_X each. In this setup, $\Pi_I = bq_I^2$ and $\Pi_X = bq_X^2$. Output for each firm depends on s, the share of firms that are multinationals. Market-crowding occurs when

$$\partial(\Pi_I - \Pi_X)/\partial s = 2b(q_I\,\partial q_I/\partial s - q_X\,\partial q_X/\partial s) < 0. \quad (7)$$

It turns out that with linear demand, $\partial q_I/\partial s = \partial q_X/\partial s < 0$. Thus

$$\partial(\Pi_I - \Pi_X)/\partial s = 2b(\partial q_I/\partial s)\,(q_I - q_X). \quad (8)$$

Since investors avoid trade costs and thereby have higher sales than exporters, $q_I > q_X$, and $\partial(\Pi_I - \Pi_X)/\partial s < 0$. Thus, market crowding occurs. Intuitively, because investors avoid trade costs and sell more output in foreign markets than do exporters, the price-depressing effect of more firms choosing to become investors has a greater impact on MNC profits than it does on the profit of exporters.

Head *et al*. (2002) show that the market-crowding extends to single-plant firms choosing whether to centralize production at home or in a foreign market. This market-crowding effect is common to models of FDI with representative firms and imperfect competition and gives rise to the coexistence of exporters and investors in equilibrium.

(ii) Single-product, Heterogeneous Firms

We have shown that the critical determinants of the choice of FDI versus exporting are trade costs, plant-level fixed costs, comparative production costs, and market size. Trivially, if we allow these parameters to vary across the firms that constitute the data set, we could observe FDI–export coexistence. An emerging literature examines how exogenous productivity differences across firms can predict whether a firm chooses to be an exporter or an investor.

Helpman *et al*. (2004) develop a monopolistic competition model where firms choose between a home centralization (exporting) and a replication strategy. Firms exogenously differ in their level of productivity that is captured by differences in marginal costs of production. Each firm produces a unique variety

and consumers have Dixit–Stiglitz preferences. Firms choose FDI over exporting if the benefits associated with avoiding transportation costs exceed the fixed costs of establishing a second plant. They find that the most productive firms engage in FDI, the least productive firms do not serve the foreign market at all, and firms with intermediate productivity levels export. Head and Ries (2003) find that, in the case where factor prices are the same in the home and foreign country and the choice is between home centralization and replication, these results extend to the case of per-unit (instead of iceberg) trade costs and linear, independent (instead of constant elasticity of substitution) demand curves for each firm's product.

Figure 6 shows profits associated with exporting and FDI for firms with different levels of productivity using the Head and Ries (2003) model (a similar graph appears in Helpman *et al*. (2004) except that profits are linear in their productivity term). Consider the solid lines. For firms with very low levels of productivity ($A < A_X$), neither exporting nor FDI are profitable. These firms do not serve the foreign market at all. Profits associated with FDI are lower than those for exporting owing to the fixed costs of establishing a foreign plant, K. As productivity increases, FDI profits rise more rapidly than exporting profits. This means that there is a critical productivity level, A_I, above which firms choose to become investors. This model predicts that, within the same industry, firms that conduct FDI and firms that export will coexist. This framework can also be used to explain why individual firms simultaneously engage in FDI and exporting as shown in Figure 5. The dotted line shows profits of FDI to a hypothetical market with a higher fixed cost, $\widetilde{K}$. In this case, the critical productivity necessary for FDI to be preferred to exporting shifts to the right. Now a firm with productivity y will export to the high-fixed-cost market and carry out FDI in the low-fixed-cost market. Aggregating across many markets with different configurations of fixed costs (or trade costs or market sizes) leads to firms having simultaneous positive levels of exports and FDI.

Head and Ries (2003) also consider the third option described in the simple theory of section II—foreign centralization. Helpman *et al*. (2004) do not consider this strategy because they assume that a firm must have a production facility in a country to be based there. We allow for separation of control (done at home in all cases) from production. Since all firms prefer big markets with low costs, the interesting situation in the home versus foreign centralization decision occurs when there is a trade-off between a large, high-cost market and a small, low-cost market. Head and Ries (2003), find that the profits associated with foreign centralization, exceed those of home centralization for firms with *low* productivity levels. Thus, it is low-productivity firms seeking low costs who invest abroad. While exporters and investors co-exist in this scenario, the productivity ordering is reversed relative to Helpman *et al*. (2004).

Empirical work supports the prediction that firms that engage in FDI tend to be more productive than firms that supply foreign markets through exports. Head and Ries (2003) consider a sample of 1,070 Japanese manufacturers and find that, within industries, firms that engage in both FDI and exporting on average have greater domestic sales and higher productivity than firms that export and do not conduct FDI. Girma *et al*. (2003) and Girma *et al*. (2004) apply tests of stochastic dominance to data sets comprising, respectively, UK and Irish firms. The papers show that the productivity distribution of multinational firms dominates that of export firms. Helpman *et al*.'s (2004) model implies that we should observe a higher ratio of export to foreign affiliate sales in industries where the sales dispersion of firms is greater, a result they find in their study of 52 US manufacturing sectors.

The recent analysis of productivity and the FDI versus export decision establishes that firm-level heterogeneity gives rise to firms in the same industry choosing different modes through which to serve foreign consumers. Aggregating across firms, we will observe one country having positive levels of FDI and exports into another country. Since firms make different mode choices for different markets, aggregating firm activities across foreign markets will result in firms both exporting and conducting FDI.

(iii) Multi-product Firms

Allowing for multi-product firms offers a straightforward explanation of the co-existence of exports and FDI in firm-level data. If a firm's products were

Figure 6
Heterogeneous Productivity and the Export versus FDI Decision

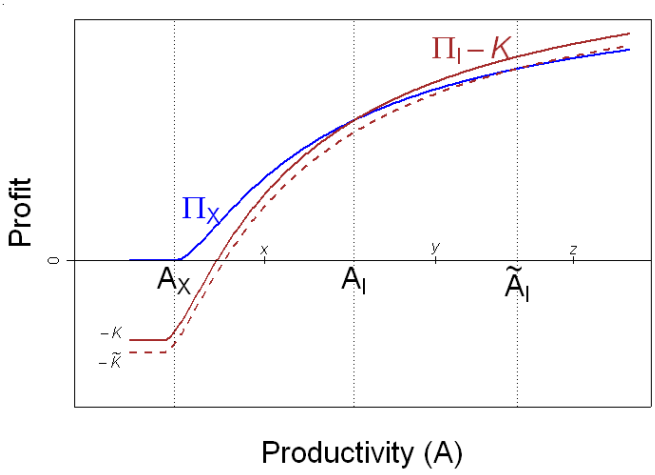
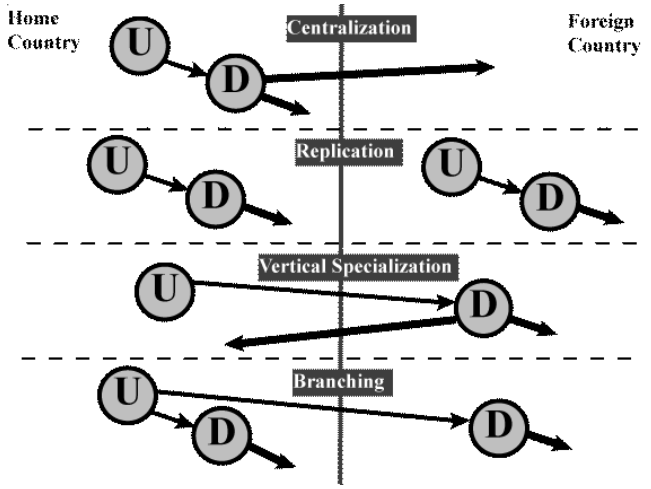


Figure 7
How FDI Affects Exports of Vertically Integrated MNCs



horizontally related and it pursued a home centralization strategy for one product but a foreign centralization or replication strategy for another (see Figure 1), then this firm would simultaneously export and conduct FDI. Baldwin and Ottaviano (2001) have a model that shows that effects similar to the market-crowding phenomenon described earlier can induce firms to separate spatially the manufacture of two (or more) horizontally related products. The idea is that if the manufacture of the two products took place in the same country it would make the products compete more with each other. The desire to avoid cross-product 'cannibalization' generates a centrifugal force that encourages firms to centralize each product in a different country (product one is home centred and product two is foreign centred).

A vertically integrated firm may also engage in simultaneous exporting and FDI. Figure 7 shows possible configurations for a firm that manufactures an upstream product (U, e.g. car parts) and downstream product (D, e.g. car assembly). Now replication means placing both stages of production, U and D, in the foreign country. Vertical specialization occurs when U and D are concentrated in single sites and located in different countries. The fourth configuration, branching, centralizes the upstream product at home but replicates the downstream product in both countries. Different combinations of the basic determinants—trade costs, plant-level economies of scale, comparative advantage, and market sizes—will make one configuration preferable to others. Vertical specialization and branching

are associated with a multi-product firm that both exports and engages in FDI. Note that vertical specialization and branching lead to greater distance between upstream and downstream activities relative to the other configurations. High trade costs between upstream and downstream activities would militate against the outcome of simultaneous export and FDI by a firm producing vertically related products.

V. EXPLAINING THE POSITIVE CORRELATION BETWEEN FDI AND EXPORTS

The previous section offers several solutions to the puzzle of the simultaneous positive levels of exports and FDI portrayed in Figures 3, 4, and 5. Since exporting and FDI are alternative modes of serving foreign consumers, we would expect conditions conducive to one to deter the other. Hence, we should expect a foreign market where exports are high to host low levels of FDI. However, these figures and most other evidence we know of suggests a raw positive correlation. In this section we consider possible explanations for the positive correlation.

Of the factors that influence the export versus FDI decision, trade costs should be positively related to FDI but negatively related to exports, whereas fixed costs and home-country comparative advantage should be positively related to exports but negatively related to FDI. Thus, variation across foreign markets in these factors cannot explain the positive correlation in the data. The remaining candidate is the size of the foreign market for the MNC's products (M_F in section II). There are three effects associated with an increase in the size of the foreign market. First, it will increase the number of firms pursuing replication and decrease the number of exporters. Second, it will also increase the foreign production levels of the firms that choose to be multinationals even in small markets. Finally, it will increase the export levels of firms who continue to export. FDI increases as the foreign market expands, but the total effect on exports is ambiguous. To investigate the effect on exports, consider the calculus. Total exports are $Q_X = (1–s)\, N\, q_X$ where s, as before, denotes the share of the N firms that choose to produce abroad. Let M represent either the exogenous size of the foreign market as in section II or, in more general models, some exogenous variable that shifts the foreign demand curve. Taking the derivative of Q_X with respect to a demand shock leads to

$$\partial Q_X / \partial \mathrm{M} = \mathrm{N} \left[(1–\mathrm{s}) (\partial q_X / \partial \mathrm{M}) – (\partial \mathrm{s} / \partial \mathrm{M})\, q_X \right].$$

The first term in brackets is positive for all $s<1$, since more demand stimulates exports of all continuing exporters. The second term is negative because increased demand causes firms to switch to overseas production. However, starting from a position where foreign demand is very low, s will be near zero and so will q_X. This means the first term will be larger in absolute value than the second and thereby ensures that, over some range, demand shocks will cause total exports, Q_X, to exhibit a positive correlation with foreign production. The correlation will be higher in situations where the shares of firms conducting FDI are not very sensitive to market size, i.e. $\partial s/\partial M$ is near zero. Multi-product firms where there is a strong incentive for spatial separation or where the two products have very different comparative advantages would be cases where we would expect low propensities for firms to switch entirely from exporting to FDI.

Most research on the correlation between exporting and FDI recognizes the potential of demand variation across foreign countries to lead to positive correlation. The problem is that it is not enough just to include a control variable, such as host-country GDP, on the right-hand side. There will inevitably be unobserved variation in firm-level demand that has the tendency to create a positive correlation between exports and FDI, even when the two are substitutes. Studies can mitigate this tendency by using a variety of controls. However, these studies generally also control for variation in trade costs and comparative production costs. The question then is, after including the full set of controls, whether the remaining variation in overseas production is more correlated with unobserved demand variation or the other types of variation that would produce a negative correlation between exports and FDI? We see no *a priori* way to answer this question and are therefore sceptical that positive partial correlations between exports and FDI can be reasonably construed as evidence against substitution.

We refer to positive correlation between FDI and exports resulting from underlying variation in demand as 'statistical complementarity' in order to contrast it with a different phenomenon that we refer to as 'economic complementarity'. The latter can be defined through either of two possible thought experiments. First, suppose a 'helicopter drop' exogenously endowed a firm with an overseas production facility. Would its exports increase as a result? If so, FDI and exports are complements in the sense that the marginal profitability of exporting is increasing in FDI. Second, suppose that the cost of FDI were to decline, would exports increase? If so then the standard condition for complementarity used in consumer theory obtains. To put these definitions in more familiar context we could say that coffee and tea, which are probably economic substitutes, could be 'statistical' complements if unobserved demand variation for hot caffeinated beverages caused consumption of tea and coffee to exhibit positive correlation in the data. Meanwhile coffee and milk would be economic complements if a helicopter drop of coffee induced the recipients to buy more milk or if a reduction in the price of coffee caused an increase in milk purchases.

Returning to exports and FDI, what forces could cause economic complementarity? Figure 7 offers an answer. A firm that produces both upstream and downstream products may exhibit economic complementarity in the case where its FDI takes the vertical specialization or branching forms. The reason is that while overseas production of D would displace exports of D from home to foreign, it would also create derived demand for home-produced U. In many plausible cases, however, FDI will not be associated with a net increase in exports. Consider a firm starting with a home centralization strategy that decides to shift to branching. Suppose exports of D in the initial centralization strategy are $100 and U constitutes 50 per cent of total D value. In this case, the shift to branching displaces the $100 D exports, a reduction partially offset by $50 of U exported from home to provide intermediates to the production facility in foreign. In this case, FDI reduces exports. For total exports to increase, production of D must increase as a consequence of the FDI. This may occur because foreign offers lower production costs or better market intelligence. The overall effect on home exports of switching from a foreign centralization strategy to a vertical specialization strategy depends on home market size and the cost share of U in final production. In the case of a 50 per cent cost share and equal sized home and foreign, total exports are unchanged. A higher cost share for parent-supplied intermediates or a larger home market would result in increased exports (complementarity).

The existence of vertically integrated firms does not contradict the results of the standard theory exposited in section II: *FDI in D still displaces exports of D*. However, the consideration of intra-firm trade does say that at the level at which we observe the data, economic complementarity could be a second source of positive correlation between exports and FDI. We now review the empirical evidence, finding some support for the standard substitutes view of the MNC, some direct evidence for the mechanisms that cause economic complementarity, and some results that could be consistent with either statistical or economic complementarity.

VI. SUBSTITUTES OR COMPLEMENTS? REGRESSION EVIDENCE

'The relationship between direct investment by US firms and the decline in US export trade shares has been a subject of bitter controversy for at least the last twenty years.' (Lipsey and Weiss, 1981)

This opening sentence—from a paper published 23 years ago—reveals that the issues considered in this paper have remained unsettled for over 40 years. We organize our review of the regression evidence on the relationship between FDI and exports as follows. First, we consider papers that regressed exports on measures of outward FDI (usually affiliate sales or employment). We then turn to papers employing the 'cross-price elasticity' method. This involves regressions where the dependent variable is exports or FDI and the explanatory variables comprise the exogenous determinants of the costs of FDI and exporting. Substitutive relationships are indicated when a rise in the cost of FDI raises exports or when an increase in the cost of exporting induces more FDI. A third set of papers explicitly addresses vertical links as a possible cause of a positive relationship between exports and FDI.

Lipsey and Weiss (1981) regress 1970 US exports to 44 destination countries on the sales of locally produced goods of US-owned affiliates in those countries. They report coefficients for 14 industries and always consider developed country destinations in separate regressions from less-developed countries. Owing to some missing data for less-developed countries, there are 25 estimates of the impact of US FDI on US exports. Of these, 23 estimates are positive and 20 of those significantly so. Lipsey and Weiss were aware of the danger that omitted variables could drive the correlations. In response, their regressions control for destination GDP and distance. These rough proxies for demand and trade costs leave a great deal in the residual. A creative idea of Lipsey and Weiss is also to run the same regressions on exports of 13 other source countries to the same destinations. To the extent that US-owned affiliate sales is just a proxy for industry-level demand, we should expect a positive correlation. However, only one of the 25 coefficients is significantly positive whereas 13 are significantly negative. One interpretation, favoured by Lipsey and Weiss, is that overseas production complements exports of the parent firm but substitutes for exports of rival firms (based in the other 13 countries). Alternatively, all three may be substitutes for each other but there may be unobserved variation in the extent that customers prefer the particular goods produced by American firms. When this demand is relatively high, US exports and US affiliate production will tend to be high and, conversely, exports by other less-preferred firms will be lower.

In a follow-up paper, Lipsey and Weiss (1984) again examine the relationship between US affiliate sales and exports to a cross-section of destination areas in 14 industries. The primary contribution of this sequel lies in its use of firm-level data. However, the study does not include destination-specific fixed effects for the five destination areas and therefore the coefficients reflect both within- and between-destination variation. Thus, omitted characteristics of destinations can generate positive bias. As with its predecessor, Lipsey and Weiss's 1984 paper concludes that the data do not exhibit the negative relationship predicted in the basic 'substitutes' model.

Using data on US, Swedish, and Japanese multinational activity, a large number of papers[2] corroborate the Lipsey and Weiss results. These studies take a variety of approaches to dealing with the problem of unobserved variables that simultaneously promote exports and FDI. Some focus on time-series variation instead of cross-sections of destinations and firms. Blomstrom *et al*. (1988) examine long differences: the changes from 1970 to 1978. Clausing (2000) uses destination-specific fixed effects. Pfaffermayr (1994) subjects export and FDI data for Austria to a battery of time-series methods and concludes that positive causation runs in both directions.

To respond to the issue of endogenous determination of FDI, a number of papers instrument for FDI and use two-stage least squares.[3] However, one cannot solve the problem of endogenous determination of FDI without an appropriate instrumental variable for affiliate production. This instrument must be (*a*) correlated with FDI, (*b*) not itself simultaneously determined with exports, and (*c*) excludable from the export equation. Condition (*c*) means that, holding FDI constant, the instrument has no effect on exports. Two examples illustrate that this condition is hard to satisfy. Blomstrom *et al*.'s (1988) use of membership of the EEC as an instrument for affiliate sales is inappropriate since the European Community levies a common external tariff that should be expected to affect exports directly. Similarly, average employee compensation (Clausing, 2000, Table A1) does not just affect export decisions by changing FDI. Higher wages in the destination country can stimulate exports regardless of the level of FDI in the host country by making the exporter more competitive relative to domestic firms in that country. Use of two-stage least squares benefits from a careful consideration of the underlying structural equation to be estimated. The stringent requirements for identifying this equation lead us to doubt that appropriate instrumental variables can be found.

Only a handful papers that regress exports on FDI find the negative partial correlation that would immediately suggest that the two are substitutes. Head

[2] These papers include Swedenborg (1979, 1982), Blomstrom *et al*. (1988), Pfaffermayr (1994), Clausing (2000), Lipsey *et al*. (2000), and Lipsey and Ramstetter (2003).

[3] See Swedenborg (1979, 1982), Blomstrom *et al*. (1988), Grubert and Mutti (1991), Svensson (1996), and Clausing (2000).

and Ries (2001) use firm-level data on Japanese manufacturers from 1965 to 1989 and find that, after controlling for firm fixed effects, FDI substitutes for the exports of 19 large Japanese electronic and automobile assemblers. These firms are not vertically integrated and, therefore, typically do not supply overseas affiliates with intermediates produced by the parent in Japan. Belderbos and Sleuwaegen (1998) use figures showing rising numbers of Japanese-owned plants apparently displacing exports from Japan for specific electronic products such as VCRs, photocopiers, and microwave ovens. In firm-level regressions, they find that new plants established in Europe between 1986 and 1988 were negatively related to exports to Europe by 86 electronics producers. Blonigen (2001) finds that Japanese affiliate employment in US plants producing specific auto parts (bumpers, rear-view mirrors, radio-cassette players, safety glass, etc.) was negatively related to Japanese exports of those same products. The success of the latter two studies in detecting substitution may arise from their focus on narrow product lines and because exports were restricted by government policy during the sample period. In Europe, a wave of anti-dumping actions against Japanese electronics products caused firms to substitute local production for exports. In the USA, voluntary export agreements in the early 1980s motivated Japanese assemblers to locate in the USA and just-in-time inventory systems required that parts-makers followed suit. Instead of there being a common cause encouraging both FDI and exports, policy-mandated impediments to exporting engendered endogenous rises in FDI.[4]

A small number of papers employ a cross-price elasticity approach that identifies substitutive and complementary relationships analogously to consumer theory.[5] Product X substitutes for Y when raising the price of X increases demand for Y. Conversely, when raising the price of X lowers consumption of Y, we say the two are complements. When X and Y are the levels of FDI and exports, the corresponding 'prices' are variables that shift the cost of exporting and FDI. Grubert and Mutti (1991) initiate this approach, showing that high corporate income taxes in the destination country tend to lower exports to that country. Interpreting the corporate income tax as part of the cost of FDI, this result supports complementarity. Clausing (2000) replicates this result using a panel data set and also finds that high wages in the destination country lower exports, a result that adds support for complementarity. Belderbos and Sleuwaegen (1998) find that the probability of a Japanese firm establishing a production plant in Europe is increasing in four different measures of trade barriers (tariffs, anti-dumping measures, quotas, and voluntary export restraints). Thus, raising the 'price' of exporting seems to increase 'demand' for FDI, suggesting substitutes. Amiti and Wakelin (2003) examine exports from the USA to 36 destination countries during the period 1986–94. They find complementarity when conditions make it attractive for US firms to locate unskilled intensive downstream manufacturing abroad. The latter likely induces exports of upstream inputs from the USA. In contrast, for countries where the probable motive for FDI is avoiding trade costs and when intermediate goods trade is therefore unattractive, FDI substitutes for exports.

Economic complementarity occurs when overseas investment induces home country exports of upstream products to the downstream affiliates. Several papers provide evidence that this mechanism is important. Belderbos and Sleuwaegen (1998) find that Japanese firms that are members of electronics *keiretsu* export more to Europe if the *keiretsu* leader has invested there. They also find that exports are higher when the parent firm has opened a distribution affiliate in Europe. Head and Ries (2001) obtain similar results. Exports of the 'followers' in *keiretsu* are higher for larger numbers of overseas investments by the leader. Overseas distribution affiliates also stimulate exports in that study. Blonigen (2001) finds that Japanese-owned auto production in the USA raises exports significantly for 9 out of 10 parts examined. Finally, Head *et al*. (2004) study bilateral US auto parts exports to 26 destinations and show that they are positively related to overseas car production by US-owned assemblers.

[4] For evidence on the US and EU experiences see Belderbos (1997), Bloningen (1998), and Girma *et al*. (2002).
[5] See Grubert and Mutti (1991), Belderbos and Sleuwaegen (1998), Clausing (2000), and Amiti and Wakelin (2003).

VII. CONCLUSION

Multinationals play leading roles in the world economy. One cannot hope to understand globalization's impact on workers, the environment, or even the balance of payments, without first understanding the factors that determine the decisions of these large firms. Analysis of the key decision of whether to serve a foreign market via exporting or FDI has been hampered by a paradox. Theory, supposedly, predicts that exports and FDI are substitutes, yet empirical work, supposedly, finds that they are complements. Both suppositions are misleading. Standard theory predicts a *substitutive relationship for a given firm selling a given product to a particular destination*. An industry comprising many firms or firms that make multiple products can choose *both* FDI and exports. Moreover, unobserved variation in the demand for the MNC's products can lead to a positive partial correlation between exports and FDI that we call 'statistical complementarity'. Our take on the empirical literature is that substitutive relationships can be found when researchers look in the places where theory predicts them—for individual products. 'Economic complementarity' resulting from vertical linkages between downstream FDI and upstream exports finds support in a number of empirical studies. We conclude that there is no compelling evidence to invalidate the standard theory where it is appropriate. However, vertical relations within and between firms argue for the relevance of extended versions of the theory of the MNC that incorporate multistage production.

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