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2 Japanese and U.S. Exports and Investment as Conduits of Growth

Jonathan Eaton and Akiko Tamura

2.1 Introduction

Japan and the United States are two major sources of technological innovation in the world economy. These two countries employ the largest number of research scientists and engineers among the OECD nations and are major patenters of innovations throughout the world (see, e.g., Eaton and Kortum 1994). The dissemination of this innovation around the world takes several forms. One is through the export of new products or of existing products at lower cost. Another is through direct foreign investment (DFI).

Our purpose here is to examine the roles of Japanese and U.S. exports and DFI as conduits of new technology. We first develop a theoretical model of technology diffusion in which one country, the source of innovation, develops new inputs into the production process at a regular rate. A fraction of these innovations are potentially useful in another country, which we call the destination. When these ideas are potentially useful, the innovating firm can introduce them into the destination country either by producing them at home and exporting them there or by investing in the destination country to produce them locally. We compare the desirability of these alternatives. Our model identifies country characteristics that determine the extent to which innovators will use one method or the other to take advantage of their ideas abroad.

The analysis has several implications for the relationship between export and DFI levels, on the one hand, and characteristics of the destination country, on the other. One is that innovators will tend to exploit new ideas in smaller countries relatively more by exporting there, and in larger countries through DFI. For many parameter values our model implies that DFI will be most sig-

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nificant for middle-income destination countries: At low levels of income market size is too small to support much DFI, while high wages in high-income countries deter it. Factors that reduce the fixed cost of DFI, such as a high level of education, obviously encourage it, while factors that raise the opportunity cost of labor, such as a high natural resource endowment, discourage it.

Our model implies that bilateral trade and investment flows can be captured by a modified "gravity model" that relates exports and DFI to destination country characteristics reflecting market size, the cost of direct investment, the level of development, and transportation costs. In the second part of our analysis we estimate such a model for annual Japanese and U.S. exports and outward DFI to a panel of 72 and 76 countries, respectively, during the period 1985–90. Our aim is to identify the characteristics of a country that are significant in determining how much Japan and the United States export and invest there.[1]

Several implications of the theoretical model find empirical support in the export and DFI patterns of both countries: First, distance, as a measure of transport costs, inhibits trade much more than it inhibits DFI. The negative effect of distance on trade exceeds that on DFI for both countries. Second, market size, as measured by population, favors DFI relative to investment: population elasticities for both Japanese and U.S. exports and DFI are less than one but closer to one for DFI than for exports. Third, a high level of human capital, which we interpret as indicative of lower overhead investment costs, is associated with a larger DFI position (although human capital also has a positive, but less substantial, effect on exports from both countries as well).

While these results are common to both Japanese and U.S. trade and investment patterns, others are not. The prediction that the importance of DFI relative to exports peaks for middle-income countries is satisfied by the United States but not by Japan. While population density, which we interpret as implying lower labor costs, is associated with more DFI from the United States, it brings in less from Japan. A possible explanation is that much Japanese DFI occurs to exploit natural resources that are processed for export to Japan (a possibility not captured by our theoretical model).

We estimate the model both with and without regional effects. Except for the role of distance, the basic implications are not very sensitive to the inclusion of

1. Leamer (1984) is the standard reference on the empirical implementation of factor endowments theory to trade flows. Helpman (1987) applies a model of imperfect competition and scale economies to the estimation of trade flows. Our analysis here combines elements of these two approaches. Less work has been done on the empirical specification of investment flows. Mundell (1957), Purvis (1972), and Markusen (1983) model the relationship between trade and investment flows. Helpman (1984) and Markusen (1984) provide models of DFI. The analysis here builds on earlier empirical work of Eaton and Tamura (1994),who analyze regional patterns of Japanese and U.S. trade and investment flows. The current paper develops a theoretical framework for modeling trade and investment flows as well as pursuing an empirical analysis. Moreover, different issues are considered. In particular, here we examine the role of distance and of potential nonlinearitics in the relationship between trade and investment, on the one hand, and the level of development, on the other.

regional effects. We do not undertake a lengthy discussion of regional trade and investment patterns here, which was the purpose of Eaton and Tamura (1994). One finding that is worth reporting, however, is that, correcting for distance and other national features, Japan imports more from the United States than does any other region of the world except East Asia.

We present our theoretical framework in section 2.2. Section 2.3 reports our results on Japanese and U.S. exports and DFI positions. We offer some conclusions in section 2.4.

2.2 A Model of Trade, Investment, and Growth

Our theoretical model focuses on two countries. One, which we call the source, constantly generates innovations for production. The other, the destination, eventually adopts these innovations, but with a lag. The number n of innovations available in the source summarizes the state of technology there, while the size of the subset m of these innovations available to the destination summarizes its state of technology. We first describe the equilibrium at any moment when m and n are given and then turn to what happens as m and n grow over time.

2.2.1 The Static Equilibrium

At any moment the source country can produce a homogeneous, costlessly tradable final output (which serves as numeraire) with a variety of n intermediate inputs according to the standard Dixit-Stiglitz (Dixit and Stiglitz 1977) production relationship:

$$Q = \left(\int_0^n x_i^\rho di\right)^{1/\rho}, \quad \rho \in (0,1).$$

Here Q represents final output and x_i denotes the amount of input i. The implied cost of producing an amount Q is

$$C(p,Q) = \left(\int_0^n p_i^{\rho/(\rho-1)} di\right)^{(\rho-1)/\rho} Q,$$

where p_i is the price of input i. The destination has the technology to use a subset m of these inputs to produce the same final output. Intermediates are produced with one unit of labor in either country.

The technology to produce each intermediate i is owned by a firm in the source, which takes the wages in each country, w_s and w_d in the source and destination, respectively, as given, as well as the prices charged by other input producers in either country. Inputs can be exported, but exporting one unit of any input requires the use of τ workers in the exporting country. Owners of individual input technologies face the decision of where to produce. Inputs in principle can be produced in each market for local production or in one market to service both (or through some combination of the two). To make the analysis less taxonomic we will assume that exporting inputs from country d to country s is so costly that it is unprofitable. (As the reader will see, even with simple assumptions things get complicated.) Hence the $n - m$ inputs that have not been absorbed into the destination's technology are solely produced in country s for use in s. Owners of the m inputs common to both countries must decide whether to serve the destination market by exporting there or by producing there. Exporting a unit requires τ country-s workers, while producing in country d at all requires employing F country-d overhead workers on an ongoing basis.

Since producers of all inputs, whether they export or produce locally, set the prices of their individual inputs taking all other input prices as given, to maximize profit individual producers will charge a markup $1/\rho$ over marginal cost. Hence producers selling in the local market of the source country will always set a price $p_s = w_s/\rho$, while those exporting to country d will set a c.i.f. price $p_X = w_s(1 + \tau)/\rho$ and those producing locally in country d will charge $p_D = w_d/\rho$.

The Source

Since the source produces all of its own inputs, we can take care of it quickly. From the cost function implied by the production function, zero profits in the production of the final (numeraire) good require that $p_s = n^{(1-\rho)/\rho}$ or a wage in the source country of

$$w_s = \rho n^{(1-\rho)/\rho}. \quad (1)$$

Hence as n grows, allowing for greater division of labor in country s, so does the wage there.

The Destination

In the destination country, however, there are two potential sources of input supply, so that things are more complicated.

Denote by λ^D the fraction of the m inputs that have been absorbed into country d's technology that producers choose to produce in country d (so that the remaining $1 - \lambda^D$ are exported from country s). The cost of producing a unit of final output in country d is then

$$c_D = \{m[(1 - \lambda^D)\upsilon_X + \lambda_D\upsilon_D]\}^{(p-1)/p},$$

where $\upsilon_X = p_X^{\rho/(\rho-1)} = (1 + \tau)^{\rho/(\rho-1)}/n$ and $\upsilon_D = p_D^{\rho/(\rho-1)}$. For country d to compete in the world market for the final good requires that local production be competitive, or that

$$1 = c_D = \{m[(1 - \lambda^D)\upsilon_X + \lambda^D\upsilon_D]\}^{(\rho-1)/\rho}. \quad (2)$$

In order for any domestic production of inputs to occur it must be the case that the marginal cost of producing locally is less than that of importing (since the first requires a fixed cost while the second does not). Thus $\upsilon_D > \upsilon_X$. Hence the zero-profitability condition (2) implies a negative relationship between λ^D and υ_D.

The profit earned from producing an input in country d is

$$\pi_D = (1 - \rho)\{m[(1 - \lambda^D)\upsilon_X + \lambda^D\upsilon_D]\}^{-1/\rho}\upsilon_D Q_d - w_d F,$$

where Q_d is the amount of the final good produced in country d, while the profit earned from exporting to country d is

$$\pi_X = (1 - \rho)\{m[(1 - \lambda^D)\upsilon_X + \lambda^D\upsilon_D]\}^{-1/\rho}\upsilon_X Q_d.$$

For $\lambda_D \in (0,1)$, then, requires that $\pi_X = \pi_D$ or, incorporating the zero profitability of final production condition (2), that

$$\upsilon_D - \upsilon_X = \frac{\rho\upsilon_D^{(\rho-1)/\rho}F}{(1 - \rho)Q_d}. \tag{3}$$

If the left-hand side of equation (3) exceeds the right, then $\lambda_D = 1$, while if the right-hand side exceeds the left, then $\lambda_D = 0$.

If there are L_d workers available to direct foreign investors in country d, then $L_d - \lambda^D mF$ of them will be available for final production of inputs. These will divide themselves evenly among the $\lambda^D m$ inputs that are locally produced. Hence the amount of each locally produced input will be $x_D = L_d/(\lambda^D m) - F$. The production of final output in country d is therefore

$$Q_d = \frac{(m\lambda^D)^{(1-\rho)/\rho}L_d - (m\lambda^D)^{1/\rho}F}{[1 - (1 - \lambda^D)m\upsilon_X]^{1/\rho}}. \tag{4}$$

Hence equation (1) determines w_s and (hence $p_s = w_s/\rho$, $p_X = w_s(1 + \tau)/\rho$, and $\upsilon_X = p_X^{\rho/(\rho-1)}$) as a function of n, the state of technology in country s, as well as the production parameter ρ and the transport cost τ. Equations (2), (3), and (4) then determine the wage in country d, w_d (and thus p_D and υ_D), the fraction of inputs produced in country d, λ^D, and output in country d, Q_d, as functions of the wage in s, the labor force in d, L_d, the number of inputs that can be used in d, m, and the production function parameter ρ and the number of overhead workers F.

Solving the four equations, the equilibrium fraction of inputs produced locally turns out to be

$$\lambda^D = \min[\tilde{\lambda}^D, 1],$$

where

$$\tilde{\lambda}^D = \frac{x}{2\rho}\left[-1 + \sqrt{1 + \frac{4(1 - \rho)\rho}{x}\frac{L}{Fn\sigma}}\right] \tag{5}$$

and where $\sigma = m/n$, the fraction of inputs that country d can use, $x = (1 - \sigma\tau')/\sigma\tau'$, and $\tau' = (1 + \tau)^{\rho/(\rho-1)}$. Note that λ^D increases with the ratio of the labor force to the required number of overhead workers $L/(Fn\sigma)$ and with the transport cost τ and decreases with the fraction of inputs σ that country d can use.

2.2.2 Dynamics

Our concern is with a situation in which the countries grow over time. We model this as the process of n and m growing at a common rate g.[2] Obviously, if the number of overhead workers required to produce a good locally remains constant, without any growth in the labor force eventually almost all inputs in the destination country will be imported. Since the ratio of the volume of trade to output seems to have remained roughly constant over time, even as the division of labor has increased, technical progress must have occurred in overhead as well. To allow for a steady state in which the proportion of trade to production remains constant even as the world economy grows we let the fixed cost of DFI fall in proportion as the number of available inputs increases. We also want to allow for the possibility that more advanced countries, that is, destination countries that are better able to absorb new foreign technologies, might also provide overhead services more efficiently. To capture these effects we set $F = f/(\sigma^{\mu}n)$, where f is a positive constant and μ is a (presumably positive) parameter capturing the effect of relative productivity on the efficiency with which overhead services can be provided.

Incorporating this expression for F into equation (5) we get a share of DFI (if it is interior) of

$$(6) \qquad \tilde{\lambda}^D = \frac{x}{2\rho}\left[-1 + \sqrt{1 + \frac{4(1-\rho)\rho}{x}\frac{L\sigma^{\mu-1}}{f}}\right],$$

which is independent of the current state of technology n. Under these assumptions output in the two countries will grow at a common rate $(1 - \rho)g/\rho$, with the relative productivity of the destination depending on σ. The fraction of inputs produced locally will remain constant over time.

It remains the case that countries that are larger relative to the fixed cost parameter f, and countries that are more expensive to export to, will have relatively more investment. Depending on the parameter μ, however, the share of products produced locally might rise or fall with the destination's relative productivity as reflected by the ratio σ.

To illustrate what the model implies for the relationship between a country's

2. Krugman (1979) provides a growth model in which the steady state has this property. Here, as in Krugman, new products erupt in the source country spontaneously and trickle down to the destination. Our model could accommodate an endogenous R&D process as in Grossman and Helpman (1991), but since our focus is on how technologies are transmitted rather than how they are developed we treat innovation as exogenous.

ability to absorb technology and how much DFI it attracts relative to exports, table 2.1 reports values of λ^D and the ratio of exports to output (X/Q) for values of σ between .1 and 1 (at intervals of .1). In our base case, reported in the first pair of columns, $L/f = 5$, $\rho = .75$, $\rho = 0.5$, and $\mu = 2$. Our choice of μ implies that overhead requirements fall more than in proportion to the number of inputs that the country can use. The chosen value of ρ implies an elasticity of substitution between inputs of 4 and a markup over the marginal cost of production of 33 percent. Transport costs are 5 percent of the marginal cost of production in the source. Given these other parameter values, our choice of the ratio of the fixed cost parameter to the labor force implies a ratio of overhead to production workers of between 5 and 10 percent.

We also report the implications of (1) dropping μ to 1 (so that overhead requirements in more advanced countries are exactly inversely proportional to their ability to adopt inputs), (2) dropping ρ to .5 (so that the elasticity of substitution between inputs is 2), (3) raising τ to .1, and (4) doubling the labor force.

Several things are worth noting in table 2.1: First, doubling the population raises the fraction of inputs produced locally, with more effect in richer countries. The model thus predicts that DFI will tend to increase more than in proportion to the destination country's size while exports will increase in less than proportion. At the same time an increase in population acts to reduce the ratio of exports to output. Hence the model predicts nonhomogeneity in the relationship between country size, on the one hand, and exports and DFI, on the other, with an increase in country size leading to a less than proportional increase in exports but a more than proportional increase in DFI.

Second, the relationship between the destination's ability to absorb technology and the extent to which source country innovators will exploit their ideas through DFI can be nonmonotonic. In all but the case in which $\mu = 1$ it is an "inverted U" relationship, with the fraction of inputs provided through invest-

Table 2.1 **Simulated DFI and Export Shares**

	Base		$\mu = 1$		$\rho = .5$		$\tau = .1$		$L/f = 10$	
σ	λ^D	X/Q	λ^D	X/Q	λ^D	X/Q	λ^D	X/Q	λ^D	X/Q
.1	.12	.08	1.00	0	.25	.07	.12	.07	.25	.07
.2	.24	.13	1.00	0	.47	.10	.24	.11	.47	.09
.3	.34	.17	.99	0	.66	.10	.35	.15	.64	.09
.4	.43	.20	.92	.03	.80	.08	.44	.17	.77	.08
.5	.49	.22	.84	.07	.89	.05	.51	.18	.84	.07
.6	.53	.25	.77	.12	.93	.04	.56	.20	.88	.06
.7	.54	.28	.70	.18	.91	.06	.59	.22	.87	.08
.8	.53	.33	.62	.27	.85	.12	.60	.24	.83	.11
.9	.49	.40	.53	.37	.72	.24	.59	.28	.76	.19
1.0	.42	.50	.41	.50	.45	.52	.55	.33	.63	.32

ment peaking for middle-income countries. The share of DFI rises between the poorest and middle-income countries because the fixed cost falls, but for richer countries this effect is overshadowed by the higher labor costs in the more advanced country. When $\mu = 1$ the first effect is inoperative so that only the second manifests itself, so that the share of inputs provided through DFI falls as σ rises.

Third, despite the nonmonotonicity in the relationship between the fraction of inputs provided through DFI and output, exports tend to rise with σ. The reason is that as σ rises so does the wage and the cost of production in the destination country relative to the cost of production in the source. Since the elasticity of substitution between inputs exceeds 1, an increased relative cost of production and, hence, through the fixed markup, an increased price, implies a lower expenditure on the input. Hence a poor country tends to use a much larger amount of a domestically produced input, relative to an imported input, than a richer country. Notice that when the elasticity of substitution falls to 2 the tendency of exports to rise with σ is much less pronounced.

Fourth, doubling transport costs, not surprisingly, reduces exports and raises the fraction of inputs produced locally. The effect is greater for richer countries. The model predicts, then, that innovators will tend to exploit their ideas in more distant countries via DFI and in closer countries through export.

2.3 Japanese and U.S. Exports and DFI

We use the model as a basis for examining Japanese and U.S. exports and outward DFI positions with a balanced panel of 72 countries in the case of Japan and 76 countries in the case of the United States, using annual data for the period 1985–90. Our model implies that exports to a country and DFI positions in that country will be determined by (1) the labor force available for employment by direct foreign investors in that country relative to the cost of investing there, (2) the country's ability to adopt technologies from the source country, and (3) the cost of exporting goods there.

2.3.1 Econometric Specification and Variables

To capture the effect of the country's available labor force relative to investment costs we relate Japanese and U.S. exports X_{it} and outward DFI O_{it} at time t to partner i's population POP_{it}. Our model implies that exports and DFI are potentially nonhomogeneous in size. Hence we introduce a specification that allows for nonhomogeneity. We capture the effect of a country's ability to absorb technology from the source through income per capita YPC_{it}. Since our model implies that the effect of σ on the relative importance of DFI and exports might be nonmonotonic, we introduce both a linear and quadratic measure of income per capita. Also, the ability of a country to make use of Japanese and U.S. ideas might depend on its factor endowments. We use the destination's population density DEN_{it} as an inverse measure of natural resource endowments and a measure of the average years of schooling per worker HK_i to capture human capital.[3] Finally we use distance d_i from Japan or the United States to capture transport costs.[4] Different regions of the world might have unobserved characteristics (such as different policies toward imports and DFI) other than those which we have taken into account. Hence in one set of estimates we include dummy variables for the region of the destination country δ_{Ri} (assigned as indicated in the appendix, table 2A.1). We also include dummy variables to take into account systematic effects of time δ_T.

As the subscripts indicate, we have annual data for the variables POP, YPC, and DEN. Our measure of human capital, taken from Kyriacou (1991), is available only at five-year intervals. Hence we use the measure for 1985 for all years.[5] Table 2A.3 in the appendix indicates sources of data.

Our specification embodies elements of both the standard gravity and factor endowments specifications of trade patterns extended to explain DFI positions as well as trade flows.[6] In contrast to these approaches, our model implies potential nonhomogeneity in the relationship between our dependent and explanatory variables. To accommodate these, we assume that for each dependent variable $V(V = X, O)$, the explanatory variables are linear homogeneous in $a_V + V_{it}$, where a_V is a threshold parameter that we estimate. A positive value of a_V implies that the function of the explanatory variables explaining V must achieve a minimum threshold value before strictly positive values of V occur. A negative value of a_V means that a minimum level of V occurs independently of the explanatory variables.

For Japan and the United States separately, then, we estimate the equations:

$$V_{it} = \max[-a_V + C_V \mathrm{POP}_{it}^{\alpha_V} \mathrm{YPC}_{it}^{\beta_V + \beta'_V \ln \mathrm{YPC}_{it}} \mathrm{DEN}_{it}^{\gamma_V} \mathrm{HK}_{it}^{\epsilon_V} d_i^{\eta_V}$$

$$\exp(D_T \delta_{VT} + D_R \delta_{VR} + u_{it}), 0]$$

for $V = X, O$. Here u_{Vit} is a normal error term associated with dependent variable V and δ_{VT} is the column vector of coefficients of dummy variables for time and δ_{VR} is the column vector of dummy variables for region. For each depen-

3. These measures also might reflect aspects of labor force availability relative to the cost of investment. A high level of human capital might, other things equal, reduce the cost of overhead, while a high natural resource endowment might reduce the labor force available for producing in the manufacturing sector (to which our model is more appropriate).

4. Distances are between major cities. Table 2A.2 reports the cities chosen and the distances between them for the cities in our sample. Distance might also raise the overhead requirement for DFI.

5. Kyriacou (1991) constructs a measure of the average level of human capital from official data on schooling using a perpetual inventory method. We thank Mark Spiegel for making the data available to us.

6. Deardorff (1984) discusses the "gravity" approach to modeling trade flows econometrically. It has its origins in the work of Tinbergen (1962) and Poyhonen (1963). The framework has recently been applied to regional trade issues by Frankel and Wei (1993). Drysdale and Garnaut (1982) provide a very thorough survey of the approach. Leamer (1974), as we do here, estimates a model that encompasses the factor endowments and gravity approaches.

dent variable V we estimate the intercept a_V, the constant C_V, the population coefficient α_V, the per capita income coefficients β_V and β'_V, the density coefficient γ_V, the human capital coefficient ϵ_V, and the distance coefficient η_V. Note that we allow for a nonconstant elasticity of income per capita.

We estimate the equations by maximum likelihood. To derive the maximum likelihood function we rearrange this relationship and take natural logarithms of each side to obtain

$$\begin{aligned}\ln(a_V + V_{it}) &= C_V + \alpha_V \ln \text{POP}_{it} + \beta_V \ln \text{YPC}_{it} \\ &\quad + \beta'_V(\ln \text{YPC}_{it})^2 + \gamma_V \ln \text{DEN}_{it} + \epsilon_V \ln \text{HK}_i \\ &\quad + \eta_V di_i + D_{VT}\delta_T + D_{VR}\delta_R + u_{Vit} \\ &\equiv Z'_{Vit}\theta_V + u_{it}.\end{aligned}$$

The density function for V_{it} is

$$f(V_{it}) = f(u_{it}) \left|\frac{\partial u_{it}}{\partial V_{it}}\right| = f(u_{it}) \frac{1}{V_{it} + a_V}.$$

We assume that $u_{it} \sim N(0, \sigma^2)$. Hence,

$$f(V_{it}) = \frac{1}{a_V + V_{it}} \cdot \frac{1}{(2\pi\sigma^2)^{1/2}} \exp\left\{ -\frac{[\ln (V_{it} + a_V) - Z'_{it}\theta_V]^2}{2\sigma^2}\right\}$$

and the log-likelihood function is

$$\ln L(V,Z';\theta_V,a_V) = \left\{-\ln (V_{it} + a_V) - \frac{1}{2}(\ln 2\pi + \ln \sigma^2) - \frac{1}{2\sigma^2} [\ln (V_{it} + a_V) - Z'_{it}\theta_V]^2\right\}.$$

The maximum likelihood estimates of a_V and θ_V maximize $\ln L(V,Z';\theta_V,a_V)$.

Tables 2.2 and 2.3 report the estimated equations for Japan and the United States, respectively. The numbers in parentheses below the estimated coefficients are Eicker-White standard errors (see White 1982). Defining $\pi_V = \{\theta_V, a_V\}$ as the vector of parameters, these are the square roots of the diagonal elements of the matrix

$$\text{Var}(\pi_V) = A^{-1}(\pi_V)B(\pi_V)A^{-1}(\pi_V),$$

where

$$A(\pi_V) = \frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N} \frac{\partial^2 \ln f(V_{it},Z'_{it},\theta_V,a_V)}{\partial\pi_V\partial\pi'_V},$$

$$B(\pi_V) = \frac{1}{NT}\sum_{t=1}^{T}\sum_{i=1}^{N}\left[\frac{\partial \ln f(V_{it},Z'_{it},\theta_V,a_V)}{\partial\pi_V} \cdot \frac{\partial \ln f(V_{it},Z'_{it},\theta_V,a_V)}{\partial\pi'_V}\right].$$

Table 2.2 **Japan: Trade and Investment Equations (maximum likelihood, Tobit estimates)**

	V = Export		V = DFI Out	
Variable	(1)	(2)	(3)	(4)
N	432	432	432	432
Log-likelihood	−3,015.62	−3,098.43	−2,749.42	−2,906.23
a	−2.428	−2.713	1.484	2.121
	(0.266)	(0.153)	(0.076)	(0.082)
C	21.746	8.920	21.386	6.334
	(3.842)	(3.957)	(7.568)	(9.634)
ln POP	0.716	0.699	0.837	0.779
	(0.025)	(0.032)	(0.048)	(0.074)
ln YPC	−6.352	−3.200	−6.985	−2.965
	(0.879)	(0.914)	(1.728)	(2.177)
(ln YPC)^2	0.409	0.234	0.417	0.210
	(0.048)	(0.050)	(0.097)	(0.118)
ln DEN	0.053	0.106	−0.050	−0.046
	(0.028)	(0.034)	(0.068)	(0.088)
ln HK	0.730	0.755	1.140	1.040
	(0.153)	(0.151)	(0.271)	(0.307)
ln JDIST	−0.022	−0.166	0.354	−0.093
	(0.027)	(0.012)	(0.045)	(0.028)
DR1:W. Europe	−0.376		−0.943	
	(0.166)		(0.254)	
DR2:C. America	−0.105		−1.423	
	(0.350)		(0.568)	
DR3:S. America	−0.775		−3.167	
	(0.229)		(0.362)	
DR4:Middle East	−0.935		−4.513	
	(0.236)		(0.518)	
DR5:E. Asia	1.774		4.102	
	(0.295)		(0.495)	
DR6:S. Asia	−0.185		−1.471	
	(0.312)		(0.565)	
DR7:Africa	−0.842		−2.855	
	(0.249)		(0.383)	
DR8:Oceania	0.525		2.075	
	(0.180)		(0.327)	

Equation: $\ln(a + V) = \max[Z'b + u, \ln a]$.

Notes: Numbers in parentheses are Eicker-White standard errors. Time dummies (DT1–DT5) are included in all regressions. $Z' = \{C$, constant; POP, population; YPC, per capita GNP; DEN, density; HK, human capital; JDIST, distance from Japan; DR1–DR8, region dummies$\}$.

Because of the intercepts a_V, the coefficients α_V, β_V, β'_V, γ_V, ϵ_V, and η_V converge only asymptotically to the elasticity of the dependent variable with respect to the corresponding independent variable as the independent variable approaches infinity. Table 2.4 reports the actual elasticities calculated at the mean values of the dependent variables.

Table 2.3 **United States: Trade and Investment Equations (maximum likelihood, Tobit estimates)**

	V = Export		V = DFI Out	
Variable	(1)	(2)	(3)	(4)
N	456	456	456	456
Log-likelihood	−3,333.44	−3,461.19	−3,341.37	−3,418.73
a	3.648	0.947	8.176	8.438
	(0.782)	(0.434)	(1.661)	(2.057)
C	−0.819	−23.623	13.116	4.862
	(3.631)	(4.599)	(6.239)	(6.569)
ln POP	0.746	0.778	0.927	0.828
	(0.027)	(0.033)	(0.055)	(0.054)
ln YPC	−0.944	3.537	−5.022	−3.285
	(0.808)	(1.023)	(1.405)	(1.457)
$(\ln \text{YPC})^2$	0.120	−0.118	0.339	0.251
	(0.045)	(0.056)	(0.078)	(0.079)
ln DEN	0.087	0.138	0.108	0.055
	(0.029)	(0.036)	(0.053)	(0.050)
ln HK	0.378	0.395	1.368	1.428
	(0.118)	(0.141)	(0.281)	(0.288)
ln UDIST	−0.129	−0.069	−0.055	−0.055
	(0.016)	(0.014)	(0.031)	(0.020)
DR1:W. Europe	−1.305		−0.974	
	(0.180)		(0.319)	
DR2:C. America	−0.632		0.002	
	(0.198)		(0.414)	
DR3:S. America	−1.102		−0.546	
	(0.169)		(0.332)	
DR4:Middle East	−0.995		−2.909	
	(0.356)		(0.666)	
DR5:E. Asia	0.528		0.022	
	(0.255)		(0.507)	
DR6:S. Asia	−1.241		−2.890	
	(0.274)		(0.550)	
DR7:Africa	−1.319		−1.222	
	(0.210)		(0.508)	
DR8:Oceania	0.109		0.904	
	(0.269)		(0.540)	
DR10:Japan	0.123		−1.003	
	(0.209)		(0.378)	

Equation: $\ln(a + V) = \max[Z'b + u, \ln a]$.

Notes: Numbers in parentheses are Eicker-White standard errors. Time dummies (DT1–DT5) are included in all regressions. $Z' = \{C$, constant; POP, population; YPC, per capita GNP; DEN, density; HK, human capital; UDIST, distance from United States; DR1–DR8, DR10, region dummies$\}$.

Table 2.4 **Trade and Investment Elasticities**

	With Region Dummies		Without Region Dummies	
	Export	DFI Out	Export	DFI Out
Japan				
Population	0.715	0.837	0.699	0.780
Income per worker	1.085	0.583	1.056	0.854
Density	0.053	−0.050	0.106	−0.046
Human capital	0.729	1.141	0.754	1.041
Distance from Japan	−0.022	0.354	−0.166	−0.093
United States				
Population	0.747	0.929	0.778	0.830
Income per worker	1.225	1.110	1.397	1.259
Density	0.087	0.108	0.138	0.055
Human capital	0.378	1.371	0.395	1.432
Distance from U.S.	−0.130	−0.055	−0.069	−0.055

2.3.2 Results

We discuss effects of population, per capita income, factor endowments, and distance in turn.

Population

Consistent with the theory we find that population has a nonhomogeneous effect both on exports and DFI. Moreover, consistent with the model we find that the population elasticity for imports tends to be lower than that for DFI, so that large countries do tend to receive more DFI than exports compared with small countries. While our estimates of population elasticities for exports are less than 1, as our theory would predict, they are also less than 1 for DFI, in contrast with what our theoretical model predicted. The results thus suggest that larger countries are more closed overall than smaller countries, but relatively less closed to DFI than to exports.

Per Capita Income

The U.S. results confirm the model's prediction of an elasticity of exports with respect to the level of development above 1. The elasticity for Japan is very close to 1, however. Our estimates imply that increases in relative per capita income increase DFI at an accelerating rate. The effect on exports differs between the Japan and the United States, however. The effect of income per capita on imports from Japan also tends to accelerate, while its effect on imports from the United States is sensitive to the inclusion of region dummies. Figures 2.1*A* and 2.1*B* illustrate (for Japan) and 2.2*A* and 2.2*B* (for the United States) the effects of increases in the destination country's income per capita on DFI and exports from the two countries, with and without the inclusion of regional dummies. A rough impression is that, for Japan, exports tend to replace DFI as income grows, with the opposite the case for the United States. This result suggests that Japan's cost of DFI tends to be relatively lower in poor countries compared with the United States.

Factor Endowments

We find that increased density acts to increase exports from both countries. An explanation is that, given per capita income, countries with less in the way of natural resources absorb more technology from the two countries and hence import more. We find less tendency for more densely populated countries to absorb more DFI. In the case of Japanese DFI the relationship is negative. One explanation, not accounted for in our theoretical model, is that some Japanese DFI is undertaken to exploit natural resources.

Increases in human capital have a significant effect on both exports and DFI from both countries, suggesting that once other factors are taken into account, countries with more human capital tend to absorb more technology from Japan and the United States. Moreover, the elasticity with respect to DFI is much larger than with respect to exports. A plausible explanation consistent with our model is that a high level of human capital reduces the fixed cost of undertaking DFI.

Distance

The effects of distance on exports and DFI, unlike the effects of most of our other explanatory variables, are quite sensitive to the inclusion of regional effects. This sensitivity is not surprising given the multicolinearity between the two. We find, however, that distance always has an inhibiting effect on exports (as a standard gravity specification would predict). Moreover, as our model would predict, distance reduces trade more than it reduces DFI. Except for the case of Japan, when regional dummies are included, we find that distance also tends to inhibit DFI, but by less than it inhibits exports. Hence Japan and the United States tend to trade relatively more close by and to invest relatively more far away.[7]

Regional Effects

Eaton and Tamura (1994) discuss the regional concentration of Japanese and U.S. trade and DFI patterns. This earlier work did not include distance as a separate explanatory variable, incorporating the effect of distance through the regional effects. A primary finding there was that, correcting for size, per capita income, and factor endowments, Japan imported more from the United

7. Brainard (1993a, 1993b) provides evidence on the role of distance in trade and DFI decisions from firm-level data. She also finds a tendency for firms to rely more on domestic production than on exports to serve more distant markets.

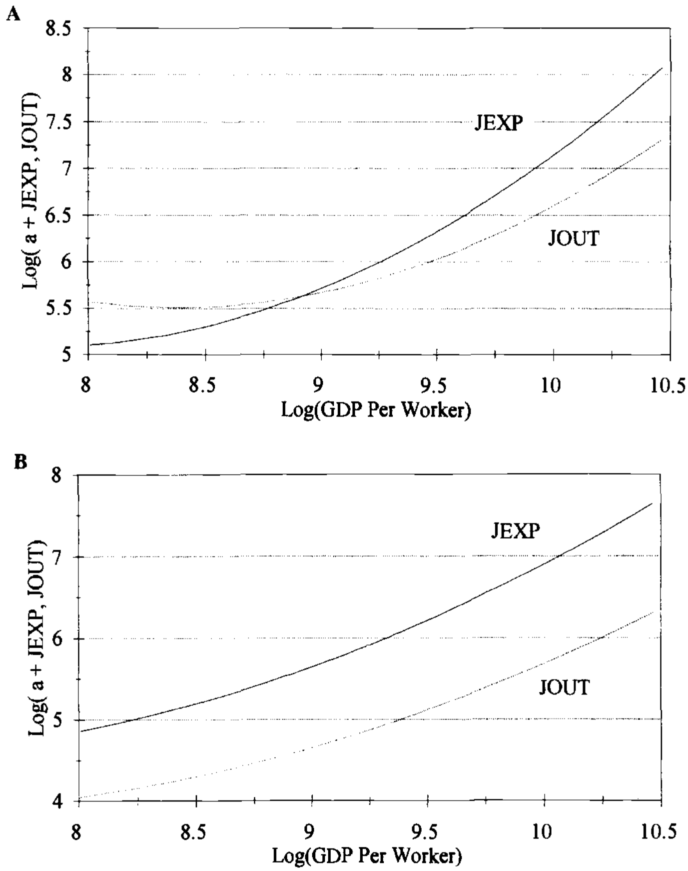

Fig. 2.1 Japan regression: export and DFI out (*A*) with region dummies and (*B*) without region dummies

States than the typical country in Western Europe. Our results here strengthen this finding significantly. We find that, once distance as well as these other factors are taken into account, Japan imports more from the United States than any other region except East Asia, including not only Western Europe but North and Central America as well. We still find Japan to be more closed than Western Europe to U.S. DFI, but only slightly so. We also continue to find Oceania and East Asia to be highly open to both exports and DFI from both countries.

2.4 Conclusion

Japan and the United States are not only the two largest economies in the world; measures of research activity and patenting indicate that they are also

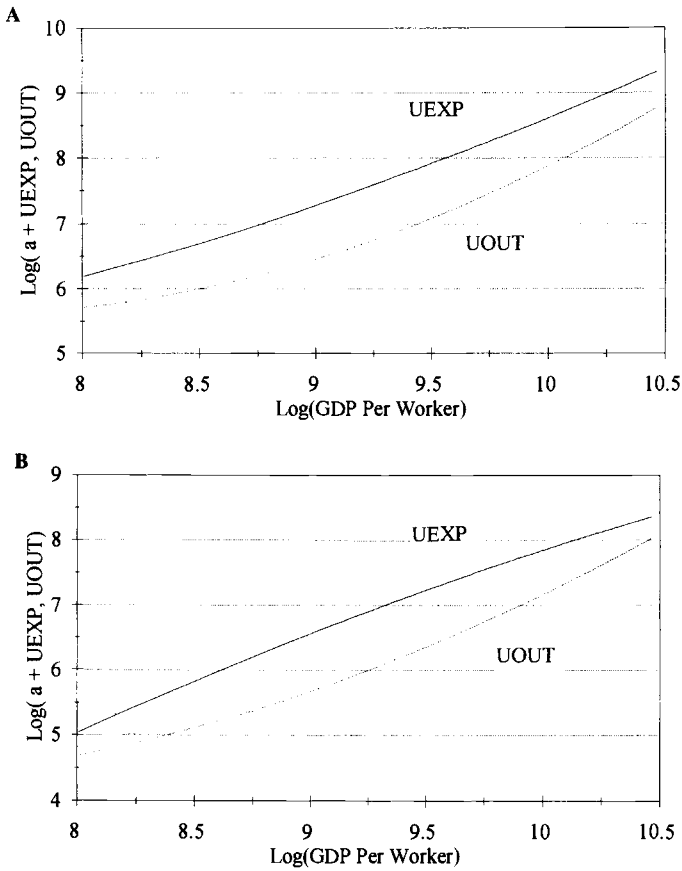

Fig. 2.2 U.S. regression: export and DFI out (*A*) with region dummies and (*B*) without region dummies

the two largest sources of technological innovation in the world. Exports and DFI are two major conduits for transferring technology abroad.

In this paper we have developed a simple model for the decision whether to exploit a technology abroad via export or via DFI. The model points to country size, technological sophistication, and distance as important factors. Moreover, it suggests that the effects of these variables may be not only nonhomogeneous but nonmonotonic as well.

We use the model as a basis for specifying a model of Japanese and U.S. export and DFI patterns around the world. The implications of some but not all aspects of the model are confirmed. We do find, for example, that the importance of DFI relative to exports tends to grow with country size, but that DFI as well as exports tend to increase less than in proportion to country size while our model predicts that DFI should increase more than in proportion. Consistent with our model we also find that distance tends to inhibit DFI much less than it inhibits exports. Both Japan and the United States tend to export relatively more close by and to invest relatively more far away. The model predicts that the relationship between exports and DFI, on the one hand, and a country's ability to absorb technology, on the other, can be very nonmonotonic. We find some tendency for Japanese exports to rise relative to DFI as countries become more advanced, with U.S. exports and DFI exhibiting the opposite tendency.

A striking finding, reinforcing a major result in Eaton and Tamura (1994), is that Japan is relatively open to U.S. exports compared with other regions of the world, taking into account size, income, and factor endowments. Here we find that taking distance into account sharply accentuates this result: once distance as well as these other factors are corrected for Japan is more open to U.S. exports than any region except East Asia.

Our empirical work has focused very narrowly on exports and DFI, taking the background of innovation and diffusion as given. A task for future research is the integration of the issues considered here with an analysis of the factors determining the rate of innovation in the world economy.

Appendix

Table 2A.1 **Region Definitions and Samples**

North America		**Central America**	
United States	(Japan)	Costa Rica	(Japan, U.S.)
Canada	(Japan, U.S.)	Dominican Republic	(U.S.)
Mexico	(Japan, U.S.)	El Salvador	(Japan, U.S.)
Western Europe		Guatemala	(Japan, U.S.)
United Kingdom	(Japan, U.S.)	Honduras	(Japan, U.S.)
Austria	(Japan, U.S.)	Panama	(Japan, U.S.)
Belgium-Luxembourg	(Japan, U.S.)	Trinidad and Tobago	(Japan, U.S.)
Denmark	(Japan, U.S.)	**South America**	
France	(Japan, U.S.)	Argentina	(Japan, U.S.)
Germany	(Japan, U.S.)	Bolivia	(Japan, U.S.)
Italy	(Japan, U.S.)	Brazil	(Japan, U.S.)
Netherlands	(Japan, U.S.)	Chile	(Japan, U.S.)
Norway	(Japan, U.S.)	Colombia	(Japan, U.S.)
Sweden	(Japan, U.S.)	Ecuador	(Japan, U.S.)
Finland	(Japan, U.S.)	Paraguay	(Japan, U.S.)
Greece	(Japan, U.S.)	Peru	(Japan, U.S.)
Iceland	(Japan, U.S.)	Uruguay	(Japan, U.S.)
Ireland	(Japan, U.S.)	Venezuela	(Japan, U.S.)
Portugal	(Japan, U.S.)	Guyana	
Spain	(Japan, U.S.)		
Turkey	(Japan, U.S.)		

(continued)

Table 2A.1 (continued)

Middle East		Ivory Coast	(Japan, U.S.)
Israel	(Japan, U.S.)	Kenya	(Japan, U.S.)
Jordan	(Japan, U.S.)	Madagascar	(Japan, U.S.)
Syria	(Japan, U.S.)	Malawi	(U.S.)
Egypt	(Japan, U.S.)	Mauritania	(Japan)
East Asia		Mauritius	(U.S.)
Taiwan	(Japan, U.S.)	Morocco	(Japan, U.S.)
Hong Kong	(Japan, U.S.)	Mozambique	(Japan, U.S.)
Indonesia	(Japan, U.S.)	Nigeria	(Japan, U.S.)
Korea	(Japan, U.S.)	Zimbabwe	(U.S.)
Malaysia	(Japan, U.S.)	Rwanda	(Japan, U.S.)
Philippines	(Japan, U.S.)	Senegal	(Japan, U.S.)
Singapore	(Japan, U.S.)	Sierra Leone	(U.S.)
Thailand	(Japan, U.S.)	Sudan	(Japan, U.S.)
South Asia		Tunisia	(Japan, U.S.)
Bangladesh	(Japan, U.S.)	Burkina Faso	(Japan)
India	(Japan, U.S.)	Zambia	(Japan, U.S.)
Pakistan	(Japan, U.S.)	**Oceania**	
Africa		Australia	(Japan, U.S.)
Algeria	(U.S.)	New Zealand	(Japan, U.S.)
Burundi	(U.S.)	Fiji	(Japan)
Cameroon	(Japan, U.S.)	Papua New Guinea	(Japan, U.S.)
Central African Republic	(U.S.)	**Japan**	
Gabon	(Japan, U.S.)	Japan	(U.S.)
Gambia	(Japan)		

Note: Sample(s) in which country is included given in parentheses.

Table 2A.2 **Distance Data in the Sample**

Country	City	JDIST[a]	UDIST[b]
United States	Chicago	10,140	0
United Kingdom	London	9,562	6,378
Austria	Vienna	9,131	7,553
Belgium	Brussels	9,456	6,678
Denmark	Copenhagen	8,696	6,855
France	Paris	9,717	6,677
Germany, West	West Berlin	8,933	7,098
Italy	Rome	9,864	7,770
Netherlands	Amsterdam	9,292	6,624
Norway	Oslo	8,664	6,685
Sweden	Stockholm	8,173	6,895
Canada	Ottawa	10,333	1,049
Japan	Tokyo	0	10,140
Finland	Helsinki	7,824	7,143
Greece	Athens	9,515	8,761
Iceland	Reykjavik	8,800	4,769
Ireland	Dublin	9,591	5,899
Portugal	Lisbon	11,150	6,438

Table 2A.2 (continued)

Country	City	JDIST[a]	UDIST[b]
Spain	Madrid	10,768	6,742
Turkey	Ankara	8,768	9,137
Australia	Canberra	7,955	15,106
New Zealand	Wellington	9,275	13,440
Argentina	Buenos Aires	18,359	9,003
Bolivia	La Paz	16,533	6,789
Brazil	Brasilia	17,686	7,602
Chile	Santiago	17,230	8,547
Colombia	Bogota	14,306	4,340
Costa Rica	San Jose	13,171	3,560
Dominican Republic	Santo Domingo	13,233	3,094
Ecuador	Quito	14,430	4,754
El Salvador	San Salvador	12,493	3,126
Guatemala	Guatemala City	12,323	3,033
Honduras	Tegucigalpa	12,601	3,081
Mexico	Mexico City	11,309	2,705
Panama	Panama	13,547	3,707
Paraguay	Asuncion	18,007	8,083
Peru	Lima	15,492	6,091
Uruguay	Montevideo	18,570	9,112
Venezuela	Caracas	14,169	4,028
Guyana	Georgetown	12,522	2,568
Trinidad and Tobago	Port-of-Spain	14,402	4,302
Israel	Jerusalem	9,155	9,972
Jordan	Amman	9,085	10,001
Syria	Damascus	8,956	9,887
Egypt	Cairo	9,578	9,899
Bangladesh	Dacca	4,897	12,727
Taiwan	Taipei	2,105	11,998
Hong Kong	Hong Kong	2,886	12,546
India	New Delhi	5,848	12,043
Indonesia	Jakarta	5,789	15,807
Korea, Republic of	Seoul	1,164	10,525
Malaysia	Kuala Lumpur	5,330	14,938
Pakistan	Islamabad	5,977	11,404
Philippines	Manila	3,007	13,099
Singapore	Singapore	5,325	15,089
Thailand	Bangkok	4,612	13,788
Algeria	Algiers	10,806	7,454
Burundi	Bujumbura	12,070	12,480
Cameroon	Yaounde	13,071	10,488
Central African Republic	Bangui	12,461	11,022
Gabon	Libreville	13,509	10,577
Gambia	Banjul	14,030	7,463
Ivory Coast	Abidjan	14,099	9,097
Kenya	Nairobi	11,262	12,896
Madagascar	Antananarivo	11,416	15,109

(continued)

Table 2A.2 (continued)

Country	City	JDIST[a]	UDIST[b]
Malawi	Lilongwe	12,339	13,643
Mauritania	Nouakchott	13,498	7,217
Mauritius	Port Louis	10,639	15,971
Morocco	Casablanca	11,604	6,853
Mozambique	Maputo	13,135	14,358
Nigeria	Lagos	13,485	9,628
Zimbabwe	Harae	12,813	13,698
Rwanda	Kigali	11,907	12,427
Senegal	Dakar	13,926	7,300
Sierra Leone	Freetown	14,337	8,094
Sudan	Khartoum	10,486	11,183
Tunisia	Tunis	10,425	7,959
Burkina Faso	Ouagadougou	13,304	8,788
Zambia	Lusaka	12,924	13,296
Fiji	Suva	7,240	11,650
Papua New Guinea	Port Moresby	5,083	13,590

[a]Distance from Japan (Tokyo) in kilometers.
[b]Distance from United States (Chicago) in kilometers.

Table 2A.3 **Data Sources**

Variable	Source
Exports	*Direction of Trade Statistics Yearbook* (Washington, D.C.: International Monetary Fund, various issues)
DFI out	
Japan	*Zaisei-Kinyu Tokei Geppou* (Fiscal/Financial Statistics Monthly) (Tokyo: Ministry of Finance, various issues)
United States	*Survey of Current Business* (Washington, D.C.: Department of Commerce, various issues)
Population	Penn World Table (Mark 5.6) (see Summers and Heston 1991)
GDP per capita	Penn World Table (Mark 5.6) (see Summers and Heston 1991)
Surface area	*Statistical Yearbook* (New York: Statistical Office United Nations, various issues)
Human capital	Kyriacou (1991)
Distance (from Tokyo; from Chicago)	Software Toolworks World Atlas v. 5.0 (The Software Toolworks Inc.)

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Comment Chong-Hyun Nam

This is an excellent piece of empirical work. The empirical part of the paper relies on a rich set of data, and estimation results by and large confirm commonsense expectations. The highlight is Eaton and Tamura's confirmation that country characteristics such as population, income level, land abundance, human capital, and locational distance are all important determinants not only of bilateral trade flows but also of bilateral direct foreign investment. The paper also develops a simple model to determine whether a country will grow as a capital importer or exporter. I have only a couple of short comments on the paper: one concerns the structure of the estimated equations, and the other concerns interpretation of some estimation results.

First, I felt that it would have been very useful if Eaton and Tamura had explained at the outset why the estimation equations were constructed as shown in the paper and, in particular, why the same structural equation could be used for explaining both bilateral trade flows and bilateral direct foreign investment flows.

In estimating bilateral trade flows, the paper seems to have included most of the important explanatory variables, but they may not be sufficient. For instance, it seems that some price variables, such as exchange rates, and some protection measures may also work as good explanatory variables for bilateral trade flows.

As for bilateral direct foreign investment flows, still more explanatory variables may be conceivable, depending on the purpose of direct foreign investment. For instance, Korea's outbound direct foreign investment is often intended to take advantage of wage rate differentials, to circumvent protection measures, or to develop and secure a stable supply of raw materials. So, it may be worthwhile to examine some variables or proxies corresponding to these purposes.

Second, the elasticity of export or import with respect to a country's population size was estimated to be significantly less than 1. Eaton and Tamura conjecture that this is so because large countries tend to be more protectionist than small countries. They further argue that if this conjecture is correct, an implication is that the formation of a trading bloc would mean less trade be-

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tween the member countries in the bloc collectively and Japan or the United States.

I am not convinced by this line of argument. First, I do not find any strong a priori reasons to believe large countries would tend to be more protectionist than small countries, or vice versa. Instead, the low trade elasticity with respect to country size could be more due to the fact that largeness in economic size allows greater exploitation of scale economies in production and a greater degree of economies of scope in products which leads to lower trade elasticity. I also think that the mere formation of a trading bloc would not necessarily reduce trade between the bloc and another country outside the bloc, unless the member countries of the bloc become more protectionistic against outsiders than before the bloc was formed.

Comment V. V. Bhanoji Rao

Eaton and Tamura's paper is very rich in statistical results. However, it appears to be somewhat unfinished because in many instances there is insufficient interpretation and explanation, as my comments below will indicate. I follow the headings in section 2.3 of the Eaton-Tamura paper for my comments.

Econometric Specification and Variables

To explain the bilateral trade and investment of Japan and the United States with a number of countries in the Asia-Pacific region, the variables used are: population of the country, per capita income, population density, years of schooling of an average worker, distance between Japan or the United States and the country, and time dummies. The selection of variables takes into account gravity models and factor intensity explanations of trade flows. One cannot but agree with the selection of variables in regard to explaining trade flows. The paper, however, lacks a discussion of the applicability of these variables to investment flows. Such a discussion would greatly improve the authority and authenticity of the paper.

Factor endowments are proxied by per capita income (proxy for capital-labor ratio), population density (proxy for labor-land ratio), and the average years of schooling of the labor force (human capital). Since the last variable, in fact, refers to the quality of the labor force, we have here capital intensity, land intensity, and quality intensity of labor. Is there some anomaly here? What is the rationale for this special treatment of labor? An explanation is needed.

As for the methodology, it would be useful to provide a short explanatory

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statement on why the maximum likelihood method is preferred to standard regression analysis.

Results

Population. Trade elasticities with respect to population are less than unity indicating that small countries are relatively more and large countries relatively less trade oriented. According to the authors, "The results thus suggest that larger countries are more closed overall than smaller countries." A more important explanation may be that large countries, by virtue of their market size, find that a wide variety of enterprises are viable in catering to domestic demands. This is the case of natural import substitution that goes on all the time. Furthermore, in the case of commodities where the large countries in the region may have a comparative advantage (e.g., rice, sugar, and textiles), it may be that protectionism in Japan and the United States is the real factor behind the relatively low trade elasticities. The authors should build into their explanation all the plausible factors rather than limit themselves to just one.

Eaton and Tamura also found that the larger countries tend to have relatively lower per capita direct foreign investment (DFI) from either Japan or the United States. This is also explained by the suggestion that large countries are more closed than small countries. The authors should recognize that in some instances, protectionism may lead to greater DFI to tap the domestic markets (e.g., the automobile sector in Indonesia), although this is not what is implied by their results. The authors should also examine more closely whether population size matters at all in regard to *per capita* DFI flows.

Per capita income. With reference to per capita income, Japan's export elasticities are slightly higher than the U.S. elasticities. Both countries, however, have either unitary or higher than unitary elasticities. DFI elasticities have the same pattern as the export elasticities. On the import side, Japan's elasticities are lower than the U.S. elasticities and somewhat lower than unity. Interpreting these patterns, the authors note that Japan buys more from poor countries and sells more to rich countries. In regard to DFI elasticities, which are close to 1 or greater than 1, the differences between Japan and the United States are relatively less pronounced, though Japan's DFI elasticities are slightly higher than the U.S. elasticities. Japan, thus, tends to invest more in and export more to countries with relatively higher per capita purchasing power. Could it be because foreign policy and human rights considerations play a relatively larger role in U.S. trade and investment policies? There is a need to probe into and explain the patterns of the elasticities and expand the discussion.

Factor endowments. The authors' finding is that land-scarce Japan tends to import significantly less from high-density countries, while the land-abundant United States tends to import more from such countries. This finding is in accordance with a priori expectations. Both the United States and Japan, however, tend to export to countries with greater population densities. This finding has been left unexplained.

The authors note that a high level of education in a country significantly reduces Japan's involvement in any form with that country. This finding too requires some explanation.

Distance. The findings confirm that distance inhibits trade. The interesting findings, however, are that U.S. trade is more inhibited by distance than Japan's and that distance also inhibits U.S. DFI, but not Japanese DFI. Could it be that the findings are evidence of the Japanese drive for markets and investment outlets in contrast to the historical U.S. drive to promote political and other noneconomic interests? The paper should add a brief explanatory statement.

Concluding Observation

The Eaton-Tamura paper in its present form remains a statistical exercise on the determinants of the trading and investment relationships of Japan and the United States individually with a group of countries. The paper's use and significance would have been greatly enhanced if the authors had interpreted and explained the results and drawn useful policy conclusions, if any.