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Trade Theory and Trade Facts*

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ABSTRACT

This paper quantitatively tests the "new trade theory" based on product differentiation, increasing returns, and imperfect competition. We employ a standard model, which allows both changes in the distribution of income among industrialized countries, emphasized by Helpman and Krugman (1985), and nonhomothetic preferences, emphasized by Markusen (1986), to effect trade directions and volumes. In addition, we generalize the model to allow changes in relative prices to have large effects. We test the model by calibrating it to 1990 data and then "backcasting" to 1961 to see what changes in crucial variables between 1961 and 1990 are predicted by the theory. The results show that, although the model is capable of explaining much of the increased concentration of trade among industrialized countries, it is not capable of explaining the enormous increase in the ratio of trade to income. Our analysis suggests that it is policy changes, rather than the elements emphasized in the new trade theory, that have been the most significant determinants of the increase in trade volume. **JEL classification numbers:** F120, F130, F170. **Key words:** product differentiation, imperfect competition, scale economies, nonhomothetic preferences, trade growth, intraindustry trade

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1. Introduction

This paper investigates the extent to which the "new trade theory" can quantitatively match some of the facts that it was designed to explain. It does so by calibrating a standard model, based on Markusen (1986), to 1990 data and then "backcasting" to 1961 to see what changes in crucial variables between 1961 and 1990 are predicted by the theory.

The new trade theory, developed by researchers like Helpman (1981), Krugman (1979), and Lancaster (1980) in the late 1970s and 1980s, was motivated by the failure of more traditional theories to explain some of the most significant facts about post World War II trade data. As Deardorff (1984) and Helpman and Krugman (1985) explain, the new trade theory was designed to account for three major facts:

- The ratio of trade to income has increased.
- Trade has become more concentrated among industrialized countries.
- Trade among industrialized countries has been largely intraindustry trade.

Figure 1 presents evidence for the first fact, showing how much faster world trade has increased than world income. To make comparisons easy in the figure, data on both world trade volume, measured by summing up exports throughout the world, and world income have been expressed as indices where 1950=100. Over the period 1950-1990, the ratio of trade to income worldwide increases by 86.1 percent. The data for both trade and income used to derive the indices in Figure 1 are measured in constant 1970 U.S. dollars. Alternatively, we could look at trade as a fraction of income, dividing the current value of trade by the current value of income. As a fraction of the value of GDP, the value of trade increased from 7.9 percent in 1950 to 15.4 percent in 1990, a 94.9 percent increase. To make the second fact

precise, we identify industrialized countries with the Organization for Economic Cooperation and Development (OECD), which was formed in 1961. Figure 2 shows how much faster trade within the OECD has increased than OECD trade with the rest of the world. The ratio of OECD-OECD trade to OECD-RW trade went from 0.84 in 1961 to 1.58 in 1990. Evidence for the third fact can be found in the high Grubel-Lloyd indices of international trade in industrialized countries. For this sort of data it is more difficult to calculate long time series. In 1990 though, Grubel-Lloyd indices based on two-digit SITC data from the OECD say that 68.4 percent of OECD-OECD trade was intraindustry compared with only 38.1 percent of OECD-RW trade.

Closely related to the first two facts is yet a fourth fact: The ratio of trade to income within the OECD increased even faster than the ratio of trade to income worldwide. Figure 3 presents the relevant data. Trade within the OECD went from 5.3 percent of OECD income in 1961 to 11.2 percent in 1990. The ratio of trade to income within the OECD increased by 111.5 percent. By comparison the United Nations data say that the ratio of trade to income worldwide increased by only 59.3 percent over 1961-1990.

That the new trade theory was developed to explain these facts is explicit in textbook expositions by the developers of the theory. Helpman and Krugman (1985), for example, point out that conventional trade models like the Ricardian model and the Heckscher-Ohlin model cannot hope to explain these facts and go on to say,

> These ... empirical weaknesses of conventional trade theory ... become understandable once economies of scale and imperfect competition are introduced into our analysis.

Helpman and Krugman stress the changes in the distribution of income among industrialized countries as a major cause of the expansion of trade relative to income. In the early post war period the United States accounted for much of the world's income and consumption. As the distribution of national income became more equal, their model predicts that trade volumes should rise.

Focusing on the increase in trade among industrialized countries, Markusen (1986) stresses unequal income elasticity of demands that result from nonhomothetic preferences. If demand for differentiated products is superior to that for homogeneous products, then intraindustry trade should expand as income rises; and, if industrialized countries are net exporters of these differentiated products, then intraindustry trade among industrialized countries should expand faster than other trade. As Markusen *et al.* (1995) point out, it was to match the facts listed above that the theory had been formulated:

> Thus, nonhomogeneous demand leads to a decrease in North-South trade and to an increase in [intraindustry trade] among the northern industrialized countries. These are precisely the facts there were to be explained.

Our model generalizes those developed by Helpman and Krugman (1985) and Markusen (1986) in that it allows changes in relative prices to have large effects on trade volumes. Because of faster total factor productivity growth in the manufacturing sector, the relative prices of manufactured goods have fallen sharply from 1961 to 1990 compared to the prices of primary goods and services.

Our numerical experiments show that, although the model can explain the increased concentration of trade among industrialized countries, it is not capable of explaining the

enormous increase in the ratio of trade to income. The simple fact is that it has been the trade of manufactured goods among OECD countries that accounts for most of the expansion of trade over the period 1961-1990. Over this same period, however, the consumption of manufactures in these countries has gone down as a fraction of income. A model that relies on the taste for variety approach developed by Spence (1976) and Dixit and Stiglitz (1977) links increases in trade to increases in consumption. It seems that it is policy changes, rather than the elements emphasized in the new trade theory, that have been the most significant determinants of the increase in trade volume.

In related literature, Hunter (1991) estimates that nonhomothetic preferences accounts for about one fourth of observed interindustry trade. Helpman (1987) reports regression results that he interprets as support for the Helpman-Krugman explanation of the distribution of national income as the driving force behind trade increases. Hummels and Levinsohn (1995), however, argue that Helpman's results are not related to the Helpman-Krugman theory. Haveman and Hummels (1999) argue that the new trade theory models rely on taste for variety that is not consistent with the data and predict too much trade. Yi (1999) argues that the new trade theory models cannot account for the increase in trade unless they incorporate changes in both trade policy and international vertical integration.

It is worth noting that lack of data on trade in services in 1961 forces us to restrict our attention to merchandise trade in both our data analysis and in our theory. Information on sources for all of the data presented in this paper are included in the data appendix.

2. A "New Trade Theory" Model

Consider a world in which there are n developed countries, identified with the 23 countries in the Organization for Economic Cooperation and Development (OECD) in 1990, and a rest of the world. (There were actually 24 countries in the OECD in 1990, but, since data for Belgium and Luxembourg are aggregated together, we treat them as one country.)

Table 1

OECD in 1990

Country	Share of Income (percent)
Australia	1.3209
Austria	0.7153
Belgium/Luxembourg	0.9254
Canada	2.5475
Denmark	0.5791
Finland	0.6046
France	5.3609
Germany	7.3549
Greece	0.3718
Iceland	0.0280
Ireland	0.2042
Italy	4.9059
Japan	13.3195
Netherlands	1.2721
New Zealand	0.1933
Norway	0.5177
Portugal	0.3027
Spain	2.2189
Sweden	1.0304
Switzerland	0.1274
Turkey	0.6757
United Kingdom	4.3747
United States	24.9076

In each country or region, there are three types of goods, a primary good that is tradable and homogeneous, manufactured goods that are tradable and differentiated by the firm that produces them, and a service good that is nontradable and homogeneous within the

country where it is produced. The OECD and the rest of the world differ in the endowments of physical capital and human capital held by consumers. Specifically, the endowments of OECD consumers are k^{oe} and h^{oe} while those of consumers in the rest of the world are k^{rw} and h^{rw}.

An individual consumer in country or region j, $j = 1, \ldots, n, oe, rw$, solves the problem of maximizing

$$\left[\beta_p \left(x_p^j + \gamma_p\right)^\eta + \beta_m \left(\int_{D^w} x_m^j (z)^\rho \, dz\right)^{\eta/\rho} + \beta_s \left(x_s^j + \gamma_s\right)^\eta - 1\right] \Big/ \eta \tag{1}$$

subject to

$$q_p x_p^j + \int_{D^w} q_m (z) \, x_m^j (z) \, dz + q_s^j x_s^j \leq r^j k^j + w^j h^j \qquad x_p^j, \; x_m^j (z) \, , \; x_s^j \geq 0. \tag{2}$$

Here x_p^j is the consumption of the primary good and q_p is its price; $x_m^j (z)$ is the consumption of the manufactured good produced by firm z and $q_m (z)$ is its price; x_s^j is the consumption of the service good and q_s^j is its price; and r^j is the return to physical capital while w^j is the return to human capital. Notice that, since we assume that consumers in different OECD countries have the same endowments k^{oe} and h^{oe}, $x_i^1 = x_i^2 = ... = x_i^n = x_i^{oe}$. The parameter ρ, $1 \geq \rho > 0$, governs the elasticity of substitution $1/(1-\rho)$ between any two differentiated manufactured goods in the interval $D^w = [0, d^w]$ of such goods produced throughout the world; the parameters γ_p and γ_s govern the income elasticities of demand for the different types of goods; and the parameter η governs the elasticity of substitution between any two types of goods, which in turn governs the price elasticities of demand for the different types

of goods. In the base case, where $\gamma_p = \gamma_s = \eta = 0$, all of the income elasticities and price elasticities are equal to one. In this case, the utility function is

$$\beta_p \log x_p^j + \beta_m \left(\int_{D^w} x_m^j (z)^\rho \, dz \right)^{1/\rho} + \beta_s \log x_s^j. \tag{3}$$

The population of each country or region j, $j = 1, \ldots, n, oe, rw$ is N^j. Of course, we require

$$N^{oe} = \sum_{j=1}^{n} N^j. \tag{4}$$

The aggregate endowments of human and physical capital are respectively

$$H^j = N^j h^j \tag{5}$$

$$K^j = N^j k^j. \tag{6}$$

In the homothetic utility case, where $\gamma_p = \gamma_s = 0$, there is no need to keep separate track of N^j, but in the nonhomothetic case there is.

Both the primary and the service good in country j are produced according to constant returns production functions,

$$Y_p^j = \theta_p \left(K_p^j \right)^{\alpha_p} \left(H_p^j \right)^{1-\alpha_p} \tag{7}$$

$$Y_s^j = \theta_s \left(K_s^j \right)^{\alpha_s} \left(H_s^j \right)^{1-\alpha_s}. \tag{8}$$

In contrast, the technology for producing manufactured goods exhibits increasing returns to scale because of the presence of fixed costs. Specifically, every firm z has the

production function

$$Y_m(z) = \max\left[\theta_m K_m(z)^{\alpha_m} H_m(z)^{1-\alpha_m} - F, 0\right]. \tag{9}$$

Here $F > 0$ are the fixed costs.

The firms in the manufacturing sector are monopolistic competitors. Firm z in country or region j sets its price $q_m(z)$ to maximize profits

$$\Pi(z) = q_m(z) Y_m(z) - r^j K_m(z) - w^j H_m(z), \tag{10}$$

taking all of the other prices q_p, $q_m(z')$, q_s^j, r^j, w^j as given. To do so, the firm solves the maximization problems of all the consumers to obtain the world demand function for its good

$$Y_m(z) = \sum_{j=1}^{n} X_m^j(z) + X_m^{rw}(z). \tag{11}$$

Here

$$X_m^j(z) = \frac{\beta_m^{\frac{1}{1-\eta}} \left(r^j K^j + w^j H^j + q_p \gamma_p N^j + q_s^j \gamma_s N^j\right)}{q_m(z)^{\frac{1}{1-\rho}} \left[\int_{D^w} q_m(z')^{\frac{-\rho}{1-\rho}} dz'\right]^{\frac{\rho-\eta}{\rho(1-\eta)}} \Delta} \tag{12}$$

where

$$\Delta = \beta_p^{\frac{1}{1-\eta}} q_p^{-\frac{\eta}{1-\eta}} + \beta_m^{\frac{1}{1-\eta}} \left[\left(\int_{D^w} q_m(z')^{\frac{-\rho}{1-\rho}} dz'\right)^{\frac{-(1-\rho)}{\rho}}\right]^{\frac{-\eta}{1-\eta}} + \beta_s^{\frac{1}{1-\eta}} {q_s^j}^{-\frac{\eta}{1-\eta}} \tag{13}$$

Given its choice of output, the firm chooses $K_m(z)$ and $H_m(z)$ to minimize costs.

Let $c\left(r^j, w^j, Y_m\left(z\right)\right)$ be the solution to the cost minimization problem of firm z:

$$c\left(r^j, w^j, Y_m^w\left(z\right)\right) = \frac{1}{\theta_m}\left(\frac{r^j}{\alpha_m}\right)^{\alpha_m}\left(\frac{w^j}{1-\alpha_m}\right)^{1-\alpha_m}\left(Y_m\left(z\right)+F\right). \tag{14}$$

Then we can write the profits (10) of firm z as

$$\Pi\left(z\right) = Aq_m\left(z\right)^{-\frac{\rho}{1-\rho}} - C^j Aq\left(z\right)^{-\frac{1}{1-\rho}} - C^j F. \tag{15}$$

Here we have expressed

$$Y_m\left(z\right) = Aq_m\left(z\right)^{-\frac{1}{1-\rho}} \tag{16}$$

$$c\left(r^j, w^j, Y_m\left(z\right)\right) = C^j\left(Y_m\left(z\right)+F\right) \tag{17}$$

where A and C^j are the appropriate expressions derived from equations (11)–(14). Differentiating profits (15) with respect to $q_m\left(z\right)$ and setting the derivatives equal to zero yields the familiar Lerner condition for profit maximization

$$q_m\left(z\right) = C^j \;/\; \rho. \tag{18}$$

Here the price elasticity of demand for good z is $1/\left(1-\rho\right)$. It is straightforward to show that this is the same result that we find if we assume that firms set quantities rather than prices.

We determine the number of firms d^w by allowing free entry and requiring that the profits of all firms are equal to zero. Using the Lerner condition (18), we can rewrite profits

(10) as

$$\Pi(z) = C^j Y_m^w(z) \,/\, \rho - C^j Y_m^w(z) - C^j F. \tag{19}$$

Setting this expression equal to zero, we obtain

$$Y_m^w(z) = \frac{\rho}{1-\rho} F. \tag{20}$$

DEFINITION 1. *An* equilibrium *is a vector of prices* q_p, $q_m(z)$, q_s^j, r^j, *and* w^j, *and quantities,* x_p^j, $x_m^j(z)$, x_s^j, X_p^j, $X_m(z)$, X_s^j, Y_p^j, K_p^j, H_p^j, $Y_m(z)$, $K_m(z)$, $H_m(z)$, Y_s^j, K_s^j, H_s^j, $z \in D^w$, $j = 1, \ldots, n, rw$, *an interval of firms* D^w, *and a measure of firms for each country or region,* D^j, $j = 1, \ldots, n, rw$, *such that*

1. *Given the prices, the individual consumption plans* x_p^j, $x_m^j(z)$, x_s^j, *solve the utility maximization problem of consumer* j *(1)–(2);*
2. *The factor prices* r^j, w^j, *and the production plans for the primary and service good satisfy the conditions for zero profit and cost minimization*

$$r^j = q_p \alpha_p \theta_p \left(H_p^j \,/\, K_p^j\right)^{1-\alpha_p} = q_s \alpha_s \theta_s \left(H_s^j \,/\, K_s^j\right)^{1-\alpha_s} \tag{21}$$

$$w^j = q_p (1-\alpha_p) \theta_p \left(K_p^j \,/\, H_p^j\right)^{\alpha_p} = q_s (1-\alpha_s) \theta_s \left(K_s^j \,/\, H_s^j\right)^{\alpha_s}; \tag{22}$$

3. *Each manufacturing firm* z *in country or region* j *chooses price* $q_m(z)$ *to maximize profits (18). Given output* $Y_m(z)$, *it chooses inputs* $K_m(z)$, $H_m(z)$ *to minimize costs;*
4. *Every firm* $z \in D^w$ *earns zero profits (20);*

5. The markets for goods clear,

$$\sum_{j=1}^{n} N^j x_p^j \left(= \sum_{j=1}^{n} X_p^j \right) = \sum_{j=1}^{n} Y_p^j \tag{23}$$

$$\sum_{j=1}^{n} N^j x_m^j (z) \left(= \sum_{j=1}^{n} X_m^j (z) \right) = Y_m (z), \quad z \in D^w \tag{24}$$

$$N^j x_s^j \left(= X_s^j \right) = Y_s^j, \quad j = 1, \ldots, n, rw; \tag{25}$$

6. The factor markets clear,

$$K_p^j + \int_{D^j} K_m (z)\, dz + K_s^j = K^j, \quad j = 1, \ldots, n, rw \tag{26}$$

$$H_p^j + \int_{D^j} H_m (z)\, dz + H_s^j = H^j, \quad j = 1, \ldots, n, rw; \tag{27}$$

7. The number of variety available for consumption is the number of varieties produced,

$$D^w = D^1 \cup D^2 \cup \cdots \cup D^n \cup D^{rw}. \tag{28}$$

If factor prices in the OECD and the rest of the world are equal, then all of the manufacturing firms are faced with symmetric problems. Consequently, they all set the same quantities and charge the same prices. Since there are 2 traded goods prices and 2 factors of production, we know that factor prices are, in fact, equal across regions if both regions produce both goods. This suggests a simple procedure for computing equilibrium common in trade models: We compute an integrated equilibrium model for the world economy. We then compute the production plan for each region. As long as both regions produce both goods, we are done with the computation. If one of the regions were to produce negative

amounts of one of the goods, we would be wrong to assume that factor prices were equal. In this case we would have to go back and compute an equilibrium in which at least one of the countries specializes. (We are not very interested in these sorts of equilibria, however, because they do not correspond with world production patterns in 1961 and 1990.)

We solve the model for a world with two regions, the OECD and the rest of the world, each of which is made up of different countries. To see how the theory matches up with the data, however, it is essential that we be able to calculate intraindustry trade in manufactures within the OECD and between the OECD and the rest of the world.

To calculate intraindustry trade, we generalize the approach developed by Helpman and Krugman (1985). Let s^j be the share of country or region j, $j = 1, \ldots, n, rw$ in the world production of manufactures,

$$s^j = \int_{D^j} Y_m(z)\, dz \Big/ \int_{Dw} Y_m(z)\, dz = Y_m^j \,/\, Y_m^w. \tag{29}$$

Let X_m^j be the total consumption of manufactures by country or region j,

$$X_m^j = \int_{D^w} X_m^j(z)\, dx. \tag{30}$$

In the absence of trade barriers, the composition of consumption baskets of manufactured goods are the same in all countries and regions. Consequently, the imports of country j from the rest of the OECD are

$$M_{oe}^j = \left(1 - s^{rw} - s^j\right) X_m^j, \qquad j = 1, \ldots, n \tag{31}$$

The imports of the rest of the world from the OECD are

$$M_{oe}^{rw} = (1 - s^{rw})\, X_m^{rw}. \tag{32}$$

To obtain total trade within the OECD, we sum the expressions for M_{oe}^{j} in (31) to obtain

$$M_{oe}^{oe} = \sum_{j=1}^{n} M_{oe}^{j} = \left(1 - s^{rw} - \sum_{j=1}^{n} \left(s^{j}\right)^{2} \Big/ \left(1 - s^{rw}\right)\right) X_m^{oe}. \tag{33}$$

3. Calibration

In this section we describe the calibration of the model to a 1990 data set. We begin by assembling a benchmark data set for the OECD in 1990. Specifically, we aggregate figures on production and factor utilization for each of the 3 sectors in the model for the 23 countries listed in Table 1.

Table 2

Benchmark 1990 OECD Data Set

(Million U.S. Dollars)

	Primaries	Manufactures	Services	Total
Y_i^{oe}	668,993	3,659,294	12,141,293	16,469,580
H_i^{oe}	228,208	2,883,736	8,543,962	11,755,906
K_i^{oe}	440,785	775,558	3,497,331	4,713,674
X_i^{oe}	861,634	3,466,653	12,141,293	16,469,580
$Y_i^{oe} - X_i^{oe}$	-192,641	192,641	0	0

The 1990 OECD data set is presented in Table 2. The figures for GDP in each of the 3 sectors are taken from OECD *National Accounts*. To obtain the factor inputs, we first

obtain a labor compensation share for the OECD,

$$\frac{\sum_{i=p,m,s} H_i^{oe}}{\sum_{i=p,m,s} Y_i^{oe}} = \frac{\sum_{j=1}^{23} LC^j}{\sum_{j=1}^{23} (LC^j + FC^j + OS^j - UP^j)}. \tag{34}$$

Here LC^j is the total labor compensation in country j; FC^j is fixed capital consumption; OS^j is operating surplus; and UP^j is unincorporated profits. What this procedure does is to split indirect taxes and unincorporated profits, which is mostly returns to self-employed workers or family businesses, proportionally between returns to labor and returns to physical capital. We then proportionally adjust the labor compensations for each of the 3 sectors reported by OECD *National Accounts* so that their total yield the labor compensation implied by relation (34). Imports of primaries by the OECD from the rest of the world are taken from OECD *Foreign Trade by Commodity*. The number reported is that for net imports. We also report results for an alternative calibration in which these imports are gross exports, 275,043 million U.S. dollars, rather than 192,641 million U.S. dollars. The results for this alternative calibration do not differ significantly from those reported in the next section. Net exports of manufacturing from the OECD to the rest of the world are set equal to imports of primaries to insure balanced trade. Notice though that, given product differentiation in manufacturing, the OECD both imports manufactured goods from the rest of the world and exports manufactured goods to it. The data on consumption by sector are obtained residually. Notice that the concept of consumption in the model corresponds to consumption plus investment plus government spending in the national income accounts.

Population figures are taken from UN *World Population Project*. They are

$$N^{oe} = 853.7, \quad N^{rw} = 4,428.3, \tag{35}$$

where the units are millions of people.

Table 3

Benchmark 1990 Rest of the World Data Set

(Million U.S. Dollars)

	Primaries	Manufactures	Services	Total
Y_i^{rw}	1,222,748	1,159,518	3,447,005	5,829,270
X_i^{rw}	1,030,107	1,352,159	3,447,005	5,829,270
$Y_i^{rw} - X_i^{rw}$	192,641	-192,641	0	0

Total income in the rest of the world is taken from UN *Yearbook of National Accounts Statistics*. In our model this figure is also equal to total consumption:

$$\sum_{i=p,m,s} Y_i^{rw} = \sum_{i=p,m,s} X_i^{rw} = 5,829,270. \tag{36}$$

Table 3 presents a benchmark data set for the rest of the world. These numbers were also derived from the UN *Yearbook of National Accounts Statistics* using the following methodology: We collect sectoral production data for any country for which such data is recorded for a year in the period 1984-1991. We use the sectoral production shares to impute sectoral production in 1990 by multiplying these shares by 1990 GDP. We are able to then impute sectoral production shares for the rest of the world and multiply these shares by total output in the rest of the world to impute sectoral outputs. The number of countries in the rest of the world for which we have sectoral output data is 103. The GDP of these countries in 1990

is 3,149,703 million U.S. dollars, which is 54.0 percent of total GDP in the rest of the world.

The value of $\rho = 0.833333$ $(= 1/1.2)$ is chosen so that the markups charged by manufacturing firms over variable costs in the Lerner condition (18) is 20 percent. This is consistent with evidence presented by Morrison (1990). We normalize $d^w = 100$. The choice of any other value of d^w proportionally scales up or down F, $x_m^j(z)$, $X_m^j(z)$, and $Y_m^j(z)$, but leaves the values of all other variables unchanged.

We calibrate the model by normalizing $q_p = q_m(z) = q_s = r = w = 1$ and then calculating values of K^{rw} and H^{rw} so that the benchmark data set is an equilibrium of the model. In numerical experiments in which we allow for nonhomothetic preferences, we can use the different consumption shares in the OECD and the rest of the world to calibrate the utility parameters γ_p and γ_p. The calibration procedure yields a rest of the world that is more capital abundant than the OECD,

$$\frac{K^{rw}}{H^{rw}} > \frac{K^{oe}}{H^{oe}} \tag{37}$$

because the rest of the world needs to export the capital intensive good, primaries. This relative capital abundance is consistent with the limited data on sectoral labor shares in the UN *Yearbook of National Accounts Statistics.* It is also consistent with the evidence presented by Trefler (1993).

4. Numerical Experiments

In our numerical experiments, we introduce changes in the parameters of the model to simulate the world in 1961. The principal facts about 1961 that we incorporate into our

model are that the world was a much poorer place than in 1990 and that the distribution of income and consumption of manufactured goods was much more concentrated than in 1990. Part of this concentration was reflected in the fact that the industrialized world, which we assume to be the OECD, consisted of fewer countries. Our model says that these differences will have effects on the direction and volume of trade.

In 1961 the OECD consisted of the 19 countries listed in Table 4. Notice the absence of Japan and the very large share of income generated by the United States.

Table 4

OECD in 1961

Country	Share of Income (percent)
Austria	0.5615
Belgium/Luxembourg	0.9354
Canada	2.5475
Denmark	0.5213
France	5.2392
Germany	7.2724
Greece	0.3778
Iceland	0.0205
Ireland	0.1569
Italy	3.4773
Netherlands	1.0276
Norway	0.4472
Portugal	0.2413
Spain	1.0300
Sweden	1.2098
Switzerland	0.8013
Turkey	0.6183
United Kingdom	6.0547
United States	41.7524

The world was much poorer in 1961 than it was in 1990 for two reasons: first, endowments of factors were smaller; and, second, total factor productivities in the different sectors were lower. We begin with total factor productivities by rescaling the constants θ_i

and the fixed costs F in the production functions,

$$\theta_{p,1961} = \theta_{p,1990} \tag{38}$$

$$\theta_{m,1961} = \theta_{m,1990}/1.014^{29},\ F_{1961} = F_{1990}/1.014^{29} \tag{39}$$

$$\theta_{s,1961} = \theta_{s,1990}/1.005^{29} \tag{40}$$

The yearly total factor productivity growth rates, 0, 0.014, and 0.005, are those derived by Echevarria (1997) for the OECD.

Population figures, again taken from the UN *World Population Project*, are

$$N^{oe}_{1961} = 536.0, \qquad N^{rw}_{1961} = 2,545.0. \tag{41}$$

We calibrate the four endowments, K^{oe}_{1961}, H^{oe}_{1961}, K^{rw}_{1961}, H^{rw}_{1961}, so the following four conditions are satisfied

$$\frac{\left(\sum_{i=p,m,s} Y^{oe}_{i,1990}\right)/N^{oe}_{1990}}{\left(\sum_{i=p,m,s} Y^{oe}_{i,1961}\right)/N^{oe}_{1961}} = 2.4003 \tag{42}$$

$$\frac{\left(\sum_{i=p,m,s} Y^{rw}_{i,1990}\right)/N^{rw}_{1990}}{\left(\sum_{i=p,m,s} Y^{rw}_{i,1961}\right)/N^{rw}_{1961}} = 2.0550 \tag{43}$$

$$\frac{K^{oe}_{1961}}{H^{oe}_{1961}} = \frac{K^{oe}_{1990}}{H^{oe}_{1990}} \tag{44}$$

$$\frac{q_{p,1961}(Y^{rw}_{p,1961} - X^{rw}_{p,1961})}{\sum_{i=p,m,s} q_{i,1961} Y^{rw}_{i,1961}} = 0.050285. \tag{45}$$

The yearly growth rates used in (42) and (43), 0.030653 for the OECD and 0.025148 for the OECD, are derived from various issues of the World Bank *World Development Report.*

Unfortunately, these growth rates are calculated for real GDP data that are chained in a complicated way, rather than based on a fixed base year's prices. An alternative is to compute growth rates for real GDP per capita based on 1961 prices, with

$$\frac{\sum_{i=p,m,s} q_{i,1961} Y^{oe}_{i,1990}/N^{oe}_{1990}}{\sum_{i=p,m,s} q_{i,1961} Y^{oe}_{i,1961}/N^{oe}_{1961}} = 2.473882, \tag{46}$$

for example. Yet another possibility would be to take the growth data for the OECD in (42) as given, but to replace the growth data for the rest of the world (43) with the requirement that

$$\frac{\sum_{i=p,m,s} q_{i,1961} Y^{oe}_{i,1961}}{\sum_{i=p,m,s} q_{i,1961} Y^{rw}_{i,1961}} = 2.985134, \tag{47}$$

which says that the ratio of OECD to rest of the world GDP, at 1961 prices, should equal that observed in the data. Results for numerical experiments with this alternative calibration are reported in the next section. They do not differ significantly from those reported here.

Requirement (44), that the capital/labor ratio in the OECD stay fixed has no significant effect on our results given the other requirements that we are imposing. Requirement (45) says that net exports of primaries from the rest of the world to the OECD should equal their observed value in 1961, taken in this case from GATT. As we have already explained it is equally possible to calibrate the model to reproduce gross exports as a faction of GDP, which were 0.081632 rather than 0.050285. The next section also presents an experiment in which we require, rather than satisfying (45), that

$$\frac{K^{rw}_{1961}}{H^{rw}_{1961}} = \frac{K^{rw}_{1990}}{H^{rw}_{1990}}, \tag{48}$$

Although the results for this alternative calibration are slightly more favorable to the new trade theory, they also imply that the rest of the world should have been a net importer of primaries in 1961, a result drastically at odds with the data.

Table 5

Results for Base Case Calibration

		1961	1990	Change
Data				
	OECD-OECD Trade / OECD Income	0.0531	0.1123	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.8435	1.5786	87.1%
	OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%
1. $\gamma_p = 0$, $\gamma_s = 0$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.1070	0.1357	26.8%
	OECD-OECD Trade / OECD-RW Trade	0.8927	1.1685	30.9%
	OECD Manf Con / OECD Income	0.2105	0.2105	0.0%
2. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.1023	0.1322	29.2%
	OECD-OECD Trade / OECD-RW Trade	0.7392	1.0603	43.4%
	OECD Manf Con / OECD Income	0.2123	0.2105	-0.8%
3. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0.4372$				
	OECD-OECD Trade / OECD Income	0.0625	0.1322	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.7384	1.0603	43.6%
	OECD Manf Con / OECD Income	0.1253	0.2105	68.0%
4. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = -1.2150$				
	OECD-OECD Trade / OECD Income	0.1323	0.1322	-0.1%
	OECD-OECD Trade / OECD-RW Trade	0.7398	1.0603	43.3%
	OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%

Table 5 reports the results of some numerical experiments with our model. We focus first on the base line experiment in which $\gamma_p = 0$, $\gamma_s = 0$, $\eta = 0$. It is this experiment that is the best test of the Helpman-Krugman explanation of the expansion of trade volume. Notice that, although trade between OECD countries as a fraction of income does expand by 26.8 percent, this increase is far short of the 111.5 percent increase in the data. Notice too that trade within the OECD increases only by 30.9 percent compared to OECD trade with the rest of the world, rather than increasing by 87.1 percent as in the data. The Helpman-Krugman

explanation of the increase in trade volumes, embodied in this experiment falls well short of accounting for the facts.

Let us now focus on the experiments in which utility is nonhomothetic. Notice that, when we calibrate the parameters γ_p and γ_s to match the consumption shares in Tables 2 and 3, setting $\gamma_p = -169.5$, $\gamma_s = 314.7$, we obtain parameters that are consistent with other evidence that it is services that have the highest income elasticity of demand, followed by manufactures, which are in turn followed by agriculture. As we can see, Markusen's (1986) story does indeed go a long way in accounting for the increase in OECD-OECD trade compared to OECD trade with the rest of the world, accounting for almost half of the observed increase.

The next experiment, in which $\gamma_p = -169.5$, $\gamma_s = 314.7$, and $\eta = 0.4372$, shows that, if we introduce price elasticities of demand that differ from 1 by letting η differ from 0, the model is indeed flexible enough to account for the increase of OECD-OECD trade compared to OECD income. The value of η that we use is very high, however: Stockman and Tesar (1995), for example, estimate η to be -1.27. Notice too that this parameterization results in a huge increase in the share of manufactures in consumption in the OECD over the period 1961-1990 as their relative price falls because of technological progress. This huge increase in share is very much at odds with the decline observed in the data.

The final experiment shows that, for a reasonable value of η, $\eta = -1.2150$, the model is capable of matching the decline in consumption share of manufactures while preserving the explanation for the expansion of OECD-OECD trade relative to OECD trade with the rest of the world. Notice that this experiment predicts that OECD-OECD trade should have fallen slightly as a fraction of OECD income, a prediction drastically at odds with the data.

The final numerical experiment is the only one consistent with the observed differences in the composition of output between the OECD and the rest of the world in 1990 and the observed change in the composition of output in the OECD between 1961 and 1990. In this numerical experiment the new trade theory fails to account for any of the increase in the ratio of OECD-OECD trade to OECD income. The theory does, however, account for half of the increase in ratio of OECD-OECD trade to OECD-RW trade.

Some simple calculations show why we should not have expected the new trade theory to simultaneously account for both the sharp increase in trade over the period 1961-1990 and the decline in the importance of manufacturing in final demand. Neglecting trade in manufactures with the rest of the world, we can approximate OECD-OECD trade in manufactures with the formula

$$\frac{M_{oe}^{oe}}{Y^{oe}} \approx (1 - \sum_{j=1}^{n} (s^j)^2) \frac{X_m^{oe}}{Y^{oe}}. \tag{49}$$

In the data, the index of size distribution of national incomes in the OECD, $(1 - \sum_{j=1}^{n} (s^j)^2)$, goes from 0.6634 in 1961 to 0.8272 in 1990, producing the increase in trade to income emphasized by Helpman and Krugman (1985). It is here that allowing the membership of the OECD to increase over time produces results favorable to the theory. The ratio of manufacturing GDP to total GDP in the OECD, X_m^{oe}/Y^{oe}, falls, however, from 0.2779 in 1961 to 0.2105 in 1990. Notice that these two changes almost exactly cancel each other out, producing the prediction of no increase in the ratio of OECD-OECD trade to OECD income trade in the final experiment.

5. Sensitivity Analysis

This section reports the results of numerical experiments of models in which we employ alternative calibration methodologies. First, we report the results of experiments where, rather than calibrating the utility parameters γ_p and γ_s to match observed consumption shares, we set them arbitrarily to $\gamma_p = -200$ and $\gamma_s = 1600$. These parameter values make primaries more inferior and services more superior than in our base case calibration. One defense for this alternative specification is that the data in Table 3, upon which our calibration of the parameters γ_p and γ_s is based, are probably the least reliable numbers in our benchmark data set.

Table 6

Results for Alternative Specification of Nonhomotheticity

	1961	1990	Change
Data			
OECD-OECD Trade / OECD Income	0.0531	0.1123	111.5%
OECD-OECD Trade / OECD-RW Trade	0.8435	1.5786	87.1%
OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%
1. $\gamma_p = -200$, $\gamma_s = 1600$, $\eta = 0$			
OECD-OECD Trade / OECD Income	0.0788	0.1093	38.7%
OECD-OECD Trade / OECD-RW Trade	0.3263	0.6074	86.1%
OECD Manf Con / OECD Income	0.2269	0.2105	-7.2%
2. $\gamma_p = -200$, $\gamma_s = 1600$, $\eta = 0.4170$			
OECD-OECD Trade / OECD Income	0.0517	0.1093	111.5%
OECD-OECD Trade / OECD-RW Trade	0.3259	0.6074	86.9%
OECD Manf Con / OECD Income	0.1449	0.2105	45.3%
3. $\gamma_p = -200$, $\gamma_s = 1600$, $\eta = -0.7416$			
OECD-OECD Trade / OECD Income	0.0957	0.1093	14.2%
OECD-OECD Trade / OECD-RW Trade	0.3265	0.6074	86.0%
OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%

Notice in Table 6 that the results for both the ratio of OECD-OECD trade to income and the ratio of OECD-OECD trade to OECD-RW trade improve significantly. Even so, in the third experiment, where η is calibrated to match the observed decline in the consumption

share of manufactures, the model is only able to replicate a small fraction of the observed increase in the ratio of OECD-OECD trade to OECD income. Nevertheless, no matter what the value of η, Markusen's (1986) story based on inferiority of primaries can account for the observed increase in the ratio of OECD-OECD trade to OECD trade with the rest of the world if utility is sufficiently nonhomothetic.

Table 7

Results for Gross Imports Calibration

		1961	1990	Change
Data				
	OECD-OECD Trade / OECD Income	0.0531	0.1123	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.8435	1.5786	87.1%
	OECD Manf Con / OECD Income	0.2674	0.2055	-23.1%
1. $\gamma_p = 0$, $\gamma_s = 0$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.1081	0.1357	25.5%
	OECD-OECD Trade / OECD-RW Trade	0.9029	1.1685	29.4%
	OECD Manf Con / OECD Income	0.2055	0.2055	0.0%
2. $\gamma_p = -134.6$, $\gamma_s = 418.0$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.0994	0.1291	29.8%
	OECD-OECD Trade / OECD-RW Trade	0.6440	0.9759	51.5%
	OECD Manf Con / OECD Income	0.2090	0.2055	-1.7%
3. $\gamma_p = -134.6$, $\gamma_s = 418.0$, $\eta = 0.4440$				
	OECD-OECD Trade / OECD Income	0.0610	0.1291	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.6430	0.9759	51.8%
	OECD Manf Con / OECD Income	0.1212	0.2055	69.6%
4. $\gamma_p = -134.6$, $\gamma_s = 418.0$, $\eta = -0.9879$				
	OECD-OECD Trade / OECD Income	0.1250	0.1291	3.3%
	OECD-OECD Trade / OECD-RW Trade	0.6448	0.9759	51.3%
	OECD Manf Con / OECD Income	0.2674	0.2055	-23.1%

Table 7 reports the results of numerical experiments of a model in which imports of primary goods by the OECD from the rest of the world are identified with gross exports, rather than with net exports as in the base case calibration. Notice that, given our calibration procedure, the fraction of income spent on manufactures in the OECD in 1990 changes from 0.2105 to 0.2055.

Table 8 reports the results of a set of numerical experiments for the calibration in which growth in the endowments of the rest of the world between 1961 and 1990 are calibrated to replicate the observed ratio of OECD income to income in the rest of the world in 1961 (47), rather than to replicate the observed growth rate (43). Similar calculations, not reported here, show that imposing growth rates based on 1961 prices (46) do not significantly affect the results.

Table 8

Results for Alternative RW Growth Calibration

	1961	1990	Change
Data			
OECD-OECD Trade / OECD Income	0.0531	0.1123	111.5%
OECD-OECD Trade / OECD-RW Trade	0.8435	1.5786	87.1%
OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%
1. $\gamma_p = 0$, $\gamma_s = 0$, $\eta = 0$			
OECD-OECD Trade / OECD Income	0.1094	0.1357	24.0%
OECD-OECD Trade / OECD-RW Trade	0.9901	1.1685	18.0%
OECD Manf Con / OECD Income	0.2105	0.2105	0.0%
2. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0$			
OECD-OECD Trade / OECD Income	0.1049	0.1322	26.0%
OECD-OECD Trade / OECD-RW Trade	0.8182	1.0603	29.6%
OECD Manf Con / OECD Income	0.2123	0.2105	-0.8%
3. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0.4437$			
OECD-OECD Trade / OECD Income	0.0625	0.1322	111.5%
OECD-OECD Trade / OECD-RW Trade	0.8152	1.0603	30.1%
OECD Manf Con / OECD Income	0.1226	0.2105	71.7%
4. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = -1.1907$			
OECD-OECD Trade / OECD Income	0.1359	0.1322	-2.7%
OECD-OECD Trade / OECD-RW Trade	0.8205	1.0603	29.2%
OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%

The final set of results reported are for numerical experiments of a model in which endowments in the rest of the world in 1961 are required to have the same capital/labor ratio as they do in 1990 (48) rather than to generate the observed exports of primaries to the OECD (45).

Table 9

Results for Alternative Endowment Calibration

		1961	1990	Change
Data				
	OECD-OECD Trade / OECD Income	0.0531	0.1123	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.8435	1.5786	87.1%
	OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%
	RW Prim Exp / RW Income	0.0503	0.0330	-34.3%
1. $\gamma_p = 0$, $\gamma_s = 0$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.1077	0.1357	26.0%
	OECD-OECD Trade / OECD-RW Trade	0.8948	1.1685	30.6%
	OECD Manf Con / OECD Income	0.2105	0.2105	0.0%
	RW Prim Exp / RW Income	0.0565	0.0330	-41.5%
2. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0$				
	OECD-OECD Trade / OECD Income	0.0920	0.1322	29.8%
	OECD-OECD Trade / OECD-RW Trade	0.7181	1.0603	47.7%
	OECD Manf Con / OECD Income	0.2123	0.2105	-0.8%
	RW Prim Exp / RW Income	-0.0407	0.0330	-
3. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = 0.3555$				
	OECD-OECD Trade / OECD Income	0.0625	0.1322	111.5%
	OECD-OECD Trade / OECD-RW Trade	0.7166	1.0603	48.0%
	OECD Manf Con / OECD Income	0.1497	0.2105	40.6%
	RW Prim Exp / RW Income	-0.0497	0.0330	-
4. $\gamma_p = -169.5$, $\gamma_s = 314.7$, $\eta = -1.2361$				
	OECD-OECD Trade / OECD Income	0.1230	0.1322	3.3%
	OECD-OECD Trade / OECD-RW Trade	0.7199	1.0603	47.3%
	OECD Manf Con / OECD Income	0.2779	0.2105	-24.3%
	RW Prim Exp / RW Income	-0.0311	0.0330	-

Notice that this calibration results in the rest of the world importing primary goods form the OECD in 1961.

6. Some Not So Recent Trade Facts

Although the three facts reported in the introduction do indeed characterize post World War II trade data, they do not characterize data before then. The new trade theorists of the 1980s may have gone too far in focusing on a limited amount of data. The historical data cast doubt on the explanations of the facts posited by the new trade theory.

The high rates of growth in foreign trade and the steady increase in the ratio of trade to income observed after the 1950s, also characterized the trends in the foreign trade statistics during the nineteenth century. In fact, as reported by Kuznets (1967), between 1800 and 1913, per capita world trade grew at an average rate of 33.0 percent per decade, whereas per capita world income did it at an average rate of 7.3 percent. As a result, during the period, the ratio of trade to income increased to over 11 times its initial level. Since estimates for 1913 show that the ratio of world exports to world income was about 17 percent, in 1800 it must have been below 2 percent. The inter war period, however, resulted in a dramatic reduction in trade, not only as a fraction of world income, but also in absolute terms. This reduction was particularly intense during the Great Depression years. United Nations data show that by 1950 the ratio of world trade to world income had fallen to less than 8 percent. By 1990, this ratio had risen to slightly more than 15 percent, still not at the level achieved in 1913.

Data for the United States show a similar pattern. Starting in the 1960s, as Figure 4 reports, there was a significant increase in the ratio of trade to income but only to reach, in 1990, a level similar to those seen during the second half of the nineteenth century. (The data in this figure calculate trade as exports plus imports.)

Finally, looking at directions of trade, Woytinsky and Woytinsky (1955) report that Europe dominated world trade during the nineteenth century. In 1913 the ratio of intra European trade to world trade was 40 percent. By 1938, however, it had fall to 29 percent, and in 1953 it was 22 percent. During the next thirty years this ratio increased steadily until reaching 38 percent in 1990, a value similar to the one seen in 1913.

7. Intermediate Goods?

Our model does not include intermediate goods. Yet much of the increase in trade has been in intermediate goods. (See, for example, Feenstra, 1998.) Could introducing intermediate goods be a way of rescuing the new trade theory? As Figure 5 shows, in the United States and in Mexico the utilization of intermediate goods has declined sharply over the past 20 years compared to GDP. Looking at Input-Output Matrices confirms that the decline in the importance of intermediate goods reflects the decline in importance of manufactures. Intermediate goods are disproportionately used by and produced by the manufacturing sector. In the United States in 1987, although the manufacturing sector accounted for 21.5 percent of GDP, it accounted for 40.0 percent of the use of intermediate goods and 38.1 percent of their production. The Mexican data are similar: In Mexico in 1985, although the manufacturing sector accounted for 23.4 percent of GDP, it accounted for 52.3 percent of the use of intermediate goods and 41.7 percent of their production. Adding intermediate goods to the models would complicate the data analysis because of the lack of comparable input-output matrices across countries and time. It would still leave us with the same mystery in relation to the new trade theory: The goods that are being traded more and more over time are the same goods whose importance is falling in relationship to domestic production.

8. Policy?

The post war years have seen substantial steps towards global trade liberalization. Could it be changes in policy rather than the features emphasized in the new trade theory that have been responsible for the dramatic increase in the ratio of trade to income? We can provide a preliminary answer to this question and highlight the issues at stake with a simple

version of the new trade theory model used in this paper.

Consider a model with only one sector, the manufacturing sector, and one set of countries that engage in international trade, the OECD. Suppose that each of the n countries in the OECD imposes trade barriers on imports from the other countries in the form of a uniform *ad valorem* tariff, τ. In contrast to our earlier analysis, we assume that all of the countries in the OECD are identical in terms of size, because trade barriers would affect countries of different size differently. In this model, each country would produce the fraction $1/n$ of the world's varieties of goods. Let X_d be the amount of each variety consumed domestically and X_f the amount consumed in each of the $n-1$ foreign countries. Symmetry and the first order conditions for utility maximization imply that

$$\frac{X_d}{X_f} = (1+\tau)^{\frac{1}{1-\rho}}. \tag{50}$$

Market clearing implies that

$$X_d + (n-1)X_f = Y. \tag{51}$$

Combining these conditions, we can obtain an expression for the ratio of exports to income:

$$\frac{(n-1)X_f}{Y} = \frac{n-1}{n-1+(1+\tau)^{\frac{1}{1-\rho}}}. \tag{52}$$

To replicate index of size distribution of national incomes in the OECD, $(1-\sum_{j=1}^{n}(s^j)^2)$, with symmetric countries where $s^j = 1/n$, we can let the number of countries take on non integer values. In 1961, $(1-\sum_{j=1}^{n}(s^j)^2) = 0.6634$, implying that $n = 2.97$. In 1990, $(1-\sum_{j=1}^{n}(s^j)^2) = 0.8272$, implying that $n = 5.79$. As we have seen, however, the change

in the size distribution of national incomes is almost exactly canceled out by the decline in the importance of the manufacturing sector. Consequently, we fix $n = 5.79$ and ask whether changes in trade barriers as represented by τ can account for the more than doubling of the ratio of trade to income. The answer to this question obviously depends on how much trade barriers have fallen and on the elasticity of substitution between varieties, $1/(1-\rho)$. Calculations for a wide variety of parameters are presented in Figure 6. What we need is a large fall in trade barriers, accompanied by a large elasticity of substitution. If $\rho = 1/1.1$, for example, implying an elasticity of substitution of 11, a fall in τ from 0.25 to 0.05 implies that the ratio of trade to income increases by a factor of 2.5. If $\rho = 1/1.2$, however, implying an elasticity of substitution of 6, we need a larger fall in τ, say from about 0.50 to 0.05 to produce the same sort of increase in the ratio of trade to income.

Yi (1999) argues that, since average tariff rates have fallen from about 15 percent in 1960 to 5 percent in 1990, incorporating policy changes into the new trade theory cannot account for the increase in trade unless we assume very high elasticities of substitution in varieties. He presents a model in which it is increases in international vertical integration, induced by changes in trade policy, that account for the increase in the ratio of trade to product. It must be pointed out, however, that Harrigan (1993) shows that even in the OECD in 1983 non tariff trade barriers were far higher than tariff barriers, in fact more than 8 times higher. Hummels (1999) has also identified a large number of trade barriers and has shown that their presence does a good job in accounting for observed trade patterns. To the extent that these trade barriers have fallen significantly, a version of the new trade model that emphasizes trade policy seems capable of explaining large increases in the ratio of trade to income.

Data sources

We report the sources for all data used in the paper ordered as they are presented.

Indices of output and exports for 1950-1990 in Figure 1:

United Nations, *Statistical Yearbook*, New York, various issues.

World exports and world GDP for 1950, 1970 and 1990:

United Nations, *Trends in International Distribution of Gross World Product, Special Issue, National Account Statistics*, New York, 1993.

Trade within the OECD and OECD trade with the rest of the world for 1961-1990 in Figures 2 and 3:

Organization for Economic Cooperation and Development, *Foreign Trade by Commodities*, volumes 1 and 2, Paris, various issues.

Grubel-Lloyd indices for 1990:

Organization for Economic Cooperation and Development, *Foreign Trade by Commodities,* volumes 1 and 2, Paris, 1993.

United Nations, *International Trade Statistics Yearbook,* New York, 1993.

GDP for each OECD country in Tables 1 and 4 and sectoral GDP and labor and capital for the OECD in Table 2:

Organization for Economic Cooperation and Development, *National Accounts*, Paris, various issues.

Net and gross imports of primaries by the OECD from the rest of the world for 1990 in Table 2:

Organization for Economic Cooperation and Development, *Foreign Trade by Commodities*, volume 1, Paris, 1993.

Population for the OECD and the rest of the world in 1990 and 1961:

United Nations, *World Population Project*, New York, various issues.

Aggregate and sectoral GDP for the rest of the world in 1990 in Table 3:

United Nations, *Yearbook of National Account Statistics*, New York, 1993.

Income per capita growth rates for the OECD and the rest of the world for 1961-1990:

World Bank, *World Development Report*, Washington, various issues.

Net exports of primaries from the rest of the world to the OECD in 1961:

General Agreement on Tariffs and Trade, *International Trade*, Geneva, 1963.

International Monetary Fund, *Direction of Trade Annual*, Washington, 1965.

Exports, imports, and GNP for the United States for 1870-1990 in Figure 4:

Department of Commerce, Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970*, Washington, 1975.

United Nations, *National Account Statistics, Main Aggregates and Detailed Tables*, New York, various issues.

Historical data on world trade:

S. Kuznets, "Quantitative Aspects of the Economic Growth of Nations: X-Levels and Structure of Foreign Trade: Long-term Trends," *Economic Development and Cultural Change*, Part II, 1967.

United Nations, *Trends in International Distribution of Gross World Product, Special Issue, National Account Statistics*, New York, 1993.

Historical data on trade within Europe:

W. S. Woytinsky and E. S. Woytinsky, *World Commerce and Governments: Trends and Outlook*, The Twentieth Century Fund, New York, 1955.

International Monetary Fund, *Direction of Trade Statistics Yearbook*, Washington, various issues.

Intermediate inputs and GDP in the United States and Mexico in Figure 5:

Instituto Nacional de Estadística, Geografia e Informática, *Anuario Estadístico de los Estados Unidos Mexicanos*, Aquascalientes, various issues.

Department of Commerce, Bureau of Economic Analysis, "Improved Estimates of Gross Product by Industry 1947-98," *Survey of Current Business*, **81** (2000). The data are available on the Bureau's website, http://www.bea.doc.gov/bea.

Input-output matrices for the United States and Mexico:

Instituto Nacional de Estadística, Geografia e Informática, *Matriz de Insumo Producto Actualizada a 1985*, Mexico, D. F., 1990.

Department of Commerce, Bureau of Economic Analysis, "Input-Output Accounts of the U.S. Economy, 1987," *Survey of Current Business,* **74** (1994). The data are available on the Bureau's website, http://www.bea.doc.gov/bea.

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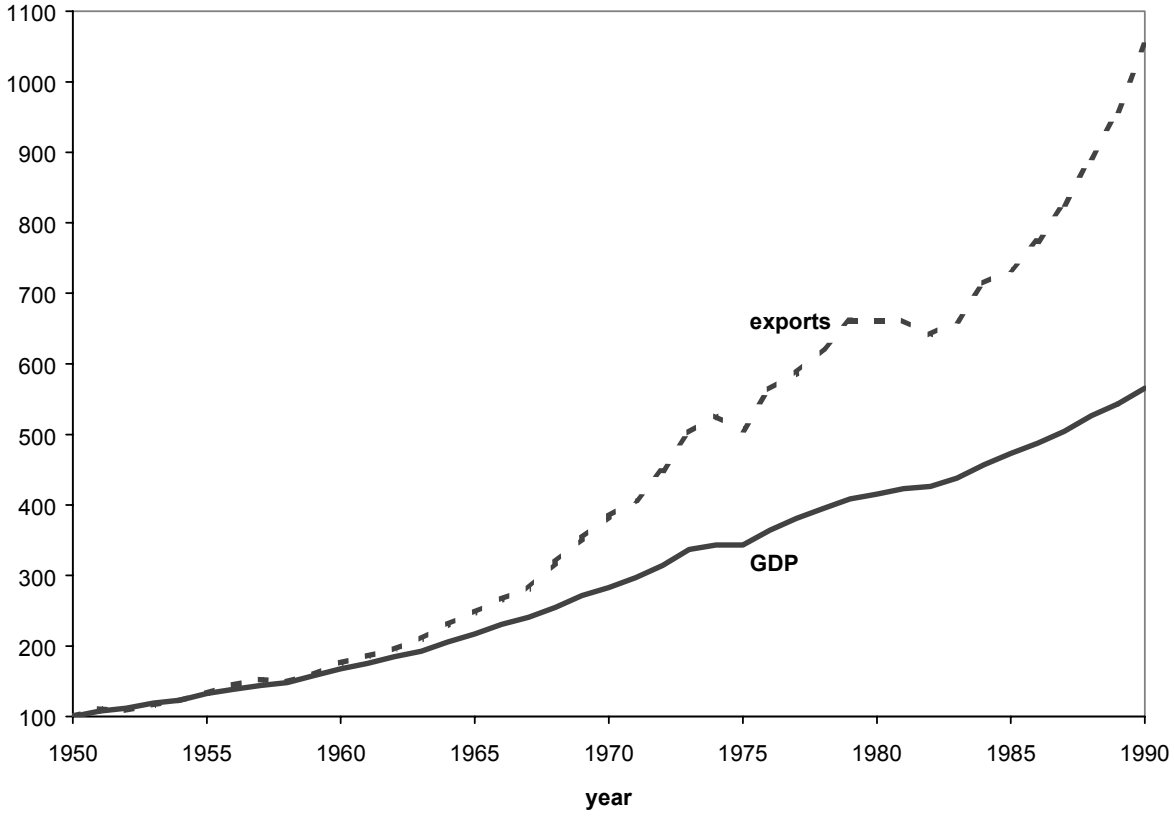

Figure 1: World Exports and World GDP (1950=100)

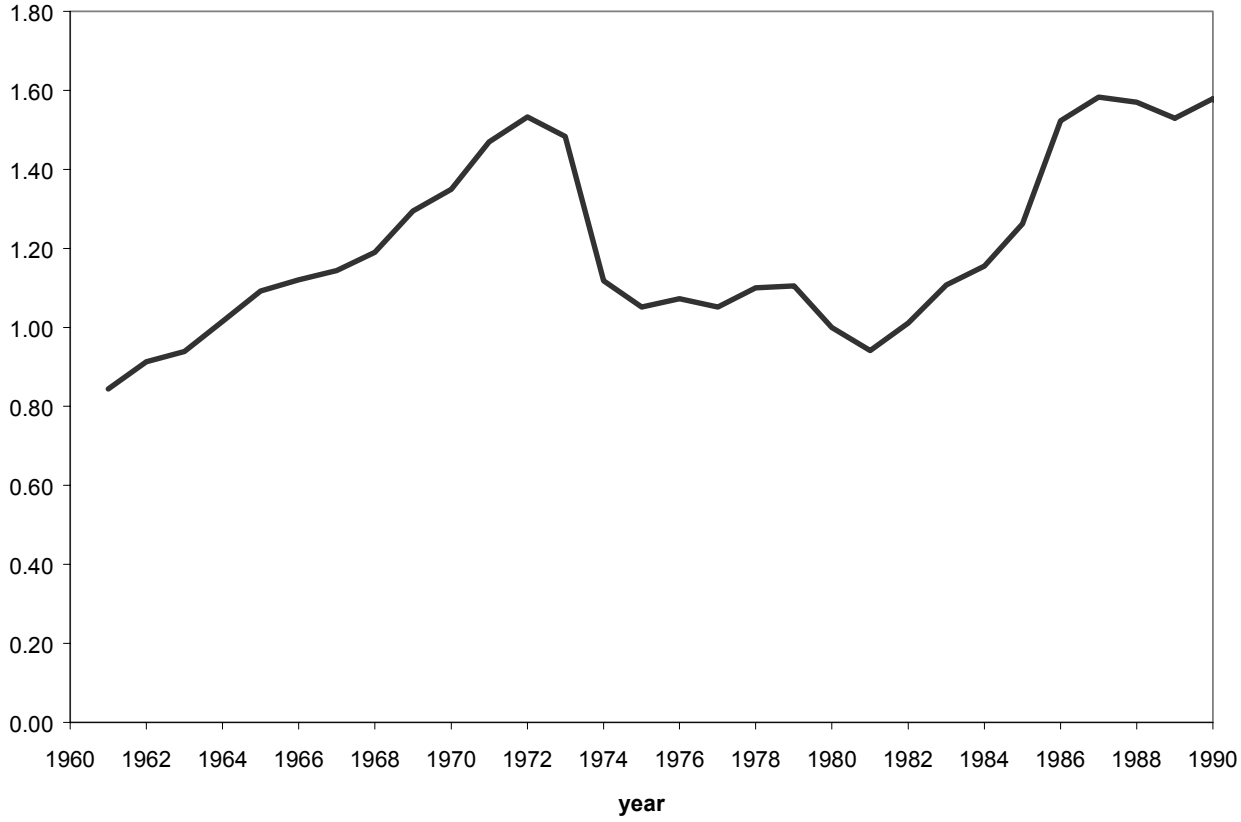

Figure 2: OECD-OECD Trade / OECD-RW Trade

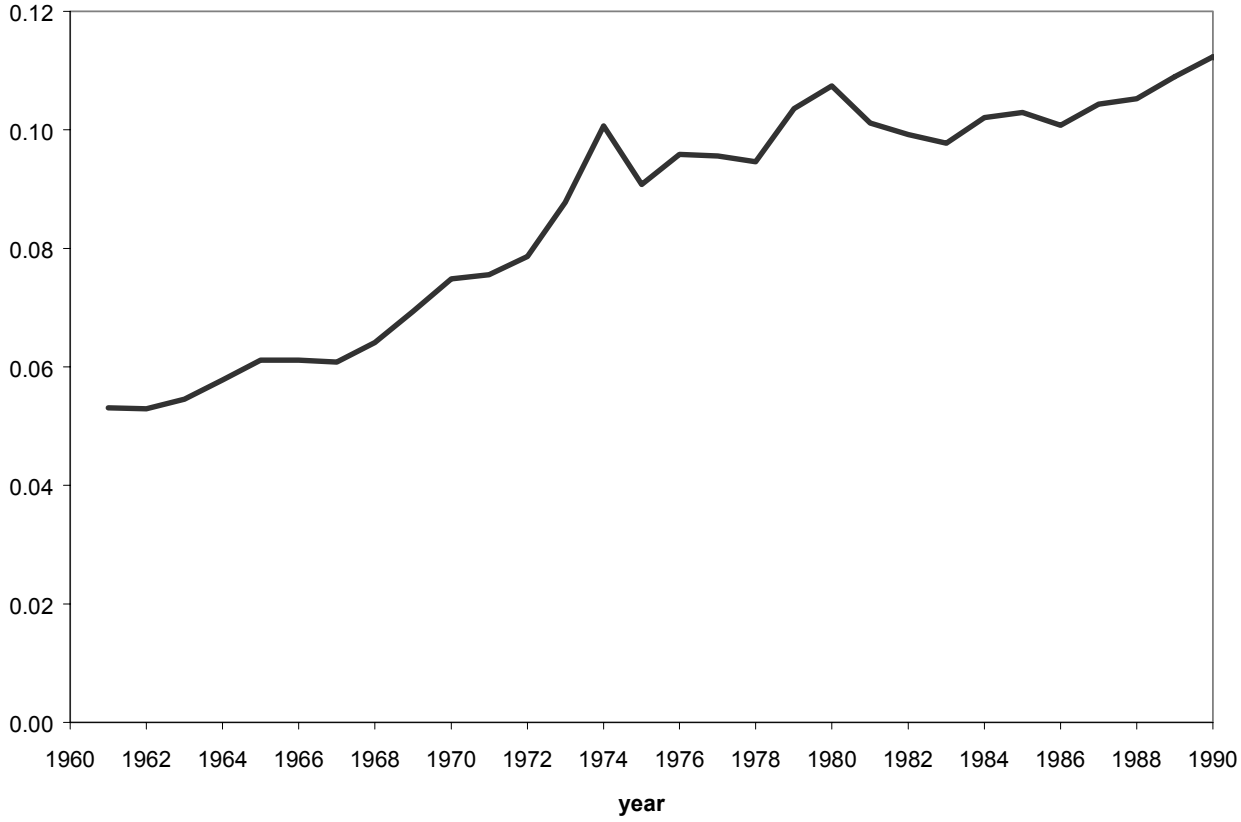

Figure 3: OECD-OECD Trade / OECD Income

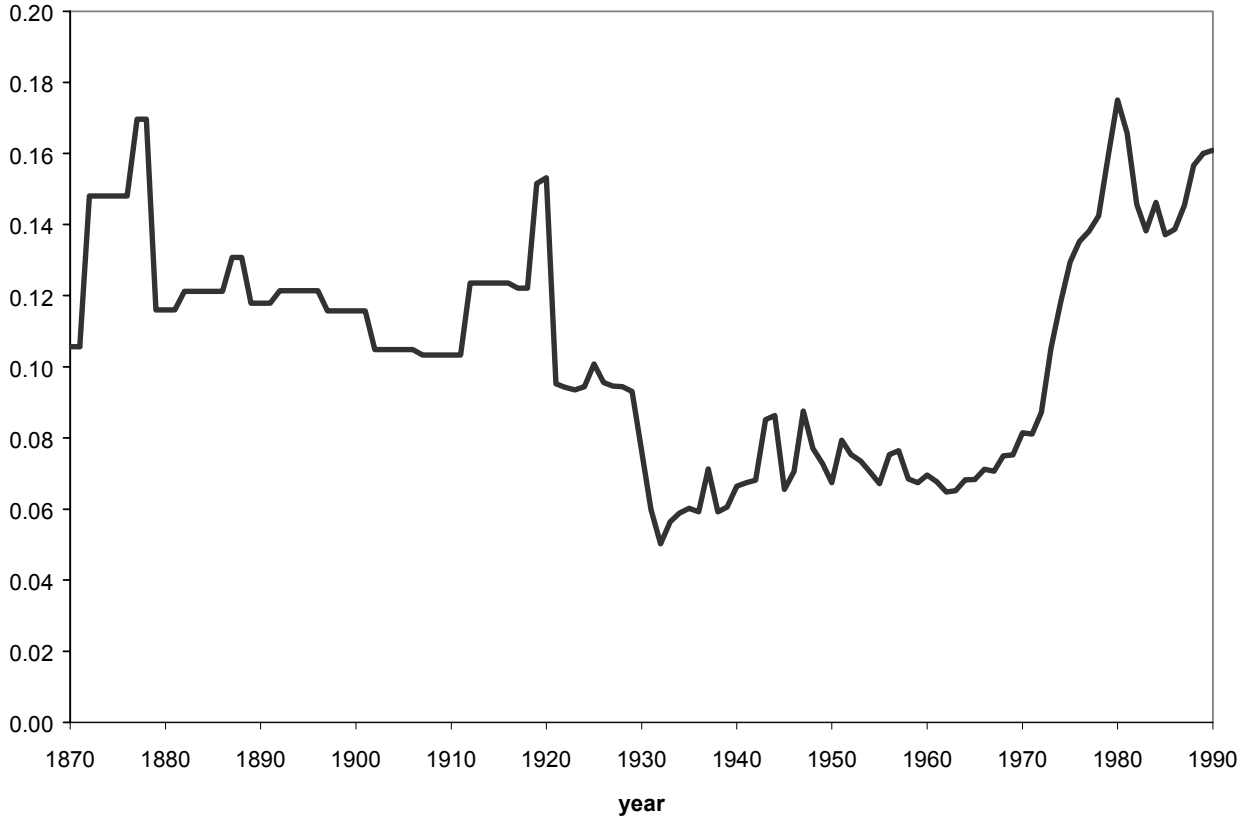

Figure 4: U.S. Total Trade / U.S. GNP

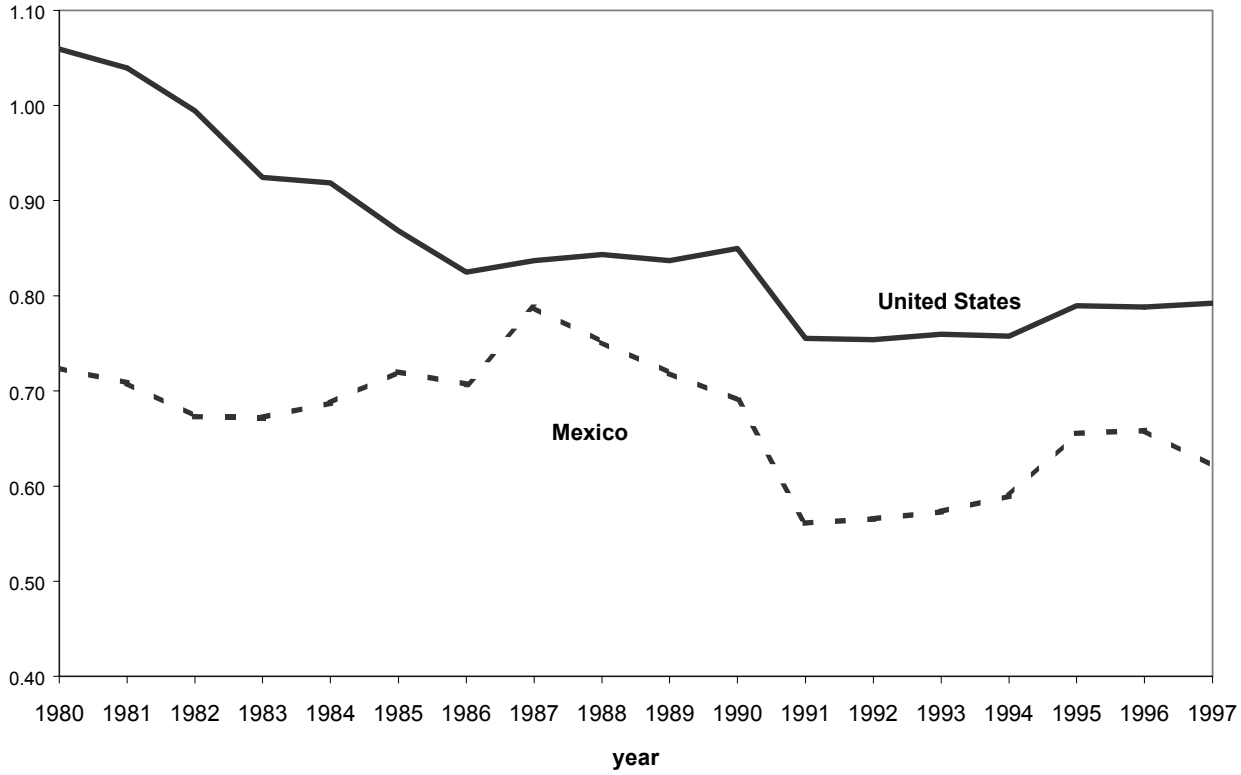

Figure 5: Intermediate Inputs / GDP in the United States and Mexico

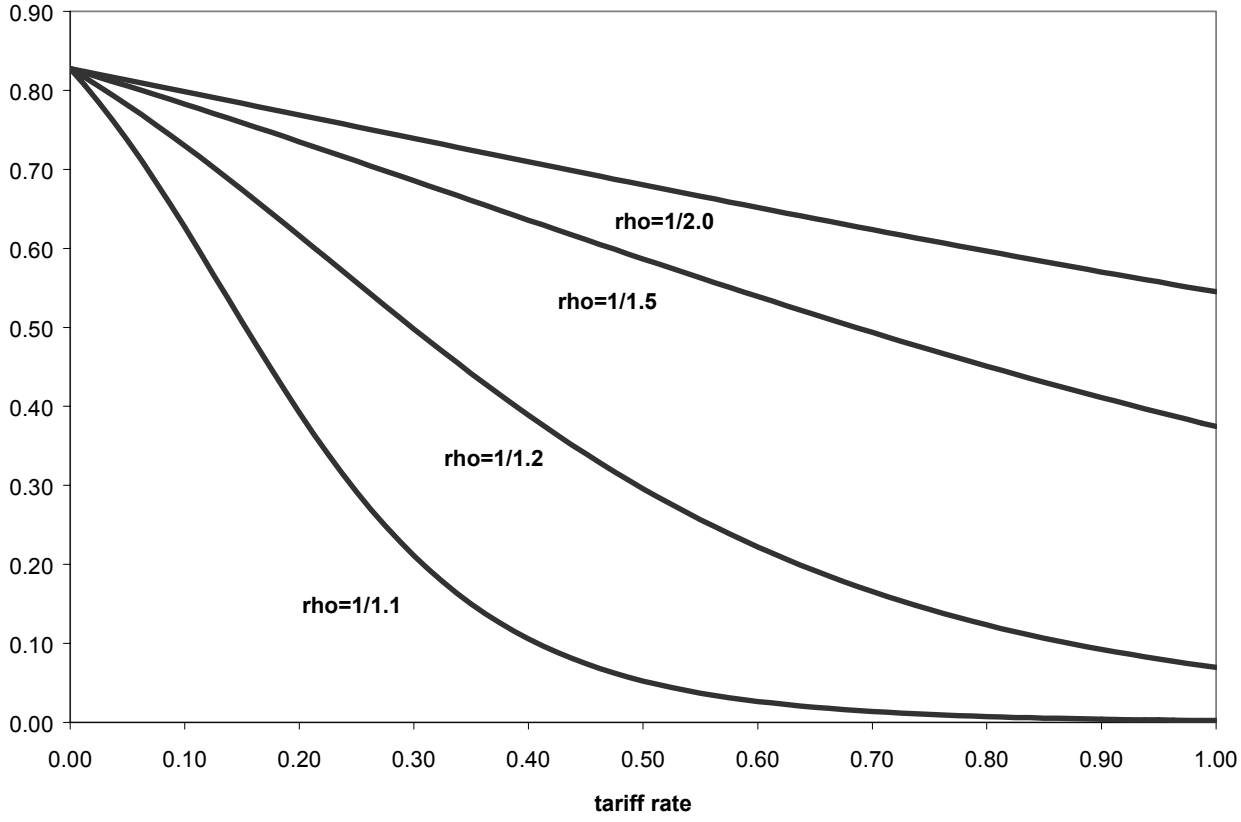

Figure 6: World Trade / World Income