DOES TRADE THEORY EXPLAIN A COUNTRY'S TERMS OF TRADE?

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ABSTRACT

Changes in a country's terms of trade have a direct impact on its welfare. Improving terms of trade enable a country to buy more imports for the same amount of exports. Decreasing terms of trade, on the other hand, cut a nation's purchasing power on international markets. Because of these welfare implications, analyses of the terms of trade have a long and distinguished history in economics. However, the extensive attention given to the topic has produced few empirical studies that explain the movements of the terms with a structural model that relates them to their determinants in the real economy. In fact, classic hypotheses such as the one by Bhagwati-Johnson, have never been put to a test. This gap in the literature leaves crucial questions unaddressed, for example: To what extent can a country influence its terms of trade? How does increasing output due to factor accumulation or technological progress affect the terms of trade? And hence, are worsening terms of trade the price to be paid for economic expansion?

In the present paper we explicitly link the analysis of the terms of trade to a core question in international trade: How is production distributed internationally, and what determines that distribution? Different views on the distribution of production generate very different hypotheses about how terms of trade will evolve. (1) In a world in which countries produce different goods, output growth will worsen a country's terms of trade. (2) However, in a diversified world, in which all countries are able to produce the same products, changes of the terms of trade critically depend on the export or import bias of the expansion. We test the first hypothesis as we model a world with complete specialization. We contrast the analysis with a model of a diversified economy for which we take to the data the famous Bhagwati-Johnson hypothesis about sector-biased economic growth and how it affects a country's terms of trade.

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Introduction

Why a country's terms of trade change and how they change are important questions. It is generally recognized that movements in a country's terms of trade are critical for its economic welfare. Improving terms of trade due to higher export or lower import prices allow a country to sell its export goods for more imports on international markets. Decreasing terms of trade, on the other hand, lower its international purchasing power. Given these direct welfare implications, it is not surprising that analyses and hypotheses concerning the terms of trade have a long history in economics. From the classical economists to Prebisch and Singer, particular attention has been given to the terms of trade between primary commodities and manufacturing that are critical for developing countries.[2] Also the current trade and wages debate hinges on the terms of trade. It is investigated whether growing trade with low-wage countries decreases the price of our unskilled-labor intensive imports vis-à-vis our skilled-labor intensive exports. And if so, whether this widens the skilled-unskilled wage gap in developed countries.

Despite the considerable attention economists have given to the terms of trade, there are hardly any empirical studies, except for CGE models, that go beyond time series analyses and that empirically relate the terms of trade to more fundamental factors such as productivity increase, factor accumulation, etc. [3, 4 5] This gap is an important shortcoming

Purdue were helpful. William Prince from the World Bank graciously provided the terms of trade data. All remaining errors are ours.

[2] See Hadass and Williamson (2001) for the classical debate and the literature in the wake of the Prebisch-Singer hypothesis.

[3] To a large extent, this lack of attention is due to the fact that most of the empirical literature makes the convenient assumption that countries are small. Because of this assumption, the terms of trade are exogenous and a country does not affect its own terms of trade. Alternatively, the literature studies the effect of exogenous terms of trade shocks. Probably best known are Easterly et al. (1993) and Barro and Sala-i-Martin (1995) who include countries' terms of trade in growth regressions. Mendoza (1996) also

in the research, since investigating the links between the real side of the economy and the terms of trade opens up crucial questions, for example: How are factor accumulation and output expansion related to a country's terms of trade? To what extent can countries affect their own terms of trade? And, are deteriorating terms of trade the price to be paid for increased output? In this paper we address this gap in the research and provide a framework for the empirical study of the real side determinants of the terms of trade.

From a theoretical point of view, terms of trade movements critically depend on the distribution of world production. When countries do not produce the same homogenous products, most theories predict that output growth due to technological progress or factor accumulation will worsen a country's terms of trade. This result is clearly observed in the Ricardian model by Dornbusch, Fischer and Samuelson (1977), its adaptation by Krugman (1985), a Heckscher-Ohlin model with complete specialization, or whenever the Armington (1969) assumption is used to distinguish goods by country of origin. The intuition for declining terms of trade is straightforward. To sell additional output on world markets, all else equal, a country has to lower its export price. Alternatively, if more output means more income and higher import demand, import prices will rise. However intuitive this result is, it is not a generally valid one

The classic papers by Bhagwati (1958,1969) and Johnson (1958) emphasize that output expansion has an ambiguous impact on the terms of trade when countries produce the same set of goods.[6] In particular, Bhagwati and Johnson study exporting countries that also produce the goods that they import. In their analysis, export-biased growth worsens a

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includes the variance of the terms of trade. In studies of the determinants of the real exchange, the terms of trade are often included as an exogenous explanatory variable, see De Gregorio and Wolf (1994) for relevant literature.

[4]There is an extensive literature on purchasing power parity and the law of one price that is reviewed in Froot and Rogoff (1995). The part of the literature that relies on structural models is dominated by the debate over the cross-country and intertemporal differences between traded and non-traded goods prices and how these explain the movements of the real exchange rate. This debate goes back to the Balassa (1964) and Samuelson (1964) hypothesis. Only in rare cases is any distinction made between the traded goods price of exports and imports as in De Gregorio and Wolf, 1994. In these rare instances, countries are by assumption small and the terms of trade are exogenous.

[5] CGE studies such as Brown (1987) find that trade liberalizations are dominated by terms of trade effects.

[6] Findlay and Grubert (1959) study how various kinds of technological progress will affect the terms of trade. See also Findlay (1984).

country's terms of trade. Import-biased growth, on the other hand, may actually improve the terms of trade, because it increases the goods that the country tends to import relative to the ones it exports. In other words, both the sectoral composition of growth and the cross-country distribution of production are critical for the terms of trade. Interestingly enough, this Bhagwati-Johnson alternative hypothesis has received virtually no attention in the empirical literature.[7] This is surprising since an important part of the empirical trade literature assumes that countries produce the same goods, see Trefler (1995), Harrigan (1997) and others. In fact, one of the central questions in international trade is currently to what extent countries produce the same goods, including Schott (1998), Debaere and Demiroglu (1998), Davis and Weinstein (2000) and others.[8] In addition, import-biased growth seems plausible. The newly industrialized countries in East Asia industrialized in record pace and increasingly produced the products they initially imported. The same probably happens, albeit at a slower pace, in countries such as Spain or Mexico.

In this paper we propose a global framework to study the terms of trade. For all goods, we model world demand and supply and construct countries' terms of trade as an index of the equilibrium prices that are set on world markets. In the empirical analysis we will then relate these terms of trade indices to the changing world demand for and supply of each country's export and import goods. This global approach explicitly links the terms of trade to the current debate about international specialization of production. In particular, we investigate the terms of trade under two alternative scenarios. First, we assume that all countries produce different goods. Second, we model the world as a diversified economy in which all countries produce the same goods. This yields the exact setting that we need to study the Bhagwati-Johnson hypothesis. Moreover, by modeling the terms of trade as an index of prices that are set at the world level, we equalize world

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[7] The argument that the Bhagwati prediction of import-biased growth is not very relevant in today's world, since it would imply less not more trade ignores a global trend toward free trade.

[8] Schott (1998), Debaere and Demiroglu (1998), Debaere (2001a), Davis and Weinstein (2000) and Harrigan and Zakrajsik (2000) use the framework of the Heckscher-Ohlin model. Their research question can be summarized with the question: Is there one cone of diversification or are there more? Helpman

demand and world supply, without making balanced trade the focus of the analysis, which is important in a world with persistent trade imbalances. In our model, the terms of trade are not by assumption this major force that balances trade and that equalizes a country's import demand with the rest of the world's demand for its exports.

The global approach that we take distinguishes our study from Krugman (1989) and Acemoglu and Ventura (2001), which are two of the few studies that explain the terms of trade with a structural model. Both studies focus on the balanced trade condition, however. Krugman (1989) investigates for manufacturing in nine OECD countries whether faster growing countries avoid deteriorating terms of trade because their import demand elasticity is lower than the elasticity of world demand for their exports. Acemoglu and Ventura (2001) study for the world as a whole whether the overall terms of trade equalize the export demand of faster growing countries to the import demand in the slower growing rest of the world, controlling for demand changes due to increasing varieties. Theirs is an explicitly dynamic model in which the terms of trade are critical to maintain a stable world income distribution. Note in addition that both studies assume that countries produce different sets of goods, which leaves little room for the Bhagwati-Johnson hypothesis and which de-emphasizes the importance of the sectoral distribution of production for the terms of trade. Different from Acemoglu and Ventura (2001) we impose less structure on the intertemporal dimension and gear our setup towards an empirical analysis that makes the use of panel data techniques possible.

Note that we assume that the world markets are integrated, in the sense of Goldberg and Knetter (1997): Geography or nationality does not have systematic effects on transactions prices for otherwise identical products (except for, of course, the marginal cost of moving a good from one location to another). We know that the latter assumption does not hold in reality. There are deviations from purchasing power parity in the short run and maybe in the medium and long run (Froot and Rogoff, 1995). There is also micro-evidence of cross-country deviations from the law of one price (Goldberg and Knetter, 1997). Admitting to a certain degree of market segmentation does not preclude, however, that relative prices may follow changing world supply and demand. In fact, we

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(1987), Hummels and Levinsohn (1995), Evenett and Keller (2001) and Debaere (2001b), on the other will exactly be able to determine to what extent global conditions do affect a country's prices. Moreover, in the empirical implementation, we correct for deviations from PPP to filter some of the short-run volatility due to exchange rate fluctuations, which Engel and Rogers (1995,1996) analyzed in their study of the deviations of the law of one price. We also relate distance to the predictions of the terms of trade theories. In doing so, we explicitly address Engel and Rogers' hypothesis that distance weakens the equalizing forces of price arbitrage and accounts for deviations from the law of one price.

Finally, our study faces the challenge of any intertemporal or cross-country study that measures production at the aggregate or at the industry level. We measure output quantities without any explicit indication of changing quality or increasing/decreasing varieties. As Krugman (1989) noted, an increase in aggregate or industry output that is accompanied by the creation of new products should not have a negative impact on the terms of trade.[9] In the empirical implementation we will investigate whether indeed more intra-industry trade (and the more likely creation new varieties) in varieties mitigates the impact of output on the terms of trade. We also proxy for changing preferences that should also capture changing quality or varieties.[10]

Our empirical evidence suggests that neither the perfect specialization approach to the terms of trade nor the analysis of the terms in the context of a diversified economy can provide an explanation for terms of trade movements of a relatively big sample of countries. However, we uncover a systematic pattern in the rejections of the theory that is in line with Engel and Rogers' (1996) analysis. Especially for the perfect specialization approach, we find fairly robust evidence in support among countries that are reasonably close to the world markets. Among these close countries, an increase in output leads to a drop in the terms of trade, holding all else equal. At the same time, there is weaker evidence for a feedback on the terms of trade from the the world supply of all the export

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hand, test the complete specialization models of "new" trade theory.

[9] In a recent study, Hummels and Klenow (2001) develop a measure for extensive (more varieties) versus intensive (more of the same varieties/goods) expansion. They relate these measures to country size to study how well the data capture the predictions of various variety models and what these imply for the impact of changing supply on the terms of trade. They find most support for Krugman (1980).

and the import-competing goods that multiple countries produce, which is in line with the Bhagwati Johnson hypothesis.

The paper is structured as follows. In the first section we derive the terms of trade equation for a world of specialization in which countries produce different sets of goods. We present the estimation equation and we address some econometric issues. In the second section we derive the test equation for a diversified economy in which all countries produce the same goods. In section three we discuss the data that we use and how we construct these. The next section focuses on the empirical results and their interpretation. In this section we address alternative hypotheses and the relation between geography and the terms of trade. We relax some of the constraints of the test specification and relate the empirical results to varying intra-industry trade and changing quality. In section five we conclude.

1. Terms of Trade in a World of Complete Specialization.

How the terms of trade change critically depends on the extent to which countries produce the same set of goods. In this section we study a world of complete specialization, in which countries produce different goods and in which by definition all output expansion is export biased. Here, technological progress and factor accumulation should negatively affect a country's terms of trade. In a world in which all countries produce a different good, the world supply of a good is identical to the supply of one particular country. [11] As noted, various models deliver this type of complete specialization. We use the Armington (1969) assumption that differentiates goods by country of origin.

A. Theoretical Setup

Preferences are defined by a CES utility function for country *j*.

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[10] Feenstra (1994) shows how changing preferences in a CES setting capture also changing quality or changing varieties.

(1) $U_j = [S_i(b_i c_{ij}^{(s-1)/s})]^{s/(s-1)}$

, where c_{ij} is country j's consumption of country i's good, and s is the elasticity of substitution between goods. Consumers in country j maximize utility subject to $S_i\, p_{ij}\, c_{ij} = y_j$, which yields country j's nominal demand for country i's product in equation (2). Note that we introduce an element of geography by allowing for iceberg transportation costs t_{ij}, so that $p_{ij} = p_i t_{ij}\ (t_{ij} > 1)$.

(2) $c_{ij} = b_i\, p_i^{-s} t_{ij}^{-s}\, y_j / P_j^{I\ 1-s}$

, with $P_j^I = [S_i b_i\, p_i^{1-s} t_{ij}^{1-s}]^{1/(1-s)}$, the aggregate price index of country j.

Summing over all countries j (including i), one obtains the total world demand for the product of country i. In equilibrium this world demand equals world supply X_i, which in turn amounts to country i's total production. After some rewriting, we obtain an expression for the price of county i's good, p_i, that is at the same time its export price, P_i^X.[12]

(3) $p_i = P_i^X = X_i^{-1/s}\, b_i^{1/s}\, [S_j\, t_{ij}^{-s}\, y_j / (P_j^I)^{1-s}]^{1/s}$

We model production with Cobb Douglas. A country's production depends on its total factor supplies and its productivity A_i that differs internationally. We consider the factors, capital, labor and human capital. There is no international factor mobility.

(4) $X_i = A_i K_i^{g0} L_i^{g1} H_i^{g2}$ *with* $S_i g^i = 1$

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[11] Alternatively, all domestic goods are perfect substitutes.

[12] We ignore that p_i is also part of P_j.

The equations (3) and (4) describe for each good how the world equilibrium price is determined. Since we want to derive an index of the terms of trade, we transform the demand equation (3). For each good that country *i* imports, there exists such an equation. Define q_{ki}^M as the fraction of *i*'s total imports that is imported from country *k* -- For notational convenience we use *k* to denote all countries from which *i* imports.[13] Then, raise for each import good the left and right-hand side of the price equation to the q_{ki}^M th power. (Note that $S_k q_{ki}^M = 1$) After multiplying the left-hand sides and the right-hand sides of the demand equations for all import goods *k* with each other, we obtain an expression for the index of the import prices of country *i*, P_i^M; we also suppress the subscripts of q_{ki}^M.

$$(5) \qquad P_i^M = P_k\, p_k^{qM} = P_k\, X_k^{-1/s\ qM}\, P_k\, b_k^{qM}\, [\,(S_j\, t_{kj}^{-s}\, y_j /(P_j^I)^{1-s}]^{1/s\ qM}$$

We finally obtain an expression for an index of country *i*'s terms of trade, T_i, by dividing a country's export price by its import prices and by taking a logarithmic transformation.[14]

$$(6) \qquad ln\,(P_i^X/P_i^M) = ln\,(T_i) = 1/s\ ln\,(b_i /P_k\, b_k^{qM}) - 1/s\ ln\, X_i + 1/s\ ln P_k X_k^{qM} - 1/s\ ln\, MP_i$$

, where $MP_i = P_k\, [\,(S_j\, t_{kj}^{-s}\, y_j / (P_j^I)^{1-s}]^{qM} / [S_j\, t_{ij}^{-s}\, y_j / (P_j^I)^{1-s}]$

Expression (6) is a relative demand equation that we will want to estimate. The equation involves the demand for domestically produced export goods versus foreign import goods. It characterizes the index of a country's terms of trade as determined by the preferences for the foreign versus the domestic goods, a term measuring the market potential of foreign versus domestic goods and the amount of import versus export goods

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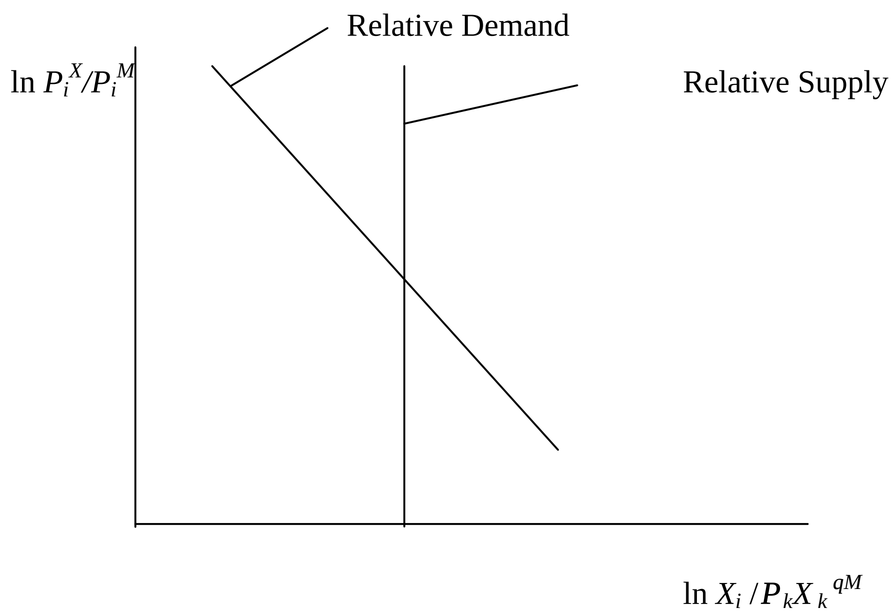
[13] To be explicit in this context, '*j*' stands for "the other countries" and *k* for 'the countries from which *i* imports'. This distinction is important in equation (5) and (6).

[14] For notational convenience we treat the import prices free of transportation costs. We could rewrite equation (6) with transportation costs, using $p_{ij} = p_i t_{ij}$. This would result in a country-specific term in (6).

available. Note that equation (6) can be viewed as one equation of a relative demand - relative supply system that determines the terms of trade. Note that such a system is by assumption recursive because a country's supply, and hence its relative supply schedule, is independent of the terms of trade. (The figure below depicts the relative demand and supply schedule that we face.) [15]



Note that the relative demand equation (6) predicts, with s positive that an increase in a country's own output, holding all else constant, should worsen its terms of trade and so should an increase in the market potential abroad.

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[15] For comparison, we report the totally differentiated balance of trade condition from which the test equation in Krugman (1989) and Acemoglu and Ventura (2001) is derived. Johnson (1955)'s totally differentiated balanced trade condition on which Krugman (1989) relies: $p_t = -1/(s_x+s_y-1) . [z_x x_t - z_m g_t]$, where p_t stands for the growth rate of the terms of trade, s_x and s_y respectively are the elasticity of the demand for exports and imports, z_x and z_m the income elasticity of the demand for exports and imports, gt stands for a country's income growth, x_t the income growth in the rest of the world. Acemoglu and Ventura (2001)'s differentiated balanced trade condition: $p_t=-1/(s-1) . [g_t-x_t] + D \ ln \ m_t$, where p_t stands for the growth rate of the terms of trade, g_t stands for a country's income growth, x_t the steady state growth that is the same across all countries and μ_t the change in varieties.

B Regression Specification

Our aim is to estimate the relative demand equation (6) as a single equation from a system of relative demand and relative supply. As can be seen, the estimation equation follows directly from the theory.

(7) $$ln\ T_{it} = J_{0i} + J_1\ ln\ X_{it} + J_2\ ln\ P_{j\backslash i} X_{jt}^{qM} + J_3\ ln\ MP_{it} + e_{it}$$

In a world of complete specialization, we expect a negative elasticity J_1 with respect to its own and a positive J_2 with respect to the rest of the world's output. Note that it is assumed that the import shares qM do not change over time, which is not uncommon for a price index. It should be noted that the pattern of countries' major importers is relatively stable anyway. Moreover, keeping import shares constant avoids any concerns about endogeneity, since the shares are exogenous to whatever happens in any period other than the base year.

As discussed in the theory section, the terms of trade are determined where relative supply and relative demand meet. In the relative demand equations, the terms of trade are a function of the relative supplies, relative market potential and tastes. Supply, and hence relative supply, is a function of given country endowments and technology and as such independent of a country's terms of trade. In other words, there is a recursive aspect to our setup. Therefore, in theory, OLS yields unbiased estimates of each single equation of the relative supply-demand system, when we have appropriate proxies for tastes and market potential and in the absence of any correlation between output shocks and the error in the terms of trade regression. Since any correlation between e_{it} and output shocks, for example because taste shocks are correlated with technology shocks, misidentifies the demand equation, we propose a two stage least square procedure. We instrument for output with the predicted values of the following panel regression that estimates the production side of the model that we discussed earlier. The fairly strong correlation between X_{it} and the predicted value should add to the quality of the instruments.

(8) $lnX_{it} = a_t + a_i + g_1 \ln K_{it} + g_2 \; lnL_{it} + g_3 \, lnH_{it} + m_{it}$

, where trend a_t and country-specific effect a_i capture differences in technology across countries and over time.

Even though a country’s output is not determined by the terms of trade in the theoretical framework that we propose, one may wonder whether the terms of trade could not affect output through capital accumulation. The latter would create a correlation between e_{it} and shocks to output and invalidate the chosen instruments. In particular, there is a body of work that links either the mean or the variance of a country’s terms of trade to its savings behavior and hence to capital accumulation. Moreover, this literature is supported by growth regressions that show the significant impact of the average and the variance of the terms of trade on economic growth.[16] The framework that we propose takes care of such concerns, since any link through capital accumulation between the variance or the mean of e_{it} and a country’s output will be picked up by the country specific-effect a_i in the output equation.[17]

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[16] See Mendoza (1996)

[17] We report the following illustrative regression results to address concerns about the relation between the terms of trade and the capital stock. As noted, because of the fixed effect, a relation between the variance or the mean of the terms of trade and the capital stock does not affect the validity of the instruments -- a contemporaneous relation, however, does. We relate a country's capital stock to variables that could affect savings behavior. We choose population and the composition of the population. (Population also controls for size.) In a cross-country regression of our capital stock on population that includes the variance and the average of the terms of trade we find a significant impact for both the variance and the mean. (POP = population, human = proxy for composition of population, ratio of educated versus low-educated fraction of the population) -- the coefficient on avgtot is of the wrong sign :

$$LnK_i = constant + 1 \, lnPOP_i \; -5.7 \ln vartot_i \; -0.18 \ln avgtot_i \qquad R^2 \; 57.5, obs{:}\ 51$$
(t,6.2) (t,-2.7) (t,-2.3)

$$LnK_i = constant + 0.97 \, lnPOP_i + 0.48 \, human_i - 3.6 \ln vartot_i \; -0.1 \ln avgtot_i \qquad R^2 \; 57.5, obs{:}\ 51$$
(t,7.5) (t,5.1) (t,-2.7) (t,-1.6)

In a fixed effect regression of countries' capital stock on country-specific fixed effects, countries' population POP and the composition of their population,human, we do not find a significant impact of the terms of trade on the capital stock. (Remember that the variance and mean of the capital stock are part of the fixed effects.)

This leaves us with the question how to proxy for market potential and tastes. As one remembers from the theory section, the market potential term, MP_i, contains income and is therefore bound to be correlated with the error term e_{it}. Therefore, we propose to instrument for income with the predicted country output from the supply regression. We propose population that is commonly used in the gravity equation literature as an alternative measure. We will proxy for transportation costs with distance. Note that we take the size of countries into account. We treat countries like circles and discount a country's output by the radius of its surface. To construct the market potential variables we assume that the elasticity of substitution is 2. The taste variables disappear into the fixed effect, which implies that tastes stay the same.

3. Terms of Trade in a World of Incomplete Specialization

To study the Bhagwati-Johnson prediction of the terms of trade, we investigate a diversified world economy in which exporting countries also produce import-competing goods.[18] To model the production side, we rely on the theory of comparative advantage and what it implies for the international distribution of production.

As noted, the effect on the terms of trade critically depends on the export or import bias in the output expansion. A bias towards exports induces a deterioration of a country's terms of trade, because it increases the relative supply of the goods the country exports relative to the ones it imports. Alternatively, import bias may improve its terms of trade. In a world in which many countries produce the same goods that are perfect substitutes, what ultimately determines a country's terms of trade is the world equilibrium

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$$Ln\ K_{it} = \text{country effects} + \underset{(t,39)}{2.2}\ ln\ POP_{it} + \underset{(t,0.6)}{.019}\ ln\ tot_{it} \quad obs{:}969,\ R2{:}\ 68.3$$

$$Ln\ K_{it} = \text{country effects} + \underset{(t,27.7)}{1.8}\ ln\ POP_{it} + \underset{(t,11.2)}{0.7}\ human_{it} + \underset{(t,0.015)}{.005}\ ln\ tot_{it} \quad obs{:}969,\ R2{:}\ 68.5$$

[18] In terms of the recent literature on international specialization, it is assumed that all OECD countries lie in one and the same cone.

and whether, from the point of view of a specific country, this world equilibrium is biased towards its export or its import goods. Therefore, it is critical to appropriately identify world demand and world supply for individual goods. In a diversified world economy, the world supply of a product is no longer identical to the production of one country. Instead it amounts to total amount of what all countries produce in given sectors.

A. Theoretical Setup

We characterize the consumers' preferences with a CES utility function. In all countries consumers consume the same goods. Since all countries *i* produce the same set of goods, the subscript *z* refers to a particular sector instead of to a particular country. For now, we do not introduce bilateral transportation costs.

(9) $c_{zi} = b_z p_z^{-s} y_i / P_i^{I\,1-s}$

, with $P_i^I = [S_z b_z p_z^{1-s}]^{1/(1-s)}$, the aggregate price index of country *I*.

From equation (9) we derive the terms of trade equation, following the same procedure as before. There are two critical differences, however. The world production of good *z*, X_z, now amounts to the sum of the X_{zi}'s across all countries of the world, $X_z = S_i X_{zi}$. Also, because a country now exports in various sectors, we have to construct an index of the export prices in the same way that we built an import price index. The demand (price) equations for the export goods are taken to the q_{zi}^{X} th power, whereas the import demand (price) equations are taken to the q_{zi}^{M} th power. With some algebra, we obtain an expression for the terms of trade of a country an incompletely specialized world.

(10) $\ln T_i = 1/s \ln (P_z b_z^{qX} / P_z b_z^{qM}) - 1/s \ln P_z X_z^{qX} + 1/s \ln P_{z,} X_z^{qM}$

We determine sectoral production starting from comparative advantage. The following equation has been a basic equation in studies about the international allocation of production and the Rybczynski effect. It relates sectoral output X_{zi} to a country's factor endowments, typically capital, various types of labor and land. This factor endowments driven model of production, as it is called in the literature, is applied and modified in Leamer (1984,1987), Harrigan (1995), Bernstein and Weinstein (1998) and Schott (2000).[19]

(11) $X_{zi} = g_{1z} K_{it} + g_{2z} L_{1i} + g_{3z} L_{2i} + g_{4z} LA_i$

To derive equation (11) one typically assumes factor price equalization. One can relax this condition by allowing for factor-augmenting productivity differences as in Trefler (1995). Note that the g_i *'s* are sometimes referred to in the literature as the Rybczynski derivatives; they are a function of technology and prices that we specify in the discussion of the empirical implementation.

B. Regression Specification

Our baseline fixed effect regression is based on equation (10).

(12) $ln\ (T)_{it} = J_{0} + J_{1} ln P_z X_{zt}^{qX - qM} + e_{it}$

In an imperfectly specialized world, we expect a negative coefficient on $J_{1.}$ In that case, from the perspective of country *i*, there is either export bias in the world economy ($P_z X_z^{qX - qM}$ increases over time), or there is import bias ($P_z X_z^{qX - qM}$ decreases over time). Regression (13) is perhaps the most interesting specification, since it disentangles the

[19] Indeterminacy because there are more goods than factors is, for the empirical implementation, no problem with international as opposed to regional data, cf. Hanson and Slaughter (1999) and Bernstein and Weinstein (1998). Note that we will implement this model for the OECD countries that have relatively similar endowments so that the existence of multiple cones should not be a primary concern.

impact on the terms of trade from the world expansion among its export goods from that among it import goods. J_1 should be negative and J_2 positive.

(13) $ln\ T_{it} = J_0 + J_1\ lnP_z\ X_{zt}^{qX} + J_2 lnP_z\ X_{zt}^{qM} + e_{it}$

Some of the concerns addressed in the previous section arise also in the estimation of the present equation. Even though the theoretical setup does not impose that the relative supply is independent of terms of trade, our empirical implementation will de facto imply just that. We use a two-stage least squares procedure to instrument for X_{it}. We take the predicted values from the panel regression of a country's sectoral output X_{it} on its exogenous endowments and we sum these predicted values across countries, i.e. X_{it} ^= $S_i X_{zit}$^ . We make use of two types of capital, four types of labor and arable land -- we discuss the data sources in the next section.

(14) $X_{zit} = a_i + a_z + g_{1z}\ K_{1it} + g_{2z}\ K_{2it} + g_{3z}\ L_{1it} + g_{4z}\ L_{2it} + g_{5z}\ L_{3it} + g_{6z}\ L_{4it} + g_{7z}\ LA_{it} + m_{zit}$

Regression (14) of course has a striking resemblance to the endowment-driven output model. To be internally consistent, we have to slightly modify the theoretical setup. In particular, we follow Leamer (1987,1984) and assume Leonrief technology. This assumption makes the g_z coefficients of the output equation a function of technology and not of prices. Therefore, the g_z coefficients that are estimated as constants do not imply that prices do not change, which would be inconsistent with studying changing terms of trade altogether. Note that Leontief technology relaxes the factor price equalization requirement. Even though the assumption that prices do not affect sectoral output may seem strong at first, one should keep in mind that we study yearly observations, which is a relatively short adjustment span with less than perfect cross-sectoral mobility in reality.

The quality of the instruments depends, of course, on the extent to which these are correlated with X_{zi}. To increase that correlation, we address some of the shortcomings of the endowment-driven model as Harrigan (1995) identified them. Since there are differences in factor productivity across countries, we introduce factor productivity corrections for labor and land. In particular we will relate the factor productivity to the US productivity in the beginning of our sample. In doing so, we will implicitly allow for technological change to take place in the specification. Note also that the instruments that we use are the sum of the predicted sectoral output of all countries, an average that should track actual world sectoral output reasonably well.

Finally, as before, any effect through the mean or the variance of the terms of trade on savings and hence on investment and capital should be neutralized by introducing country- specific fixed effects in the endowment-driven model. As we argue below, because of the fairly drastic changes in the sectoral import and export structure we allow the trade shares that we use to construct the export and import supply variables to change over time. To avoid any endogeneity we take the lagged values of these shares.

3. The Data Requirements

a. Terms of trade

We study the world of complete specialization at the country level. Our analysis of the incomplete specialization case is mainly based on countries' manufacturing sectors due to data limitations. To construct an index of a country's overall terms of trade and its terms of trade in manufacturing we rely on price indices from the World Bank's World Tables (1991), which has been the data source for Baxter and Kouparitsas (2000), Mendoza (1996) and Acemoglu and Ventura (2001). The World Tables provides for over one hundred countries' overall export price and import price between 1970 and 1988. In addition, export price indices for overall manufacturing (SITC categories 5, 6, 7 and 8, except for code 68), fuels (SITC categories 3) and non-fuel commodities (SITC categories 0,1, 2 and 4) are provided. Import prices for these three categories are not available, however. Baxter and Kouparitsas (2000) provide a very good analysis of the variability of these various price indices across categories and sectors.[20] Note that all the price indices are based on dollar denominated unit value calculations.

For the case of complete specialization we use two different measures of the terms of trade -- the difference will turn out to be negligible from an empirical perspective. On the one hand, we directly take the ratio of the overall export and import price from the World Tables. The disadvantage of this measure is, of course, that it also reflects changing prices of trade with third countries -- countries that are not part of the 51 countries for which we also have output and endowment data. To compensate for this disadvantage we construct a terms of trade index that is consistent with the set of countries that we use in our dataset. Following Baxter and Kouparitsas (2000), we construct for each country its aggregate import price P_{it}^{M}. We combine the export prices of the other 50 countries from which a country imports with the shares of these countries in total imports to construct a fixed-base geometric-means price index. We hold the import shares fixed for 1985, which is the base year of all our variables in which by definition real and nominal shares are the same. We note that changing the year of the weights to the real import shares of 1975 for example, hardly makes any difference, which is mostly due to the relative stability of countries' major import partners.

(15) $P_{it}^{M} = P_j P_{jt}^{qij0}$

, where *qij0* is the fraction of country *i*'s imports that come from country *j* in the base year 0. We discuss the sources of the bilateral trade shares under c.

For the incomplete specialization case, we follow a parallel strategy. Ideally, one would combine the export or import prices for the various manufacturing sectors into a terms of trade index. However, the World Tables only provide a country's export price in manufacturing and a sectoral breakdown for a wide variety of countries is not readily

[20] From the variance decompositon of the terms of trade in Baxter and Kouparitsas (2000) we know that the variation of export vs. import prices in manufacturing is responsible for about half the variation in the overall terms of trade in developed countries. In developing countries the variability of the manufacturing terms of trade accounts for about 40 percent of the overall variability of the terms of trade. Also, the terms of trade tend to be more volatile for developing countries compared to developed countries.

available.[21] Consequently, we construct the same fixed-base geometric means import price index as in (15). This time, however, we rely on the bilateral import shares in total manufacturing for our 18 countries. In other words, *qij0* in the terms of trade formula will represent the share of country *j*'s goods in total manufacturing imports of country *i* in base year *0.*

Finally, we also introduce a PPP-corrected measure of the terms of trade, since the latter are based on dollar-denominated unit values. Using PPP-values and exchange rates from either the World Bank or the Penn World Tables (The difference does not matter for our estimation.), we multiply countries export prices with which we construct the terms of trade with the ratio of PPP over the exchange rate. Clearly, should the exchange rates follow purchasing power parity, the ratio is one and no correction is made.

b. Factor supplies and Output Predictions

To instrument for output, we need output predictions at the country and at the sectoral level for 1970-1988. To obtain these predictions, we use sectoral and aggregate output data and data of country endowments. For the incomplete specialization case, we rely on the factor endowments of Harrigan (1997). We use two types of capital from the Penn World Tables, population from Penn World and four categories of schooling from Barro and Lee (1993). Arable land is taken from the FAO. Sectoral gross output for 25 manufacturing sectors in 18 countries is drawn from the OECD STAN database. (Since the World Bank price data for manufacturing do not contain fuels, we drop the sectors Petroleum and Refining from the dataset.) We deflate sectoral output by sectoral value added prices from the OECD STAN data, for lack of gross output prices and use PPP values instead of nominal exchange rates. In Table 1 and 2, more details on the data sources are provided.

[21] We will be able to use these prices in a separate study that specifically tries to explain the US terms of trade movements.

In Table 3 we present panel regressions for the endowment-driven sectoral output model as estimated by Harrigan (1995). Note that we adjust the labor and endowment factors for productivity differences with respect to the US in 1970 to improve the predictive power. In other words, we multiply them by $Y_{ict}/Y_{us,1970.}$ We correct for heteroskedasticity that may arise and allow for an AR1 component in the error term. All regressions contain country specific effects. We take the predictions of sectoral output to construct the predicted value of world output in a sector, X_{it} ^= $S_i X_{zit}$^.

For the complete specialization case, we use capital, population and human capital data. We aggregate durable goods and nonresidential capital from the Penn World data. To construct the human capital measure, we take the ratio of the sum of the two categories of highest educated to the lowest educated people. The aggregate output data for 51 countries are taken from the Penn World Tables in PPP values. Table 1 discusses the data sources for the complete specialization case in detail.

The predicted values of a country's real output are obtained from the following fixed effect production regression. We suppress the coefficients of the 51 country specific effects.

(8) $$lnX_{it} = -13.6 + 0.01t + a_i + 0.24ln\,K_{it} + 0.37\,lnL_{1it} + 0.06lnH_{it} + m_{it}$$

(t,-5.1) (t,7.3) (t, 9.8) (t,6.5) (t,3.1)

n: 969 R^2:

c. Trade shares

Trade data enter the analysis in two ways. We need them to construct our price indices and our output measures.

We extract the bilateral import shares of our 51 countries and the bilateral import shares in total manufacturing of our 18 countries from Feenstra et al. (1997). Table 5A and B report these data for 1985, which is the base year of all our indices and real values. When calculating 1975 shares we deflate trade flows with the export and import price indices from the World Bank. Table 4 provides the sectoral export and import shares for the 18 OECD countries -- we provide them at the two-digit level, even though we use 25 three-digit sectors in the implementation. Note that these data are based on the OECD STAN data and reported in ISIC categories by the OECD. For Korea these data are not available from the OECD. We therefore take the data from Feenstra (1997) and concord the SITC classification of the trade data with the industrial ISIC classification, as suggested by the trade-production concordance that is available from Haveman's website. The year of the reported data is 1985.

Note that we face a particular challenge in the diversified economy case. As noted for the complete specialization case, the import shares of the major trading partners are relatively stable, so that changing the year for the trade shares that we use as weights in the price and output index hardly matters. In the incomplete specialization case, however, this is not the case. To determine world export and import supply, export and import shares are of critical importance. However, there are dramatic changes in these over time, so that it is not advisable to keep the export and import shares fixed. For example, for countries such as Japan or Spain the rough correlation between the sectoral net-export positions in 1970 and 1988 is a mere 61 and 66 percent. If one correlates sectoral export and import shares between these same years (and takes the average), one obtains for countries such as Korea and Greece a rough correlation of only 66 and 73 percent.[22] We therefore allow the sectoral import shares with which we weight output to change over time. To avoid any endogeneity in the regression, we will use the export and import shares of the previous year. Moreover, changing sectoral shares should be a better match with the terms of trade index that is based on overall manufacturing export prices that allow for changing sectoral composition. Since we have no sectoral deflators for our 25 manufacturing sectors across 18 countries we have to restrict ourselves to nominal trade shares -- in the

[22] Note that the average correlation of net-exports and for export and imports in the other 14 OECD countries is respectively 90 and 92 percent.

empirical implementation we check the robustness of the results with the sample of the fourteen countries whose sectoral trade shares are subject to less change. In this case we will use the 1985 trade shares.

d. Bilateral distance

In the complete specialization case, we introduce an element of geography on the demand side. To construct the market potential measures, we need bilateral distance. We take the values from Jon Haveman’s website. Table 6 A and B provide the bilateral distance matrix. Since we also want to account for country size, we take the radius of a country's surface to proxy for its internal distance. One finds these distance measures in Table 6 C. Country surfaces are taken from the *CIA Factbook*.

4. Estimation Results

As the estimates in the first two columns of Table 7 illustrate, it is hard to argue that the complete or the incomplete specialization approach to the terms of trade presents an overarching explanation of the actual terms of trade movements. In the first two columns of the table we present the estimates of the fixed effect regressions that are based on equation (7) for the perfect specialization case and based on the equations (12) and (13) for the diversified world economy. For the total group of 51 countries, the signs are the opposite of what the theory predicts in a specialized world economy. In the complete specialization case, the world supply of the export good is identical to the output of one country. The estimates show that an increase in the supply of a country's (export) good versus the import goods produced in the rest of the world has a positive (yet insignificant) effect on the terms of trade and so does an increase in the relative market potential. Separating the (domestic) supply of the export good from the foreign supply of the import goods only confirms this sign pattern. Let's now turn to the lower part of Table 7 that presents the results for 18 countries with which we investigate the incomplete specialization case. Note that the world supply of the export good no longer is identical to one country's output. This variable measures for each country the world output in its export sectors. The world supply of the import good is evidently the world output in each country's import sector. As the first two columns indicate we the estimated coefficients are insignificant at the 90 or 95 percent level and of the right sing. An increase in the world supply of a country’s export goods relative to its import goods does not have a negative impact on the terms of trade. Moreover, if one takes the long-term differences of all variables (not reported), one finds little support for the predicted relationship between output and terms of trade for either theory: The signs are either wrong or insignificant.

In what follows we explore alternative hypotheses about why the results are as disappointing as they are. We explore whether there is a systematic aspect to the failures of the theory -- and we will provide some evidence that there probably is. We investigate whether the rejection is obtained across different sub-groups of countries and whether there is a geographical explanation for the poor results. We subsequently adjust or relax the test specification. We enrich the supply and demand side as we proxy for changes in quality and introduce Engel curves. We also investigate the link between the performance of the model and the extent of intra-industry trade. Finally, we study the impact on the estimates of transforming the data and correcting for deviations from PPP.

We take the hypothesis that Engel and Rogers (1995,1996) put forward to explain failures of the law of one price as a starting point and investigate whether they help explain the obtained results. In Engel and Rogers' view, the extent to which markets are integrated or segmented --i.e. the extent to which people pay the same price for identical products or, in our case, the extent to which prices for similar products are subject to the same market forces -- depends on the distance between markets. The further markets are apart, the more segmented these markets tend to be and the weaker the forces of arbitrage are to align goods prices. In other words, with increasing distance there should be more room for different price movements for similar goods.

We investigate whether distance affects how terms of trade relate to output changes. Of course, in a multicountry world, it is critical to find an appropriate measure for "distance". We take the market potential measure that we defined earlier and that tells us how far or how close a country is to the world market compared to the other countries.[23] If a country is small and surrounded by other high-income countries (take the Netherlands) its market potential will be high compared to that of the rest of the world. The further a country lies from the mass of the world economy (e.g. Australia) or the larger (less dense) the country is in surface, the smaller is its market potential.

We have ranked all our 51 and all our 18 countries according to "closeness" to world markets, using the average of our market potential measure. In the upper part of Table 8 we have split the 51 countries in three equal groups of 17 that are either close, moderately close and far from the world markets. For each of the groups we run the proposed fixed effect regression. We obtain results that are strikingly different across groups. The further groups exemplify the same pattern that rejected the theory in Table 7 when we ran the regression for the total group of 51. For the closer 17 countries, however, we find support for the hypothesis of complete specialization. An increase in a country's output (i.e. the world output of the its export good) leads to a drop in a country's terms of trade, whereas an increase in the output of (the import goods of) the rest of the world has exactly the opposite effect. In addition, an increase in the relative demand for the goods of other countries leads as expected to a drop in our terms of trade. Note that the first two signs are maintained when we use population, yet significance on the relative population variable is lost, which is probably a function of the limited variation in the population variable. As can be seen in Table 9, a similar pattern emerges for the incomplete specialization case. The nine closer countries provide some support for the Bhagwati-Johnson hypothesis. For these countries we are not able to reject the model of incomplete specialization. An increase in the world supply of a country's output good compared to the world supply of the import good tends to worsen the terms of trade. If one separates the export and import goods, one notices that the impact of the import good is of the right sign, yet not significant. The countries that are further removed, as before, clearly reject the predictions.

[23] Hanson (1998) operationalized market potential in a study of the US. Redding (2001) subsequently

It is not inconceivable that it takes some time for prices to adjust. As in Harrigan (1997) we therefore introduce the lagged dependent variable. To avoid any inconsistent and downward biased estimates of the coefficient on the lagged, as noted in Hsiao (1986), we use the two-period lag of the dependent variable to instrument for the lagged dependent variable. Note that the sign pattern is remarkably robust. Including the lagged dependent variable in the regressions for the close economies for either of the two theories, we see in the lower part of Table 8 and 9 that the signs of the output variables do not change. (When separating export from import good in the diversified economy, neither of the coefficients is significant at the 90 percent level.) Note that in virtually all other cases (not reported) the only significant variable is the lag of the terms of trade variable.

As noted, an alternative explanation for what drives the terms of trade is provided by Krugman (1989): When output expansion results in the production of more varieties, there need not be any adverse effect on the terms of trade. Hummels and Klenow, 2001, explore this idea by constructing measures of extensive and intensive output increase and by relating these measures to the predictions of various models. They note that the Armington model only captures the idea of "more of the same" and does not take into account the existence of new varieties. The question arises, whether we can relate the failure of the model predictions to the extent to which there is intra-industry trade. (We implicitly assume that there has to be sufficient mass of intra-industry trade, if new goods are thought to play a critical role in determining the terms of trade of a country.)[24] We split the sample in three equal groups after having ranked countries according to their Grubel Lloyd index (GL). In doing so, we implicitly assume that a higher GL (more intra-industry trade) also makes it more likely that new goods determine terms of trade. The results that we obtain are mixed. As predicted by Krugman, for the high GL countries, there is no significant impact of a country's output on the terms of trade. For the very low

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applied it to explain cross-country differences in per capita GDP.

[24] We also assume that X^ is a reasonable proxy for the aggregate of the total output of varieties that are being produced in the imperfect competition model that Krugman (1980) develops.

GL countries, with hardly any intra-industry trade, however, we obtain a similar result. No significant impact of a country's output on the terms of trade.

One could argue that the poor overall results that we obtain are probably due to missing variables. It could be argued that preferences between goods may have changed in the almost twenty years that we study, which would contradict our assumption that the *b*'s of the CES utility function stay the same.[25] We introduce an Engel-curve type relation as we link each good, and hence each b_z, to per capita GDP in the world, $b_{zt} = (Y_{wt}/L_{wt})^{fz}$. The latter adds another term, $q_{4i}\ (Y_{wt}/L_{wt})$, with a country-specific coefficient to the regression.[26] As can be seen from Table 11 the fixed effect regressions with the extra term for changing preferences yield coefficients on the world supply of the export and the world supply of the import goods that have the right (but insignificant) sign. (We do not report the 18 country specific coefficient on world per capita income.) When we break down the sample according to closeness, we get the same sign pattern as before. There is support for the imperfect specialization world among the closer countries and not among the ones that are further off. (Again, the impact of the world output of the export good is significant, whereas the one of the import good is not.)

Note that one could also let the preferences of the complete specialization case change over time. For example one can explicitly relate the amount that countries spend on country *i*'s product to *i*'s productivity that is approximated by (predicted) output per unit of labor, i.e. $b_{it} = g_i(X_{it}/L_{it})$. A possible interpretation would be that higher productivity signals higher quality of goods and therefore it might also triggers higher demand. Since the first term of equation (6) is for each country a different combination of *b*'s, it can be rewritten as a country-specific constant and $J_4\ [P_k(X_{kt}/L_{kt})^{qM} /(X_{it}/L_{it})]$. Introducing this term does not significantly alter the result as can be seen in Table 8.

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[25] Feenstra (1994) shows how changing preferences in a CES setting capture also changing quality or changing varieties.

[26] Deardorff (2001) puts structure on the b_i's in a similar fashion. Note that the results are similar if one were to use the each country's per capita income, proxied for by (predicted) output over population.

Concerns could also arise with respect to the production side. The imperfect specialization regression only contains the world supply of a country's export goods and the world supply of country's import goods and in no way controls for what happens to a country's output or how a country's size might change with respect to the other countries. To address this issue, we introduce the ratio of a country's own output to that of the rest of the world, weighted by import shares -- this is exactly for our 18 countries the variable that is used in the complete specialization case. (We take the predicted value of country's output based on the output regression of the previous case.) The attractive part about introducing this variable is that it helps nest, to a certain extent, the imperfect and perfect specialization case. If the world were for close countries truly a diversified economy, a country's size or the extent of its expansion with respect to the rest of the world should not matter, so the coefficient should be zero. Alternatively, to the extent that the world would be completely specialized, the output of the export and import good should be insignificant.

As the estimation results in the bottom part of Table 9 (regression 3) illustrate, however, the relative size of a country and how it changes does matter in the regression. The coefficient on the ratio of the relative supply of a country's export and import goods is not significant at the 95 percent level, whereas the relative size variable is and has the sign that is consistent with the perfect specialization model. (If one enters the world export and import goods variables separately, the signs are even reversed.)

One may wonder what it exactly implies that distance affects whether or not prices respond in the way predicted by the theory. It could be, for example, that countries can differentiate their export price and charge further countries prices that differ from the ones predicted by the perfect competition models. Note that is hard to confirm this conjecture in our analysis, especially when we use a terms of trade measure that is based on export prices. (This measure assumes that all countries are charged the same price.) A possible scenario in this particular instance is that countries can charge a different price in the domestic vs. in the foreign market. Our results would then suggest that the closer countries differentiate between the domestic and the foreign market to a lesser extent, so that the predictions of perfect competition models about the relation between total (i.e. for export and domestic consumption) production and the export and import prices are better borne out by the data.

Finally, we investigate the estimation results by varying the measure that we used for the terms of trade. As illustrated in Table 12, the estimates for the complete specialization case do not change as we use the overall terms of trade measure from the World Tables that includes trade with all countries of the world instead of our terms of trade for 51 countries. Also changing the year of fixed real import shares weights does not significantly affect the outcome. Note, however, that when we use fixed real import shares of 1985 to construct the output measures for the 14 countries for which these change the least, we cannot confirm the previous results for the imperfect specialization case. (We drop Japan, Korea, Greece and Spain.)[27] This suggests that either the effects from the world supply of the import and export goods in the incomplete specialization case are not that strong or that they are fairly sensitive to the changing shares that are used.

There may be an additional concern about the data. The prices from the World Tables are expressed as dollar unit values. It is well known that purchasing power parity does not hold at every moment in time -- prices of goods differ when expressed in the same currency. Engel and Rogers' analysis suggests that exchange rate movements combined with price stickiness are a potential cause for the deviations from the law of one price. In what follows, we propose to correct the terms of trade for deviations from PPP. (In the data section we discussed the correction procedure.)

[27] As noted before, we use two criteria to measure the change in the trade shares: the rough correlation between the sectoral net-export position between 1970 and 1988 (esp. low on this score are Spain and Japan with 61 and 65 percent) and the average of the change in the export and the import share between 1970 and 1988 (esp. low on this score are Korea and Greece with 66 and 73 percent).

In the last two columns of Table 7 we present estimates of the complete and the incomplete specialization case in which we have corrected the terms of trade measure for any deviations between a country's exchange rate and its PPP-value. For complete specialization, it turns out that the PPP-correction improves the estimates somewhat. The relative world supply variables now have the right sign -- the market potential measure is insignificant, however. Note that if one breaks the data in the previous three categories of closest, less close and furthest, we also notice an improvement for the furthest group -- no change occurs for the middle group. (The relative demand variables still have the wrong sign.) This evidence suggests that the deviations from PPP may well be one of the reasons why the terms of trade, as we observe them, do not follow the pattern as predicted by the complete specialization model. For the imperfect specialization case, PPP-corrections improve the support for the theory somewhat in that it tends to improve the significance (with right sings) among the closer countries.

Conclusion

In the present paper we have taken a global approach in which we relate the terms of trade as an index of world prices to changes in the relative demand for and supply of a country's export and import goods. We have related the discussion of the terms of trade movements to the debate of the international distribution of production, since output expansion due to factor accumulation or technological change has very different effects in a diversified world economy compared to a world in which countries produce different goods. In the latter case, an expansion should worsen a country's terms of trade. In a diversified economy, as pointed by Bhagwati-Johnson, the terms of trade movements ultimately depend on the export or import bias of the changing world supply.

The empirical evidence that we present suggests that neither of the two approaches provides an accurate description of actual terms of trade movements. We explore possible explanations for this failure as we explore alternative hypotheses. We find that the closeness to the world markets is critical for both theories. We do find empirical support for both theories among those countries that are closest and whose markets are probably most closely integrated. This results relates to Engel and Rogers' (1996) hypotheses that distance and borders are critical for the presence or absence of market integration/segmentation and the violation of the law of one price. In other words, both theories highlight a particular aspect of terms of trade movements for close economies. Indeed, an individual country expansion has a negative impact on its terms of trade. However, the sectoral composition of the world economy and how it changes (biased towards a country’s export or import goods) also determines a country’s terms of trade. The latter provides some support for the celebrated Bhagwati-Johnson hypothesis.

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Figure 1

Overall vs Manufacturing Terms of Trade

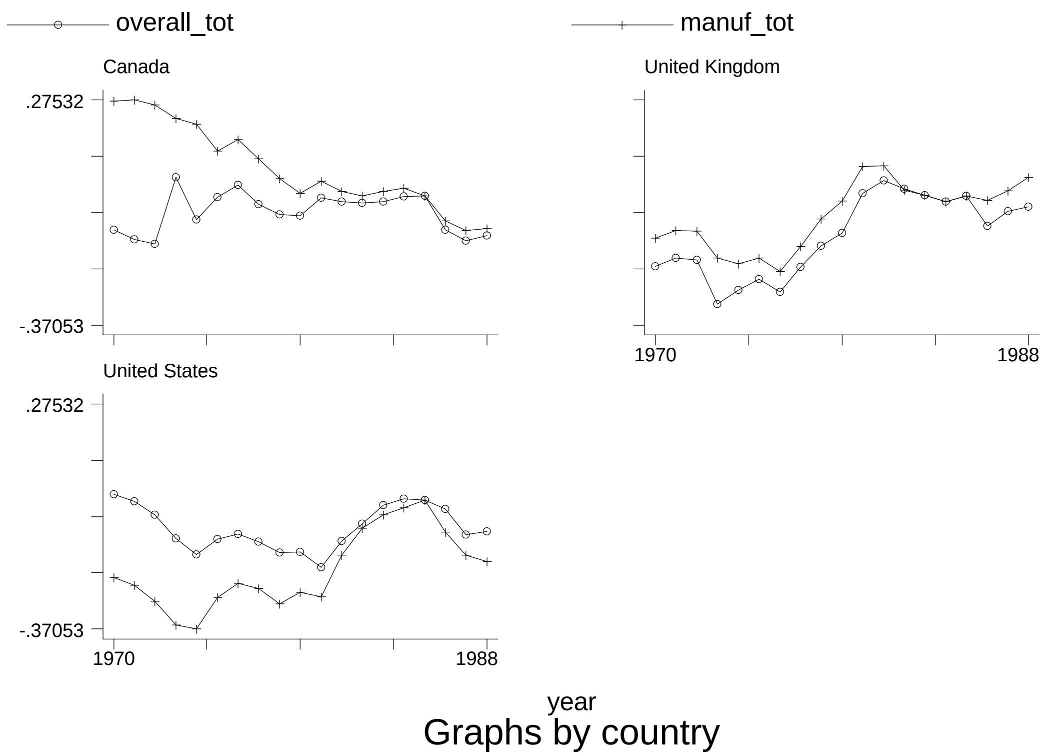

Figure 2
Terms of Trade

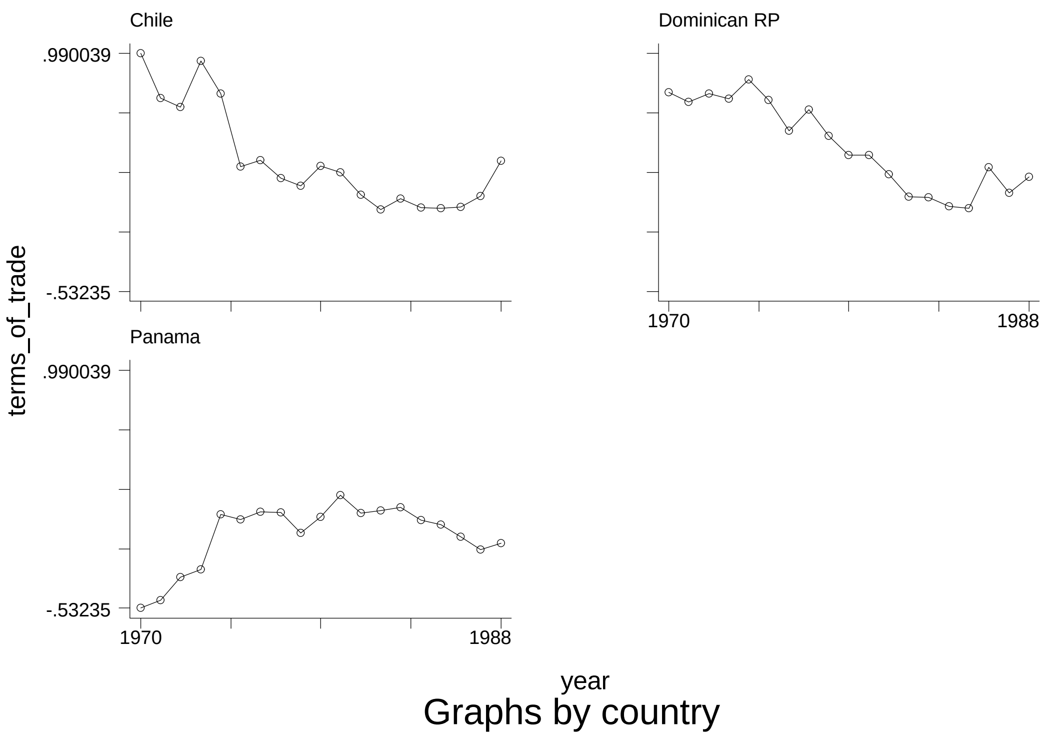

Table 1
Endowment and Production Data: Complete Specialization

Years:	1970 - 1988
Countries:	Argentina, Australia, Austria, Belgium, Bolivia, Canada, Chile, Colombia, Denmark, Dominican RP, Ecuador, Finland, France, Germany, Greece, Guatemala, Honduras, Hong Kong, Iceland, India, Ireland, Israel, Italy, Jamaica, Japan, Kenya, Korea RP, Malawi, Mauritius, Mexico, Nepal, Netherlands, New Zealand, Norway, Panama, Paraguay, Peru, Philippines, Portugal, Sierra Leone, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Turkey, United Kingdom, USA, Venezuela, Zambia, Zimbabwe (51 countries)
Real GDP:	Real GDP: Penn-World Tables 5.6 (PWT 5.6)
Capital:	PWT 5.6 Sum of (1) durable goods capital, and (2) nonresidential construction capital
Labor :	PWT 5.6 Total Population
Human Capital:	Barro and Lee (1993) Ratio of population with at least secondary education over population with at most primary education.
Distance:	Bilateral distance between capital cities (kilometers), from Jon Haveman's website (http://www.macalester.edu/research/economics/PAGE/HAVEMAN)
Internal Distance:	CIA, The World Factbook 2001 (www.cia.gov/cia/publications/factbook/index.html)

Table 2
Endowment and Production Data: Incomplete Specialization

Years:	1970 - 1988	
OECD countries:	Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Korea RP, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, USA	
Production:	Gross industry output, three-digit ISIC Revision 2 from OECD STAN. ISIC 353, Petroleum Refineries, ISIC 354, Petroleum & Coal Products, and ISIC 390, Other Manufacturing, are excluded.	
Food	311/2	Food
	313	Beverages
	314	Tobacco
Apparel	321	Textiles
	322	Wearing Apparel
	323	Leather & Products
	324	Footwear
Products of Wood	331	Wood Products
	332	Furnitures & Fixtures
Paper	341	Paper & Products
	342	Printing & Publishing
Chemicals	351	Industrial Chemicals
	352	Other Chemicals
	355	Rubber Products
	356	Plastic Products, nec
Glass	361	Pottery, China etc
	362	Glass & Products
	369	Non-Metallic Products, nec
Metals	371	Iron & Steel
	372	Non-Ferrous Metals
Machinery	381	Metal Products
	382	Non-Electrical Machinery
	383	Electrical Machinery
	384	Transport Equipment
	385	Professional Goods
Real GDP:	Real GDP: Penn-World Tables 5.6 (PWT 5.6)	
Capital:	PWT 5.6 (1) Capital 1: Durable goods capital (2) Capital 2: Nonresidential construction capital	
Labor :	PWT 5.6 / Barro and Lee (1993) (1) Labor 1: No Schooling + Primary School Attained (2) Labor 2: Primary School Complete + Secondary School Attained (3) Labor 3: Secondary School Complete + Higher School Attained (4) Labor 4: Higher School Complete The educational classification for 1970, 1975, 1980, 1985, and 1990 comes from Barro and Lee (1993), intervening years are interpolated. The population data are from PWT 5.6	
Land:	Arable land from Food and Agriculture Organization of the United Nations (http://www.fao.org)	

Table 3
Endowment-driven output model, Estimates of equation (14)
(Hetereoskedasticity correction and AR1)

	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
	Food 311/2		*Beverages 313*		*Tobacco 314*		*Textiles 321*	
Capital 1	1.4	0.04	9.2	1.6	-16.5	-2.7	-25.9	-1.5
Capital 2	48	1.6	6.1	1.1	15.8	2.7	25.2	1.6
Labor 1	25856	0.9	3173	07	5679	1	21646	1.5
Labor 2	-65915	-3	-9832	-2.6	-11564	-2.9	-10625	-0.9
Labor 3	77217	2.7	13792	2.7	18505	2.3	2569	0.2
Labor 4	-182718	-1.8	-39693	-2	-63513	-3.1	-5617	0.174
Land	1300963	5.9	134022	3.5	60315	1.4	441548	3.9
	Wearing Apparel 322		*Leather & Products 323*		*Footwear 324*		*Wood Products 331*	
Capital 1	-23.4	-3.1	-7.5	-3	-4.9	-1.2	-5.1	-0.8
Capital 2	20.6	2.9	6.6	2.8	2.6	0.7	5.9	6.9
Labor 1	3804	0.9	1246	0.6	7201	2	243	0.04
Labor 2	-4262	-0.9	-151	-0.1	-1372	-0.5	-2921	0.7
Labor 3	-1826	-0.3	-1576	-0.7	1011	0.3	-10172	-1.8
Labor 4	16712	0.6	2849	0.3	-8295	-0.6	35596	1.8
Land	276183	5.5	40749	2.4	24086	0.9	371715	8.5
	Furniture & Fixtures 332		*Paper & Products 341*		*Printing & Publishing 342*		*Industrial Chemicals 351*	
Capital 1	-6.4	-1.6	-24	-2.9	28	3.5	-26	-1.8
Capital 2	8.62	2.3	39	5.3	-10	-1.4	51	3.8
Labor 1	88501	2.5	2471	0.4	-2377	-0.3	-4565	-0.3
Labor 2	-5432	-2.1	-10904	-2.1	-4353	-0.8	-19434	-2.1
Labor 3	41962	1.2	1320	0.18	-50556	0.7	7976	0.6
Labor 4	-9136	-0.7	17309	0.6	18022	0.7	24810	0.5
Land	270001	9.9	382819	6.6	330326	6.1	595453	5.7
	Other Chemicals 352		*Rubber Products 355*		*Plastic Products, nec 356*		*Pottery, China etc 361*	
Capital 1	12.1	1.2	-8.5	-2.6	17	3.1	0.7	-.04
Capital 2	15	1.5	11.3	3.8	4.2	0.9	24.5	1.6
Labor 1	7010	0.8	-4073	1.4	4341	0.9	10401	0.7
Labor 2	-5200	-0.8	-329	-0.2	-5668	-1.7	-10337	-0.9
Labor 3	-11219	-1.2	-8317	-2.8	-4606	-0.9	8132	0.5
Labor 4	558827	1.6	183298	1.8	298925	1.7	-27220	-0.5
Land	380639	5.1	156158	6.7	328087	8.2	772786	6.7
	Glass & Products 362		*Non-Metallic Products 369*		*Iron & Steel 371*		*Non-Ferrous Metals 372*	
Capital 1	-0.1	-0.05	-2.1	-0.3	-44	-1.4	-121	-1.7
Capital 2	4.5	2.9	12.6	1.9	46	1.4	26	3.4
Labor 1	-103	-0.7	-935	-1.6	-3064	-1	-1143	-1.3
Labor 2	131	0.9	1010	1.8	3590	1.2	1327	1.6
Labor 3	-109	0.6	-147	-.2	-1488	-1.2	374	0.3
Labor 4	-354	-0.5	-5232	-1.9	-18452	-1.3	-5361	-1.3
Land	503	1.4	2075	1.4	-1511	-0.2	-859	-0.4

Table 3 Continued

	coeff	t-stat	coeff	t-stat	coeff	t-stat	coeff	t-stat
	Metal Products 381		*Non-Electrical Machnery 382*		*Electrical Machinery 383*		*Transport Equipment 384*	
Capital 1	33	2.1	120	3.8	135	3.9	30	0.8
Capital 2	11.5	0.7	5.9	0.2	39.2	1.1	111	3.1
Labor 1	-748	-0.4	-896	-0.3	-567	-0.7	-1667	0.4
Labor 2	299	0.2	-411	-0.12	-252	-0.8	2693	0.7
Labor 3	206	6.1	243	0.1	-1296	-0.4	-57	-0.01
Labor 4	-3306	0.4	-4373	-.0.3	-1238	-01	-0.27122	-1.5
Land	2445	0.6	8851	1.1	6033	0.7	15909	-1.6
	Professional Goods 385							
Capital 1	75.8	13						
Capital 2	-36	-6.4						
Labor 1	538	0.5						
Labor 2	-1134	-1.1						
Labor 3	727	0.6						
Labor 4	-361	-0.1						
Land	-861	0.6						

Note:

(1) Capital 1: Durable goods capital, PWT 5.6
(2) Capital 2: Nonresidential construction capital, PWT 5.6
(3) Labor 1: No Schooling + Primary School Attained, PWT 5.6 / Barro and Lee (1993)
(4) Labor 2: Primary School Complete + Secondary School Attained, PWT 5.6 / Barro and Lee(1993)
(5) Labor 3: Secondary School Complete + Higher School Attained, PWT 5.6 / Barro and Lee(1993)
(6) Labor 4: Higher School Complete, PWT 5.6 / Barro and Lee (1993)
(7) Land: Arable land, FAO

Table 4
Industry share in Total Manufacturing Exports and Imports, 1985

		Food	Apparel	Wood	Paper	Chemicals	Glass	Metals	Machinery
Australia	Exp	0.371	0.086	0.019	0.011	0.050	0.004	0.342	0.116
	Imp	0.050	0.089	0.025	0.052	0.152	0.021	0.025	0.584
Austria	Exp	0.037	0.109	0.048	0.076	0.137	0.040	0.123	0.431
	Imp	0.054	0.122	0.030	0.049	0.174	0.023	0.069	0.479
Canada	Exp	0.054	0.010	0.071	0.124	0.085	0.007	0.075	0.573
	Imp	0.041	0.051	0.010	0.030	0.098	0.014	0.040	0.717
Denmark	Exp	0.314	0.067	0.057	0.025	0.132	0.015	0.027	0.363
	Imp	0.111	0.096	0.038	0.056	0.182	0.017	0.081	0.419
Finland	Exp	0.030	0.070	0.084	0.326	0.081	0.010	0.083	0.317
	Imp	0.050	0.096	0.015	0.024	0.193	0.018	0.079	0.525
France	Exp	0.119	0.072	0.012	0.029	0.208	0.024	0.087	0.450
	Imp	0.111	0.101	0.025	0.049	0.190	0.021	0.082	0.422
Germany	Exp	0.053	0.055	0.014	0.029	0.184	0.018	0.077	0.570
	Imp	0.104	0.138	0.024	0.044	0.176	0.019	0.094	0.401
Greece	Exp	0.242	0.370	0.005	0.012	0.079	0.069	0.153	0.071
	Imp	0.164	0.120	0.014	0.037	0.160	0.016	0.080	0.408
Italy	Exp	0.063	0.211	0.032	0.020	0.143	0.041	0.062	0.429
	Imp	0.160	0.093	0.019	0.035	0.195	0.015	0.084	0.399
Japan	Exp	0.008	0.032	0.001	0.008	0.086	0.013	0.087	0.765
	Imp	0.189	0.127	0.045	0.036	0.190	0.011	0.122	0.281
Korea*	Exp	0.012	0.066	0.003	0.010	0.101	0.014	0.203	0.591
	Imp	0.262	0.109	0.057	0.039	0.139	0.009	0.099	0.286
Netherlands	Exp	0.233	0.055	0.010	0.034	0.285	0.012	0.062	0.308
	Imp	0.130	0.099	0.030	0.048	0.193	0.019	0.064	0.416
Norway	Exp	0.112	0.019	0.016	0.094	0.143	0.007	0.249	0.361
	Imp	0.041	0.105	0.043	0.038	0.117	0.020	0.099	0.538
Portugal	Exp	0.096	0.384	0.068	0.076	0.089	0.034	0.031	0.221
	Imp	0.098	0.136	0.004	0.027	0.219	0.012	0.094	0.410
Spain	Exp	0.109	0.113	0.020	0.038	0.145	0.038	0.149	0.388
	Imp	0.100	0.047	0.018	0.038	0.207	0.016	0.068	0.506
Sweden	Exp	0.024	0.028	0.067	0.154	0.090	0.012	0.091	0.534
	Imp	0.060	0.101	0.019	0.027	0.173	0.019	0.078	0.523
U.K	Exp	0.076	0.059	0.007	0.028	0.213	0.017	0.059	0.540
	Imp	0.115	0.091	0.032	0.055	0.149	0.013	0.061	0.484
USA	Exp	0.078	0.031	0.011	0.032	0.155	0.009	0.021	0.662
	Imp	0.061	0.105	0.033	0.033	0.095	0.017	0.070	0.586

Note: Each cell gives an industry's share in a country's total manufacturing exports and imports in 1985.
Source: OECD STAN database
* In the case of Korea, shares computed from Feenstra et al. (1997)

Table 5A
Bilateral shares of total manufacturing imports

	Aus.	Austria	Canada	Den.	Finland	France	Ger.	Greece	Italy	Japan	Korea	Neth.	Norway	Por.	Spain	Swe.	U.K	USA
Australia		0.0009	0.0041	0.0059	0.0044	0.0072	0.006	0.0065	0.0108	0.1326	0.0538	0.0051	0.0047	0.0109	0.0026	0.009	0.0106	0.0094
Austria	0.0046		0.0021	0.0132	0.0179	0.01	0.0498	0.0167	0.0316	0.0037	0.0026	0.0093	0.0128	0.0103	0.0142	0.0121	0.0102	0.0037
Canada	0.0295	0.0052		0.0044	0.0107	0.0098	0.0112	0.0046	0.0096	0.0934	0.0338	0.0093	0.0201	0.0125	0.0071	0.0068	0.0252	0.3204
Denmark	0.0061	0.0086	0.0025		0.0403	0.0107	0.0263	0.0178	0.015	0.0108	0.004	0.0142	0.0806	0.0098	0.0856	0.0092	0.0279	0.0079
Finland	0.0081	0.0069	0.0022	0.0392		0.008	0.0128	0.01	0.0062	0.0042	0.0035	0.0102	0.0428	0.0084	0.0772	0.007	0.0199	0.004
France	0.0291	0.0506	0.0154	0.0569	0.0541		0.1478	0.1076	0.2267	0.0253	0.0279	0.1079	0.0452	0.1409	0.0642	0.1905	0.1102	0.04
Germany	0.0909	0.5956	0.028	0.2727	0.2342	0.2947		0.2744	0.301	0.0571	0.0446	0.3483	0.1802	0.1915	0.2194	0.2044	0.211	0.0871
Greece	0.0017	0.004	0.0005	0.0023	0.0023	0.0056	0.0092		0.0112	0.001	0.0009	0.0037	0.0011	0.001	0.0017	0.0025	0.0042	0.0017
Italy	0.0432	0.1163	0.0142	0.0454	0.0531	0.1583	0.1273	0.1847		0.02	0.0126	0.0518	0.0378	0.0889	0.0402	0.0865	0.0728	0.0445
Japan	0.3067	0.0404	0.0659	0.0485	0.0745	0.0386	0.0668	0.0925	0.0278		0.4089	0.036	0.0616	0.0432	0.0552	0.0566	0.0639	0.3073
Korea	0.0223	0.0052	0.0181	0.0047	0.0048	0.0055	0.01	0.033	0.0041	0.094		0.0071	0.0363	0.0029	0.0095	0.0045	0.0117	0.0503
Netherlands	0.0177	0.0428	0.0063	0.0711	0.0519	0.0987	0.2003	0.0925	0.0902	0.0087	0.0117		0.0459	0.0592	0.054	0.0449	0.1034	0.0183
Norway	0.0031	0.0094	0.0011	0.0564	0.0394	0.0188	0.034	0.0041	0.0052	0.0057	0.0096	0.0236		0.0135	0.0751	0.008	0.0744	0.0046
Portugal	0.0013	0.0052	0.0009	0.0081	0.0103	0.0104	0.0081	0.002	0.0051	0.001	0.0009	0.0078	0.0083		0.0098	0.0141	0.0108	0.0024
Spain	0.0059	0.0079	0.0036	0.0119	0.0138	0.0565	0.0246	0.0194	0.0353	0.0067	0.0026	0.0252	0.0108	0.1103		0.0237	0.0284	0.0114
Sweden	0.0248	0.0253	0.0075	0.1681	0.1978	0.0227	0.0359	0.017	0.0218	0.0085	0.0106	0.0311	0.2217	0.0233	0.0129		0.0402	0.0166
U.K	0.1021	0.035	0.0337	0.1225	0.1178	0.1419	0.1321	0.0661	0.0961	0.0283	0.0305	0.1776	0.1198	0.1286	0.1803	0.134		0.0704
USA	0.303	0.0406	0.7939	0.0687	0.0726	0.1028	0.0978	0.0512	0.1021	0.4989	0.3415	0.1318	0.0704	0.145	0.0909	0.1865	0.1751	
Total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note: Year 1985; source: Feenstra et al. (1997)

Table 5B: Bilateral shares of total imports: Year 1985; Source: Feenstra et al. (1997)

	Arg	Aus	Aut	Bel	Bol	Can	Chi	Col	Den	Dom,Rp	Ecu	Fin	Fra	Ger	Gre	Gua	Hon	HK	Ice	Ind	Ire	Isr	Ita	Jam	Jap	Ken
Argentina		0.001	0.0003	0.0032	0.1772	0.0008	0.046	0.0305	0.0037	0.0122	0.0106	0.0009	0.0025	0.0036	0.0014	0.0025	0.0076	0.0005	0.0002	0.0059	0.0006	0.0047	0.0071	0.0003	0.0066	0.0001
Australia	0.0159		0.0008	0.0031	6E-05	0.0039	0.0035	0.0025	0.0053	3E-05	0.0048	0.0041	0.0059	0.0048	0.0059	3E-05	3E-05	0.0329	0.0356	0.03	0.0007	0.0027	0.0091	0.0005	0.1075	0.0167
Austria	0.0109	0.004		0.0078	0.0016	0.002	0.0061	0.0031	0.012	0.001	0.0058	0.0164	0.0082	0.0401	0.0151	0.0034	0.0031	0.0027	0.0056	0.0042	0.0033	0.0069	0.0266	0.0006	0.003	0.0113
Belgium	0.0164	0.0093	0.0267		0.0174	0.0055	0.0122	0.0071	0.0366	0.0054	0.0063	0.028	0.1116	0.0788	0.0416	0.004	0.0067	0.0162	0.031	0.0753	0.0219	0.105	0.0546	0.0059	0.0077	0.0321
Bolivia	0.1345	0	0	0.0002		8E-06	0.0027	0.0012	3E-05	0	8E-05	0	0.0002	0.0004	1E-05	0	0	0	0	0	0	0	2E-05	2E-05	6E-05	0
Canada	0.016	0.0257	0.0046	0.0072	0.0117		0.0273	0.048	0.004	0.0181	0.0272	0.0098	0.0079	0.0091	0.0041	0.0132	0.0128	0.0141	0.0037	0.0397	0.0078	0.0156	0.0081	0.0464	0.0757	0.0198
Chile	0.0286	0.0002	0.0003	0.0016	0.0388	0.001		0.0131	8E-05	0.0027	0.0205	0.0001	0.0024	0.0033	0.0025	0.0013	0.0003	0.0006	0	0.0012	3E-05	5E-05	0.0036	0	0.0077	0
Colombia	0.0089	0.0001	0.0012	0.0012	0.0032	0.0007	0.0104		0.0023	0.0162	0.0322	0.0076	0.0011	0.0045	0.0006	0.005	0.0091	0.0001	0.0005	0.0016	0.0011	0.0009	0.0016	0.0008	0.0027	0
Denmark	0.0038	0.0053	0.0076	0.0061	0.0037	0.0023	0.005	0.0037		0.0008	0.0031	0.0368	0.0087	0.0212	0.016	0.0016	0.003	0.0045	0.1109	0.0051	0.0115	0.005	0.0126	0.0009	0.0087	0.0203
Dom. Rep	0	5E-06	5E-05	0.0005	2E-05	0.0002	3E-06	0.0002	5E-05		0	0.0009	8E-05	0.0002	0	0.0002	0.0019	2E-05	0	0.0006	1E-06	0	0.0001	0.001	0.0003	0
Ecuador	0.0031	0.0001	0.0001	0.0002	0	0.0001	0.0206	0.0192	1E-05	6E-06		0.0003	0.0002	0.0005	8E-05	6E-05	0.0012	8E-05	0.0007	0	0.0007	0.0012	0.0004	0	0.0007	0
Finland	0.0037	0.0071	0.0061	0.004	0.0015	0.0021	0.0061	0.0053	0.0355	0.0004	0.0009		0.0065	0.0103	0.009	0.0019	0.0003	0.0021	0.0264	0.0067	0.0075	0.0061	0.0052	0.0002	0.0034	0.0106
France	0.0736	0.0253	0.0447	0.165	0.0271	0.0145	0.0323	0.038	0.0516	0.0071	0.0156	0.0494		0.1191	0.0969	0.0205	0.0204	0.0255	0.0329	0.0588	0.0501	0.0489	0.1903	0.0102	0.0205	0.0596
Germany	0.1282	0.079	0.5259	0.2533	0.0943	0.0264	0.0849	0.0632	0.2434	0.0335	0.084	0.2139	0.2398		0.2473	0.0665	0.0384	0.0462	0.1468	0.1209	0.0972	0.1349	0.2526	0.0117	0.0463	0.128
Greece	2E-05	0.0015	0.0035	0.0015	0	0.0005	2E-05	4E-06	0.0021	0.0002	7E-06	0.0021	0.0046	0.0074		5E-05	0	0.0005	0.0002	0.0014	0.0014	0.0021	0.0094	0.0002	0.0008	0.002
Guatemala	0	1E-05	0.0006	9E-05	0	0.0001	3E-05	0.0003	0.0001	0.0028	0.0013	0.0015	0.0001	0.0003	0		0.0396	2E-05	0.0009	0	7E-06	0.0001	0.0011	0.0026	0.0006	0
Honduras	5E-06	7E-06	0	0.0004	0	7E-05	0	0.0003	1E-05	7E-05	0	4E-05	5E-05	0.0005	0	0.0034		7E-06	0.0012	0	6E-06	3E-05	0.0009	0.0008	0.0008	0
Hong Kong	0.0009	0.0314	0.0057	0.0027	0.0007	0.0101	0.0083	0.0004	0.0053	0.0042	0.0013	0.0052	0.0038	0.0099	0.0024	0.003	0.0049		0.0053	0.0127	0.0053	0.0046	0.0037	0.0094	0.0213	0.0089
Iceland	0	4E-05	5E-05	0.0002	0	3E-05	0.0006	8E-05	0.0015	0	0	0.0021	0.0004	0.0006	0.0011	0	7E-06	3E-06		0	6E-05	5E-05	0.0003	0	0.0007	6E-06
India	0.0002	0.0053	0.0014	0.0037	0.0001	0.0015	0.0003	0.0003	0.0023	9E-05	2E-05	0.0007	0.0024	0.0033	0.0011	9E-05	8E-06	0.0098	0.0007		0.0013	0.0018	0.0032	0.0002	0.0178	0.0242
Ireland	0.0017	0.0075	0.0037	0.0074	0.0005	0.0033	0.0012	0.0015	0.0063	0.0005	0.0015	0.007	0.0108	0.0087	0.0059	0.0027	0.0066	0.0012	0.003	0.0008		0.0026	0.0067	0.0012	0.0029	0.0014
Israel	0.0033	0.0031	0.0021	0.0054	0.0046	0.0009	0.0019	0.0027	0.0015	0.0012	0.0135	0.0026	0.0034	0.0028	0.0071	0.0009	0.0006	0.0105	0.0004	0.0039	0.0017		0.0045	0.0014	0.0036	0.0048
Italy	0.08	0.0375	0.1027	0.0449	0.0097	0.0134	0.0229	0.0201	0.0411	0.0118	0.0297	0.0485	0.1289	0.1026	0.1665	0.0081	0.0179	0.0264	0.0322	0.0276	0.0236	0.0654		0.0108	0.0162	0.0509
Jamaica	0	1E-05	1E-06	1E-06	0	0.0014	0	0.0002	3E-06	0.0007	0	0	2E-06	6E-05	0	0.001	0.0025	2E-06	1E-05	0	0.0024	0	5E-06		0.0001	0
Japan	0.0843	0.2666	0.0357	0.0245	0.1349	0.0622	0.0774	0.105	0.044	0.0622	0.1104	0.068	0.0314	0.0538	0.0833	0.0493	0.0712	0.391	0.0423	0.1504	0.0338	0.0271	0.0234	0.0821		0.1586
Kenya	0	0.0002	0.0001	0.0003	0	9E-05	0	0	0.0001	0	0	0.001	0.0003	0.001	0.0004	0	0	6E-05	0	0.0007	0.0008	4E-05	0.0005	0	0.0001	
Korea, Rep	0.0034	0.0194	0.0046	0.0019	0.0078	0.0171	0.0271	0.0006	0.0043	0.0055	0.0298	0.0044	0.0045	0.008	0.0297	0.0024	0.0031	0.0918	0.0018	0.0487	0.0021	0.0009	0.0035	0.0046	0.0762	0.0104
Malawi	0	0.0002	8E-05	0.0001	0	4E-06	0	0	7E-05	0	0	5E-05	0.0001	0.0002	8E-05	0	0	0	0	6E-07	0.0001	0	3E-06	0	0.0002	0.0001
Mauritius	0	9E-05	2E-05	0.0001	0	6E-05	0	0	0.0003	0	0	1E-06	0.0011	0.0002	3E-06	0	0	0.0002	8E-06	0	0.0001	0	0.0002	0	6E-07	0.0004
Mexico	0.0193	0.0011	0.0035	0.0013	0.0029	0.0091	0.0063	0.0382	0.0005	0.074	0.0352	0.0007	0.0065	0.0023	0.0004	0.1759	0.0624	0.001	0	0.0011	4E-05	0.0624	0.0056	0.0521	0.0308	3E-05
Nepal	0	9E-06	6E-07	5E-06	0	3E-06	0	0	1E-06	0	0	1E-06	5E-06	6E-05	0	0	0	2E-05	0	0.0064	0	0	0.0001	0	1E-05	0
Netherlands	0.0209	0.0154	0.0378	0.2038	0.0252	0.006	0.0124	0.0151	0.0645	0.0083	0.0127	0.0474	0.0803	0.1614	0.0833	0.0127	0.0291	0.0123	0.1032	0.0283	0.0405	0.033	0.0757	0.0134	0.0071	0.0483
New Zealand	0.0002	0.0467	0.0004	0.0013	0	0.0015	0.0029	0.0003	0.0008	0.0035	0.0023	0.0005	0.0015	0.0011	0.0042	0.0013	0.0007	0.0054	0.0042	0.0024	0.0009	6E-05	0.0024	0.0022	0.0141	0.0029
Norway	0.0034	0.0027	0.0083	0.0088	9E-05	0.001	0.0058	0.0007	0.0511	0.0041	0.0023	0.036	0.0153	0.0274	0.0037	0.0022	0.0003	0.0012	0.0832	0.0057	0.0039	0.0228	0.0044	0.0036	0.0046	0.0036
Panama	0	3E-06	0	0.0002	0.0003	3E-05	4E-05	0.0011	0	0.0015	0.0006	0	4E-06	0.0002	0	0.0024	0.0046	1E-05	0	0	0	0.0001	0.0002	0.0005	0.0001	0
Paraguay	0.0044	0	1E-05	0.0006	0.0015	5E-06	0.0075	0.0004	4E-06	0	5E-06	0	0.0003	0.0003	0.0004	0	0	0	0	0	1E-06	0.0002	0.0002	0	6E-05	0
Peru	0.012	0.0002	0.0004	0.0027	0.0542	0.0007	0.018	0.0275	0.0004	0.0006	0.0587	0.0002	0.0012	0.0012	0.0004	0.0001	0.001	0.0004	0	0.0007	5E-05	3E-05	0.0018	6E-05	0.0054	0
Philippines	0.0001	0.0038	0.0004	0.0002	0	0.001	0.0001	4E-05	0.0007	1E-05	3E-05	0.0005	0.0012	0.0022	0.0002	3E-05	3E-05	0.0114	4E-05	0.0015	0.0003	0.0002	0.0005	2E-05	0.0154	6E-05
Portugal	0.0009	0.0011	0.0046	0.0043	0.0004	0.0009	0.001	7E-05	0.0073	0.0005	0.0018	0.0094	0.0084	0.0066	0.0018	0.0027	0.0043	0.0003	0.0244	0.0016	0.0045	0.0019	0.0043	0.0002	0.0008	0.0012
Sierra Leone	0	0	0.0001	0.0009	0	2E-07	0	0	2E-06	0	0	5E-06	5E-05	0.0002	3E-06	0	0	0	0	8E-05	1E-05	0	4E-06	0	2E-05	0
Spain	0.0252	0.0051	0.007	0.0125	0.0132	0.0034	0.0463	0.0341	0.0108	0.0219	0.0259	0.0126	0.046	0.0198	0.0175	0.0178	0.0151	0.0048	0.0065	0.0147	0.0102	0.011	0.0296	0.0012	0.0054	0.0075
Sri Lanka	0.0002	0.0009	0.0001	0.0004	4E-05	0.0003	0.0018	1E-06	0.0003	0	0	6E-05	0.0002	0.0006	0.0002	6E-05	4E-05	0.0006	8E-05	0.0007	0.0002	0	0.0003	0.0001	0.0012	0.0005
Sweden	0.0122	0.0215	0.0223	0.0238	0.0089	0.0071	0.0172	0.0095	0.1524	0.0009	0.0143	0.1806	0.0185	0.0289	0.0153	0.0029	0.0022	0.0052	0.0901	0.0118	0.0203	0.0108	0.0183	0.0023	0.0069	0.0226
Switzerland	0.0397	0.0127	0.0589	0.0124	0.0095	0.0047	0.0148	0.0188	0.0213	0.0029	0.0179	0.024	0.026	0.0437	0.019	0.0109	0.0108	0.0276	0.0118	0.0159	0.0096	0.0635	0.0374	0.0043	0.015	0.0218
Thailand	2E-05	0.0061	0.001	0.0016	0	0.0011	7E-05	3E-06	0.0021	4E-05	0	0.001	0.0019	0.0028	0.0003	0	7E-05	0.0171	0.0001	0.0075	0.0006	0.0011	0.0026	0.0009	0.0165	0.0044
Turkey	1E-05	0.0003	0.0057	0.0029	0	0.0003	7E-05	6E-05	0.0019	8E-05	0	0.001	0.0033	0.0108	0.005	0	0	2E-05	0.0003	0.0025	0.0011	0.0019	0.0076	0	0.0008	0.0006
UK	0.0009	0.0888	0.0309	0.0991	0.0539	0.0318	0.0431	0.024	0.111	0.011	0.0524	0.1076	0.1143	0.1065	0.0596	0.0174	0.0176	0.0716	0.1253	0.1203	0.4662	0.1071	0.0806	0.0591	0.0229	0.2421
US	0.2426	0.2628	0.0359	0.0739	0.2943	0.7496	0.2978	0.3834	0.0547	0.4366	0.3735	0.0663	0.0837	0.0788	0.0461	0.3891	0.4006	0.163	0.0684	0.1698	0.1658	0.2467	0.0857	0.5206	0.4043	0.0773
Venezuela	0.0006	0	0.0034	0.002	0.0007	0.0112	0.1277	0.0803	0.0048	0.2475	0.0037	6E-05	0.0024	0.0089	0.0028	0.1735	0.1999	0.0008	0	0.002	0	5E-05	0.0108	0.1478	0.012	0
Zambia	0	0.0001	2E-05	0.0006	0	3E-07	0	0	2E-06	0	0	0.0003	0.0008	0.0002	0.0015	5E-06	0	2E-06	0	0.0099	2E-06	0	0.0014	0	0.0036	0.0023
Zimbabwe	0.0001	0.0003	0.0007	0.0004	0	5E-05	0.0002	8E-06	0.0003	0	4E-05	0.0001	0.0002	0.0008	0.0002	0	0	0.0007	0	0.0009	0.0005	0.0002	0.0013	0	0.0008	0.0045
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 5B Continued

	Kor	Mal	Mau	Mex	Nep	Nrth	NZ	Nor	Pan	Par	Peru	Phi	Por	Sleo	Spa	S La	Swe	Swi	Tha	Tur	UK	USA	Ven	Zam	Zimb
Argentina	0.0012	0	0	0.0171	0	0.0093	0.0008	0.002	0.0011	0.2556	0.1101	0.0002	0.0155	0	0.0114	0.0234	0.0007	0.0008	0.0018	0.0105	3E-06	0.004	0.0125	0.0004	0.0004
Australia	0.0486	0.0012	0.0659	0.0045	0.0033	0.004	0.1932	0.0044	0.0003	0	0.0073	0.0465	0.0093	0.0122	0.0072	0.048	0.0024	0.0014	0.024	0.0109	0.0086	0.0075	0.0008	0.0017	0.0088
Austria	0.0023	0.0041	0.0015	0.0009	0.0008	0.0072	0.004	0.0119	0.0005	0.0064	0.005	0.0045	0.0088	0.0034	0.0097	0.0039	0.0129	0.0389	0.0029	0.0209	0.0083	0.0029	0.0056	0.0043	0.0141
Belgium	0.01	0.0092	0.0269	0.0066	0.004	0.1432	0.0085	0.0282	0.0014	0.0043	0.02	0.0063	0.0294	0.0517	0.0258	0.0135	0.031	0.0464	0.0156	0.0308	0.0598	0.0123	0.0102	0.0206	0.0145
Bolivia	0	0	0	1E-05	0	1E-05	0	4E-06	0.0002	0	0.0086	0	0	0	0.0002	0	0	0.0002	0	0	0.0004	0.0003	0	0	0
Canada	0.0305	0.0018	0.0023	0.0201	0.0033	0.0073	0.0311	0.0186	0.0064	0.0033	0.0236	0.0092	0.0106	0.0012	0.0055	0.0253	0.0064	0.0078	0.0211	0.0249	0.0205	0.2541	0.0436	0.0101	0.0218
Chile	0.0047	0.0003	0	0.0044	0	0.0015	0.0005	4E-05	0.001	0.0194	0.031	0.0003	0.0032	0	0.005	0	0.0024	0.0002	0.0009	0.0044	0.0021	0.0029	0.0054	0	0
Colombia	0.0007	0	0	0.0004	0	0.0023	6E-05	0.0025	0.0055	5E-05	0.0217	0	0.0008	0	0.0043	0	0.0039	0.0015	0.0001	2E-05	0.0013	0.0045	0.0199	0	0
Denmark	0.0036	0.0297	0.0015	0.001	0.0068	0.0111	0.0055	0.0748	0.0281	0.0029	0.0018	0.0025	0.0084	0.0065	0.0074	0.0041	0.0775	0.0105	0.0073	0.0043	0.0228	0.0063	0.0061	0.01	0.0078
Dom. Rep	0	0	0	2E-06	0	3E-05	2E-06	8E-07	3E-05	0	0	2E-05	3E-05	0	0.0011	0	0.0002	4E-05	0	0	0.0001	0.0035	0.0006	0	0
Ecuador	0.0073	0	0	8E-05	0	0.0002	0.0016	2E-06	0.0146	0.0004	0.004	0	0.0002	0	0.0003	0	9E-06	0.0003	0	4E-05	9E-05	0.0066	0.0003	0	0
Finland	0.0032	0.0108	0	0.0013	0.0004	0.008	0.0029	0.0397	0.0049	0.0011	0.0045	0.0022	0.0072	0.0036	0.0057	0.0023	0.0699	0.0056	0.002	0.0062	0.0162	0.0031	0.0045	0.0124	0.0089
France	0.0253	0.0488	0.2021	0.0179	0.0106	0.0842	0.0189	0.042	0.0045	0.0403	0.0424	0.0185	0.1205	0.0585	0.1533	0.036	0.0581	0.1382	0.0483	0.0822	0.0898	0.0318	0.0461	0.0349	0.0628
Germany	0.0403	0.086	0.0611	0.0478	0.0309	0.2719	0.0609	0.1672	0.0061	0.0858	0.0787	0.0479	0.1638	0.1257	0.1645	0.0698	0.1986	0.3352	0.0754	0.2078	0.1719	0.0691	0.0597	0.0844	0.1283
Greece	0.0008	0.0009	0.0074	7E-05	0	0.0029	0.0015	0.001	0.0002	0.0024	0.0003	0.0006	0.0008	0.0029	0.002	8E-05	0.0015	0.0015	0.0008	0.0058	0.0035	0.0013	9E-05	0.0004	0.0004
Guatemala	0	0	0	0.0007	0	0.0003	2E-05	0.0003	0.0028	0	3E-05	0	0.001	0	0.0001	0.0029	0.0003	0.0006	6E-06	1E-06	6E-05	0.0013	1E-05	0	0
Honduras	0	0	0	0.0003	0	0.0002	0	0.0002	0.0012	0	0	0	4E-05	0	0.001	0	0.0004	0.0003	0	0	0.0001	0.0013	9E-05	0	0
Hong Kong	0.0294	0.0127	0.1678	0.0013	0.05	0.0057	0.0179	0.0055	0.0151	0.0482	0.0017	0.1019	0.0011	0.0239	0.0055	0.0703	0.0087	0.0118	0.0398	0.0019	0.0142	0.0338	0.006	0.0035	0.0038
Iceland	0	0	0	0	0	0.0001	4E-06	0.0012	1E-05	0	0	0.0002	0.009	0	0.0015	0	0.0004	0.0009	0	6E-06	0.0016	0.0008	0	0	0
India	0.0053	0.0106	0.0351	0.0002	0.5584	0.0017	0.0037	0.0008	8E-05	0.0002	0.0001	0.0007	0.0021	0.0048	0.0033	0.059	0.0014	0.003	0.0054	0.0008	0.0051	0.007	0.0001	0.0147	0.0059
Ireland	0.0004	0.0022	0.0041	0.0024	0.0002	0.0111	0.005	0.0068	0.0006	2E-05	0.002	0.0018	0.0045	0.0034	0.0074	0.0017	0.0074	0.0044	0.0016	0.0009	0.0372	0.0037	0.0038	0.0095	0.0012
Israel	0.0004	0.0026	0.0001	0.0007	0	0.004	0.0012	0.0016	0.002	0.0168	0.0044	0.0008	0.007	0.0001	0.0015	0.0003	0.0014	0.0033	0.0034	0.0049	0.0053	0.0078	0.002	0.0006	0.0032
Italy	0.0114	0.037	0.0535	0.0154	0.0062	0.0404	0.022	0.0351	0.0298	0.0196	0.0298	0.0094	0.076	0.0377	0.0696	0.0134	0.0364	0.1102	0.0168	0.1049	0.0593	0.0353	0.0697	0.0251	0.0642
Jamaica	0	0	0	1E-06	0	0.0002	0.0002	0.0005	5E-05	0	0	0	0	0	5E-06	0	0.0002	9E-06	0	0	0.0011	0.0007	2E-05	0	0
Japan	0.3698	0.1243	0.0686	0.0545	0.1603	0.0281	0.2413	0.0572	0.5271	0.0884	0.0926	0.2377	0.0369	0.0747	0.0456	0.2591	0.05	0.0403	0.4111	0.0656	0.0521	0.2438	0.0604	0.146	0.0685
Kenya	3E-05	0.0102	0.0138	0	0	0.0008	0.0001	5E-05	0	0	0	0.0006	0.0003	0.0002	0.0003	0.0023	0.0009	0.0003	0.0005	2E-05	0.0019	0.0002	0	0.0048	0.0019
Korea, Rep		0.0149	0.0293	0.0012	0.0768	0.0055	0.0087	0.0337	0.1212	0.005	0.0044	0.0877	0.0024	0.047	0.0036	0.0706	0.0086	0.0053	0.0335	0.0151	0.0095	0.0399	0.0048	0.0011	0.0023
Malawi	0		0.0006	0	0	0.0003	0.0001	8E-05	0	0	2E-05	1E-05	0.0002	0.0018	1E-04	0	6E-05	0.0001	0	1E-06	0.0009	0.0001	0	0.0217	0.0125
Mauritius	0	0.0002		0	0	7E-05	5E-06	4E-06	0	0	0	0	0	0	3E-06	0	4E-06	8E-05	0	0	0.0018	0.0002	0	0	0
Mexico	0.0064	0	0		0	0.0029	0.0021	0.0004	0.0203	0.0014	0.0111	0.0013	0.0183	0	0.0813	7E-05	0.0002	0.0007	0.0041	0.0009	0.003	0.0569	0.008	0	0
Nepal	2E-06	0	0	0		0	5E-06	0	0	0	0	0	0	0	4E-06	0.0039	8E-06	5E-05	8E-06	0	5E-05	0.0001	0	0	0
Netherlands	0.0106	0.024	0.0135	0.0057	0.0042		0.0192	0.0426	0.0025	0.0088	0.0152	0.0151	0.0507	0.0852	0.0361	0.0188	0.0489	0.0495	0.0167	0.0335	0.0843	0.0145	0.0189	0.0335	0.0487
New Zealand	0.0055	0.0088	0.0582	0.0025	0.0026	0.0005		0.0002	0.0012	0	0.0105	0.0092	0.0014	0	0.0014	0.0155	0.0003	0.0004	0.004	0.0014	0.0063	0.0031	0.0031	0	8E-05
Norway	0.0087	0.0088	0.0002	0.001	3E-05	0.0184	0.0019		0.0379	1E-04	0.001	0.0015	0.0116	0.0011	0.0064	0.005	0.068	0.0045	0.0086	0.0036	0.0606	0.0037	0.0021	0.011	0.0068
Panama	0	0	0	1E-04	0	6E-05	0	0.0003		0.001	0.0008	0	0	0	0.0001	0	0.0002	0.0002	6E-05	0	7E-05	0.0008	0.003	0	0
Paraguay	0.0001	0	0	4E-05	0	0.0004	0	7E-07	0.0018		0.0004	9E-05	0.0035	0	0.0012	0.0002	0	0.0003	0	0	2E-05	2E-05	2E-05	0	0
Peru	0.0053	0	0	0.001	0	0.0007	3E-05	8E-05	0.0012	0.0002		0.0017	0.0025	0	0.001	0.0002	0.0007	0.0005	0	0.0003	0.0014	0.0039	0.0074	0	0
Philippines	0.0038	0	0	3E-05	0.0007	0.0017	0.0036	0.0003	0.0007	0	0.0001		7E-05	0.0009	0.001	0.0053	0.0007	0.0003	0.0169	6E-05	0.0019	0.0062	1E-05	5E-05	0
Portugal	0.0008	0.0028	0.0003	0.0001	0	0.0061	0.0014	0.0077	0.0008	9E-05	0.0009	1E-04		0.0022	0.0113	0.0006	0.0089	0.0042	0.0006	0.004	0.0088	0.0019	0.001	6E-05	0.0007
Sierra Leone	0	0	0	2E-06	0	0.0002	0	7E-06	0	0	0	0	0.0002		4E-05	0	0.0002	7E-06	3E-06	0	0.0002	6E-05	0.0017	0	0
Spain	0.0023	0.0044	0.0009	0.0142	0.0001	0.0197	0.0057	0.01	0.0073	0.0603	0.027	0.003	0.0943	0.0405		0.0015	0.0117	0.0143	0.0057	0.0441	0.0232	0.0091	0.0299	0.0007	0.0043
Sri Lanka	9E-05	7E-05	0.0026	0.0005	6E-05	0.0005	0.0012	0.0001	5E-06	0	0.0008	0.0001	0.0004	0	0.0003		0.0003	0.0001	0.0005	0.0001	0.0009	0.001	3E-05	0.0001	0.0003
Sweden	0.0096	0.0062	0.0013	0.0106	0.0049	0.0243	0.0115	0.2058	0.0155	0.0054	0.0144	0.006	0.0199	0.0049	0.0191	0.0131		0.0198	0.0118	0.0189	0.0328	0.0131	0.0056	0.0202	0.0235
Switzerland	0.0063	0.014	0.0175	0.0095	0.0097	0.0134	0.0101	0.016	0.0039	0.027	0.0233	0.0111	0.0277	0.0103	0.023	0.0083	0.0211		0.0216	0.0339	0.0262	0.0107	0.0114	0.0192	0.0336
Thailand	0.0065	0	0.0072	0.0005	0.0178	0.0066	0.0019	0.0006	0.0001	0	1E-05	0.0181	0.0047	0.0043	0.0009	0.0184	0.0012	0.0021		0.0005	0.0018	0.0051	2E-05	0	7E-05
Turkey	0.0002	0	0	8E-06	0	0.0039	0.0001	0.0004	6E-05	0	0.0004	0.001	0.0038	0	0.003	0.0058	0.0027	0.0033	0.0003		0.0055	0.0019	0.001	0	0
UK	0.0276	0.2395	0.1025	0.0217	0.0335	0.1386	0.12	0.1111	0.0087	0.0686	0.0343	0.0362	0.11	0.2711	0.1078	0.0948	0.1632	0.0625	0.0406	0.0878		0.0558	0.0352	0.2689	0.2407
US	0.3088	0.0627	0.041	0.7319	0.0143	0.1029	0.1894	0.0654	0.1048	0.2265	0.3338	0.3151	0.124	0.1197	0.1501	0.1021	0.0823	0.0678	0.1449	0.1664	0.1427		0.5089	0.149	0.1617
Venezuela	0.0018	0	0	0.002	0	0.0066	0	0.0035	0.0182	0.0006	0.0318	0	0.003	0	0.0122	0	0.0068	2E-05	0.007	0.0009	0.0031	0.0251		0	0
Zambia	0.0002	0.0287	0	0	0	2E-05	6E-05	4E-07	0	0	0	0	0.0011	0	2E-05	0.0002	0.0004	8E-05	0.0034	0.0007	0.0004	0.0002	0		0.0483
Zimbabwe	0.0001	0.1924	0.0134	3E-05	0	0.0006	0.0005	0.0002	0	0	8E-05	0.001	0.004	0.0004	0.0008	0.0003	0.0004	0.0003	0.0006	1E-05	0.0012	0.0003	0.0004	0.0911	
Total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 6A
Bilateral Distance between capital cities (kilometers)

	Aus.	Aut.	Can.	Den.	Fin.	Fra.	Ger.	Gre.	Italy	Jap.	Kor.	Neth.	Nor.	Por.	Spa.	Swe.	UK	US
Australia		15936	16123	16057	15233	16943	16557	15224	16239	7966	8430	16648	15998	18074	17593	15632	17004	15958
Austria			6574	871	1442	1036	727	1284	765	9140	8284	935	1354	2300	1810	1244	1236	7130
Canada				5913	6278	5652	5857	7753	6735	10327	10521	5639	5604	5392	5698	5999	5367	734
Denmark					885	1028	660	2138	1533	8700	7948	622	485	2480	2075	522	957	6518
Finland						1912	1532	2471	2205	7826	7063	1505	789	3365	2953	399	1824	6938
France							400	2100	1108	9723	8975	428	1343	1454	1055	1544	341	6169
Germany								1932	1066	9357	8590	235	1048	1845	1421	1182	511	6406
Greece									1053	9518	8525	2164	2609	2854	2370	2411	2393	8261
Italy										9867	8977	1295	2009	1863	1363	1978	1434	7222
Japan											1158	9300	8414	11155	10775	8180	9570	10910
Korea												8566	7724	10428	10006	7440	8867	11174
Netherlands													916	1864	1483	1126	359	6198
Norway														2741	2392	416	1156	6238
Portugal															504	2990	1586	5742
Spain																2595	1433	6641
Sweden																	1265	6096
U.K																		5904
USA																		

Source: Jon Haveman's website

Table 6B: Bilateral Distance between capital cities (kilometers) ; Source: Jon Haveman's website

	Arg	Aus	Aut	Bel	Bol	Can	Chi	Col	Den	Dom,Rp	Ecu	Fin	Fra	Ger	Gre	Gua	Hon	HK	Ice	Ind	Ire	Isr	Ita	Jam	Jap
Argentina		11738	11824	11317	2235	9074	1134	4661	12081	6030	4358	12963	11064	11457	11702	6348	6215	18482	11448	15814	11004	12234	11165	6168	18374
Australia			15936	16741	13050	16123	11327	14435	16057	15763	13709	15233	16943	16557	15224	13628	13954	7396	16770	10374	17261	14062	16239	15124	7966
Austria				917	10982	6574	12518	9669	871	8225	10396	1442	1036	727	1284	10097	9828	8742	2892	5566	1683	2370	765	8763	9140
Belgium					10259	5679	11900	8807	768	7334	9533	1653	261	195	2092	9181	8913	9409	2132	6416	774	3248	1173	7858	9462
Bolivia						6934	1903	2437	10961	3897	2138	11776	10037	10434	11298	4159	3999	19349	9802	16242	9750	12178	10486	3955	16542
Canada							8793	4546	5913	3047	5087	6278	5652	5857	7753	3804	3651	12436	3864	11343	4905	8926	6735	3054	10327
Chile								4250	12640	5779	3788	13497	11659	12060	12570	5648	5576	18700	11668	16937	11477	13216	11920	5763	17244
Colombia									9385	1609	728	10071	8639	9000	10383	2065	1787	16913	7812	15222	8148	11499	9391	1521	14326
Denmark										7861	10105	885	1028	660	2138	9568	9326	8682	2110	5847	1240	3143	1533	8333	8700
Dom. Rep											2283	8506	7189	7529	9072	2269	1912	15480	6210	13706	6637	10242	8039	731	13242
Ecuador												10779	9366	9726	11102	2033	1861	17224	8492	15946	8869	12208	10115	2036	14444
Finland													1912	1532	2471	10040	9831	7839	2420	5218	2028	3210	2205	8917	7826
France														400	2100	9084	8808	9642	2234	6589	778	3284	1108	7732	9723
Germany															1932	9373	9106	9242	2258	6223	957	3073	1066	8053	9357
Greece																11104	10806	8554	4168	5010	2857	1201	1053	9678	9518
Guatemala																	360	15217	7621	15144	8426	12302	10051	1547	12411
Honduras																		15364	7420	14987	8165	12001	9755	1196	12607
Hong Kong																			9699	3768	9865	7769	9293	15398	2894
Iceland																				7594	1499	5244	3305	6553	8805
India																					7079	4066	5919	14135	5848
Ireland																						4021	1885	7133	9597
Israel																							2254	10863	9175
Italy																								8633	9867
Jamaica																									12922
Japan																									
Kenya																									
Korea, Rep																									
Malawi																									
Mauritius																									
Mexico																									
Nepal																									
Netherlands																									
New Zealand																									
Norway																									
Panama																									
Paraguay																									
Peru																									
Philippines																									
Portugal																									
Sierra Leone																									
Spain																									
Sri Lanka																									
Sweden																									
Switzerland																									
Thailand																									
Turkey																									
UK																									
US																									
Venezuela																									
Zambia																									
Zimbabwe																									

Table 6B Continued

	Ken	Kor	Mal	Mau	Mex	Nep	Nrth	NZ	Nor	Pan	Par	Peru	Phi	Por	Sleo	Spa	S La	Swe	Swi	Tha	Tur	UK	USA	Ven	Zam	Zimb
Argentina	10418	19443	9339	10928	7393	16519	11459	9985	12262	5334	1041	3136	17805	9612	6754	10058	14773	12575	11206	16895	12496	11141	8402	5099	8757	8898
Australia	11942	8430	11299	8882	13183	9702	16648	2324	15998	14298	12721	12861	6300	18074	16553	17593	8627	15632	16615	7489	14516	17004	15958	15460	11628	11194
Austria	5852	8284	7132	8640	10165	6237	935	18173	1354	9707	10993	11265	9859	2300	5220	1810	7494	1244	683	8451	1603	1236	7130	8652	7179	7502
Belgium	6565	8717	7761	9455	9259	7053	174	18747	1089	8813	10417	10459	10523	1711	4981	1316	8404	1283	492	9262	2517	319	6221	7799	7735	8090
Bolivia	11571	17258	10808	12828	5241	17036	10364	10913	10998	3099	1463	1080	19030	8685	6654	9182	16394	11378	10303	18779	12113	10010	6235	3008	10196	10438
Canada	11858	10521	12636	14932	3610	11670	5639	14500	5604	4073	8077	6398	13147	5392	7208	5698	13718	5999	6093	13437	8169	5367	734	3976	12317	12751
Chile	11552	18372	10457	11920	6614	17653	12024	9355	12743	4814	1554	2469	17626	10237	7649	10713	15800	13098	11863	17667	13382	11684	8079	4908	9880	10009
Colombia	12347	14858	12067	14518	3180	15811	8865	12114	9286	774	3769	1882	17327	7535	6734	8030	16866	9697	9001	17906	11115	8509	3829	1027	11477	11823
Denmark	6710	7948	8002	9442	9523	6438	622	17980	485	9325	11172	11099	9791	2480	5719	2075	7967	522	1036	8629	2300	957	6518	8395	8049	8373
Dom. Rep	11826	13550	11921	14529	3077	14241	7375	13458	7727	1483	5046	3486	16166	6230	6207	6703	15673	8142	7579	16297	9745	7026	2376	943	11395	11797
Ecuador	12834	15122	12413	14733	3138	16520	9590	11389	9996	1029	3577	1326	17358	8257	7299	8753	17517	10409	9729	18524	11839	9235	4357	1751	11809	12124
Finland	6916	7063	8291	9413	9858	5741	1505	17096	789	9939	12045	11843	8942	3365	6569	2953	7471	399	1862	7894	2319	1824	6938	9109	8418	8701
France	6491	8975	7651	9424	9207	7243	428	19007	1343	8671	10170	10264	10757	1454	4724	1055	8524	1544	441	9455	2602	341	6169	7625	7601	7966
Germany	6438	8590	7656	9303	9442	6864	235	18623	1048	9009	10569	10646	10357	1845	5060	1421	8209	1182	425	9074	2330	511	6406	7991	7647	7996
Greece	4572	8525	5878	7373	11296	5767	2164	17537	2609	10545	11016	11778	9645	2854	4949	2370	6601	2411	1660	7932	820	2393	8261	9357	5962	6265
Guatemala	14078	13117	14028	16558	1122	15410	9184	11402	9322	1306	5608	3222	15353	8334	8428	8775	17510	9731	9507	16753	11687	8862	3110	2591	13460	13828
Honduras	13717	13261	13682	16229	1401	15310	8923	11709	9099	1014	5430	3119	15579	8017	8068	8465	17292	9511	9226	16819	11409	8595	2936	2243	13118	13491
Hong Kong	8771	2102	9644	7759	14150	2966	9292	9436	8603	16251	19137	18389	1117	11039	13358	10552	4055	8238	9411	1725	7734	9638	13129	16387	10251	10040
Iceland	8694	8388	9884	11532	7462	8047	2023	17275	1749	7592	10425	9659	10721	2954	6232	2897	9889	2136	2621	10103	4410	1893	4518	6916	9828	10198
India	5442	4691	6660	5834	14669	803	6357	12667	5986	15155	15566	16785	4764	7778	9608	7275	2436	5570	6242	2925	4217	6712	12051	14213	7195	7137
Ireland	7265	8962	8406	10200	8485	7678	758	18696	1267	8109	10052	9860	10964	1641	5029	1452	9140	1629	1208	9869	3286	463	5448	7156	8333	8707
Israel	3718	8090	5126	6299	12489	4858	3297	16355	3569	11705	11689	12773	8814	4012	5596	3544	5437	3279	2845	6938	891	3559	9452	10477	5331	5565
Italy	5394	8977	6592	8316	10253	6641	1295	18562	2009	9517	10377	10871	10404	1863	4493	1363	7635	1978	686	8840	1725	1434	7222	8364	6583	6930
Jamaica	12557	13366	12635	15236	2360	14593	7884	12850	8156	1047	5243	3345	15915	6859	6935	7319	16255	8571	8137	16488	10318	7543	2326	1353	12099	12495
Japan	11268	1158	12352	10647	11311	5166	9300	9288	8414	13577	18004	15499	3005	11155	14359	10775	6865	8180	9679	4613	8775	9570	10910	14177	12936	12788
Kenya		10120	1453	3079	14833	6102	6672	13676	7177	12935	10407	12579	9426	6467	5660	6192	4866	6943	6080	7218	4604	6825	12152	11546	1832	1932
Korea, Rep			11239	9696	12063	4022	8566	10034	7724	14164	18596	16320	2627	10428	13449	10006	5844	7440	8872	3727	7753	8867	11174	14490	11813	11688
Malawi				2613	14994	7240	7887	12688	8481	12760	9499	11873	10114	7369	5765	7182	5595	8282	7269	7975	6001	7991	12781	11439	613	493
Mauritius					17589	6114	9536	10626	9864	15256	11390	13900	7950	9539	8372	9243	3884	9550	8992	6035	7161	9742	15225	13998	3137	2746
Mexico						14767	9231	11112	9208	2411	6699	4257	14234	8684	9277	9077	17101	9597	9645	15761	11767	8942	3039	3597	14454	14844
Nepal							6980	11966	6526	15636	16350	17501	3963	8489	10411	7985	2385	6114	6918	2214	4962	7338	12396	14833	7801	7702
Netherlands								18588	916	8851	10551	10540	10404	1864	5152	1483	8385	1126	632	9184	2536	359	6198	7862	7872	8223
New Zealand									17692	11984	10861	10599	8319	19592	16295	19868	10937	17464	18847	9756	16839	18837	14098	13140	12838	12439
Norway										9170	11318	11054	9698	2741	6065	2392	8195	416	1463	8683	2704	1156	6238	8320	8533	8855
Panama											4488	2356	16569	7696	7281	8174	17142	9585	9062	17505	11227	8504	3341	1394	12180	12539
Paraguay												2513	18836	8732	6104	9197	15083	11650	10349	17416	11829	10221	7421	4106	8894	9100
Peru													18059	9017	7419	9520	17436	11457	10583	19710	12568	10181	5671	2748	11260	11512
Philippines														12156	14369	11669	4572	9340	10528	2211	8825	10748	13793	17109	10728	10458
Portugal															3389	504	9447	2990	1629	10695	3585	1586	5742	6508	7175	7585
Sierra Leone																3675	10242	6240	4707	12311	5748	4935	7162	5889	5297	5725
Spain																	8970	2595	1152	10192	3087	1265	6096	7003	7037	7434
Sri Lanka																		7784	8118	2385	5939	8720	14402	15872	6206	5984
Sweden																			1547	8278	2397	1433	6641	8728	8371	8675
Switzerland																				9132	2184	751	6607	7981	7244	7599
Thailand																					7141	9542	14169	17000	8587	8351
Turkey																						2836	8733	10089	6179	6430
UK																							5904	7505	7941	8307
US																								3317	12400	12835
Venezuela																									10876	11255
Zambia																										436
Zimbabwe																										

Table 6C
Internal Distance

Country name	Internal Distance	Country name	Internal Distance
ARGENTINA	938	KOREA RP	177
AUSTRALIA	1564	MALAWI	194
AUSTRIA	163	MAURITIUS	24
BELGIUM-LUX.	99	MEXICO	792
BOLIVIA	591	NEPAL	212
CANADA	1782	NETHERLANDS	115
CHILE	491	NEW ZEALAND	292
COLOMBIA	602	NORWAY	321
DENMARK	117	PANAMA	158
DOMINICAN RP	125	PARAGUAY	360
ECUADOR	300	PERU	640
FINLAND	328	PHILIPPINES	309
FRANCE	417	PORTUGAL	171
GERMANY	337	SIERRA LEONE	151
GREECE	205	SPAIN	401
GUATEMALA	186	SRI LANKA	145
HONDURAS	189	SWEDEN	378
HONG KONG	19	SWITZERLAND	115
ICELAND	181	THAILAND	404
INDIA	1023	TURKEY	498
IRELAND	150	UNITED KINGDOM	279
ISRAEL	81	USA	1751
ITALY	310	VENEZUELA	539
JAMAICA	59	ZAMBIA	489
JAPAN	347	ZIMBABWE	112
KENYA	431		

Source: CIA, The World Factbook 2001

Table 7
Fixed effect regressions for Complete and Incomplete Specialization

A. Complete Specialization (equation 7)

	Dependent variable: Terms of Trade		Dependent variable: Terms of Trade, PPP adjusted	
	(1)	(2)	(3)	(4)
Output of Export vs Import goods	0.16 (0.9)		-1.55 (-3)	
World Output of Export good		0.37 (2)		-1.51 (-3.2)
World Output of Import goods		-0.57 (-2.9)		1.47 (2.8)
Relative Market Potential	2.5 (3.9)	1.8 (2.8)	1.7 (1.1)	1.5 (0.96)
within R2	0.03	0.04	0.05	0.05
Observations	969	969	969	969

B. Incomplete Specialization (equation 12 and 13)

	Dependent variable: Terms of Trade		Dependent variable: Terms of Trade, PPP adjusted	
	(1)	(2)	(3)	(4)
Output of Export vs Import goods	0.03 (0.4)		-0.09 (-0.9)	
World Output of Export goods		0.02 (0.3)		-0.11 (-1.2)
World Output of Import goods		-0.1 (-1.4)		0.08 (-6.8)
within R2	0.001	0.02	0.01	0.06
Observations	342	342	342	342

Note: t-statistics in parentheses.

Table 8
Fixed effect regressions for Complete Specialization
(for subsamples with varying distance to world market)

	Dependent variable: Terms of Trade			Dependent variable: Terms of Trade, PPP adjusted		
	Closest	Medium	Furthest	Closest	Medium	Furthest
World Output of Export good	-1.67	1.16	0.52	-1.53	1.3	-2.4
	(-8.1)	(2.6)	(1.7)	(-6.8)	(3.5)	(-1.9)
World Output of Import goods	1.53	-1.21	-1.14	1.26	-1.7	3.9
	(7.1)	(-2.6)	(-3.8)	(4.8)	(-4.3)	(3.1)
Relative Market Potential	-1.3	3.2	-0.06	0.28	7.5	15.5
	(-2.8)	(1.7)	(-0.03)	(0.5)	(4.7)	(2.2)
within R2	0.33	0.02	0.14	0.42	0.22	0.07
Observations	323	323	323	323	323	323

Notes:
(1) Data set is classified into three categories according to closeness, measured by relative market potential.
(2) t-statistics in parentheses.

In the case of closest countries:

	Dep. variable: Terms of Trade	
	(1)	(2)
World Output of Export good	-0.95	-1.64
	(-4.5)	(-8.13)
World Output of Import goods	0.87	1.51
	(3.9)	(7)
Relative Market Potential	-0.98	-0.67
	(-2.2)	(-1.3)
Lagged terms of trade	0.49	
	(9.6)	
Relative per Capita Income		-0.19
		(-3.07)
within R2	0.52	0.35
Observations	306	323

Notes: t-statistics in parentheses

Table 9
Fixed effect regressions for Incomplete Specialization
(for subsamples with varying distance to world market)

	Dependent variable: Terms of Trade				Dependent variable: TOT, PPP adjusted			
	Closest		Furthest		Closest		Furthest	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outupt of Export vs Import goods	-0.29 (-2.7)		0.19 (2)		-0.63 (-4.6)		0.2 (1.5)	
World Output of Export goods		-0.16 (-1.8)		0.19 (2		-0.62 (-4.3)		0.1 (0.1)
World Output of Import goods		0.04 (0.4)		-0.18 (-1.9)		0.61 (3.6)		-0.3 (-2.4)
within R2	0.04	0.09	0.02	0.02	0.12	0.11	0.006	0.11
Observations	171	171	171	171	171	171	171	171

Notes:
(1) Data set is classified into two categories according to closeness, measured by relative market potential.
(2) t-statistics in parentheses.

In the case of closest countries:

	Dependent variable: Terms of Trade			
	(1)	(2)	(3)	(4)
Output of Export vs Import goods	-0.16 (2)		-0.16 (-1.1)	
World Output of Export goods		-0.14 (-1.6)		0.13 (1)
World Output of Import Goods		0.07 (0.7)		-0.27 (-1.9)
Lagged terms of trade	0.56 (8.2)	0.53 (7.2)		
Own Output vs Rest of World			-0.81 (-2.1)	-0.84 (-3.2)
within R2	0.36	0.37	0.16	0.16
Observations	153	153	171	171

Notes: t-statistics in parentheses

Table 10
Fixed effect regressions for Complete Specialization
(for subsamples with varying Grubel-Lloyd index)

	Dependent variable: Terms of Trade		
	High GL	Medium GL	Low GL
World Output of Export good	0.12	2.5	-0.06
	(0.4)	(6.2)	(-0.2)
World Output of Import goods	-0.16	-2.9	-0.4
	(-0.6)	(-6.5)	(-1.4)
Relative Market Potential	1.8	2.4	0.37
	(2.6)	(2.0)	(0.4)
within R2	0.04	0.11	0.25
Observations	323	323	323

Notes: t-statistics in parentheses

Table 11
Regression for Incomplete Specialization
with country-specific coefficient on world per capita income*

	Dependent variable: Terms of Trade		Dependent variable: Terms of Trade, PPP adjusted	
	(1)	(2)	(3)	(4)
Output of Export vs Import goods		0.009 (0.15)		-0.14 (-1.4)
World Output of Export goods	0.004 (0.07)		-0.16 (-1.6)	
World Output of Import goods	-0.09 (-1.3)		-0.06 (-0.5)	
within R2	0.43	0.42	0.3	0.29
Observations	342	342	342	342

Notes: (1) * We do not report the 50 coefficients on world per capita income
(2) t-statistics in parentheses.

For Closest and Furthest countries:

	Dependent variable: Terms of Trade				Dependent variable: TOT, PPP adjusted			
	Closest		Furthest		Closest		Furthest	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Output of Export vs Import goods		-0.17 (-1.8)		0.18 (1.9)		-0.67 (-4.5)		0.16 (0.1)
World Output of Export goods	-0.27 (-2.7)		0.17 (1.8)		-0.7 (-4.4)		-0.02 (-0.03)	
World Output of Import goods	-0.14 (-0.9)		-0.18 (-1.9)		0.6 (2.4)		-0.32 (-2.3)	
within R2	0.44	0.42	0.41	0.44	0.37	0.36	0.37	0.28
Observations	171	171	171	171	171	171	171	171

Notes: t-statistics in parentheses

Table 12
Robustness: Fixed effect regressions
(for subsamples with varying distance to world market)

A. Complete Specialization

	Dep. variable: Terms of Trade with real value shares of 1975				Dep. variable: Overall Terms of Trade from World Bank			
	all countries	Closest	Medium	Furthest	all countries	Closest	Medium	Furthest
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
World Output of	0.3	-1.4	0.94	0.36	0.18	-1.3	0.78	-0.04
Export good	(1.7)	(-6.8)	(2.1)	(1.3)	(0.9)	(-4.7)	(1.7)	(-0.15)
World Output of	-0.55	1.2	-1	-0.99	-0.75	0.83	-1.2	-0.88
Import goods in1975	(-2.8)	(5.7)	(-2.2)	(-3.5)	(-3.5)	(2.8)	(-2.5)	(-2.7)
Relative Market	1.7	-0.9	2.4	0.22	1.3	-0.5	-0.49	-0.53
Potential	(2.7)	(-1.9)	(1.1)	(0.1)	(1.9)	(-0.7)	(-0.2)	(-0.3)
within R2	0.07	0.32	0.02	0.22	0.21	0.43	0.07	0.4
Observations	969	323	323	323	969	323	323	323

B. Incomplete Specialization,
75% of sample, 1985 shares, countries whose trade shares change the least between 1970-1988

	Dep. variable: Terms of Trade	
	Closest	Furthest
World Output of	0.81	-0.2
Export goods	(2.9)	(-5.7)
World Output of	-0.6	2
Import goods	(-2.6)	(-5.5)
within R2	0.07	0.23
Observations	133	133

Notes:
(1) *not in sample: Korea, Japan and Spain and Greece.
(2) t-statistics in parentheses.