Gains from trade and total factor productivity across economies

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Abstract

This article studies and measures the gains from openness and the effects of international trade policy on productivity and output levels. It is assumed an economy with two tradable and non-storable intermediate goods, used in the production of a non-tradable final good. The solution of the static trade and factor allocation problem generates implicitly a mapping between factor endowments and final output, which is then used as an exogenous production function. We find that for very poor economies gains from trade are sizable and in many cases more than 50% of their per capita income. Most of these countries have high tariffs but enjoy most of their potential gains from trade as their factor endowment is very different from that of the rich countries that they trade with. However, there are a group of low-to-middle income countries (e.g., India and Pakistan), with sizeable potential gains from trade, and for whom barriers to trade imply a significant loss.

1 Introduction

We study and measure the effects of international trade policy on total factor productivity (TFP) and output levels. We use as our main instrument a dynamic Heckscher-Ohlin model that follows, among others, Ferreira and Trejos

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(2006). In this framework, it is assumed an economy with two tradable and non-storable intermediate goods, used in the production of a non-tradable final good. We focus on the case of a small, price-taking economy. The solution of the static trade and factor allocation problem generates implicitly a mapping between factor endowments and final output, which can then be used as an exogenous production function. This formulation is similar to Corden (1971), Trejos (1992) and Ventura (1997) that use a factor-endowments framework to introduce trade in a macro model.

In this model, policy instruments that increase the cost of international trade generate an inefficient equilibrium allocation of factors across industries. This inefficiency has an effect similar to a fall in total factor productivity.

We first use this framework to measure the static gains from trade assuming a move from autarky to free trade. Under a very conservative calibration we show that for a country with around one per cent of the capital-labor ratio of the rich economies (e.g. Mozambique and Rwanda in our sample) these potential gains from trade area sizable, reaching 75% of their own output. We them apply observed tariff data to measure what portion of these potential gains are actually being enjoyed. The answer depends on the magnitude of the trade barriers and also on the relative capital-labor ratio, a fact not always observed in the literature. For instance, in 1985 Brazil and Benin had similar nominal tariff rates (unweighted averages). However, while the latter realized almost all its potential gains from trade, Brazil lost almost them all. This is because capital-labor ratio in Benin is only, on average, 4% of the rich economies it trade with, while in Brazil it was 57%. However, there are a group of low-to-middle income countries (e.g., India and Pakistan), with sizeable potential gains from trade, and for whom barriers to trade imply a significant loss.

These results compare with those in the "pure trade part" (i.e., the model without diffusion) of Rodriguez-Clare (2006), who also found sizable gains for very poor economies. However, they contrast with those in Eaton and Kurtun (2002) because, by construction, the gains from trade between two rich economies in our model are small, while they found relatively large gains.

As opposed to the previous development accounting literature[1], we are not worried whether TFP or factors are more relevant in explaining output

[1] See for instance, Mankiw, Romer and Weil (1992) Klenow and Rodriguez-Clare (1997), Prescott (1998) and Hall and Jones (1999).

differences. Instead, we perform output decompositions from a distinctive perspective. The fact that countries with very different factor endowments to the rich economies are trading with them, and obtaining a productivity gain from that trade (that is not enjoyed by the richer nations, at least not in a similar scale), implies that TFP decompositions that ignore the effects of this type of trade would yield a higher TFP residual for many nations; perhaps quite a bit higher, as suggested by the gains from trade numbers. We measure this difference and show that for a group of poor economies the TFP constructed ignoring trade in general overestimate the true TFP. For instance, while in a closed economy model productivity would explain 32.4% of the income difference of Mozambique with respect to the leading economies, once we correct for the gains from trade - which are huge in this case - the TFP residual explains only 18.2% of the income disparity.

This article has four sessions in addition to this introduction. The next session presents the model used in our development decomposition exercises, while session three discusses data and calibration. Session four presents the main results and session five concludes.

2 The model

The model follows Ferreira and Trejos (2006). Time is discrete and unbounded. The world contains many countries, one of which is a large economy that has converged to its steady state, and that we will call the Center. Other countries are small relative to the Center, in the sense that they are price-takers at the Center´s autarkic price. Our representative country is populated by a continuum of identical, infinitely-lived individuals. Three goods are produced: two non-storable, tradable intermediate products, A and B, and a a final good, Y, which can be consumed or invested, but that cannot be traded. There are also two factors of production in this economy: labor in efficient units H and physical capital K. Labor and capital are used in producing A and B, and these in turn are used to produce Y. The endowment of labor, measured in efficiency units, is given by:

$$H = Lh = Le^{\phi s},$$

where L is the number of workers, h represents efficiency-units of labor per worker and s stands for schooling. The production functions of A and B are:

$$\begin{aligned} A &= K_A^{\alpha_a} H_A^{1-\alpha_a} \\ B &= K_B^{\alpha_a} H_B^{1-\alpha_b}. \end{aligned}$$

Without loss of generality, A is labor-intensive: $\alpha_a < \alpha_b$. We use B as numeraire, with the prices of A and Y denoted p and π. All markets are perfectly competitive; in the case of intermediate products, these are not domestic markets but rather a single world market, from which local Y producers can import intermediate products provided they pay an ad-valorem tariff τ. This τ captures all the (policy or non-policy induced) costs of bringing imported intermediate products into the local market.

Because intermediate goods are tradable, the amounts of them that are used in the production of the final good (denoted by lowercase a and b) may differ from the amounts produced A and B. Total output of Y is given by:

$$Y = \Theta a^{\gamma} b^{1-\gamma}, \tag{1}$$

where Θ is total factor productivity.

We derive the allocation of capital K and labor H among the production of A and B, the quantities a and b of intermediate goods used domestically, and the amount of final output Y that is produced. Because intermediate goods are assumed to be non-storable, and the final good is not tradable, this is a static problem, which yields an equilibrium mapping

$$Y = \Theta F(K, H|\tau, p)$$

that relates final output with factor endowments. This mapping is not a production function, in the sense that it does not describe a technology: it describes an equilibrium relationship that takes into account the technologies for all the products, and the equilibrium effects of trade in the intermediate inputs in the optimal choice for final good producers.

The equilibrium solutions for $\{A, B, a, b, q, w, r, K_i, H_i\}$ must satisfy the following properties:

1. Producers of intermediate goods choose K_i, H_i in order to maximize the period's profits:

$$\begin{aligned} \Pi_A &= \max_{K_A, H_A} qK_A^{\alpha_a} H_A^{1-\alpha_a} - wH_A - rK_A \\ \Pi_B &= \max_{K_B, H_B} K_B^{\alpha_b} H_B^{1-\alpha_b} - wH_B - rK_B \end{aligned}$$

2. Producers of final goods maximize profits, taking domestic prices as given:

$$a, b = \arg\max_{a,b} \quad \pi a^{\gamma} b^{1-\gamma} - qa - b$$

3. Firms make zero profits,

$$\begin{aligned} \Theta a^{\gamma} b^{1-\gamma} &= qa + b \\ qA &= wH_A + rK_A \\ B &= wH_B + rK_B \end{aligned}$$

markets clear,

$$\begin{aligned} K &= K_A + K_B \\ H &= H_A + H_B \end{aligned}$$

and agents neither borrow from nor lend to the world economy,

$$pA + B = pa + b$$

4. Local prices of tradable goods satisfy an after-tariff law of one price:

$$q = \begin{cases} p/(1+\tau) & if \quad a < A \\ p \cdot (1+\tau) & if \quad b > B \end{cases}.$$

Based on these requisites, one can derive the equilibrium relationship F. As is standard in the Hecksher-Ohlin model:

1. If K/H is much lower [much higher] than the world's ratio $(K/H)^*$, only the intermediate good A [B] will be produced, as its production uses more intensively the relatively abundant labor [capital]. There are critical levels $s_1 < (K/H)^*$ and $z_2 > (K/H)^*$ such that if $K/H \leq s_1$ then the country *only* produces A, and if $K/H \geq z_2$ then the country *only* produces B. Then, Y is a Cobb-Douglas function of K and H, with capital share α_a [α_b]. Furthermore, the critical values s_1 and z_2 are sensitive to τ. In particular, with higher tariffs the economy is less prone to specialize, so $\partial s_1/\partial\tau < 0$ [$\partial z_2/\partial\tau > 0$], with $s_1 \to 0$ [$z_2 \to \infty$] as $\tau \to \infty$.

2. If K/H is very close to $(K/H)^*$ a high enough tariff will make the economy not trade at all: There exist x_1 and x_2, where $s_1 < x_1 \leq (K/H)^*$ and $(K/H)^* \leq x_2 < z_2$ such that if $(K/H) \in (x_1, x_2)$ then there is no trade, so $a = A$, $b = B$. We have: $\partial x_1/\partial\tau < 0$ and $\partial x_2/\partial\tau > 0$. Also, $x_1 \to 0$ and $x_2 \to \infty$ as $\tau \to \infty$, while $x_1 = x_2$ if $\tau = 0$.

3. If K/H is neither too close nor too far from $(K/H)^*$, the economy will produce both intermediate goods, yet still trade. In those cases holds a result analogous to the Factor Price Equalization Theorem, which states that equilibrium marginal returns of capital and labor are not sensitive to small variations in the factor endowment. What that means is that final output Y is linear in K and H when $K/H \in [s_1, x_1]$ or when $K/H \in [x_2, z_2]$.

   Hence, the equilibrium relationship from K and H to Y takes the form

$$F(K, H|\tau, p) = \begin{cases} \Omega_1 K^{\alpha_a} H^{1-\alpha_a} \text{ if } K/H < s_1 \\ \Omega_2 K + \Omega_3 H \text{ if } K/H \in [s_1, x_1] \\ \Omega_4 K^{\overline{\alpha}} H^{1-\overline{\alpha}} \text{ if } K/H \in [x_1, x_2] \\ \Omega_5 K + \Omega_6 H \text{ if } K/H \in [x_2, z_2] \\ \Omega_7 K^{\alpha_b} H^{1-\alpha_b} \text{ if } K/H > z_2, \end{cases}$$

where the values Ω_i are functions of parameters, and are affected by p and τ. For a closed economy it is the case that $[x_1, x_2) = \Re_+$. Consequently, without trade our model simply collapses to one with the aggregate production function is $Y = \Theta F^*(K, H|\tau, p) = \Theta\Omega_4 K^{\overline{\alpha}} H^{1-\overline{\alpha}}$, for $\overline{\alpha} = \gamma\alpha_a + (1-\gamma)\alpha_b$. For all values of p and τ, F is homogeneous of degree one and continuous in K and H. F is decreasing in τ (strictly decreasing if $k \notin [x_1, x_2]$).

The fact that $\partial F//\partial\tau < 0$ implies that a more liberal trade policy carries as a consequence a gain in output, given inputs. Hence, if one ignores the effects of trade, one may attribute them to Θ. The effect of τ on output is not because tariffs appear directly in any of the production functions, but rather because trade changes domestic prices, q, in a way that expands the set of choices producers have for their inputs.

The effects of trade on measured productivity will vary according to the capital labor ratio $k = K/H$. A country with low k, much lower than the Center, will derive large gains from trade, and thus also lose much from a high τ. A more capital-rich country, where k is similar to that of the Center, has less to benefit from trade as international prices will resemble more closely its autarkic prices.

3 Data and calibration

In what follows, we try to assess the impact of the gains from trade on measured productivity for a large set of countries. We use the Penn-World Tables (PWT) data for output per worker and to construct the physical capital series using the Perpetual Inventory Method. The initial capital stock, K_0, was approximated by $K_0 = I_0/[(1+g)(1+n) - (1-\delta)]$, where I_0 is the initial investment expenditure, g is the rate of technological progress and n is the growth rate of the population. In this calculation it is assumed that all economies were in a balanced growth path at time zero, so that $I_{-j} = (1+n)^{-j}(1+g)^{-j} I_0$.

We use the same depreciation rate for all economies, which was calculated from US data. We employed the capital stock at market prices, investment at market prices, I, as well as the law of motion of capital to estimate the implicit depreciation rate according to:

$$\delta = 1 - \frac{K_{t+1} - I_t}{K_t}.$$

From this calculation, we obtained $\delta = 3.5\%$ per year (average of the 1950-2000 period). To minimize the impact of economic fluctuations we used the average investment of the first five years as a measure of I_0. When data was available we started this procedure taking 1950 as the initial year in order to reduce the effect of K_0 in the capital stock series.

For human capital, we use a standard Mincer function of schooling, of the form $h = e^{\phi s}$. Following Psacharopoulos (1994), we set the return of schooling to $\phi = 0.099$. We used data on the average educational attainment of the population aged 15 years and over, taken from Barro and Lee (2000).

For trade policy we use several data sources. The only uniform estimates for a large sample of countries that we know of is World Bank (2005) data on average tariff rates (unweighted). The calculations in the next section are done using those numbers for τ. Of course, there are problems with this. First, unweighted averages usually include the very low tariffs that most countries have for their export goods, which are rarely also imported. This drives down the average. Second, as extensively documented in the survey by Anderson and van Wincoop (2004), the costs associated with international trade include, besides tariffs, a series of policy-induced non-tariff barriers, plus costs related to transportation and distance, the latter two exceeding the tariff for many products and countries, according to several estimates.

However, no uniform measurement or estimation of these other costs for a large sample of countries seems to exist. Hence, we perform our analysis mostly with the large dataset that contains only average tariffs, and later contrast it with the estimates of other trade barriers for a small group of countries that have been estimated elsewhere. The references behind this appear below.

For callibration, we use the sum of the European Union and the United States for k and h in the Center, getting p as the autarkic relative price of A for a closed economy with those levels of capital.[2]

As is conventional, we match the capital share of a closed economy to be $\overline{\alpha} = 1/3$. This pins down the average $\overline{\alpha}$, but leaves freedom in choosing γ, α_a and α_b. These parameters are particularly important, as the quantitative effects of all trade-related phenomena, for low k, are bound to be larger with a big spread $\alpha_b - \alpha_a$, and with a lower γ, given $\overline{\alpha}$. We choose conservatively the values of α_a, α_b and γ to limit the size of the gains from trade within reasonable bounds. These parameters are chosen so that exports cannot amount to more than half of output, and so that for the countries about to enter the EU in 1985 (Portugal and Spain), or any richer nation, the potential gains from trade (the difference in output between $\tau = \infty$ and $\tau = 0$) are at most 1% of GDP. This leads to $\gamma = 1/2$, $\alpha_a = 0.19$ and $\alpha_b = 0.408$. We analyze below the effects on our results from varying α_a.

4 Results

We first assess the potential and realized gains from trade, which are shown in Tables 1.1 to 1.4. Column (3) shows what our model predicts in terms of the output difference between $\tau = 0$ and $\tau = \infty$, given each country´s levels of schooling and capital:

$$F(K, H|\tau = 0)/F(K, H|\tau = \infty) - 1.$$

Column (4) shows the predicted output difference between autarky ($\tau = \infty$), and applying the tariff rate given by the World Bank data:

$$F(K, H|\tau = \tau_i)/F(K, H|\tau = \infty) - 1$$

[2] To normalize capital for this callibration, we follow Ferreira-Trejos (2006) to estimate the balanced growth path for k in a closed-economy standard Cass-Koopmans model with 6.1% net return of capital and 2% annual growth.

We remove from our sample those countries with high k for which potential gains from trade represent less than 1%.

<< Insert Tables 1.1. to 1.4>>

We present together as Group 1 countries with relatively high capital-labor ratios, for whom the potential increase in productivity from autarky to free trade is small (say, less than 10%). The tariffs necessary, at those higher levels of k, to prevent trade altogether are not so large; notice that, for example, Mexico, Barbados and Cyprus have tariffs under 20%, yet they miss all their gains from trade in 1985 according to our model.[3] Nevertheless, some of these countries, with really low tariffs, do specialize somewhat and reap benefits from trade, as in the cases of Ireland, Hong Kong or Poland.

On the other extreme, the sixteen countries in Group 2 are very poor (the lowest k in the sample), so their gains from trade are very large (over 40%). In the case of Mozambique, for instance, which in 1985 had 1/72 of the US-EU capital-labor ratio, the productivity hike due to trade can be as much as 75%.

Interestingly, most of these countries have high tariffs; much higher than in Group 1. Yet, these poor nations get to enjoy most of their potential gains from trade. Why? Because their factor endowment is very different from that of the Center with which they trade, so the barriers to trade that would be necessary to drive them to autarky are just immense. Hence, even with a relatively high τ those countries still remain fully specialized in the production of A, the labor-intensive good, which is the efficient allocation of capital and labor among the intermediate industries when you are that poor. With $k = 0.04$, as several of those countries have, a tariff in excess of 100% is necessary to induce the production of *any* amount of B, the capital-intensive good. Even with high barriers to trade,which induce a very inefficient choice of a and b by final good producers, the allocation of K and H among the intermediate goods is not affected in these cases. Almost all sub-Saharan countries in our sample are in that situation.

Group 3 contains ten countries that are low-to-middle income, with sizeable potential gains from trade, and for whom barriers to trade imply a significant loss. Notice for instance that Bangladesh, the country with the highest tariff in our sample, could get a 36% boost in productivity from free

[3]For instance, with the capital/labor ratio of Mexico, a tariff of 16% is enough to rule out trade.

trade, yet wastes three quarters of that potential loss due to protectionism. India, Pakistan and Colombia are not very far behind. Finally, neither here nor there, the 26 nations in Group 4 have lower tariffs, enjoy significant benefits from international trade, yet also waste a non-negligible fraction of that potential.

4.1 Productivity decomposition

The fact that countries with very different factor endowments to the Center are trading with it, and obtaining a productivity gain from that trade (that is not enjoyed by the richer nations, at least not in a similar scale), implies that TFP decompositions that ignore the effects of this type of trade would yield a higher TFP residual for many nations; perhaps quite a bit higher, as suggested by the numbers that we saw above. Now, we try to see the size of this difference.

The usual approach yields

$$Y = \widehat{\Theta} K^{\overline{\alpha}} H^{1-\overline{\alpha}}$$

where $\widehat{\Theta} = \Theta \Gamma_\tau$ - and is usually labeled TFP in level decomposition exercises - and Γ_τ is the increase in productivity due to trade, so

$$\Gamma_\tau = \frac{F(K, H|\tau)}{F(K, H|\tau = \infty)}$$

If an economy is in autarky, then $\Gamma_\tau = \Gamma_\infty = 1$, and thus $\widehat{\Theta} = \Theta$. However, if tariffs are low enough, then $\Gamma_\tau > 1$, and thus one may overestimate the true TFP, Θ, if one ignores the impact of international trade.

Dividing by the number of workers, L, we get output per worker, or

$$\frac{Y}{L} = \widehat{\Theta} \left(\frac{K}{H}\right)^{\overline{\alpha}} \frac{H}{L}$$

Now, if the country does trade, and thus reaps the gains from trade, we can rewrite the previous equation as

$$\frac{Y}{L} = \left(\frac{K}{H}\right)^{\overline{\alpha}} \frac{H}{L} \frac{F(K, H|\tau)}{F(K, H|\tau = \infty)} \Theta.$$

We use this expression in a otherwise standard level decomposition exercise, in which income difference with respect to Center is measured as

$$\frac{Y_i/L_i}{Y_C/L_C} = \left(\frac{K_i}{H_i}/\frac{K_C}{H_C}\right)^{\overline{\alpha}} \times \left(\frac{H_i}{Li}/\frac{H_C}{L_C}\right) \times \frac{F(K_i, H_i|\tau = \tau_i)}{F(K_i, H_i|\tau = \infty)} \times \frac{\Theta_i}{\Theta_C}$$

The two first components in the right hand side are standard in level decomposition exercises; first comes the effect of different levels of capital per efficiency unit of labor, and then the amount of efficiency units of labor per worker. i.e., human capital. The product of the last two components is $\widehat{\Theta}$, what usually appears for productivity, which we separate in Tables 2.1 to 2.4 between the trade-related part and the residual productivity, for our sample[4]. Countries are arranged in the same groups as in Table 1.

<< Insert Tables 2.1 to 2.4 >>

As expected, the relatively well-off countries in Group 1 (not to mention the even better-off countries that were deleted from the sample) display very low levels of Γ_τ. Therefore, estimates of $\widehat{\Theta}$ obtained ignoring trade are very similar to those of Θ. There are still some exceptions: very open economies where gains from trade are not negligible, like Panama, Hong Kong, Ireland or Trinidad. Similarly, for some of the countries in Group 3 it is also the case that $\widehat{\Theta}$ is very close to Θ, not because there are few gains from trade to be obtained, but rather because the high τ implies low Γ_τ. In fact, the correlation between Θ and $\widehat{\Theta}$ is high for the overall sample.

Nevertheless, in the other two groups, productivity is significantly overestimated by assessing $\widehat{\Theta}$. In the very poor countries of Group 2 trade matters a lot. In the case of Mozambique and Rwanda, for instance, $\widehat{\Theta}$ is almost twice as large than Θ, because the measured gains from trade are huge. In no country in this group Γ_τ was found to be smaller than 40%, so the discrepancy between measured and trade-corrected TFP. Similarly, for those countries in Group 4 enough trade takes place, for the usual measure of TFP, $\widehat{\Theta}$, to be quite an overestimation of Θ. Guatemala and Jordan, for instance, two countries that usually surprise in standard TFP measures, resemble much more closely others with similar income once a correction for trade is made.

What about the opposite question: Are the losses of productivity from imposing trade barriers significant relative to overall TFP? We calculate $\Gamma_0 - \Gamma_\tau$

[4] For simplicity we called the first component of the expression above k and the second h.The latter measure the impact of H/L after account for differences in K/H.

and compare it to $1/\Theta - 1$, to verify if the productivity increase that could have been obtained by trade liberalization in 1985 was a large component of the overall productivity difference for these countries. We know that, relative to their own output, gains from trade liberalization are large. Are they large relative to the distance that these countries must make up? The answer, not surprisingly, is that for most countries, TFP losses due to the undone trade liberalization are not large relative to their productivity backwardness. In Group 1, this is the case because the gains to be ripped from trade are not large. In Group 2, because most of those gains are enjoyed anyway. Nevertheless, it is the case that in Groups 3 and 4, additional trade liberalization could make up for a significant fraction of the TFP differentials: 10% of them, on average, for Group 3, around 20% for Bangladesh and Colombia, and at least 4% for 13 countries in total.

4.2 2000 data

Between 1985 and 2000 most countries in the world experienced aggressive trade liberalization. In our sample of developing countries, average tariff dropped from 27% to 13% in the period, while the coefficient of variation - the ratio between variance and mean - went from 10.1 to 3.0. Not surprisingly, the number of countries that wasted a significant share of their potential gains from trade decreased. For instance, average nominal tariff in Bangladesh fell to 21.6% from 94.5% in the period. Hence, while in 1985 it lost more than three quarters of the potential gains from trade, in 2000 it reap them all.

Nonetheless, there is still a group of middle-income countries - with relatively high capital-labor ratios - that lose a large part of their potential gains from trade (e.g., Brazil, Malaysia, Thailand, Hungary, etc.). As seen before, the potential increase in productivity from autarky to free trade is small in this case and the tariffs necessary to prevent trade are not large. Some countries such as Mexico, Iran and Cyprus did not improve at all and still miss all benefits from trade.

However, there are marked changes. Because tariffs are now much lower, there is a group of countries - for instance, India and Pakistan, in addition to Bangladesh - that used to miss these gains from trade in the past but now benefit from it. Although tariffs are still relatively high - in all three cases well above the average 2000 tariff - they are now low enough so that, given their relative low k, these countries are not shut down from trade as in the past.

5 Conclusion

In this paper we presented evidence that gains from trade are very relevant. We used a very simple dynamic version of the Hecksher-Ohlin model so that the only reason countries trade are factor differences. This contrasts with Eaton and Kurtum (2002) Ricardian trade model in which there is a continuum of goods and countries have differential access to technology. In that model efficiency varies across commodities and countries. As opposed to Rodriguez-Clare (2006), which builds on Eaton and Kurtun(2002), there is no diffusion in our model. Nonetheless, the model is able to capture some important features of the international comerce - poor countries do trade because of factor differences - and so our measured gains from trade may be be seen as a (large) lower bound of the gains from openness. As a matter of fact, they are very close to those Rodriguez-Clare (2006) obtained in the pure trade model.

Moreover, the methodology we use does not capture the fact that barriers to trade do affect investment decisions and so capital stocks, something we have shown in a previous paper (Ferreira and Trejos (2006)). In this sense, the current exercise is also limited as it takes stocks as given but does not consider that, if it were not for trade restrictions, they would be considerably larger.

Of course, the fact that poor countries with high tariffs are still enjoying most of the gains from trade could be reverted if we have more realistic data, and not only nominal tariffs data. Anderson and van Wincoop (2004) survey the literature on trade costs and show that for the OECD economies they are quite large and well above nominal tariffs. We wanted, however, to use homogeneous data and the only source we know for this is the WorldBank database on nominal tariff. A natural extension of this work is to use (and construct in some cases) data of trade cost based on gravitation models for a large set of economies.

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A.1 Gains from Trade, 1985

Group 1: Richer countries with small gains from trade

Country	K/H	τ(%)	Pot.Gains (%)	Realized (%)
Barbados	0,60	17,30	2.,81	-
Brazil	0,57	47,00	3,33	-
Cyprus	0,67	12,80	1,69	-
Ecuador	0,38	34,30	9,25	-
Hong Kong	0,49	-	5,18	5,18
Hungary	0,54	24,00	3,86	-
Iran	0,58	20,70	3,06	-
Ireland	0,65	8,70	2,02	1,15
Mexico	0,59	19,70	2,93	-
Panama	0,37	12,80	9,64	8,46
Peru	0,51	37,60	4,68	-
Poland	0,48	13,40	5,70	3,81
South Africa	0,57	21,20	3,37	-
Trindad and Tobago	0,38	17,20	8,97	6,35
Tunisia	0,46	25,90	6,15	-
Uruguay	0,50	36,30	5,07	-

Group 2: Very poor countries with large gains from trade

Country	K/H	τ(%)	Pot.Gains (%)	Realized (%)
Benin	0,04	48,30	51,22	48,34
Central African Republic	0,04	32,00	48,49	47,07
China	0,05	49,50	46,06	43,16
Congo	0,03	22,60	59,00	58,18
Guinea Bisseau	0,06	27,80	42,60	41,54
Haiti	0,03	27,70	57,97	56,80
Lesotho	0,04	17,40	50,87	50,38
Malawi	0,04	31,60	48,63	47,24
Mali	0,06	17,00	42,79	42,36
Mozambique	0,01	15,60	75,54	75,08
Nepal	0,05	21,90	46,74	46,02
Niger	0,05	18,50	44,35	43,83
Rwanda	0,02	33,00	71,98	70,24
Senegal	0,06	13,20	42,74	42,46
Sierra Leone	0,02	25,80	66,83	65,74
Togo	0,04	19,50	51,03	50,44

Group 3: Low-to-middle income countries that waste significant gains due to tariffs

Country	K/H	τ(%)	Pot.Gains (%)	Realized (%)
Bangladesh	0,08	94,50	35,82	8,60
Chile	0,32	20,80	11,69	8,69
Colombia	0,25	35,70	15,73	7,97
Egypt	0,14	47,40	25,71	20,07
Honduras	0,14	51,30	26,30	18,87
India	0,06	91,00	40,80	24,41
Korea	0,33	21,00	11,55	8,41
Mauritius	0,22	36,20	17,88	11,41
Pakistan	0,09	72,20	33,36	20,29
Thailand	0,21	38,10	19,23	12,80

Group 4: Developing countries with somewhat freer trade policy

Country	K/H	τ(%)	Pot.Gains (%)	Realized (%)
Bolivia	0,18	17,60	21,71	21,31
Botswana	0,21	30,00	18,96	16,45
Cameron	0,09	30,20	34,45	33,29
Costa Rica	0,28	19,50	14,07	12,64
Dominican Republic	0,21	27,80	19,26	17,98
El Salvador	0,17	20,00	22,01	21,50
Fiji	0,32	12,40	11,67	11,23
Ghana	0,07	26,30	38,12	37,19
Guatemala	0,22	19,40	18,33	17,86
Guyana	0,33	18,70	11,49	9,17
Indonesia	0,09	30,20	34,67	33,51
Jamaica	0,34	17,90	10,83	8,52
Jordan	0,28	15,20	13,77	13,49
Kenya	0,07	39,90	39,48	37,54
Malaysia	0,31	14,00	12,15	11,50
Nicaragua	0,23	22,10	17,29	16,71
Papua New Guinea	0,19	14,20	21,02	20,75
Paraguay	0,21	11,00	18,98	18,82
Philippines	0,18	29,20	21,53	20,54
Sri Lanka	0,08	36,20	36,03	34,42
Syria	0,26	14,80	15,51	15,23
Taiwan	0,25	23,30	15,79	13,95
Tanzania	0,07	28,50	39,00	37,91
Turkey	0,23	27,90	17,48	14,84
Zambia	0,17	29,90	22,47	21,43
Zimbabwe	0,35	9,40	10,61	10,45

A.2 Productivity Decomposition, 1985

Group 1: Richer countries with small gains from trade

Country	y	k	h	$\widehat{\Theta}$	$\mathbf{\Gamma}_\tau - 1$	$\mathbf{\Theta}$
Barbados	49,0%	84,2%	68,9%	71,2%	0,0%	71,2%
Brazil	38,3%	82,9%	47,3%	81,0%	0,0%	81,0%
Cyprus	48,7%	87,6%	71,0%	68,6%	0,0%	68,6%
Ecuador	30,8%	72,3%	51,2%	60,1%	0,0%	60,1%
Hong Kong	55,8%	79,0%	70,1%	79,6%	5,2%	75,7%
Hungary	44,6%	81,7%	76,0%	58,6%	0,0%	58,6%
Iran	36,1%	83,6%	47,3%	76,3%	0,0%	76,3%
Ireland	68,2%	86,5%	72,7%	93,8%	1,1%	92,8%
Mexico	55,2%	83,9%	55,8%	98,9%	0,0%	98,9%
Panama	39,8%	71,7%	54,1%	73,5%	8,5%	67,8%
Peru	32,9%	80,0%	57,2%	57,6%	0,0%	57,6%
Poland	29,6%	78,1%	71,9%	41,2%	3,8%	39,7%
South Africa	55,6%	82,8%	55,6%	100,0%	0,0%	100,0%
Trindad & Tobago	62,0%	72,7%	56,4%	110,0%	6,3%	103,4%
Tunisia	36,3%	77,3%	43,3%	83,7%	0,0%	83,7%
Uruguay	37,9%	79,2%	61,4%	61,6%	0,0%	61,6%

Group 2: Very poor countries with large gains from trade

Country	y	k	h	$\widehat{\Theta}$	$\mathbf{\Gamma}_\tau - 1$	$\mathbf{\Theta}$
Benin	6,0%	33,9%	16,1%	37,2%	48,3%	25,1%
Central Africa Repub	7,4%	35,4%	16,9%	43,9%	47,1%	29,9%
China	6,0%	36,8%	23,9%	25,1%	43,2%	17,5%
Congo	3,9%	30,2%	15,9%	24,5%	58,2%	15,5%
Guinea Bisseau	2,7%	38,9%	16,9%	15,8%	41,5%	11,2%
Haiti	5,4%	30,7%	16,6%	32,3%	56,8%	20,6%
Lesotho	6,5%	34,1%	20,0%	32,4%	50,4%	21,5%
Malawi	3,5%	35,3%	18,9%	18,4%	47,2%	12,5%
Mali	6,5%	38,8%	17,1%	37,8%	42,4%	26,6%
Mozambique	3,5%	24,0%	10,7%	32,4%	75,1%	18,5%
Nepal	5,7%	36,4%	16,9%	33,7%	46,0%	23,1%
Niger	4,2%	37,8%	16,8%	24,9%	43,8%	17,3%
Rwanda	5,1%	25,2%	12,4%	40,7%	70,2%	23,9%
Senegal	8,2%	38,8%	19,7%	41,5%	42,5%	29,1%
Sierra Leone	7,6%	27,0%	13,3%	57,4%	65,7%	34,6%
Togo	7,3%	34,0%	18,1%	40,5%	50,4%	27,0%

Group 3: Low-to-middle income countries that waste significant gains due to tariffs

Country	y	k	h	$\widehat{\Theta}$	$\mathbf{\Gamma}_\tau - 1$	$\mathbf{\Theta}$
Bangladesh	9,7%	43,6%	21,9%	44,2%	8,6%	40,7%
Chile	33,3%	68,7%	52,3%	63,7%	8,7%	58,7%
Colombia	32,2%	63,2%	39,9%	80,9%	8,0%	74,9%
Egypt	24,0%	52,2%	30,0%	80,2%	20,1%	66,8%
Honduras	18,0%	51,6%	31,1%	58,0%	18,9%	48,8%
India	8,4%	40,1%	23,1%	36,4%	24,4%	29,3%
Korea	38,3%	68,9%	62,8%	61,0%	8,4%	56,3%
Mauritius	28,8%	60,6%	41,0%	70,1%	11,4%	62,9%
Pakistan	11,5%	45,5%	22,9%	50,4%	20,3%	41,9%
Thailand	15,0%	59,0%	39,2%	38,1%	12,8%	33,8%

Group 4: Developing countries with somewhat freer trade policy

Country	y	k	h	$\widehat{\Theta}$	$\boldsymbol{\Gamma}_\tau - 1$	$\boldsymbol{\Theta}$
Bolivia	19,3%	56,3%	36,1%	53,6%	21,3%	44,2%
Botswana	28,4%	59,3%	34,2%	83,1%	16,4%	71,3%
Cameroon	17,3%	44,6%	23,7%	72,8%	33,3%	54,6%
Costa Rica	31,7%	65,4%	44,3%	71,5%	12,6%	63,4%
Dominican Republic	24,6%	59,0%	35,5%	69,2%	18,0%	58,7%
El Salvador	26,0%	55,9%	32,2%	80,7%	21,5%	66,5%
Fiji	30,8%	68,7%	56,2%	54,8%	11,2%	49,3%
Ghana	7,6%	41,9%	24,1%	31,3%	37,2%	22,8%
Guatemala	29,9%	60,1%	32,2%	92,8%	17,9%	78,8%
Guyama	14,9%	69,0%	47,1%	31,7%	9,2%	29.1%
Indonesia	14,2%	44,5%	26,5%	53,4%	35,5%	40,0%
Jamaica	16,7%	69,9%	43,3%	38,5%	8,5%	35,5%
Jordan	46,4%	65,8%	43,8%	106,1%	13,5%	93,5%
Kenya	6,9%	41,0%	23,0%	30,1%	37,5%	21,9%
Malaysia	32,6%	68,0%	46,5%	70,1%	11,5%	62,0%
Nicaragua	23,4%	61,3%	34,7%	67,4%	16,7%	57,8%
Papua New Guinea	15,2%	57,0%	28,4%	53,3%	20,8%	44,2%
Paraguay	31,1%	59,3%	39,4%	78,8%	18,8%	66,3%
Philippines	18,0%	56,4%	43,0%	41,8%	20,5%	34,7%
Sri Lanka	12,9%	43,4%	30,7%	42,0%	34,4%	31,3%
Syria	29,5%	63,5%	39,7%	74,3%	15,2%	64,5%
Taiwan	41,5%	63,2%	52,1%	79,7%	13,9%	69,9%
Tanzania	3,1%	41,3%	22,3%	13,8%	37,9%	10,0%
Turkey	26,7%	61,1%	35,5%	75,3%	14,8%	65,6%
Zambia	7,7%	55,4%	33,1%	23,2%	21,4%	19,1%
Zimbabwe	17,4%	70,3%	37,3%	46,6%	10,4%	42,2%