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WHY TRADE MATTERS AFTER ALL

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ABSTRACT

I show that accounting for cross-industry variation in trade elasticities greatly magnifies the estimated gains from trade. The main idea is as simple as it is general: While imports in the average industry do not matter too much, imports in some industries are critical to the functioning of the economy, so that a complete shutdown of international trade is very costly overall.

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1 Introduction

Either the gains from trade are small for most countries or the workhorse models of trade fail to adequately capture those gains. This uncomfortable conclusion seems inevitable given recent results in quantitative trade theory. As shown by Arkolakis et al (2012), the gains from trade can be calculated in the most commonly used quantitative trade models from the observed share of a country's trade with itself, λ_j, and the elasticity of aggregate trade flows with respect to trade costs, ε, using the formula $G_j = (\lambda_j)^{-\frac{1}{\varepsilon}}$.[1] Given a typical estimate of $\varepsilon = 4$ and trade data described in more detail below, this implies that a move from autarky to current levels of trade only increases real income by 6.4 percent in the US and by 10.8 percent in the UK.[2] While the US is relatively closed by international comparison, the UK's degree of openness actually coincides with the world average so that its gains from trade are representative of the average country in the world.

In this paper, I argue that the workhorse models of trade actually predict much larger gains once the industry dimension of trade flows is taken into account. The main idea is as simple as it is general: While imports in the average industry do not matter too much, imports in some industries are critical to the functioning of the economy, so that a complete shutdown of international trade is very costly overall. In particular, I show that the above formula can be written as $G_j = (\lambda_j)^{-\frac{1}{\bar{\bar{\varepsilon}}_j}}$ in a multi-industry environment, where the aggregate $\frac{1}{\bar{\bar{\varepsilon}}_j}$ is now a weighted average of the industry-level $\frac{1}{\varepsilon_s}$ with industry expenditure shares and industry trade exposures as weights. The point is that if ε_s is close to zero in some industries, $\frac{1}{\varepsilon_s}$ is close to infinity in these industries which is sufficient to push $\frac{1}{\bar{\bar{\varepsilon}}_j}$ up a lot. Loosely speaking, ε is a weighted average of ε_s so that the exponent of the aggregate formula is the *inverse of the average* of the trade elasticities whereas the exponent of the industry-level formula is the *average of the inverse* of the trade elasticities.

I make this point in the context of a simple Armington (1969) model in which consumers have CES preferences within industries and goods are differentiated by country of origin. As is well-known, the trade elasticities then depend on the elasticities of substitution through

[1] This includes the Armington (1969) model, the Krugman (1980) model, the Eaton and Kortum (2002) model, and the Melitz (2003) model. The aggregate trade elasticity ε corresponds to different structural parameters in different models.

[2] $\varepsilon = 4$ is, for example, the preferred estimate of Simonovska and Waugh (2011).

the simple relationship $\varepsilon_s = \sigma_s - 1$. Using the 4-digit elasticity estimates of Broda and Weinstein (2006) which are broadly consistent with the above value of $\varepsilon = 4$, I show that the industry-level formula predicts that a move from autarky to current levels of trade increases real income by 42.0 percent in the US and by 79.2 percent in the UK which are around seven times the numbers predicted by the aggregate formula. These numbers fall a bit once I allow for non-traded goods and intermediate goods which have opposing effects on the gains from trade. All things considered, I find that the gains from trade are 23.5 percent for the US and 42.1 percent for the UK.

While my point may seem obvious once stated, I believe it has not been made explicitly before. Arkolakis et al (2012) briefly discuss a multi-industry formula in an extension but never contrast it to their aggregate formula or use it to actually calculate the gains from trade. Caliendo and Parro (2011), Hsieh and Ossa (2012), Ossa (2012), and others work with multi-industry versions of standard trade models but also do not point out that cross-industry heterogeneity in the trade elasticities has the potential to greatly magnify the gains from trade. Closest in spirit is perhaps the recent contribution by Edmond et al (2012) which measures the gains from trade originating from pro-competitive effects in an oligopolistic trade model. A key finding is that such pro-competitive effects are large if there is a lot of cross-industry variation in markups which is the case if there is a lot of cross-industry variation in the elasticities of substitution.[3]

The remainder of this paper is divided into three sections. In the first section, I develop a multi-industry Armington (1969) model of international trade featuring nontraded goods and intermediate goods and show what it implies for the measurement of the gains from trade. In the second section, I describe the data and discuss all applied aggregation, extrapolation, and matching procedures. In the final section, I report the gains from trade for 50 countries in the world and document that a small share of industries typically accounts for a large share of the gains from trade as one would expect from my argument.

[3] Related points have, of course, also been made in other areas of macroeconomics. For example, Nakamura and Steinsson (2010) show how cross-industry heterogeneity in menu costs substantially increases the degree of monetary non-neutrality. Also, Jones (2011) argues that cross-industry complementarities through intermediate goods matter a great deal for understanding cross-country differences in incomes.

2 Model

There are M countries indexed by i or j and S industries indexed by s. In each country, there is a final good X_j which is a Cobb-Douglas aggregate of a nontraded good N_j and an aggregate traded good T_j. The aggregate traded good T_j is itself a Cobb-Douglas aggregate of industry-specific traded goods T_{js} which are in turn CES aggregates of industry-specific traded varieties T_{ijs} differentiated by the location of their production. To be clear, T_{ijs} denotes the quantity of the industry s traded variety from country i available in country j and it is at that level of disaggregation that trade physically takes place. In sum,

$$X_j = \left(\frac{N_j}{1-\beta_j}\right)^{1-\beta_j} \left(\frac{T_j}{\beta_j}\right)^{\beta_j} \tag{1}$$

$$T_j = \prod_{s=1}^{S} \left(\frac{T_{js}}{\alpha_{js}}\right)^{\alpha_{js}} \tag{2}$$

$$T_{js} = \left(\sum_{i=1}^{M} (T_{ijs})^{\frac{\sigma_s - 1}{\sigma_s}}\right)^{\frac{\sigma_s}{\sigma_s - 1}} \tag{3}$$

The final good is used in consumption and production. In consumption, it translates one-for-one into utility U_j. In production, it is combined with labor L_i using a Cobb-Douglas technology to produce the output of the nontraded good Q_i^N and the country-industry-specific traded variety Q_{is}^T with total factor productivities A_i^N and A_{is}^T respectively. With superscripts indicating the uses of X_i and L_i so that L_i^N is the amount of labor used in the production of the nontraded good in country i, $X_i^{T,s}$ is the amount of the final good used in the production of the industry s traded variety in country i, and so on, this implies

$$U_j = X_j^U \tag{4}$$

$$Q_i^N = A_i^N \left(\frac{L_i^N}{\gamma_i}\right)^{\gamma_i} \left(\frac{X_i^N}{1-\gamma_i}\right)^{1-\gamma_i} \tag{5}$$

$$Q_{is}^T = A_{is}^T \left(\frac{L_i^{T,s}}{\gamma_i}\right)^{\gamma_i} \left(\frac{X_i^{T,s}}{1-\gamma_i}\right)^{1-\gamma_i} \tag{6}$$

There is perfect competition in the nontraded and traded goods sector and the shipment of an industry s traded variety from country i to country j involves iceberg trade barriers $\tau_{ijs} > 1$ in the sense that τ_{ijs} units must leave country i for one unit to arrive in country j.[4] The model can be solved by invoking the standard requirements that consumers maximize utility, firms maximize profits, firms make zero profits, and all markets clear. Since the model's equilibrium is quite intuitive, I only highlight its core aspects in the following and relegate a step by step derivation to an online appendix.

In equilibrium, a share β_i of workers is working in the traded goods sector earning a share γ_i of revenues. Denoting the wage rate by w_i and the value of industry s trade flowing from country i to country j by V_{ijs}, this implies $w_i L_i = \frac{\gamma_i}{\beta_i} \sum_{s=1}^{S} \sum_{j=1}^{M} V_{ijs}$, where L_i is the labor endowment of country i. V_{ijs} follows a simple gravity equation of the form $V_{ijs} = \left(\frac{p_{ijs}}{P_{js}^T} \right)^{1-\sigma_s} \frac{\alpha_{js}\beta_j}{\gamma_j} w_j L_j$, where p_{ijs} is the price of an industry s variety from country i in country j, P_{js}^T is the ideal price index of the industry s traded good in country j, and $\frac{\alpha_{js}\beta_j}{\gamma_j} w_j L_j$ is overall spending in country j on industry s traded varieties.

Upon recognizing that α_{js} is just the industry consumption share and that aggregate trade must be balanced in equilibrium, the above two relationships combine to $\frac{p_{jjs}}{P_{js}^T} = (\lambda_{js})^{\frac{1}{1-\sigma_s}}$, where $\lambda_{js} \equiv V_{jjs} / \sum_{i=1}^{M} V_{ijs}$ is country j's share of industry s trade with itself. Cost minimization implies that $p_{jjs} = \frac{(w_j)^{\gamma_j} (P_j)^{1-\gamma_j}}{A_{js}^T}$, where $P_j \equiv \left(P_j^N \right)^{1-\beta_j} \left(P_j^T \right)^{\beta_j}$ is the ideal aggregate price index in country j, P_j^N is the price of the nontraded good in country j and $P_j^T \equiv \prod_{s=1}^{S} \left(P_{js}^T \right)^{\alpha_{js}}$ is the ideal price index of the traded good in country j. Substituting these price relations yields the intermediate result

$$\frac{w_j}{P_j} = \left(\frac{P_j^T}{P_j^N} \right)^{\frac{1-\beta_j}{\gamma_j}} \prod_{s=1}^{S} \left(A_{js}^T (\lambda_{js})^{\frac{1}{1-\sigma_s}} \right)^{\frac{\alpha_{js}}{\gamma_j}} \tag{7}$$

P_j^T / P_j^N can also be expressed in terms of λ_{js} be equating the relative supply and the relative demand of tradables versus nontradables. The supply side can be summarized by combining the production technologies (5) and (6) with the equilibrium relationship $\frac{L_i^N}{L_i^{T,s}} = \frac{X_i^N}{X_i^{T,s}}$ which yields $\frac{Q_i^N}{Q_{is}^T} = \frac{A_i^N}{A_{is}^T} \frac{L_i^N}{L_i^{T,s}}$. The demand side can be captured by recognizing that workers earn the same fraction of revenues in both industries which ultimately implies $\frac{Q_i^N}{Q_{is}^T} =$

[4] As usual, I set $\tau_{iis} = 1$ throughout.

$\frac{P_{is}^T}{P_i^N}\frac{L_i^N}{L_i^{T,s}}(\lambda_{is})^{\frac{1}{1-\sigma_s}}$ once the relationship $\frac{p_{iis}}{P_{is}^T} = (\lambda_{is})^{\frac{1}{1-\sigma_s}}$ is substituted. Equating relative supply and demand and using the definition of P_i^T yields

$$\frac{P_j^T}{P_j^N} = \prod_{s=1}^{S}\left(\frac{A_j^N}{A_{js}^T}(\lambda_{js})^{\frac{1}{\sigma_s-1}}\right)^{\alpha_{js}} \tag{8}$$

Substituting result (8) into equation (7) yields an expression for real income which is just in terms of technology parameters and trade shares, namely $\frac{w_j}{P_j} = A_j\prod_{s=1}^{S}(\lambda_{js})^{\frac{\alpha_{js}}{1-\sigma_s}\frac{\beta_j}{\gamma_j}}$, where I have defined $A_j \equiv \left(A_j^N\right)^{\frac{1-\beta_j}{\gamma_j}}\prod_{s=1}^{S}\left(A_{js}^T\right)^{\frac{\alpha_{js}\beta_j}{\gamma_j}}$ to simplify the notation. Notice that A_j is just the Cobb-Douglas aggregate over all total factor productivities one would expect from equations (1) - (6). Since $\lambda_{js} = 1$ for all s under autarky, the proportional gains of moving from autarky to current levels of trade are captured by the formula $\widehat{\frac{w_j}{P_j}} = \prod_{s=1}^{S}(\lambda_{js})^{-\frac{1}{\sigma_s-1}\frac{\alpha_{js}\beta_j}{\gamma_j}}$. To be able to clearly contrast this to the aggregate formula, I implicitly define $(\lambda_j)^x \equiv \prod_{s=1}^{S}(\lambda_{js})^{-\frac{1}{\sigma_s-1}\frac{\alpha_{js}\beta_j}{\gamma_j}}$ and solve for x, which then implies[5]

$$\widehat{\frac{w_j}{P_j}} = (\lambda_j)^{-\frac{\beta_j}{\gamma_j}\sum_{s=1}^{S}\alpha_{js}\frac{\log\lambda_{js}}{\log\lambda_j}\frac{1}{\sigma_s-1}} \tag{9}$$

For the purposes of calculating the gains from trade, the correct approach is therefore to take a weighted average of the inverse of the industry-level trade elasticities $\frac{1}{\sigma_s-1}$ with industry expenditure shares α_{js} and industry trade exposures $\frac{\log\lambda_{js}}{\log\lambda_j}$ as weights.[6] As a consequence, $\widehat{\frac{w_j}{P_j}} \to \infty$ as $\sigma_s \to 1$ in some industries as long as $\alpha_{js}\frac{\log\lambda_{js}}{\log\lambda_j}$ is strictly positive there. While equation (9) is admittedly based on very special assumptions, it nevertheless captures what has to be a general point: Even if imports in the average industry do not matter too much, a complete shutdown of international trade is still very costly, if imports in some industries are critical to the functioning of the economy.

Notice that this point is overlooked if the aggregate formula is used. In the special case $S = 1$, equation (9) simplifies to $\widehat{\frac{w_j}{P_j}} = (\lambda_j)^{-\frac{\beta_j}{\gamma_j}\frac{1}{\sigma-1}}$, where $\sigma - 1$ is now the aggregate trade elasticity. If the multi-industry model is correct, the aggregate trade elasticity $\sigma - 1$ is some weighted average of the industry-level trade elasticities $\sigma_s - 1$ because the latter ultimately

[5] To be clear, $\lambda_{js} \equiv \frac{V_{jjs}}{\sum_{i=1}^{M}V_{ijs}}$ and $\lambda_j \equiv \frac{\sum_{s=1}^{S}V_{jjs}}{\sum_{s=1}^{S}\sum_{i=1}^{M}V_{ijs}}$.

[6] Notice that $\frac{\log\lambda_{js}}{\log\lambda_j} \approx \frac{1-\lambda_{js}}{1-\lambda_j}$ and that $1-\lambda_{js}$ and $1-\lambda_j$ are the shares of industry-level and aggregate imports in country j's total expenditure.

govern how trade flows respond to trade costs. Loosely speaking, the exponent of the aggregate formula is therefore the *inverse of the average* of the trade elasticities whereas the exponent of the industry-level formula is the *average of the inverse* of the trade elasticities which is different as long as the elasticities vary across industries.

3 Data

I focus on the world's 49 largest economies and a residual Rest of the World in the year 2005. To quantify the gains from trade using formula (9), I need the full matrix of industry-level trade flows to compute the statistics λ_{js} and λ_j as well as estimates of the elasticities of substitution σ_s, the value added in the traded goods sector as a fraction of GDP β_j, and the share of value added in the gross production of the traded goods sector γ_j. I take the manufacturing sector to be the traded goods sector in order to obtain a conservative estimate of my point. Taking into account essential nonmanufactured inputs such as mineral fuels would likely yield even higher estimates of the gains from trade.

The data on international trade flows is from the UN-Comtrade database which covers most countries in the world. It is originally at the HS 6-digit level and I convert it to the SITC-Rev2 4-digit level using an NBER concordance which I downloaded from Jon Haveman's website at Maclester College. I impute domestic trade flows using US shipment data from the NBER-CES manufacturing industry database which is originally at the SIC 4-digit level as well as worldwide value added data from the World Bank-WDI database which is at the country level. The NBER-CES manufacturing data is only available until the year 2005 which is why I choose this year for my analysis. I use the following procedure to impute domestic trade flows:

First, I convert the US shipment data to the SITC-Rev2 4-digit level using a concordance between SIC 4-digit codes and SITC-Rev2 4-digit codes constructed by matching concordances from Feenstra (1996) and Pierce and Schott (2010). Second, I merge the US shipment data with the US trade data and compute the US industry expenditure shares which I subsequently apply to all other countries. Third, I compute total expenditures for all countries from total shipments, minus total exports, plus total imports. I impute total shipments for all countries other than the US by dividing value added by 0.312 which is the number for value added reported by Dekle et al (2007) as I discuss below. Fourth, I compute domestic trade flows for all countries other than the US by multiplying the expenditure shares with total expenditures and subtracting industry imports.

The elasticities are taken from Broda and Weinstein (2006). I use the SITC-Rev3 4-digit level elasticities computed for the period 1990-2001 for the US which I bring to the SITC-Rev2 4-digit level using an NBER concordance by Robert Lipsey which I downloaded from the website of the Center for International Data at UC Davis. Broda and Weinstein (2006) report $\sigma_s = 1$ for SITC-Rev3 code 6593 which corresponds to "Kelem, Schumacks, Karamanie and similar hand-woven rugs". With no offence intended to rug-loving readers of this work, I drop this industry in all my calculations since it strikes me as an unlikely source of infinite gains from trade. Among the 470 industries I am left with, the elasticity of substitution averages 4.8 implying an average trade elasticity of 3.8.

Following Dekle et al (2007), I use the values $\beta_j = 0.188$ and $\gamma_j = 0.312$ for all countries in the world. It is easy to verify that $\beta_j = w_j \sum_{s=1}^{S} L_j^{T,s} / w_j L_j$ which makes it the share of value added in the traded goods sector as a fraction of GDP. Similarly, it is easy to show that $\gamma_i = w_i \sum_{s=1}^{S} L_i^{T,s} / \sum_{s=1}^{S} \sum_{j=1}^{M} V_{ijs}$ which makes it the share of value added in the gross production of the traded goods sector. Needless to say, this treatment of nontraded goods and intermediate goods is highly stylized and I refer the reader to Caliendo and Parro (2011) for a more sophisticated analysis. I choose this simple approach to focus attention on my main point and also always report results for the benchmark case $\beta_j = \gamma_j = 1$.

4 Results

Table 1 summarizes the changes in real income resulting from a move from autarky to year 2005 levels of trade. The results under "True gain" are computed using the industry-level formula $\widehat{\frac{w_j}{P_j}} = (\lambda_j)^{-\frac{\beta_j}{\gamma_j} \sum_{s=1}^{S} \alpha_{js} \frac{\log \lambda_{js}}{\log \lambda_j} \frac{1}{\sigma_s - 1}}$, the results under "Naive gains" are computed using the aggregate formula $\widehat{\frac{w_j}{P_j}} = (\lambda_j)^{-\frac{\beta_j}{\gamma_j} \frac{1}{\sigma - 1}}$, and the results under "Ratio" are simply the ratio of the two. Columns 1-3 do not adjust for nontraded goods or intermediate goods (i.e. set $\beta_j = 1$ and $\gamma_j = 1$) while columns 4-6 do (i.e. set $\beta_j = 0.188$ and $\gamma_j = 0.312$). When using the aggregate formula, I work with $\sigma - 1 = 4.1$ which is the simple cross-country average of the expenditure share weighted cross-industry averages of all $\sigma_s - 1$. Notice that this aggregate trade elasticity is virtually identical to the preferred estimate of Simonovska and Waugh (2011) I referred to above.

As can be seen, allowing for cross-industry heterogeneity in the trade elasticities substantially increases the estimated gains from trade for all countries in the sample. For example, the estimated gains from trade of the US increase from 6.4 percent to 42.0 percent if I do not adjust for nontraded goods and intermediate goods and from 3.8 percent to 23.5 percent if I do. Similarly, the gains from trade of the UK increase from 10.8 percent to 79.2 percent if I do not adjust for nontraded goods and intermediate goods and from 6.4 percent to 42.1 percent if I do. On average, the "true" gains from trade exceed the "naive" gains from trade by a factor of 8.5 if I do not adjust for nontraded goods and intermediate goods and by a factor of 7.5 percent if I do.

There is significant variation in the "true" gains from trade across countries. At 263.4 percent without the adjustment and 117.6 with the adjustment, Hungary is estimated to gain the most. At 13.4 percent without the adjustment and 7.9 with the adjustment, Japan is estimated to gain the least. While the cross-country variation in the adjusted "true" gains from trade is due to variation in λ_j and $\sum_{s=1}^{S} \alpha_{js} \frac{\log \lambda_{js}}{\log \lambda_j} \frac{1}{\sigma_s - 1}$, most of it can be attributed to variation in λ_j. This can be seen from Figure 1 which plots the adjusted "true" gains from trade against λ_j exhibiting a rather tight relationship. A notable outlier is China whose estimated gains from trade are much larger than the estimated gains from trade of other countries with a comparable degree of trade openness.

Figure 2 illustrates that a large share of the adjusted "true" gains from trade can be attributed to a small share of critical industries. I construct this figure based on the relationship $\log \widehat{\frac{w_j}{P_j}} = -\frac{\beta_j}{\gamma_j} \sum_{s=1}^{S} \frac{\alpha_{js}}{\sigma_s - 1} \log (\lambda_{js})$ which follows immediately from the above formulas for the gains from trade. First, I rank all industries by their contribution to the overall log gains from trade $-\frac{\alpha_{js}}{\sigma_s - 1} \log (\lambda_{js})$ for each country. Then, I compute the shares of the log gains from trade due to shares of most important industries by cumulating over $-\frac{\alpha_{js}}{\sigma_s - 1} \log (\lambda_{js})$ for each country. Finally, I take the simple average of these shares across countries. As can be seen, the 10 percent most important industries account for more than 80 percent of the log gains from trade on average.

Variation in $\sigma_s - 1$ is the most important source of variation in $-\frac{\alpha_{js}}{\sigma_s - 1}\log(\lambda_{js})$ across countries so that the rankings of industry importance are highly correlated internationally. To provide a sense of the characteristics of the critical industries, Table 2 list the 10 percent of industries in the sample with the lowest elasticities of substitution σ_s as estimated by Broda and Weinstein (2006). With a few puzzling exceptions such as "8952: Pens, pencils, and fountain pens", these industries appear to be plausible sources of sizeable gains from trade within manufacturing. For example, "7763: Diodes, transistors, and semi-conductor devices" or "8745: Measuring, controlling, and scientific instruments" are likely to include highly specialized imported varieties for which domestic substitutes are hard to find.

5 Conclusion

In this paper, I argued that accounting for cross-industry variation in trade elasticities greatly magnifies the estimated gains from trade. The main idea was that a complete shutdown of international trade is very costly even though imports in the average industry do not matter too much since imports in some industries are critical to the functioning of the economy. While I have made this point in the context of a simple Armington (1969) model, it should be clear that it extends to other commonly used quantitative trade models. In an Eaton and Kortum (2002) model, for example, the interpretation would be that international productivity differences are so large in some industries that replacing efficiently-produced imports with inefficiently-produced domestic substitutes in these industries would imply extreme costs.

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TABLE 1: Gains from trade

	Unadjusted (β=0, γ=0)			Adjusted (β=0.188, γ=0.312)		
	True gain (%)	Naïve Gain (%)	Ratio	True gain (%)	Naïve gain (%)	Ratio
Argentina	39.7	4.8	8.2	22.3	2.9	7.8
Australia	73.1	9.1	8.0	39.2	5.4	7.2
Austria	145.7	16.2	9.0	71.9	9.5	7.6
Belgium	158.2	22.3	7.1	77.1	12.9	6.0
Brazil	21.7	3.2	6.7	12.6	1.9	6.5
Canada	96.3	12.9	7.5	50.2	7.6	6.6
Switzerland	135.1	14.3	9.4	67.4	8.4	8.0
Chile	49.8	7.6	6.6	27.6	4.5	6.1
China	152.6	8.6	17.8	74.8	5.1	14.7
Colombia	52.1	6.3	8.3	28.8	3.7	7.7
Czech Republic	193.4	18.1	10.7	91.3	10.5	8.7
Germany	86.9	10.0	8.7	45.8	5.9	7.7
Denmark	139.0	15.5	9.0	69.0	9.0	7.6
Spain	73.1	10.0	7.3	39.2	5.9	6.6
Finland	99.6	10.0	9.9	51.7	5.9	8.7
France	104.6	12.9	8.1	54.0	7.6	7.1
United Kingdom	79.2	10.8	7.3	42.1	6.4	6.6
Greece	76.9	10.4	7.4	41.0	6.1	6.7
Croatia	98.9	13.1	7.5	51.3	7.7	6.6
Hungary	263.4	18.1	14.6	117.6	10.5	11.2
Indonesia	25.5	3.6	7.1	14.7	2.2	6.8
India	42.4	5.0	8.5	23.7	3.0	8.0
Ireland	133.5	14.0	9.5	66.7	8.2	8.1
Iran	54.3	8.3	6.6	29.9	4.9	6.1
Italy	60.1	7.9	7.6	32.8	4.7	7.0
Japan	13.4	2.3	5.8	7.9	1.4	5.7
Kazakhstan	71.7	11.3	6.4	38.5	6.6	5.8
Korea	70.7	7.1	9.9	38.0	4.2	9.0
Morocco	95.4	9.6	10.0	49.7	5.7	8.8
Mexico	117.2	10.1	11.6	59.6	6.0	10.0
Netherlands	188.9	19.8	9.5	89.5	11.5	7.8
Norway	78.5	11.3	6.9	41.8	6.7	6.3
New Zealand	55.9	8.5	6.6	30.7	5.0	6.1
Pakistan	57.6	6.1	9.4	31.5	3.6	8.7
Peru	41.1	5.2	7.8	23.1	3.1	7.4
Poland	123.0	13.3	9.2	62.1	7.8	7.9
Portugal	89.0	11.9	7.5	46.7	7.0	6.7
Rest of World	68.1	11.4	6.0	36.8	6.7	5.5
Russia	39.8	5.4	7.3	22.3	3.2	6.9
Saudi Arabia	75.4	9.8	7.7	40.3	5.8	7.0
Sin/Mal/Phi	144.8	13.6	10.6	71.5	8.0	8.9
Slovakia	129.5	15.7	8.2	65.0	9.2	7.1
Slovenia	149.9	17.5	8.6	73.6	10.2	7.2
Sweden	110.8	12.4	9.0	56.7	7.3	7.8
Thailand	115.8	10.5	11.0	58.9	6.2	9.5
Turkey	47.4	7.6	6.3	26.3	4.5	5.9
Ukraine	104.6	12.8	8.2	53.9	7.5	7.2
United States	42.0	6.4	6.6	23.5	3.8	6.2
Venezuela	54.4	6.3	8.6	29.9	3.8	8.0
South Africa	63.9	8.3	7.7	34.7	4.9	7.0
Average	92.1	10.5	8.5	47.1	6.2	7.5

Note: This table summarizes the changes in real income resulting from a move from autarky to year 2005 levels of trade. The results under “True gain” are computed using the industry-level formula, the results under “Naïve gain” are computed using the aggregate formula, and the results under “Ratio” are just the ratio of the two. Columns 1-3 do not adjust for nontraded goods or intermediate goods while columns 4-6 do. Sin/Mal/Phi combines Singapore, Malaysia, and the Philippines.

TABLE 2: Industries with the lowest elasticities of substitution

Sigma	SITC code	Product description
1.1	6648	GLASS MIRRORS(INCL.REAR-VIEW MIR.),UNFRAMED.FRAMED
1.1	6747	TINNED SHEETS AND PLATES,OF STEEL
1.1	7763	DIODES,TRANSISTORS AND SIM.SEMI-CONDUCTOR DEVICES
1.1	7782	ELECT.FILAMENT LAMPS AND DISCHARGE LAMPS
1.1	8993	CANDLES,MATCHES,PYROPHORIC ALLOYS ETC.
1.2	5122	CYCLIC.ALCOHOLS & THEIR HALOGENATED DERIVATIVES
1.2	5163	INORGANIC ESTERS,THEIR SALTS,& THEIR DERIVATIVES
1.2	5311	SYNTHETIC ORGANIC DYESTUFFS
1.2	6597	PLAITS AND SIMILAR PRODUCTS OF PLAITING MATERIALS
1.2	6951	HAND TOOLS OF A KIND USED IN AGRICULTURE ETC
1.2	6954	INTERCHANGEABLE TOOLS FOR HAND & MACHINE TOOLS
1.2	7169	PARTS OF ROTATING ELECTRIC PLANT
1.2	7263	MACH.,APPAR.,ACCESS.FOR TYPE FOUNDING OR SETTING
1.2	7451	TOOLS FOR WORKING IN THE HAND,PNEUMATIC,PARTS
1.2	7643	RADIOTELEGRAPHIC & RADIOTELEPHONIC TRANSMITTERS
1.2	7723	RESISTORS,FIXED OR VARIABLE AND PARTS
1.2	8482	ART.OF APPAREL & CLOTHING ACCESSORIES,OF PLASTIC
1.2	8952	PENS,PENCILS AND FOUNTAIN PENS
1.2	8982	OTHER MUSICAL INSTRUMENTS OF 898.1-
1.2	8997	BASKETWORK,WICKERWORK ETC. OF PLAITING MATERIALS
1.2	8998	SMALL-WARES AND TOILET ART.,FEATHER DUSTERS ETC.
1.3	5335	COLOUR.PREPTNS OF A KIND USED IN CERAMIC,ENAMELLI.
1.3	5983	ORGANIC CHEMICAL PRODUCTS,N.E.S.
1.3	6549	FABRICS,WOVEN,N.E.S.
1.3	6624	NON-REFRACT.CERAMIC BRICKS,TILES,PIPES & SIM.PROD.
1.3	6637	REFRACTORY GOODS(EG.,RETORTS,CRUJCIBLES ETC) N.E.S
1.3	6924	CASKS,DRUMS,BOXES OF IRON/STEEL FOR PACKING GOODS
1.3	6978	HOUSEHOLD APPUANCES,DECORATIVE ART.,MIRRORS ETC.
1.3	7246	AUXIL.MACHINERY FOR HEADINGS 724.51/52/53
1.3	7268	BOOKBINDING MACHINERY AND PARTS
1.3	7272	OTHER FOOD PROCESSING MACHINERY AND PARTS
1.3	7422	CENTRIFUGAL PUMPS,OTHER THAN 742.81
1.3	7423	ROTARY PUMPS,OTHER THAN 742.81
1.3	7712	OTHER ELECTRIC POWER MACHINERY,PARTS OF 771-
1.3	8742	DRAWING,MARKING-OUT,DISC CALCULATORS AND THE LIKE
1.3	8842	SPECTACLES AND SPECTACLE FRAMES
1.3	8935	ART.OF ELECTRIC LIGHTING OF MATERIALS OF DIV.58
1.3	8981	PIANOS AND OTHER STRING MUSICAL INSTUMENTS
1.3	8989	PARTS OF AND ACCESSORIES FOR MUSICAL INSTRUMENTS
1.3	8124	LIGHTING FIXTURES AND FITTINGS AND PARTS
1.4	5123	PHENOLS & PHEN.-ALCO.& THEIR HALOGENAT.DERIVATIVES
1.4	5222	INORGANIC ACIDS AND OXYGEN COMPOUNDS OF NON-METAL
1.4	5223	HALOGEN AND SULPHUR COMPOUNDS OF NON-METALS
1.4	5322	TANNING EXTRACTS OF VEGET.ORIGIN;TAN.& DERIVATIVES
1.4	6665	TABLEWARE & OTHER ARTICLES OF OTH.KINDS OF POTTERY
1.4	8745	MEASURING,CONTROLLING & SCIENTIFIC INSTRUMENTS
1.4	8748	ELECTRICAL MEASURING,CHECKING,ANALYSING INSTRUM.

Note: These are the bottom 10% industries in terms of elasticity of substitution as measured by Broda and Weinstein (2006).

Figure 1: Openness and the gains from trade

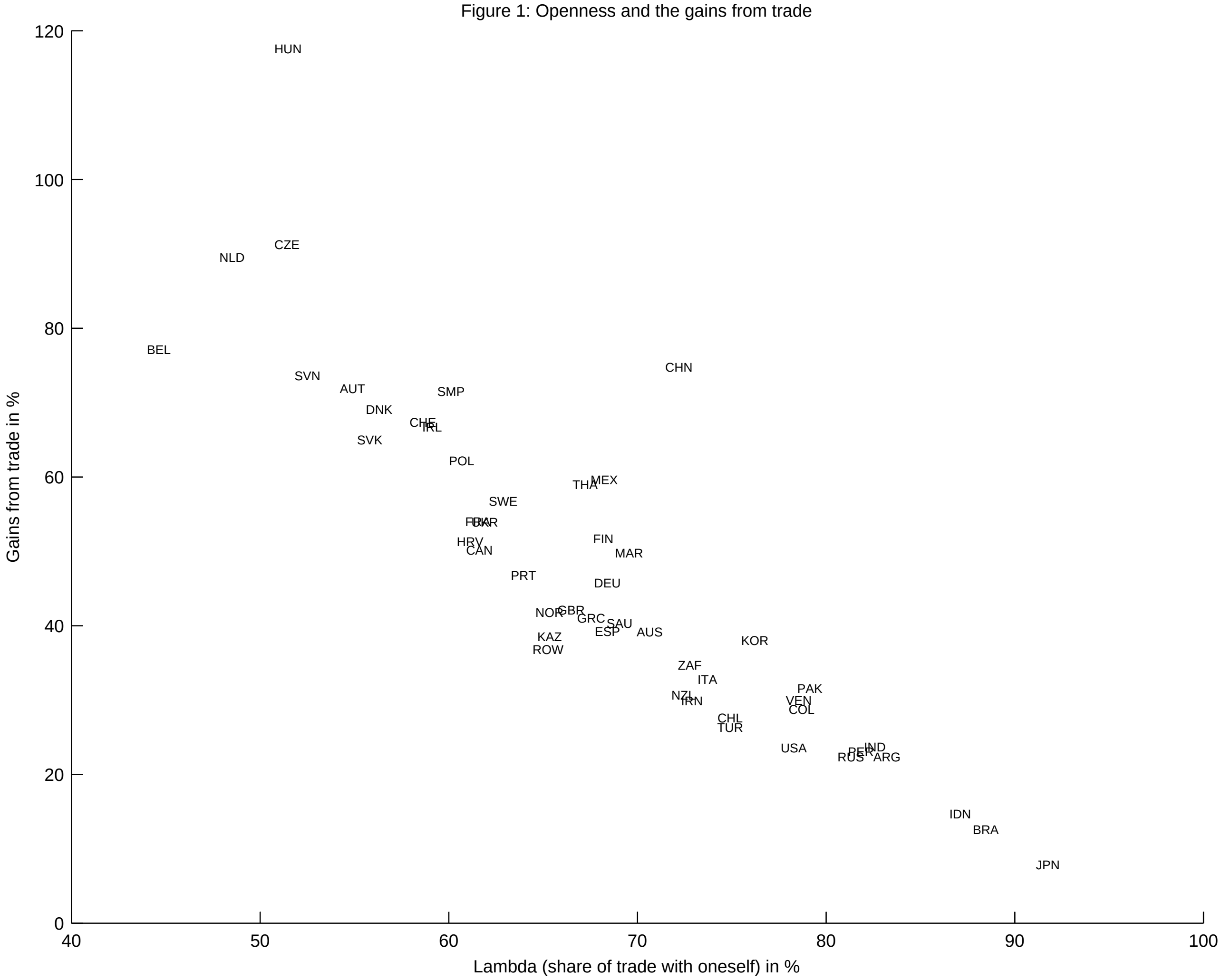

Figure 2: Industry contributions to gains from trade