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WTO AND TRADE: WAS ROSE RIGHT?

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INTRODUCTION

Since before Seattle and as recently as Cancun, there have been demonstrations against the WTO¹. But is the WTO so significant to justify such demonstrations? Professor Andrew Rose² has questioned the WTO's value to trade³ and has been frequently quoted (e.g. *The Economist*⁴, *BBC*⁵, *FT*⁶, *National Post*⁷). In his October 2002 paper ("Rose Paper")⁸, he used an econometric gravity model to test whether GATT/WTO Members trade more than non-members and concluded that membership had an insignificant, in fact somewhat negative, impact on trade.

This dissertation investigates the Rose Paper. I will summarize the Rose Paper jumping from specification to results. This provides the essence of the Rose Paper but the reader can go directly to his paper for further clarification if necessary. But what is the problem? Using a simulation, I demonstrate that this data is vulnerable to an interaction between the selection process, multicollinearity and the gravity specification. I also consider how WTO membership could be beneficial to trade depending upon the type of good. I suggest that the WTO has been more influential on manufactured goods trade.

One other aspect that has not touched upon in this dissertation is whether the joining GATT/WTO Members are being asked to liberalize their trade. "Many scholars... know that very few newcomers were asked to liberalise anything as a price of admission".⁹ Under such circumstances, it would be doubtful that there would be a meaningful positive impact on trade by simply joining the WTO, the true test would be to investigate the trade expansion when the trade liberalisation mandate advanced versus when it did not.

¹ In this document, WTO has been used interchangeably for both the GATT and WTO as the context requires.

² B.T. Rocca Jr. Professor of International Business, Economic Analysis and Policy Group, Haas School of Business at the University of California, Berkeley.

³ Rose, Andrew K., "Do We Really Know that the WTO Increases Trade?" *NBER Working Paper w9273*, 2002 <http://www.nber.org/papers/w9273>

⁴ *The Economist*, "Weighing up the WTO." *The Economist*, 2002 http://www.economist.com/displaystory.cfm?story_id=1454428

⁵ *BBC*, "Who needs the WTO?" *BBC News World Edition*, 2002 <http://news.bbc.co.uk/2/hi/business/2406331.stm>

⁶ Most recently Plender, J., "Unsmash the WTO: Tweaking the ground rules for global capital." *Financial Times*, 2003 ; and before that Rose, Andrew K., "A free trade club without benefits." *Financial Times*, 2002 <http://faculty.haas.berkeley.edu/arose/ft110702.htm>

⁷ Watson, W, "Does the WTO really boost trade?" *Financial Post*, 2002 <http://faculty.haas.berkeley.edu/arose/FPWTO.htm>

⁸ Referred to in footnote 3, I will not address Professor Rose's other later paper: Rose, Andrew K., "Do WTO Members have More Liberal Trade Policy?" *NBER Working Paper w9347*, 2002 <http://www.nber.org/papers/w9347>

⁹ Hufbauer, Clyde, "Letters to the Editor: Wrong test applied to trading system." *Financial Times*, 2002 <http://search.ft.com/search/article.html?id=021121002111>



SUMMARIZING THE ROSE PAPER

THE SPECIFICATION

To analyse the effect of WTO membership on trade, Professor Rose used a benchmark gravity model to predict the total bilateral trade between any two countries¹⁰ (i and j) in year t:

$$\begin{aligned} \ln(X_{ijt}) = & \beta_0 + \beta_1 \ln D_{ij} + \beta_2 \ln(Y_i Y_j)_t + \beta_3 \ln(Y_i Y_j / \text{Pop}_i \text{Pop}_j)_t + \beta_4 \text{Lang}_{ij} + \beta_5 \text{Border}_{ij} \\ & + \beta_6 \text{Land}_{ij} + \beta_7 \text{Island}_{ij} + \beta_8 \ln(\text{Area}_i \text{Area}_j) + \beta_9 \text{ComCol}_{ij} + \beta_{10} \text{CurCol}_{ijt} \\ & + \beta_{11} \text{Colony}_{ij} + \beta_{12} \text{ComCtry}_{ij} + \beta_{13} \text{CU}_{ijt} + \beta_{14} \text{Regional}_{ijt} + \phi_t T_t \\ & + \gamma_1 \text{Bothin}_{ijt} + \gamma_2 \text{Onein}_{ijt} + \gamma_3 \text{GSP}_{ijt} + \varepsilon_{ijt} \end{aligned}$$

where i and j denotes trading partners, t denotes time, and the variables are defined as:

- X_{ijt} denotes the average value of real bilateral trade between i and j at time t,
- Y is real GDP and used in the variable $\ln \text{rgdp}$ (log real gdp) as well as the next variable,
- Pop is population and used in $\ln \text{rgdppc}$ (log real gdp per capita),
- D is the distance between i and j and used in $\ln \text{dist}$ (log distance),
- Lang (= comlang in the tables) is a binary variable: 1 if common language, 0 if otherwise,
- Border is binary: 1 if i and j share a land border,
- Landl is the number of landlocked countries in the country-pair (0, 1, or 2),
- Island is the number of island nations in the pair (0, 1, or 2),
- Area is the area of the country (in km^2) and referred in the tables as $\ln \text{areap}$ (log area product),
- ComCol is binary: 1 if i and j were ever colonies after 1945 with the same colonizer,
- CurCol is binary: 1 if i and j are colonies at time t,
- Colony is binary: 1 if i ever colonized j or *vice versa*,
- ComCtry is binary: 1 if i and j remained part of the same nation during the sample (e.g., France and Guadeloupe)¹¹,
- CU (= custrict in the tables) is binary: 1 if i and j use the same currency at time t,
- Regional is binary: 1 if i and j both belong to the same regional trade agreement,
- T_t is a “comprehensive set of time “fixed effects” binary variables”; in effect 51 dummy variables corresponding to each year,
- β and ϕ are vectors of “nuisance” coefficients,
- Bothin_{ijt} is binary: 1 if both i and j are GATT/WTO members at t,
- Onein_{ijt} is binary: 1 if one (and only one) of either i or j is a GATT/WTO member at t,
- GSP_{ijt} is binary: 1 if i was a GSP beneficiary of j or *vice versa* at t, and
- ε_{ijt} is the error term.

This benchmark specification appears standard and reasonable for frictionless gravity models. Some practitioners will treat GDP and GDP per capita differently.¹² There are “fixed time effects” but no “bilateral fixed effects”. That has been criticised by some.¹³

¹⁰ Not all trading entities are countries but like Professor Rose, I will use the term for convenience.

¹¹ I could take issue with Professor Rose’s treatment of Hong Kong & China. He has chosen to ignore the special relationship between these two entities. I have tested the special relationship with a dummy variable and found that relationship to be positively significant (the coefficient of the dummy variable (1.61) suggests that the HK-China trade is 5 times higher than what could be explained by the other variables with a t-stat greater than 13) as one would expect but given there are only 40 data points involved, the overall conclusion would remain unchanged. Hence I have chosen to ignore this oversight.

¹² Egger, P., "An Econometric View on the Estimation of Gravity Models and the Calculation of Trade Potentials." *World Economy*, Feb2002, V25 (12) EBSCO Research p 299

¹³ The need for bilateral fixed effects is sometimes argued for this analysis to incorporate “multilateral resistance”; Subramanian, A and Wei Shang-Jin, "The WTO Promotes Trade, Strongly but Unevenly." *IMF Working Paper*, 2003 pg 5.



The study focuses on the three coefficients γ_1 , γ_2 and γ_3 . If GATT/WTO membership creates trade between Members, then the first coefficient γ_1 for Bothin should be positive and significant. The second coefficient γ_2 for Onein measures the effect of trade between Members and non-Members; positive would imply trade is created, negative would imply trade is diverted. The last coefficient γ_3 measures the effect of a GSP preferential treatment on the trade.

THE RESULT

The benchmark result is in Table 1. Trade is negatively affected (albeit insignificantly) when both are GATT/WTO Members and also negatively affected (again rather insignificantly) if only one is a GATT/WTO member. If a preferential GSP treatment has been granted then there is a positive significant affect on that trade to the tune of $\sim 2.4x$ ($= e^{(0.859)}$) than that otherwise would have been experienced.¹⁴ This is

TABLE 1: THE ROSE BENCHMARK

Regressor	Coef.	St.dev.	t-stat	P> t
bothin	-0.042	0.053	-0.800	0.423
onein	-0.058	0.049	-1.200	0.231
gsp	0.859	0.032	26.960	0.000
regional	1.199	0.106	11.290	0.000
custrict	1.118	0.122	9.190	0.000
ldist	-1.119	0.022	-50.690	0.000
lrgdp	0.916	0.010	95.310	0.000
lrgdppc	0.321	0.014	22.830	0.000
comlang	0.313	0.040	7.760	0.000
border	0.526	0.111	4.750	0.000
landl	-0.271	0.031	-8.660	0.000
island	0.042	0.036	1.160	0.245
lareap	-0.097	0.008	-12.100	0.000
comcol	0.585	0.067	8.700	0.000
curcol	1.075	0.235	4.580	0.000
colony	1.164	0.117	9.930	0.000
comctry	-0.016	1.081	-0.020	0.988
_cons	-27.773	0.370	-75.070	0.000
R-squared	0.648			

surprising. “[Studies indicate that] only 18% of imports from preference-receiving countries in fact received GSP treatment in the main preference-giving countries... this would seem a modest base from which to double trade flows [as the Rose Paper suggests]”.¹⁵

Professor Rose provides a battery of sensitivity tests (e.g. different periods and tests) to assert the result is robust.

So what happened?

¹⁴ Noting there is possibly a substitution effect, it may not be correct to portray that GSP treatment increases trade by this amount. It may also not be correct to assert that the increase in trade is limited to this amount because the GSP can cause a virtuous cycle of increasing GDP which may in turn increase trade. This is a general observation for whenever this paper refers to an increase or decrease in trade ‘caused’ by some factor. Causation should not automatically be assumed.

¹⁵ Low, Patrick, "Letters to the Editor: WTO is about more than just free trade" *Financial Times*, 2002 <http://search.ft.com/search/article.html?id=021114000651>

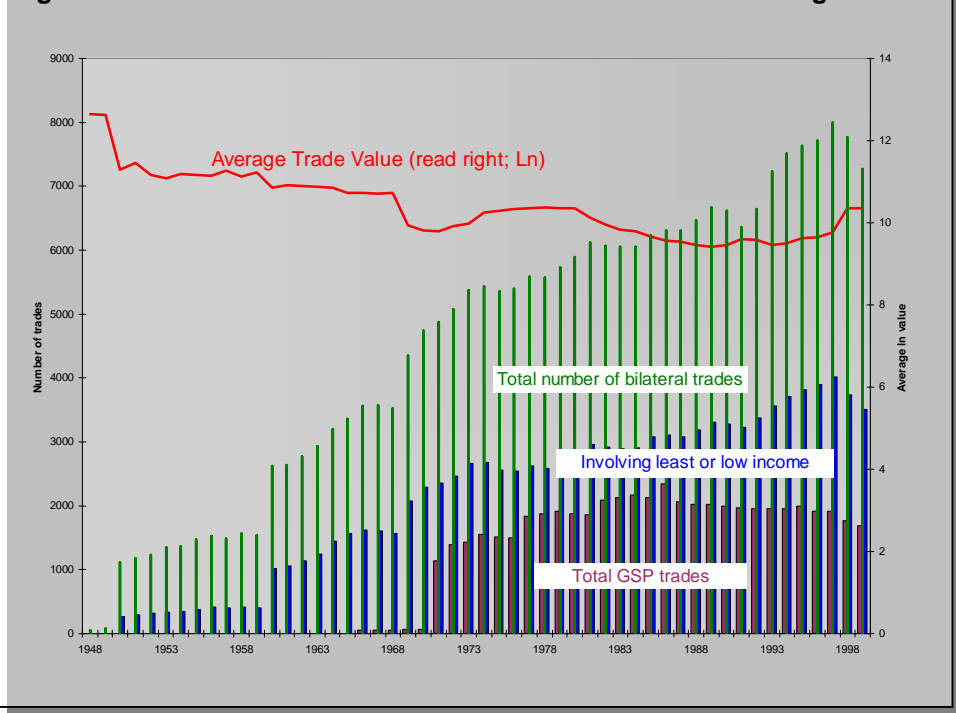


THE POTENTIAL PROBLEMS

A SELECTION BIAS?

The data used by Professor Rose has been well identified and specified.¹⁶ I will not regurgitate the sources of his data here with the exception of the trade data. The IMF compiled bilateral goods trade between 178 IMF trading entities for 1948 through

Figure 1: Rose Data: Number of Bilateral Observations & Average Value



1999 inclusively (IMF Direction of Trade; “DoT”). 178 trading entities for 52 years creates 819,156 opportunities for bilateral trade but there were *only* 234,597 observations (29%)¹⁷ in Professor Rose’s database. Professor Rose averages the four trade values (import and export for each i and j) and deflates by the US CPI to estimate the real trade flow in each year.¹⁸ Obviously there will be missing data. Some trade data was not reported. In addition very reasonably, countries missing national accounts data (hence no GDP data) were dropped.

The problem here is the potential selection bias. Only 54 *bilateral trade observations* were observed in the first year (1948) involving a mere ten countries. This builds up to 7,996 trades involving 158 countries in 1997¹⁹. Least developed or low income countries (LDC/LYs) were obviously under-represented in the data in the early years and there is a rather consistent stream (measured in number of trades) entering into the database in each period. As a result then, as these LDC/LYs enter and increase fairly steadily as a percentage from 0% in 1948 to about 50% of total trades in the year by the early 1970’s, the *average* bilateral trade observed has fallen over the years (see Figure 1) even

¹⁶ Professor Rose is to be complemented on his openness. His web site contains his data. His description of the data is impressive. My only problem occurs because I have to estimate his individual country GDP figures based upon the product he gives and the methodology he apparently uses. I was not able to precisely back-out these numbers.

¹⁷ As if 234,597 observations could be considered *only*.

¹⁸ Allegedly because in trying to confirm a couple of trade flows, it appears that he sums the four numbers (expressed in \$000), deflates by CPI and uses the natural log. By my judgement this will not result in a different conclusion than if he had averaged.

¹⁹ The number of trades reported in 1998 and 1999 were less. I speculate there were reporting problems (?) Of the 20 missing in 1997, the majority were former USSR states that entered in 1998.



though undoubtedly if we had a complete dataset, the actual amount of each bilateral trade would be generally rising.²⁰ I suggest this does constitute a selection bias.²¹

MULTICOLLINEARITY?

The Vulnerable Variable

Multicollinearity always exists in econometric data; it's just a matter of degree.²² This Bothin dummy variable has a disconcerting characteristic²³. It will be off (=0) and then turn on (=1) if the country-pair joins the WTO and never come off.²⁴ That variable will be susceptible to any underlying variable or set of variables that also consistently increase or decrease with time. And we have potential culprits: One is GSP, another is buried in our 'fixed time effects' set of dummies.

Interaction with Selection Bias?

It's easy to envisage a scenario of how the selection bias combines with GSP multicollinearity. As LDC/LYs get their act together to report GDP and trade numbers, they graduate onto the database and on or shortly thereafter, are recognized as receiving GSP trades. This effect is compounded because the GSP didn't exist before 1966²⁵ and has become more prevalent. So not only do we have selection bias but it is directly correlated to the GSP. Such would suggest that GSP could be significant simply because of timing.

To confirm how this selection bias is combining with the year dummies, I regress replacing the 51 year dummies with the one Year variable losing little in terms of explanatory power in R². Note the coefficient of the Year regressor is bizarrely negative and very significant (Table 2; Appendix A.2). This goes against reason. Trade should be increasing with time.

This may also explain why by limiting the sample to industrial countries, the WTO membership is positive on trade (and in the case of Bothin, significant).²⁶ Such a sample would limit the selection bias and GSP impact.

TABLE 2: BENCHMARK BUT USING YEAR AS A LINEAR REGRESSOR

Regressor	Bench Coef.	Using Year Coef.	t-sta
bothin	-0.042	-0.044	-0.840
onein	-0.058	-0.093	-1.920
gsp	0.859	0.720	24.190
regional	1.199	1.251	11.510
custRICT	1.118	1.160	9.540
ldist	-1.119	-1.126	-50.550
lrgdp	0.916	0.925	95.380
lrgdppc	0.321	0.306	21.660
comlang	0.313	0.295	7.240
border	0.526	0.495	4.470
landl	-0.271	-0.242	-7.690
island	0.042	0.036	0.970
lareap	-0.097	-0.098	-12.190
comcol	0.585	0.503	7.450
curcol	1.075	1.152	4.830
colony	1.164	1.207	10.280
comctry	-0.016	-0.187	-0.180
year	absorbed	-0.061	-65.490
_cons	-27.773	94.008	52.780
R-squared	0.648	0.636	

To "raise deflector shields", Professor Rose tabulates the estimates cross-sectionally in each individual year, every five years of 1955, 1960, ... to 1995.²⁷ Curiously he fails to note that the

²⁰ Not to belabour the point but there are no zero trades in his database. I would suggest that the amount of say Fiji / Bulgaria bilateral trade was effectively zero in 1948 even though it shows up later in the database as non-zero.

²¹ Rose refers to a Tobit estimator but the actual results were not disclosed. Rose, Andrew K., loc. cit. n. 13 p 16

²² Gujarati, D, *Basic Econometrics*, (NY, McGraw-Hill, 2003) p 359

²³ Onein also has the disconcerting characteristic for largely the same reason – it goes on and only comes off if Bothin comes on. Note that if Bothin is 1 then Onein is 0 but if Onein is 0 then Bothin is not necessarily 1.

²⁴ No country leaves the WTO in the data.

²⁵ According to the Rose database.

²⁶ Table 5, third row, Rose, Andrew K., loc. cit. n. 13



entrance of the GSP schemes in 1970 and later, seems to have removed the rather significant positive advantage of WTO membership of the cross-sectional analysis prior to 1970.

Testing for Multicollinearity

Professor Rose tests for multicollinearity using various techniques including pairwise correlation and auxiliary regression – the standard textbook stuff and Professor Rose does it extensively and professionally. There does not appear to be substantial multicollinearity although there are significant correlations, specifically between bothin, onein, gsp, year (which could be imbedded in the ‘fixed time effects’), and the GDP product (see Table 3).

The pairwise directions are understandable: (1) if Bothin, they can’t be Onein and hence negative, (2) the GDP product will reflect that WTO Members (if Bothin) are more likely to be larger economies hence positively correlated; and (3) the WTO Members are joining and not leaving so Bothin and Year are correlated.

All correlations are significant even if the key Bothin & Onein ones are on appearance small.

THE GRAVITY SPECIFICATION?

So there are concerns with the selection and potential multicollinearity and these may be exacerbated by the gravity specification. Professor Rose uses the product of the two GDPs before taking the natural logarithm²⁸ which is consistent with a frictionless gravity equation. Another “Sum&Sim” specification effectively breaks out the product into a sum of the two GDPs before taking the logarithm and then adds a similarity term, that is:²⁹

$$\begin{aligned} (Y_{it}Y_{jt}) &= \text{GDPSum}_{ijt} \times \text{GDPSim}_{ijt} \\ &= (Y_{it} + Y_{jt}) \times (1 - (Y_{it}/(Y_{it} + Y_{jt}))^2 - (Y_{jt}/(Y_{it} + Y_{jt}))^2) \end{aligned}$$

A SIMPLE SIMULATION DEMONSTRATES

Putting these three concerns together, I created a simple simulation model (Appendix A.4). I have assumed ten countries and six time periods. The largest country grows (log) linearly from \$1,560b to \$9,210b (equivalent to the real US GDP from 1948 to 1999). The ten countries get (log) linearly progressively smaller to the smallest country in 1999 of \$226 million (equivalent to Vanuatu ranked 148th in the WDI database³⁰). Natural logarithms are taken and then all the remaining GDP data is linearly extrapolated. I assume the four largest countries are originally in my sample and then

TABLE 3: PAIRWISE CORRELATION

	ltrade	bothin	onein	year	gsp	lrgdp
ltrade	1.0000					
bothin	0.1202	1.0000				
onein	-0.0773	-0.8347	1.0000			
year	-0.1184	0.2467	-0.1421	1.0000		
gsp	0.2370	0.1567	-0.0625	0.2015	1.0000	
lrgdp	0.6711	0.1912	-0.0952	0.0946	0.2697	1.0000

Probability of insignificance shown below the correlations

²⁷ Table 3, Rose, Andrew K., loc. cit. n. 13

²⁸ If you’ve forgotten your high school math: $\ln(a \times b) = \ln(a) + \ln(b) \neq \ln(a + b)$

²⁹ As for instance found in Peter Egger papers: Egger, P., "A note on the proper econometric specification of the gravity equation." *Elsevier Economics Letters*, 2000, V66 <http://durandal.cnrs-mrs.fr/GREQAM/DEA/SeminaireDP/1631.pdf> p 27 and Egger, P., loc. cit. n. 4 p 300.

³⁰ World Bank *World Development Indicators* Online



incorporate progressively smaller countries to eventually including all ten countries by the last period. I assume the three largest belong to a club (the WTO) increasing to eventually seven club members by the end. There is also a flag for all trades between any of the largest top four countries and the lowest bottom four during the last three periods (GSP proxy). This simulates the entry of data and the circumstances of the WTO membership and GSP in the Rose data.³¹

Let me assume that the trade X between any two countries i and j at time t is:

$$\ln(X_{ijt}) = \beta_0 + 0.5 \times \ln(\text{GDPSum}_{ijt}) + 0 \times \ln(\text{GDPSim}_{ijt}) + 0.35 \times \text{Bothin}_{ijt} + 0 \times \text{Onein}_{ijt} + 0 \times \text{GSP}_{ijt}$$

Note that I use the *Sum&Sim specification* to create the trade (although not weighting the Sim) with a substantial increase in trade of 42% ($= e^{(0.35)} - 1$) if both countries belong to the club (Bothin = 1) but with no other effects for Similarity, Onein (neither creation nor diversion) nor GSP.

Now let me estimate the simulation observations *with the GDP product specification* with an additional time period explanatory variable:

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \text{Year}_t + \beta_2 \ln(Y_i Y_j)_t + \gamma_1 \text{Bothin}_{ijt} + \gamma_2 \text{Onein}_{ijt} + \gamma_3 \text{GSP}_{ijt} + \varepsilon_{ijt}$$

The results are startling (Table 4, Appendix A.6). **Instead of a substantial positive effect of Bothin on trade as would be implied by the generating simulation equation, we see a negative insignificant effect. The GSP, even though it has no underlying role in the generating equation, appears significantly positive and all, as to be expected, with a high R² to the regression equation.**

TABLE 4: SIMULATED RESULT

Regressor	Coef.	St.dev.	t-stat	P> t
bothin	-0.022	0.309	-0.072	0.943
onein	0.651	0.221	2.949	0.004
gsp	1.396	0.157	8.878	0.000
lrgdp	0.581	0.025	23.560	0.000
year	0.194	0.048	4.006	0.000
_cons	-3.646	1.204	-3.028	0.003
R-squared	0.924			

All somewhat like the Rose result.³² This is not to say this is what happened but rather to indicate that the data combined with the specification could be vulnerable. So perhaps the Rose result is hidden in the interrelationship of all three effects. But it is well hidden...

³¹ Note in this exercise, I do not use a Monte Carlo simulation but rather use a simple deterministic approach. The former may provide more meaningful R² and other observations but the deterministic more clearly defines the relationship implicit between the variables.

³² Agreed, there are differences – the coefficients of time and onein are positive – but then I have not included all the other regressors. This demonstration was only that Bothin coefficient can seem to be negative even if the underlying factor is positive and GSP becomes highly significant for no underlying reason – the very concern referred to by Mr. Patrick Low, see footnote 15.



REGRESSING USING ALTERNATIVE SPECIFICATIONS

GDP Sum&Sim Specification

Re-specifying the gravity model using the GDP Sum&Sim rather than the GDP product and re-estimating the regression, confirms the Rose result (Table 5A)³³. The similarity term becomes very significant leaving once again the Bothin coefficient abysmally insignificant. It is only if we remove the Sim term will Bothin become positive and significant.³⁴ But this is not consistent with the standard economic gravity specification.

Trade/GDP Specification

Another technique used when one suspects multicollinearity is to create a ratio of the regressand over the regressor of concern, i.e. ltrade/lrgdp. This is a statistical technique with little economic basis to justify but simply as a test. The coefficient of Bothin becomes positive and significant but the R² falls to 0.41 (Appendix 3).

REGRESSING LIMITING THE SAMPLE

Given the surprisingly high impact of GSP and negative-to-non-existence of the effect of Bothin, two other robustness checks were performed: (1) limiting the sample to only those countries that were Bothin and then (2) limiting the sample to only those that constitute GSP trades (Table 5B; Appendix 2). This way, I attempt to limit the interaction between the GSP and Bothin variables. By focusing on Bothin trades (both bilateral trading partners are WTO members), we still see a surprisingly strong GSP. More noticeable is the effect of considering only GSP trades, Bothin becomes somewhat significantly positive. Hence with

TABLE 5A: BENCHMARK BUT USING GDP SUM&SIM

Regressor	Bench	Using Sum & Sim		With No Sim	
	Coef.	Coef.	t-stat	Coef.	t-stat
bothin	-0.042	-0.037	-0.700	0.441	7.810
onein	-0.058	-0.067	-1.390	0.042	0.820
gsp	0.859	0.846	26.570	0.808	19.880
regional	1.199	1.213	11.420	1.360	14.410
custrict	1.118	1.109	9.070	0.523	3.900
ldist	-1.119	-1.135	-50.860	-1.226	-45.870
lrgdp	0.916				
lgdpsum		1.830	95.090	1.030	59.680
lgdp sim		0.866	65.150		
lrgdppc	0.321	0.325	23.140	0.692	46.790
comlang	0.313	0.304	7.540	0.055	1.100
border	0.526	0.515	4.650	0.468	4.230
landl	-0.271	-0.268	-8.570	-0.395	-10.740
island	0.042	0.018	0.500	-0.394	-8.200
lareap	-0.097	-0.095	-11.810	0.119	13.260
comcol	0.585	0.608	8.980	0.792	10.050
curcol	1.075	1.026	4.370	0.499	1.540
colony	1.164	1.129	9.720	1.199	9.650
comctry	-0.016	-0.061	-0.060	-0.162	-0.130
_cons	-27.773	-28.447	-76.020	-20.384	-49.700
R-squared	0.648	0.649		0.571	

TABLE 5B: LIMITING THE SAMPLE

Regressor	Bench	Those Bothin		Those GSP	
	Coef.	Coef.	t-stat	Coef.	t-stat
bothin	-0.042			0.564	2.040
onein	-0.058			0.703	2.540
gsp	0.859	0.639	16.810		
regional	1.199	0.839	6.210	2.029	6.850
custrict	1.118	1.442	9.650	0.985	4.420
ldist	-1.119	-1.132	-38.790	-0.939	-24.000
lrgdp	0.916	0.926	74.700	0.977	62.850
lrgdppc	0.321	0.381	21.060	0.342	13.020
comlang	0.313	0.385	7.510	0.531	9.000
border	0.526	0.578	3.320	-1.038	-2.900
landl	-0.271	-0.309	-7.640	-0.317	-6.230
island	0.042	0.007	0.170	-0.092	-1.720
lareap	-0.097	-0.068	-6.810	-0.131	-10.620
comcol	0.585	0.454	4.930	(dropped)	
curcol	1.075	0.955	3.670	0.346	0.980
colony	1.164	1.185	8.290	1.212	10.350
comctry	-0.016	-0.005	0.000	-1.108	-3.130
_cons	-27.773	-29.977	-61.820	-31.975	-47.160
R-squared	0.648	0.649		0.749	
Observations	234,597	114,750		54,285	

³³ The GDP by country was not on Prof. Rose's web site. These have been approximated principally using the Rose products, estimations of the US GDP and repetitive approximations. It was an extremely painful experience of learning how to program a loop in Stata.

³⁴ A similar result is observed by Professor Rose, p 18 Rose, Andrew K., loc. cit. n. 13



the parameter estimation varying so significantly in the Bothin, we must have concerns about the parameter stability of that estimate. In latter tests, the parameter stability of the GSP becomes questionable. Under those circumstances, can we really be definitive?

ONE FINAL CHECK USING WTA DATA

Using GDP Product & GDP Sum&Sim

Trade data is available from 1985 using the World Trade Analyzer (WTA).³⁵ I use this data over the 15 years up to 1999 when the Rose database ends. The logs of trade used by Rose (IMF DoT) and the WTA data are highly correlated – 96% – giving confidence that the trade flows are comparable.³⁶ Using the WDI data for GDP (rather than my approximations

TABLE 6: BENCHMARK POST 1984

Regressor	Rose Post 1984		Using WTA trade		WDI & Sum/Sim	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
bothin	0.029	0.310	0.038	0.330	-0.547	-4.320
onein	-0.050	-0.530	0.056	0.480	-0.331	-2.600
gsp	0.731	19.910	0.293	7.440	0.081	2.050
regional	1.099	9.170	1.149	10.220	0.966	7.120
custrict	1.387	7.930	1.400	7.890	1.049	5.450
ldist	-1.259	-47.690	-0.993	-36.480	-1.014	-36.500
lrgdp	0.988	88.370	0.875	73.250		
lgdpsum					1.863	78.410
lgdpsim					0.854	55.290
lrgdppc	0.252	15.900	0.251	15.420	0.005	0.270
comlang	0.381	7.680	0.472	10.110	0.499	10.440
border	0.794	6.240	0.621	5.240	0.693	5.380
landl	-0.388	-10.570	-0.436	-10.670	-0.593	-14.710
island	-0.006	-0.140	0.028	0.660	-0.002	-0.040
lareap	-0.114	-12.460	-0.113	-11.800	-0.103	-11.240
comcol	0.424	5.340	0.357	4.400	0.762	8.970
curcol	0.312	2.400	0.465	3.830	0.455	3.660
colony	1.236	10.170	1.160	10.520	0.979	8.840
comctry	0.306	0.430	-0.652	-0.980	-2.121	-28.260
_cons	-29.215	-65.670	-27.675	-59.660	-26.417	-58.520
R-squared	0.642		0.699		0.738	

of the Rose data) and a GDP Sum&Sim specification makes the Bothin coefficient become more negative and more significant (Table 6). The table does suggest parameter instability though. For instance consider the coefficients for GSP. They drop from the benchmark of 0.859 to 0.731 if the period is restricted to post 1984 and to 0.293 and 0.081 using WTA trade data and WTA trade with WDI GDP estimates. These are not stable results.

Using Exporter & Importer Coefficients

The WTA data is directional with an exporting and importing country designated for each trade amount. Hence the gravity equation for any real value of trade X from country i to j can be generalised:

$$\ln(X_{ijt}) = \beta_0 + \beta_1 \ln(Y_{it}) + \beta_2 \ln(Y_{jt}) + \beta_3 \ln(Y_i/Pop_i)_t + \beta_4 \ln(Y_j/Pop_j)_t + \sum \beta_k \text{RoseFactor}_{kijt} + \varphi_t T_t + \gamma_1 \text{Bothin}_{ijt} + \gamma_2 \text{Onein}_{ijt} + \gamma_3 \text{GSP}_{ijt} + \varepsilon_{ijt}$$

Where RoseFactor_k are the other 11 factors considered by

TABLE 7: USING TOTAL TRADE WITH EXPORTER/IMPORTER COEFFICIENTS

Regressor	Coef.	t-stat	P> t
bothin	-0.083	-2.460	0.014
onein	-0.014	-0.440	0.662
gsp	0.335	12.060	0.000
regional	0.258	5.970	0.000
custrict	0.553	3.880	0.000
ldist	-1.195	-50.400	0.000
ex_lgdp	1.011	94.890	0.000
ex_lgdppc	0.099	6.930	0.000
im_lgdp	0.811	76.550	0.000
im_lgdppc	0.067	4.740	0.000
comlang	0.481	11.130	0.000
border	0.943	8.310	0.000
landl	-0.468	-13.420	0.000
island	0.057	1.570	0.118
lareap	-0.072	-9.230	0.000
comcol	0.654	10.590	0.000
curcol	0.042	0.090	0.926
colony	1.436	11.640	0.000
_cons	-19.359	-62.120	0.000
Rsqr Within	0.070		
Rsqr Between	0.720		
Rsqr Overall	0.656		
Observations	141,073		

³⁵ Statistics Canada, *World Trade Analyzer*, (Canada, 2002)

³⁶ WTA trade data makes several adjustments to the UN trade data, so 100% was not expected. Evenett, S., "Sticking to the Rules: Quantifying the market access that is potentially protected by WTO-sanctioned trade retaliation." *Paper prepared for the World Trade Forum*, 2002 p 9



Professor Rose from Regional to Colony³⁷ excluding the GDP (lrgdp and lrgdppc) terms. Instead of composing a joint measure, each GDP and GDP per capita of exporter and importer is used.³⁸ These can be “good measures of the demand for imports and supply of exports”³⁹ Logically, higher GDP of either exporter or importer increases trade (Table 7, Appendix 5). The exporter’s and importer’s GDP per capita are also positive & significant. The exporter’s per capita can be interpreted as “a measure of the output per person and thus as an indirect measure of the exporter’s capital-labour ratio.”⁴⁰ The positive value implies that the traded goods are on average relatively capital intensive. The positive GDP/capita for the importer would suggest that imported goods are normal goods with a positive income elasticity. Hence Table 7 coefficients are understandable, except...

This analysis also continues to confirm the Rose result. The Bothin coefficient is not only negative but now bordering on being significantly negative.⁴¹ GSP continues to be positively significant although the actual contribution to trade is estimated to be less: $\sim 1.4x$ ($= e^{(0.335)}$) rather than the $\sim 2.4x$ Rose result.

CONCLUSION

So the Rose result seems robust but there are signs of parameter instability and there could be legitimate concerns about the interaction of the selection, multicollinearity and the gravity model specification. Another concern is that these trade flows are aggregate across products. It is questionable how much we can reasonably learn from such aggregated data.

³⁷ Variable ComCtry drops away because there are no common country pairings after 1984 for the countries defined in the WTA database.

³⁸ Ln of real GDP and GDP/capita designated as xx_lgdp and xx_lgdppc where xx=ex=exporter and xx=im=importer.

³⁹ Baldwin, R, *Towards an Integrated Europe*, (London, CEPR, 1994) p 4-5

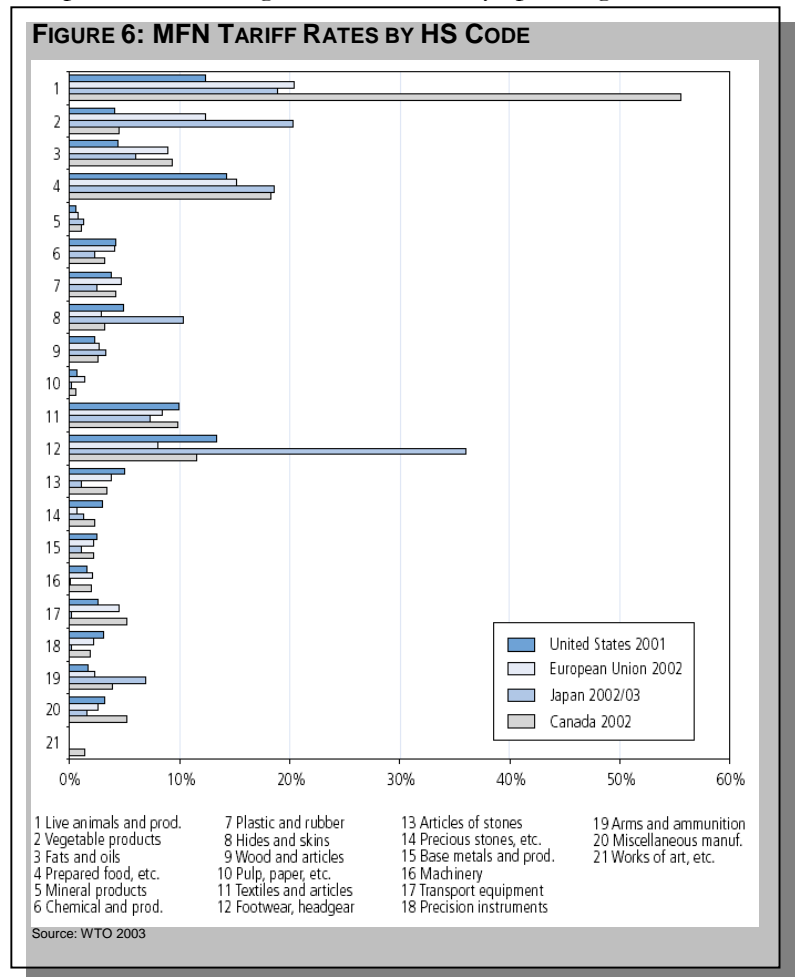
⁴⁰ Baldwin, R, op. cit. n. 1 p 4-4

⁴¹ This analysis uses Stata xtreg random effects GLS regression with each directional pair of countries and years identified.



SPLITTING TOTAL INTO MANUFACTURED & COMMODITY GOODS TRADE

Tariffs differ substantially between the traded products, see Figure 6.⁴² Generally speaking, lower commodity products face lower tariffs. Many countries (rightly or wrongly) promote development by tariff peaks & escalation allowing raw inputs for industrialization (oil, minerals, etc.) in at low tariffs and keep tariffs higher on the higher value-added products in the hopes of promoting such production within the country.⁴³ This is independent upon whether the country is a WTO Member. It is the reduction of manufactured goods tariffs which has been the principal success of the GATT/WTO. They have been coming down (see Table 8)⁴⁴. If we see any significant increase in trade because of WTO membership, it should be in the manufactured goods.⁴⁵



THE DATA

That WTA trade data also segregates trade by the sections of the Harmonized System (customs product codes). The top levels of codes are:

- 0-Food and live animals chiefly for food
- 1-Beverages and tobacco
- 2-Crude materials, inedible, except fuels
- 3-Mineral fuels, lubricants and related mate
 - 33-Petroleum, petroleum products and related
- 4-Animal and vegetable oils, fats and waxes
- 5-Chemicals and related products, n.e.s.
 - 56-Fertilizers, manufactured
- 6-Manufactured goods classified chiefly**
 - 61-Leather, leather manufactures, n.e.s.and dressed f
 - 62-Rubber manufactures, n.e.s.
 - 63-Cork and wood manufactures (excl. furniture
 - 64-Paper, paperboard, articles of paper, paper-pulp
 - 65-Textile yarn, fabrics, made-up articles, related products
 - 66-Non-metallic mineral manufactures, n.e.s.
 - 67-Iron and steel
 - 68-Non-ferrous metals

TABLE 8: AVERAGE TARIFF RATES OF MANUFACTURED PRODUCTS (% OF VALUE)

	1913	1950	1990
France	21	18	6
Germany	20	26	6
Italy	18	25	6
Japan	30	-	5
Holland	4	11	6
Sweden	20	9	4
Britain	-	23	6
United States	44	14	5

Source: The Economist 24 June 1995

⁴² WTO, *Annual Report 2003*, (Geneva, WTO, 2003) Chart II.1 pg 16

⁴³ For a discussion, see pg 18, WTO, op. cit. n. 21

⁴⁴ The Economist. "Who Wants to be a Giant?" *The Economist*, 1995 Available on Ebsco: Business Source Elite

⁴⁵ Professor Rose also considers such an analysis to be the "next generation" of future work; pg 19 Rose, Andrew K., loc. cit. n. 13



69-Manufactures of metal, n.e.s.

6X-Residual

7-Machinery and transport equipment

71-Power generating machinery and equipment

72-Machinery specialized for particular industry

73-Metalworking machinery

74-General industrial machinery & equipment

75-Office machines & automatic data processing

76-Telecommunications & sound recording apparatus

77-Electrical machinery, apparatus & appliance

78-Road vehicles (incl. air cushion vehicles)

79-Other transport equipment

7X-Res: Machinery and transport equipment

8-Miscellaneous manufactured articles

81-Sanitary, plumbing, heating and lighting fix

82-Furniture and parts thereof

83-Travel goods, handbags and similar contain

84-Articles of apparel and clothing accessories

85-Footwear

87-Professional, scientific & controlling instruments

88-Photographic apparatus, optical goods, watch

89-Miscellaneous manufactured articles, n.e.s.

8X-Res: Miscellaneous manufactured articles

9-Commodities & trans. not classified

91-Postal packages not classified according t

93-Special transactions & commodities, not classified

94-Animals, live, n.e.s., incl. zoo-animals

95-Armoured fighting vehicles, arms of war & a

96-Coin (other than gold) not being legal tender

97-Gold, non-monetary

99-Non-identified products

9X-Res: Commodities

I sum the three principal manufacturing sections: 6th, 7th and 8th level of HS Code and deem this to be the manufactured goods trade.⁴⁶ The difference between total and manufactured, I define as the “commodities” trade.

As referred to in discussing Table 7, I used all the other regressors from the Rose data with the exception of the GDP (real & real per capita) data which was drawn from the WDI database. For this next section, I leave both the Onein and the GSP variable ‘on’ for both directions. That is to say, for Onein, I do not distinguish whether the Onein is the exporter or the importer. For GSP, I also do not distinguish which country grants the other GSP treatment. This is questionable. The GSP preference will typically be in one direction (from poor to rich country) and often limited by product type (commodity rather than manufactured). I investigate varying these two dummy variables later.

⁴⁶ Admittedly some of this trade, e.g. textiles, steel and footwear, one can legitimately question whether the GATT/WTO has been effective.



THE ANALYSIS

General Fit & Understanding

Table 9 summarizes the results for the three values of trade: total, manufactured and commodity products. Putting aside the Bothin, Onein and GSP terms for the moment, the coefficients are as expected except perhaps the GDP/capita terms for the importing country.⁴⁷ Both manufactured and commodity products coefficients are somewhat insignificant and in the manufactured products case, negative.

Commodity products may tend to be more income inelastic reflecting the more staple nature of the type of goods. Hence, positive

but modestly so is quite reasonable. For manufactured products, the negative phenomena is unlikely to be that the manufactured goods tend to be inferior (negative income elasticity) and certainly not so in comparison with commodity goods. I suggest the insignificant negative coefficient suggests that lower GDP/capita countries must import more manufactured goods reflecting the standard economic theory of competitive advantage – less industrialised (hence lower GDP/capita) countries export commodities to import manufactured goods.

I would not want to over-analyse this table but there a few interesting confirmations: (a) commodity trade is more susceptible to being landlocked; (b) manufactured products are generally products of higher GDP economies; and (c) manufactured products appear somewhat more susceptible to distance, common border, language and currency. This latter observation is consistent with Rauch: manufactured products will tend to be more heterogeneous and therefore require more networking and higher search costs relative to homogeneous commodity products found on market exchanges.⁴⁸ Hence language, distance, common border and somewhat currency play more of a role for manufactured rather than commodity products. One last word of caution is that although significant, the overall R² for commodity products has dropped to 39%.⁴⁹

TABLE 9: SEPARATING MANUFACTURING & COMMODITY TRADE

Regressor	Total trade		Manufactured		Commodity	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
bothin	-0.083	-2.460	1.188	13.740	-0.122	-1.470
onein	-0.014	-0.440	0.743	8.800	-0.029	-0.350
gsp	0.335	12.060	0.338	5.230	0.714	11.410
regional	0.258	5.970	0.157	1.430	0.210	2.000
custrict	0.553	3.880	2.353	7.480	0.260	0.850
ldist	-1.195	-50.400	-1.901	-37.850	-1.781	-36.250
ex_lgdp	1.011	94.890	2.063	89.480	1.189	52.840
ex_lgdppc	0.099	6.930	0.042	1.390	0.064	2.160
im_lgdp	0.811	76.550	1.208	52.680	1.089	48.650
im_lgdppc	0.067	4.740	-0.051	-1.660	0.033	1.090
comlang	0.481	11.130	1.221	13.390	0.784	8.780
border	0.943	8.310	1.301	5.430	1.089	4.650
landl	-0.468	-13.420	-0.061	-0.830	-0.937	-12.950
island	0.057	1.570	0.006	0.080	0.199	2.640
lareap	-0.072	-9.230	-0.359	-21.620	-0.034	-2.100
comcol	0.654	10.590	0.705	5.380	1.002	7.810
curcol	0.042	0.090	-0.010	-0.010	-0.033	-0.030
colony	1.436	11.640	1.372	5.290	1.839	7.240
_cons	-19.359	-62.120	-44.607	-65.560	-28.112	-42.370
R-sq Within	0.070		0.056		0.018	
R-sq Betw een	0.720		0.600		0.495	
R-sq Total	0.656		0.511		0.394	
Observations	141,073		141,073		141,073	
Groups	12,241		12,241		12,241	

⁴⁷ A feature shared (negative insignificant importer GDP/capita coefficients) but ignored in Subramanian, A and Wei Shang-Jin, loc. cit. n. 17, Core Regressions # (1) & (2)

⁴⁸ Rauch, J, "Networks Versus Markets in International Trade." *NBER Working Paper 5617*, 1996 <http://papers.nber.org/papers/w5617.pdf>. Although the colonial relationship advantage for heterogeneous products does not particularly show.

⁴⁹ Possibly reflecting that a substantial portion of this trade will be oil & petroleum. Referred to later in this paper, this trade is unusual.



Bothin Becomes Significantly Positive

The coefficient for both Onein and Bothin turn significantly positive in manufactured products. For manufactured products, should both countries be WTO Members then trade could be 3.3x (= $e^{(1.188)}$) than that that otherwise would have occurred between non-members.

Exporting v Importing Onein

The Rose Paper focuses on total bilateral trade.

Using the WTA directional trade, I can investigate in the event of Onein (one of the countries is a WTO

Member), whether the impact of trade depends upon whether the WTO Member is the importer or exporter. You will recall from the Rose Benchmark (Table 1), that the coefficient of Onein is negative (suggesting trade diversion) but insignificant. In the total and commodity product trade, this trade diversion is somewhat suggested if the exporter is the WTO Member (Table 10, Appendix 6). If the WTO Member is the importer, then it would marginally benefit trade even if the exporter is not a WTO Member although the evidence is not highly significant. We might speculate that being a WTO Member means a more open economy with less restrictions on imports no matter where the product's origin. On manufactured goods though, the evidence is stronger that no matter if the Onein country is the exporter or the importer, there will be trade creation; more if the Onein is the exporter⁵⁰. We might therefore also speculate that being a WTO Member means that your exporters are seeking more opportunities (and able to compete) even into markets that have not made WTO commitments such as MFN and national treatment.

TABLE 10: ONEIN SEPARATED: EXPORTER V IMPORTER

Onein is	Total trade		Manufactured		Commodity	
	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Exporter	-0.086	-2.50	0.966	10.90	-0.138	-1.62
Importer	0.064	1.84	0.500	5.59	0.090	1.05

GSP is Good for Commodity Products

According to Table 9, GSP has the most significant effect (both in coefficient value and statistical significance) on commodity product trade⁵¹. Such is

logical given that the GSP preferences are often beneficial only to products lower in the value chain. Interestingly enough though, by breaking the GSP dummy into two (one for each direction – poor to rich country and *vice versa*), the coefficients of these dummies are positive and significant irrespective of the direction or whether the manufactured or commodity products are considered (Table 11, Appendix 7). An Abba Lerner symmetry appears for not only the aggregate level but also as it relates to bilateral trade. As one would expect the commodity trade is most affected but surprisingly as much from Rich-to-Poor as Poor-to-Rich. Rather than considering this a *Faustian*

TABLE 11: GSP COEFFICIENTS BY DIRECTION

Direction of GSP trade	Total trade	Manufactured	Commodity
	Coef.	Coef.	Coef.
Poor->Rich	0.348	0.283	0.687
Rich->Poor	0.324	0.388	0.739

All coefficients significant

⁵⁰ The F-test value >100 for the equivalence of coefficients implies a significant difference. Manufacturing goods trade would be more positively affected should the One-in WTO Member be the exporter rather than the importer.

⁵¹ No judgment is made on whether the GSP is beneficial. Increasing trade does not imply automatically a benefit. A discussion focused on whether GSP/S&DT is beneficial may be found in Hoekman, B et al. "More Favorable and Differential Treatment of Developing Countries: Towards a New Approach in the WTO." *World Bank Working Paper 3107*, 2003 http://econ.worldbank.org/files/28991_wps3107.pdf



*Bargain*⁵² for the developing countries, a better description may be a *Self-Interest Deal* for the developed countries.

Industrial v Developing Countries

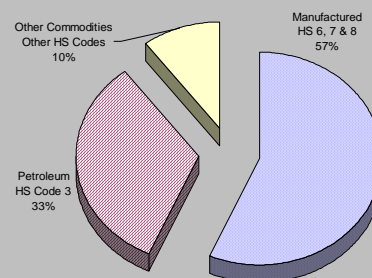
The GATT/WTO is a two-tier organization. Special & Differential Treatment afforded developing countries means that their liberalization has been less. Hence an

asymmetry has developed between industrial and developing countries. Subramanian & Wei (S&W) offer an analysis of total directional trade and assess that there is a significant difference between industrial and developing country within the WTO.⁵³ Table 12 confirms this and goes further by incorporating the difference between manufactured and commodity goods. WTO membership has its most positive effect on manufactured products. Interestingly though Industrial WTO members tend to import commodity products from non-WTO Members. This trade is principally oil & petroleum products (HS Code 3); 33% of total goods trade and 76% of 'commodity' trade in 1999 (Figure 1). Oil must be considered unique with its non-WTO sources (e.g. Saudi Arabia, Iran, Iraq, UAE, Kuwait, Oman, Qatar) feeding the industrial world. This analysis again emphasises the need to segregate total trade into its components in order to analyse trade effects.

TABLE 12: INDUSTRIAL V DEVELOPING COUNTRIES

Importer	Exporter	S&W	Total trade		Manufactured		Commodity	
		Coeff.	Coeff.	t-stat	Coeff.	t-stat	Coeff.	t-stat
Industrial & WTO member	WTO member	0.578	0.192	3.38	0.981	7.92	0.035	0.29
Industrial & WTO member	Not WTO	0.292	0.487	8.24	0.249	1.89	0.504	3.94
Developing & WTO member	WTO member	-0.007	-0.002	-0.16	0.338	8.75	0.010	0.26
Developing & WTO member	Not WTO	0.091	0.024	0.95	-0.236	-3.75	0.024	0.39

FIGURE 1: NON WTO TO INDUSTRIAL TRADE (1999)



Robustness Checks

I have performed the following robustness checks. The complete analysis is provided in Appendix 10. The summary of how the Bothin coefficient for manufactured products trade is summarized in Table 13.

- I broke the time frame into two: before and after January 1992. Bothin remains positive and reasonably significant.

TABLE 13: ROBUSTNESS CHECKS

Robustness Check	Manuf. Bothin		R-sq total	Comment
	Coef.	t-stat		
Benchmk 1985-99	1.19	13.74	0.51	
1985-1991	0.72	5.23	0.52	
1992-1999	0.58	3.64	0.51	
1985	0.84	3.28	0.52	
1999	-0.39	-1.27	0.43	Negative but not significant. Prior year 0.93 & significant.
Rose areg	0.51	2.31	0.51	
No year dummies	0.55	2.59	0.51	
Comp. GDP/cap	1.19	13.77	0.51	Relative GDP/cap positive but rather insignificant

⁵² Ozden, C and Reinhardt, E., "Faustian Bargain: The Effects of Unilateral Trade Preferences." *World Bank Working Paper*, 2003. Prior draft available at http://www.biz.uiowa.edu/econ/seminars/Spring02/Ozden_gsp2.pdf

⁵³ Subramanian, A and Wei Shang-Jin, loc. cit. n. 17 referring to Table 5; Core Regression #(5). I have used the same 23 industrial countries identified by S&W (Appendix Table 2; p 34)



- Cross sectional analysis for 1985 and 1999. Only in 1999 does the Bothin become insignificantly negative. A check of Bothin coefficient using the prior year 1998 is positive and significant suggesting 1999 may be an aberration.
- Like the above analysis, Rose uses a series of dummies for the years but instead of using GLS, he assumes a sandwich estimator of variance (“Rose areg” in Table 13).⁵⁴
- A standard regression with no year dummies but with the robust clustering of each directional pair of countries shows still a positive and modestly significant Bothin coefficient.
- Another specification adjustment was to remove the log GDP per capita regressors and use a composite comparative GDP/capita index.⁵⁵

CONCLUSION

Professor Rose has raised the debate on whether the WTO is effective. I have not proved him wrong. But using the simulation, I have surmised that this data and approach are generally vulnerable. It would be an interesting subject for further research. How can all those robustness checks that Prof. Rose performs be so definitive when the underlying data and specification are so vulnerable? Mr. Lowe’s insight that the impact of the GSP is hard to justify⁵⁶, corresponds to a possible general underlying vulnerability in the data and specification. Hence we should be wary. I did find some evidence of parameter instability but do we need better statistical robustness checks, amongst the battery of ones that Prof. Rose uses to warn us?

Also the data is so aggregated; it hides some important relationships. By separating the total trade into manufacturing and commodity product trade, a significant positive Bothin coefficient in the trade of manufactured products appears. There are also some interesting apparent relationships depending upon what product is being traded as to both the implications of one member being a WTO Member, GSP and also the differences between industrial and developing countries:

- In the event that one of the trading partners is a WTO member, for manufactured goods trade, there will be a positive impact to the value of trade. Significantly more so if the WTO member is the exporter suggesting the exporters are generally more opportunistic and able to compete even if the importing nation is not a WTO member.
- The GSP also appears principally as a commodity product impact as one would expect given GSPs are usually given on products which are lower-value added and not for those products competing with the developed country giving the preference.

⁵⁴ Rose uses “areg [regression spec] , robust cluster(pairid) a(year)”. Curiously Rose ignores that if even in his data, if he chooses a random or fixed effects assumption using GLS, then the Bothin becomes significantly positive; Table 6 rows 7, 8 & 9 Rose, Andrew K., loc. cit. n. 13 . The need for fixed effects is sometimes argued for this analysis, See Footnote 13.

⁵⁵ Comparative Relative GDP/Capita = $|a - b| / (a + b)$ where a and b are the GDP per capita of each country.

⁵⁶ Again referring to Footnote 15.



- A surprising result was that rich countries were also positively impacted in particular for their *commodity* export trade by granting a GSP exemption to the poor country. There seems to be a strong symmetry in the granting of GSP preferences.
- By splitting the WTO members into industrial and developing, we further see the key effect on manufactured goods trade particularly if the importer is an Industrial WTO member.
- There was a surprise was in the non-WTO to Industrial WTO trade flow, but the impact was probably the unique circumstances of the oil trade.

Throughout the analysis when using gravity models, segregating total trade both by product and direction is useful and possibly essential to understand trade. Trade developments like WTO membership will affect different products differently. The example of the oil trade into industrial countries is just another example which again emphasises that trade should be segregated out to really understand the trade flows. For example, separating out the oil trade in particular seems essential to understand the flow of the commodity products and would be useful to explore in future research.



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APPENDICES

A.1 ROSE BENCHMARK

```
log: C:\Documents and Settings\JG\My Documents\wti\Rose\GATT\benchmark.log
log type: text
opened on: 19 Jul 2003, 11:46:31
```

```
. set mem 60m
```

Current memory allocation

settable	current value	description	memory usage (1M = 1024k)
set maxvar	5000	max. variables allowed	1.733M
set memory	60M	max. data space	60.000M
set matsize	400	max. RHS vars in models	1.254M

			62.987M

```
. use "C:\Documents and Settings\JG\My Documents\wti\Rose\GATT\data4web.dta", clear
```

```
. areg ltrade onein bothin gsp regional custrict ldist lrgdp lrgdppc comlang border landl island
lareap comcol curcol colony comctry, robust cluster(pairid) a(year)
```

Regression with robust standard errors

```
Number of obs = 234597
F( 17,234528) = 1932.38
Prob > F = 0.0000
R-squared = 0.6480
Adj R-squared = 0.6479
Root MSE = 1.9796
```

(standard errors adjusted for clustering on pairid)

ltrade	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
onein	-.0582516	.048594	-1.20	0.231	-.1534945	.0369913
bothin	-.0422915	.0527784	-0.80	0.423	-.1457358	.0611528
gsp	.8585277	.0318465	26.96	0.000	.7961093	.9209461
regional	1.198811	.1062062	11.29	0.000	.9906494	1.406972
custrict	1.118147	.1216956	9.19	0.000	.8796271	1.356668
ldist	-1.119029	.0220752	-50.69	0.000	-1.162296	-1.075762
lrgdp	.915903	.0096096	95.31	0.000	.8970685	.9347375
lrgdppc	.3214132	.0140799	22.83	0.000	.293817	.3490093
comlang	.3125448	.0402906	7.76	0.000	.2335764	.3915133
border	.5257054	.1107187	4.75	0.000	.3086995	.7427112
landl	-.2705915	.0312307	-8.66	0.000	-.3318028	-.2093802
island	.041927	.0360915	1.16	0.245	-.0288114	.1126654
lareap	-.0967329	.0079963	-12.10	0.000	-.1124055	-.0810604
comcol	.5845614	.0671616	8.70	0.000	.4529265	.7161964
curcol	1.075146	.2347197	4.58	0.000	.6151014	1.53519
colony	1.163838	.1172448	9.93	0.000	.9340408	1.393635
comctry	-.0163045	1.081065	-0.02	0.988	-2.135163	2.102554
_cons	-27.77277	.3699594	-75.07	0.000	-28.49788	-27.04766
year	absorbed				(52 categories)	



A.2 BENCHMARK USING YEAR AS A REGRESSOR, CORRELATION & LIMITING THE SAMPLE

Objective of this appendix is to demonstrate the Year when used as a regressor is *negative and significant*.

```
. reg ltrade onein bothin gsp regional custrict ldist lrgdp lrgdppc comlang border landl island  
lareap comcol curcol colony comctry year, robust cluster(pairid)
```

```
Regression with robust standard errors                                Number of obs = 234597  
                                                                    F( 18, 12149) = 1810.51  
                                                                    Prob > F      = 0.0000  
                                                                    R-squared    = 0.6361  
                                                                    Root MSE    = 2.0124  
  
Number of clusters (pairid) = 12150
```

ltrade	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]
onein	-.0933134	.0486765	-1.92	0.055	-.188727 .0021002
bothin	-.0442583	.0527376	-0.84	0.401	-.1476325 .0591158
gsp	.7204958	.0297851	24.19	0.000	.6621123 .7788794
regional	1.250599	.1086522	11.51	0.000	1.037623 1.463574
custrict	1.160367	.1216545	9.54	0.000	.9219044 1.398829
ldist	-1.125803	.0222689	-50.55	0.000	-1.169453 -1.082152
lrgdp	.9245902	.0096941	95.38	0.000	.9055882 .9435922
lrgdppc	.305868	.0141202	21.66	0.000	.2781903 .3335458
comlang	.2952555	.0408031	7.24	0.000	.215275 .3752359
border	.4949194	.1106396	4.47	0.000	.2780482 .7117905
landl	-.2423835	.0315123	-7.69	0.000	-.3041526 -.1806143
island	.0355404	.0366088	0.97	0.332	-.0362187 .1072995
lareap	-.0983154	.0080685	-12.19	0.000	-.114131 -.0824997
comcol	.5026393	.0674907	7.45	0.000	.3703469 .6349318
curcol	1.15171	.2382947	4.83	0.000	.6846143 1.618805
colony	1.207044	.1174104	10.28	0.000	.9769007 1.437187
comctry	-.1873255	1.06102	-0.18	0.860	-2.267093 1.892442
year	-.0614853	.0009388	-65.49	0.000	-.0633255 -.0596452
_cons	94.00759	1.781268	52.78	0.000	90.51602 97.49916

Objective of this table is to emphasise that there are some correlated regressors.

```
. pwcorr ltrade bothin onein year gsp lrgdp , sig
```

	ltrade	bothin	onein	year	gsp	lrgdp
ltrade	1.0000					
bothin	0.1202 0.0000	1.0000				
onein	-0.0773 0.0000	-0.8347 0.0000	1.0000			
year	-0.1184 0.0000	0.2467 0.0000	-0.1421 0.0000	1.0000		
gsp	0.2370 0.0000	0.1567 0.0000	-0.0625 0.0000	0.2015 0.0000	1.0000	
lrgdp	0.6711 0.0000	0.1912 0.0000	-0.0952 0.0000	0.0946 0.0000	0.2697 0.0000	1.0000

Limiting the Sample to only those Bothin (i.e. WTO Members) trading partners

```
. use "C:\Documents and Settings\JG\My Documents\wti\Rose\GATT\data4web.dta", clear
```

```
. drop if bothin ~= 1  
(119847 observations deleted)
```

```
. areg ltrade bothin onein gsp regional custrict ldist lrgdp lrgdppc comlang border landl is  
> land lareap comcol curcol colony comctry, robust cluster(pairid) a(year)
```



```
Regression with robust standard errors      Number of obs = 114750
                                           F( 15,114683) = 1516.51
                                           Prob > F      = 0.0000
                                           R-squared    = 0.7185
                                           Adj R-squared = 0.7183
                                           Root MSE    = 1.8122
```

(standard errors adjusted for clustering on pairid)

ltrade	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
bothin	(dropped)					
onein	(dropped)					
gsp	.6392848	.0380358	16.81	0.000	.5647351	.7138344
regional	.8387034	.1351416	6.21	0.000	.573828	1.103579
custrict	1.442101	.1493924	9.65	0.000	1.149294	1.734908
ldist	-1.131906	.0291795	-38.79	0.000	-1.189097	-1.074714
lrgdp	.9260222	.0123968	74.70	0.000	.9017246	.9503198
lrgdppc	.3810086	.0180905	21.06	0.000	.3455516	.4164656
comlang	.3852096	.0513253	7.51	0.000	.2846129	.4858063
border	.5780402	.1740306	3.32	0.001	.2369428	.9191375
landl	-.309489	.0404842	-7.64	0.000	-.3888373	-.2301407
island	.0074018	.0446732	0.17	0.868	-.080157	.0949607
lareap	-.0675102	.0099094	-6.81	0.000	-.0869325	-.0480879
comcol	.4544678	.0921628	4.93	0.000	.2738302	.6351054
curcol	.9551986	.2602167	3.67	0.000	.4451779	1.465219
colony	1.185142	.1430305	8.29	0.000	.9048042	1.465479
comctry	-.0051113	1.034411	-0.00	0.996	-2.03254	2.022318
_cons	-29.97651	.4848938	-61.82	0.000	-30.9269	-29.02613
year	absorbed				(52 categories)	

Limiting the Sample to only those GSP trading partners

```
. use "C:\Documents and Settings\JG\My Documents\wti\Rose\GATT\data4web.dta", clear
. drop if gsp ~= 1
(180312 observations deleted)
. areg ltrade bothin onein gsp regional custrict ldist lrgdp lrgdppc comlang border landl is
> land lareap comcol curcol colony comctry, robust cluster(pairid) a(year)
```

```
Regression with robust standard errors      Number of obs = 54285
                                           F( 15, 54236) = 798.56
                                           Prob > F      = 0.0000
                                           R-squared    = 0.7492
                                           Adj R-squared = 0.7489
                                           Root MSE    = 1.3219
```

(standard errors adjusted for clustering on pairid)

ltrade	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
bothin	.5636904	.276187	2.04	0.041	.0223618	1.105019
onein	.7027727	.2762431	2.54	0.011	.1613341	1.244211
gsp	(dropped)					
regional	2.029416	.2961149	6.85	0.000	1.449029	2.609804
custrict	.9851601	.2227272	4.42	0.000	.5486131	1.421707
ldist	-.9386522	.0391151	-24.00	0.000	-1.015318	-.8619864
lrgdp	.9771623	.0155464	62.85	0.000	.9466913	1.007633
lrgdppc	.3419229	.0262667	13.02	0.000	.29044	.3934058
comlang	.531034	.0589995	9.00	0.000	.4153946	.6466734
border	-1.038266	.3580047	-2.90	0.004	-1.739957	-.3365736
landl	-.3169551	.0508729	-6.23	0.000	-.4166663	-.2172439
island	-.0915028	.0532329	-1.72	0.086	-.1958397	.0128342
lareap	-.1310305	.0123377	-10.62	0.000	-.1552125	-.1068485
comcol	(dropped)					
curcol	.3455436	.3536975	0.98	0.329	-.3477062	1.038793
colony	1.211862	.1170355	10.35	0.000	.9824711	1.441252
comctry	-1.107545	.3533699	-3.13	0.002	-1.800153	-.4149377
_cons	-31.97535	.6780146	-47.16	0.000	-33.30426	-30.64643
year	absorbed				(34 categories)	



A.3 A QUICK TEST USING THE RATIO OF TRADE/GDP

Objective of this appendix uses the standard procedure for multicollinear problems of using a ratio for the regressand.

```
log: C:\Documents and Settings\JG\My Documents\wti\Rose\GATT\trade_gdp.log
log type: text
opened on: 3 Aug 2003, 14:54:52

. gen ltr_lgdp = ltrade / lrgdp

. areg ltr_lgdp bothin onein gsp regional custrict ldist lrgdppc comlang border landl island
> lareap comcol curcol colony comctry, robust cluster(pairid) a(year)
```

```
Regression with robust standard errors                                Number of obs = 234597
                                                                    F( 16,234529) = 721.68
                                                                    Prob > F      = 0.0000
                                                                    R-squared     = 0.4084
                                                                    Adj R-squared = 0.4082
                                                                    Root MSE     = .04855
```

(standard errors adjusted for clustering on pairid)

ltr_lgdp	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
bothin	.0147417	.0012936	11.40	0.000	.0122062	.0172771
onein	.0060303	.001192	5.06	0.000	.0036939	.0083666
gsp	.0214195	.0008765	24.44	0.000	.0197016	.0231373
regional	.0241266	.0023902	10.09	0.000	.0194419	.0288113
custrict	.0057011	.0028298	2.01	0.044	.0001547	.0112474
ldist	-.0211616	.0005773	-36.66	0.000	-.022293	-.0200301
lrgdppc	.0186999	.0003011	62.10	0.000	.0181097	.0192901
comlang	.0006381	.0010835	0.59	0.556	-.0014854	.0027617
border	.0127521	.0024341	5.24	0.000	.0079814	.0175229
landl	-.0114923	.0008214	-13.99	0.000	-.0131021	-.0098824
island	-.006746	.0010762	-6.27	0.000	-.0088553	-.0046367
lareap	.0053316	.0001759	30.31	0.000	.0049869	.0056764
comcol	.0103376	.001777	5.82	0.000	.0068547	.0138205
curcol	.0225614	.0053299	4.23	0.000	.0121149	.033008
colony	.0378684	.00249	15.21	0.000	.0329879	.0427488
comctry	.0134502	.0212551	0.63	0.527	-.0282092	.0551097
_cons	-.0603208	.0076478	-7.89	0.000	-.0753102	-.0453313
year	absorbed				(52 categories)	



A.4 SIMULATION

Objective of this appendix is to show how a positive effect of WTO membership can be lost in the selection bias, multicollinearity and specification difference between the GDP SumSim Specification with a twist of no similarity term and the Rose GDP Product Specification.

Ln GDP	Yr:											SUMMARY OUTPUT														
Cty:	1	2	3	4	5	6																				
1	28.08	28.43	28.79	29.14	29.50	29.85											Regression Statistics									
2	26.97	27.31	27.65	27.99	28.33	28.67											Multiple R 0.96138166									
3	25.86	26.18	26.51	26.84	27.16	27.49											R Square 0.924254695									
4	24.75	25.06	25.37	25.69	26.00	26.31											Adjusted R Square 0.921642788									
5	23.64	23.94	24.24	24.54	24.83	25.13											Standard Error 0.674581452									
6	22.53	22.82	23.10	23.38	23.67	23.95											Observations 151									
7	21.42	21.69	21.96	22.23	22.50	22.77																				
8	20.31	20.57	20.83	21.08	21.34	21.60																				
9	19.20	19.45	19.69	19.93	20.17	20.42																				
10	18.09	18.32	18.55	18.78	19.01	19.24																				
							ANOVA																			
							Regression	5	805.1424843	161.0284969	353.8620162	2.40272E-79														
							Residual	145	65.98371958	0.455060135																
							Total	150	871.1262039																	
							Coefficients																			
							Intercept	-3.6455	1.2039	-3.0280	0.0029	Lower 95%	-6.025078226	Upper 95%	-1.265968018	Lower 95.0%	-6.025078226	Upper 95.0%	-1.265968018							
							Year	0.1936	0.0483	4.0060	0.0001	0.098086087	0.289126159	0.098086087	0.289126159	0.098086087	0.289126159									
							Bothin	-0.0222	0.3094	-0.0718	0.9429	-0.633722328	0.589300992	-0.633722328	0.589300992	-0.633722328	0.589300992									
							Onein	0.6505	0.2206	2.9485	0.0037	0.214453712	1.086553433	0.214453712	1.086553433	0.214453712	1.086553433									
							GSP	1.3963	0.1573	8.8782	0.0000	1.085462382	1.707155552	1.085462382	1.707155552	1.085462382	1.707155552									
							GDPProd	0.5811	0.0247	23.5601	0.0000	0.532360808	0.629859486	0.532360808	0.629859486	0.532360808	0.629859486									
							Parameters used in creating Ltrade																			
							1										0.35 0 0									
Ncty1	Ncty2	Nyr	Cty1	Cty2	Yr	GDP1	GDP2	AvgGDP	WTO1	WTO2	Constant	Year	Bothin	Onein	GSP	GDPProd	Ltrade									
-	-	-	1.00	2.00	1.00	28.08	26.97	28.08	1	1	1	1.00	1	0	0	55.04	28.426									
-	-	-	1.00	2.00	2.00	28.43	27.31	28.43	1	1	1	2.00	1	0	0	55.74	28.7808									
-	-	-	1.00	2.00	3.00	28.79	27.65	28.79	1	1	1	3.00	1	0	0	56.43	29.1356									
-	-	-	1.00	2.00	4.00	29.14	27.99	29.14	1	1	1	4.00	1	0	0	57.13	29.4904									
-	-	-	1.00	2.00	5.00	29.50	28.33	29.50	1	1	1	5.00	1	0	0	57.83	29.8452									
-	-	-	1.00	2.00	6.00	29.85	28.67	29.85	1	1	1	6.00	1	0	0	58.52	30.2									
-	1.00	-	1.00	3.00	1.00	28.08	25.86	28.08	1	1	1	1.00	1	0	0	53.93	28.426									
-	-	-	1.00	3.00	2.00	28.43	26.18	28.43	1	1	1	2.00	1	0	0	54.62	28.7808									
-	-	-	1.00	3.00	3.00	28.79	26.51	28.79	1	1	1	3.00	1	0	0	55.30	29.1356									
-	-	-	1.00	3.00	4.00	29.14	26.84	29.14	1	1	1	4.00	1	0	0	55.98	29.4904									
-	-	-	1.00	3.00	5.00	29.50	27.16	29.50	1	1	1	5.00	1	0	0	56.66	29.8452									
-	-	-	1.00	3.00	6.00	29.85	27.49	29.85	1	1	1	6.00	1	0	0	57.34	30.2									
-	1.00	-	1.00	4.00	1.00	28.08	24.75	28.08	1	0	1	1.00	0	1	0	52.82	28.076									
*** Rows hidden ***																										
-	1.00	-	7.00	9.00	5.00	22.50	20.17	22.50	0	0	1	5.00	0	0	0	42.68	22.50412722									
-	-	-	7.00	9.00	6.00	22.77	20.42	22.77	1	0	1	6.00	0	1	0	43.19	22.77483107									
-	1.00	-	7.00	10.00	6.00	22.77	19.24	22.77	1	0	1	6.00	0	1	0	42.01	22.77483107									
1.00	-	-	8.00	9.00	4.00	21.08	19.93	21.08	0	0	1	4.00	0	0	0	41.01	21.08226059									
-	-	-	8.00	9.00	5.00	21.34	20.17	21.34	0	0	1	5.00	0	0	0	41.51	21.33894842									
-	-	-	8.00	9.00	6.00	21.60	20.42	21.60	0	0	1	6.00	0	0	0	42.01	21.59563625									
-	1.00	-	8.00	10.00	6.00	21.60	19.24	21.60	0	0	1	6.00	0	0	0	40.83	21.59563625									
1.00	-	-	9.00	10.00	5.00	20.17	19.01	20.17	0	0	1	5.00	0	0	0	39.18	20.17376963									
-	-	-	10.00	10.00	6.00	19.24	19.24	19.24	0	0	1	6.00	0	0	0	38.47	19.23724662									



A.5 SEPARATING MANUFACTURED & COMMODITY TRADE

Objective of this appendix is to show split the manufactured versus the commodity traded products. The three tables are for All Products, Manufactured Products and Commodity Products

```
. iis dirpair
. tis year
```

Total Trade

```
. xtreg lartrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdpca
> p2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =    12241
```

```
R-sq:  within = 0.0698                   Obs per group:  min =     1
        between = 0.7201                   avg =                   11.5
        overall = 0.6555                   max =                   29
```

```
Random effects u_i ~ Gaussian           Wald chi2(18)    =   41343.82
corr(u_i, X) = 0 (assumed)              Prob > chi2      =     0.0000
```

lartrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	-.0829366	.0337628	-2.46	0.014	-.1491106 -.0167627
onein	-.0143428	.0328275	-0.44	0.662	-.0786836 .049998
gsp	.3350335	.0277738	12.06	0.000	.280598 .3894691
regional	.2577653	.0431867	5.97	0.000	.1731209 .3424097
custrict	.5528999	.1423185	3.88	0.000	.2739607 .8318391
ldist	-1.194707	.0237046	-50.40	0.000	-1.241168 -1.148247
lwgdp1	1.011056	.0106555	94.89	0.000	.9901716 1.03194
lwgdp2	.0985097	.0142205	6.93	0.000	.070638 .1263814
lwgdpca	.8106552	.0105901	76.55	0.000	.789899 .8314114
comlang	.0674616	.0142177	4.74	0.000	.0395954 .0953277
border	.4808703	.0431885	11.13	0.000	.3962224 .5655182
landl	.9430023	.1134561	8.31	0.000	.7206324 1.165372
island	-.4680876	.0348903	-13.42	0.000	-.5364712 -.3997039
lareap	.0568802	.0363425	1.57	0.118	-.0143498 .1281103
comcol	-.0718591	.0077827	-9.23	0.000	-.0871128 -.0566053
curcol	.6541991	.0617648	10.59	0.000	.5331424 .7752558
colony	.0420846	.4503025	0.09	0.926	-.8404921 .9246613
_cons	1.436484	.1233997	11.64	0.000	1.194625 1.678343
_cons	-19.35909	.3116234	-62.12	0.000	-19.96986 -18.74832
sigma_u	1.6910701				
sigma_e	1.0313894				
rho	.72887244	(fraction of variance due to u_i)			

Manufacturing Trade

```
. xtreg lmrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdpca
> p2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =    12241
```

```
R-sq:  within = 0.0557                   Obs per group:  min =     1
        between = 0.6002                   avg =                   11.5
        overall = 0.5110                   max =                   29
```

```
Random effects u_i ~ Gaussian           Wald chi2(18)    =   25939.67
corr(u_i, X) = 0 (assumed)              Prob > chi2      =     0.0000
```

lmrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	1.188457	.0864864	13.74	0.000	1.018946 1.357967
onein	.7434526	.0844617	8.80	0.000	.5779107 .9089944
gsp	.3380442	.0646437	5.23	0.000	.2113449 .4647435
regional	.1574927	.109901	1.43	0.152	-.0579094 .3728948
custrict	2.352701	.3143937	7.48	0.000	1.7365 2.968901
ldist	-1.901427	.050233	-37.85	0.000	-1.999881 -1.802972
lwgdp1	2.063049	.0230549	89.48	0.000	2.017862 2.108236
lwgdp2	.0423643	.0305496	1.39	0.166	-.0175118 .1022405
lwgdpca	1.20753	.0229225	52.68	0.000	1.162603 1.252457
comlang	-.0506991	.0305928	-1.66	0.097	-.1106599 .0092616
border	1.220652	.0911529	13.39	0.000	1.041996 1.399309
landl	1.300672	.2395246	5.43	0.000	.8312127 1.770132
island	-.0613939	.0739475	-0.83	0.406	-.2063283 .0835405
lareap	.0063796	.0766904	0.08	0.934	-.1439308 .15669
comcol	-.3586178	.0165859	-21.62	0.000	-.3911257 -.3261099
curcol	.7048702	.1310922	5.38	0.000	.4479342 .9618061
colony	-.0101134	1.155561	-0.01	0.993	-2.274972 2.254745
_cons	1.372044	.2593863	5.29	0.000	.8636567 1.880432
_cons	-44.6074	.680372	-65.56	0.000	-45.9409 -43.27389
sigma_u	3.5149017				



```
sigma_e | 2.7097272
rho      | .62722427 (fraction of variance due to u_i)
```

Commodity Trade

```
. xtreg lcrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdp3 lwgdp4
> p2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =    12241
```

```
R-sq:  within = 0.0177           Obs per group: min =    1
        between = 0.4954         avg           =   11.5
        overall = 0.3940         max           =    29
```

```
Random effects u_i ~ Gaussian           Wald chi2(18)    =   14240.67
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
```

lcrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
bothin	-.1219045	.0827165	-1.47	0.141	-.2840259	.0402169
onein	-.0286105	.0807349	-0.35	0.723	-.1868481	.129627
gsp	.7144736	.0626092	11.41	0.000	.5917618	.8371854
regional	.210059	.1052227	2.00	0.046	.0038263	.4162918
custrict	.2603894	.3062417	0.85	0.395	-.3398332	.8606121
ldist	-1.781364	.0491478	-36.25	0.000	-1.877692	-1.685036
lwgdp1	1.189268	.0225088	52.84	0.000	1.145151	1.233384
lwgdp2	.0644402	.0298508	2.16	0.031	.0059337	.1229466
lwgdp3	1.088832	.0223787	48.65	0.000	1.04497	1.132693
lwgdp4	.0326055	.0298888	1.09	0.275	-.0259739	.0911849
comlang	.7836995	.0892338	8.78	0.000	.6088044	.9585946
border	1.089396	.2344692	4.65	0.000	.6298447	1.548947
landl	-.9372847	.0723521	-12.95	0.000	-1.079092	-.7954772
island	.1985465	.0750782	2.64	0.008	.0513959	.345697
lareap	-.0341411	.01622	-2.10	0.035	-.0659317	-.0023505
comcol	1.001944	.128242	7.81	0.000	.7505946	1.253294
curcol	-.0328169	1.105108	-0.03	0.976	-2.19879	2.133156
colony	1.838851	.2540708	7.24	0.000	1.340881	2.33682
_cons	-28.11181	.6634752	-42.37	0.000	-29.41219	-26.81142

```
sigma_u | 3.4574344
sigma_e | 2.5892608
rho      | .64067816 (fraction of variance due to u_i)
```



A.6 ONEIN: EXPORTER V IMPORTER

This appendix considers the implications of only one country being in the WTO (Onein) but varies if it is the Exporter or Importer.

Total Trade

```
. xtreg lartrade bothin expin impin gsp regional custrict ldlist lwgdp1 lwgdp2 1
> wgdpcap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =   12241
```

```
R-sq:  within = 0.0703                Obs per group:  min =    1
        between = 0.7195                avg   =   11.5
        overall = 0.6549                max   =   29
```

```
Random effects u_i ~ Gaussian           Wald chi2(19)    =  41434.00
corr(u_i, X) = 0 (assumed)              Prob > chi2      =    0.0000
```

lartrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
bothin	-.0850639	.0337585	-2.52	0.012	-.1512293 - .0188985	
expin	-.0860624	.034448	-2.50	0.013	-.153642 - .0184828	
impin	.0640889	.034801	1.84	0.066	-.0041197 .1322976	
gsp	.3353785	.027763	12.08	0.000	.280964 .3897929	
regional	.2583246	.043179	5.98	0.000	.1736954 .3429539	
custrict	.5547004	.1422425	3.90	0.000	.2759102 .8334906	
ldlist	-1.19435	.023689	-50.42	0.000	-1.240779 -1.14792	
lwgdp1	1.014671	.0106621	95.17	0.000	.9937739 1.035569	
lwgdp2	.0975	.0142125	6.86	0.000	.0696441 .1253559	
lwgdp2	.8067369	.0105999	76.11	0.000	.7859615 .8275124	
lwgdp2	.0684164	.0142098	4.81	0.000	.0405658 .0962671	
comlang	.4812259	.0431598	11.15	0.000	.3966343 .5658175	
border	.9432247	.1133806	8.32	0.000	.7210028 1.165447	
landl	-.4680896	.0348674	-13.42	0.000	-.5364284 -.3997508	
island	.0576736	.0363185	1.59	0.112	-.0135094 .1288566	
lareap	-.0717518	.0077777	-9.23	0.000	-.0869959 -.0565078	
comcol	.6539599	.0617245	10.59	0.000	.5329821 .7749377	
curcol	.0423284	.4502296	0.09	0.925	-.8401054 .9247623	
colony	1.436708	.1233165	11.65	0.000	1.195012 1.678404	
_cons	-19.35681	.3114448	-62.15	0.000	-19.96723 -18.74639	
sigma_u	1.6897159					
sigma_e	1.0311653					
rho	.72864162	(fraction of variance due to u_i)				

Manufacturing Trade

```
. xtreg lmrtrade bothin expin impin gsp regional custrict ldlist lwgdp1 lwgdp2 1
> wgdpcap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =   12241
```

```
R-sq:  within = 0.0562                Obs per group:  min =    1
        between = 0.6000                avg   =   11.5
        overall = 0.5118                max   =   29
```

```
Random effects u_i ~ Gaussian           Wald chi2(19)    =  26017.19
corr(u_i, X) = 0 (assumed)              Prob > chi2      =    0.0000
```

lmrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
bothin	1.194532	.0864694	13.81	0.000	1.025056 1.364009	
expin	.9663926	.0886588	10.90	0.000	.7926244 1.140161	
impin	.4998805	.0894528	5.59	0.000	.3245563 .6752048	
gsp	.3369549	.0646315	5.21	0.000	.2102795 .4636303	
regional	.1560869	.109876	1.42	0.155	-.059266 .3714399	
custrict	2.349018	.31434	7.47	0.000	1.732923 2.965113	
ldlist	-1.902601	.0502253	-37.88	0.000	-2.00104 -1.804161	
lwgdp1	2.053225	.023082	88.95	0.000	2.007985 2.098464	
lwgdp2	.0420234	.0305447	1.38	0.169	-.0178431 .1018899	
lwgdp2	1.218509	.0229572	53.08	0.000	1.173514 1.263504	
lwgdp2	-.0507588	.0305878	-1.66	0.097	-.1107098 .0091923	
comlang	1.219557	.0911388	13.38	0.000	1.040928 1.398186	
border	1.299633	.2394873	5.43	0.000	.8302466 1.76902	
landl	-.0615335	.0739358	-0.83	0.405	-.2064451 .0833781	
island	.0042119	.0766789	0.05	0.956	-.146076 .1544998	
lareap	-.3590264	.0165834	-21.65	0.000	-.3915292 -.3265236	
comcol	.7051148	.1310715	5.38	0.000	.4482194 .9620101	
curcol	-.0110191	1.155292	-0.01	0.992	-2.27535 2.253312	
colony	1.371576	.2593464	5.29	0.000	.8632667 1.879886	
_cons	-44.61257	.6802576	-65.58	0.000	-45.94585 -43.27929	
sigma_u	3.5150121					
sigma_e	2.7095509					
rho	.62726939	(fraction of variance due to u_i)				



Commodity Trade

```
. xtreg lcrtrade bothin expin impin gsp regional custrict ldlist lwgdp1 lwgdp2 1
> wgdpcap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair            Number of groups =    12241
```

```
R-sq:  within = 0.0180                Obs per group: min =      1
        between = 0.4948                avg =                11.5
        overall = 0.3935                max =                29
```

```
Random effects u_i ~ Gaussian           Wald chi2(19)    =   14274.95
corr(u_i, X) = 0 (assumed)              Prob > chi2      =    0.0000
```

```
-----+-----
```

lcrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	-.1250441	.0827117	-1.51	0.131	-.287156 .0370678
expin	-.1375458	.0847664	-1.62	0.105	-.3036849 .0285934
impin	.0901404	.0855295	1.05	0.292	-.0774942 .2577751
gsp	.7152847	.0625827	11.43	0.000	.5926248 .8379445
regional	.2110365	.1052099	2.01	0.045	.0048288 .4172441
custrict	.2623945	.306065	0.86	0.391	-.3374818 .8622708
ldlist	-1.780771	.0491137	-36.26	0.000	-1.877033 -1.68451
lwgdp1	1.194148	.0225241	53.02	0.000	1.150002 1.238295
lwgdp2	.064342	.029831	2.16	0.031	.0058743 .1228097
lwgdp2	1.0834	.0224015	48.36	0.000	1.039494 1.127306
wgdpcap2	.0328145	.0298684	1.10	0.272	-.0257264 .0913555
comlang	.7842339	.0891704	8.79	0.000	.609463 .9590047
border	1.089842	.2343027	4.65	0.000	.6306176 1.549067
landl	-.9372571	.0723016	-12.96	0.000	-1.078966 -.7955485
island	.199598	.0750251	2.66	0.008	.0525515 .3466446
lareap	-.0339553	.016209	-2.09	0.036	-.0657244 -.0021863
comcol	1.001881	.1281531	7.82	0.000	.7507051 1.253056
curcol	-.0327104	1.105006	-0.03	0.976	-2.198481 2.133061
colony	1.839007	.2538862	7.24	0.000	1.341399 2.336615
_cons	-28.10863	.6630717	-42.39	0.000	-29.40823 -26.80903
sigma_u	3.4545723				
sigma_e	2.5890941				
rho	.64032643	(fraction of variance due to u_i)			

```
-----+-----
```



A.7 GSP BY DIRECTION & PRODUCT TRADE

This appendix confirms that GSP appears to have a positive influence no matter the direction of trade or type of product.

Using All Goods

```
. xtreg lartrade bothin onein gspdir gsprevdir regional custrict ldist lwgdp1 lwgdp2cap1 lwgdp2cap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =   12241
```

```
R-sq:  within = 0.0698                Obs per group:  min =    1
        between = 0.7201                avg   =   11.5
        overall = 0.6555                max   =   29
```

```
Random effects u_i ~ Gaussian          Wald chi2(19)   =  41347.75
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
```

lartrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
bothin	-.0829585	.0337629	-2.46	0.014	-.1491326 -.0167845	
onein	-.0143661	.0328276	-0.44	0.662	-.0787071 .0499749	
gspdir	.3476976	.0364638	9.54	0.000	.2762299 .4191653	
gsprevdir	.3239102	.0346859	9.34	0.000	.2559271 .3918932	
regional	.2578246	.0431868	5.97	0.000	.17318 .3424691	
custrict	.5528171	.1423124	3.88	0.000	.27389 .8317442	
ldist	-1.194736	.0237032	-50.40	0.000	-1.241193 -1.148278	
lwgdp1	1.011399	.0106734	94.76	0.000	.9904797 1.032319	
lwgdp2cap1	.0995658	.0143584	6.93	0.000	.0714238 .1277078	
lwgdp2	.8102768	.0106138	76.34	0.000	.7894741 .8310794	
lwgdp2cap2	.066322	.0143733	4.61	0.000	.0381508 .0944932	
comlang	.4808218	.043186	11.13	0.000	.3961788 .5654648	
border	.94309	.1134494	8.31	0.000	.7207333 1.165447	
landl	-.4681477	.0348884	-13.42	0.000	-.5365276 -.3997677	
island	.0568711	.0363403	1.56	0.118	-.0143546 .1280969	
lareap	-.0718555	.0077822	-9.23	0.000	-.0871084 -.0566026	
comcol	.6543511	.0617618	10.59	0.000	.5333002 .775402	
curcol	.0420649	.4503035	0.09	0.926	-.8405138 .9246436	
colony	1.436336	.1233924	11.64	0.000	1.194491 1.678181	
_cons	-19.35764	.311621	-62.12	0.000	-19.96841 -18.74688	
sigma_u	1.6909507					
sigma_e	1.0313917					
rho	.72884369	(fraction of variance due to u_i)				

Using Manufactured Goods

```
. xtreg lmrtrade bothin onein gspdir gsprevdir regional custrict ldist lwgdp1 lwgdp2cap1 lwgdp2cap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =   12241
```

```
R-sq:  within = 0.0557                Obs per group:  min =    1
        between = 0.6001                avg   =   11.5
        overall = 0.5108                max   =   29
```

```
Random effects u_i ~ Gaussian          Wald chi2(19)   =  25940.21
corr(u_i, X) = 0 (assumed)            Prob > chi2     =    0.0000
```

lmrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
bothin	1.188599	.0864866	13.74	0.000	1.019088 1.358109	
onein	.7435873	.0844618	8.80	0.000	.5780451 .9091295	
gspdir	.2826887	.0857947	3.29	0.001	.1145341 .4508433	
gsprevdir	.3878859	.0822146	4.72	0.000	.2267482 .5490236	
regional	.1572932	.1099014	1.43	0.152	-.0581095 .3726959	
custrict	2.353109	.314397	7.48	0.000	1.736902 2.969316	
ldist	-1.901317	.0502337	-37.85	0.000	-1.999773 -1.802861	
lwgdp1	2.061595	.023103	89.23	0.000	2.016314 2.106876	
lwgdp2cap1	.0372992	.0309825	1.20	0.229	-.0234254 .0980237	
lwgdp2	1.209146	.0229816	52.61	0.000	1.164103 1.254189	
lwgdp2cap2	-.0453646	.0310723	-1.46	0.144	-.1062652 .0155361	
comlang	1.220855	.0911543	13.39	0.000	1.042196 1.399514	
border	1.300362	.2395277	5.43	0.000	.8308959 1.769827	
landl	-.0611803	.0739487	-0.83	0.408	-.206117 .0837564	
island	.0064159	.0766913	0.08	0.933	-.1438963 .1567281	
lareap	-.3586461	.0165862	-21.62	0.000	-.3911544 -.3261378	
comcol	.7042994	.131095	5.37	0.000	.4473579 .9612408	
curcol	-.0100157	1.155562	-0.01	0.993	-2.274876 2.254845	
colony	1.372535	.2593899	5.29	0.000	.8641397 1.880929	
_cons	-44.61294	.6804016	-65.57	0.000	-45.9465 -43.27938	
sigma_u	3.5149636					
sigma_e	2.7097374					
rho	.62723075	(fraction of variance due to u_i)				



Using Commodity Trade

```
. xtreg lcrtrade bothin onein gspdir gspreaddir regional custrict ldist lwgdp1 lwgdp2
> lwgdp2 lwgdp2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =   12241
```

```
R-sq:  within = 0.0177                Obs per group:  min =    1
        between = 0.4955                avg   =   11.5
        overall = 0.3940                max   =   29
```

```
Random effects u_i ~ Gaussian          Wald chi2(19)   =  14251.57
corr(u_i, X) = 0 (assumed)            Prob > chi2    =    0.0000
```

```
-----
```

lcrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	-.1219509	.0827147	-1.47	0.140	-.2840687 .0401669
onein	-.0286544	.080734	-0.35	0.723	-.1868901 .1295813
gspdir	.6879122	.0829618	8.29	0.000	.52531 .8505143
gspreaddir	.7387374	.0794286	9.30	0.000	.5830602 .8944145
regional	.2101916	.1052184	2.00	0.046	.0039674 .4164158
custrict	.260717	.3061281	0.85	0.394	-.339283 .8607171
ldist	-1.78129	.0491254	-36.26	0.000	-1.877574 -1.685006
lwgdp1	1.188573	.0225452	52.72	0.000	1.144385 1.232761
lwgdp2	.0619421	.0302433	2.05	0.041	.0026663 .1212179
lwgdp2	1.089605	.0224262	48.59	0.000	1.045651 1.133559
lwgdp2	.0351856	.0303254	1.16	0.246	-.0242511 .0946224
comlang	.7837965	.0891923	8.79	0.000	.6089828 .9586102
border	1.089203	.2343598	4.65	0.000	.629866 1.54854
landl	-.9372103	.0723193	-12.96	0.000	-1.078954 -.7954671
island	.1985495	.075043	2.65	0.008	.051468 .3456311
lareap	-.0341626	.0162128	-2.11	0.035	-.0659391 -.0023862
comcol	1.001714	.128185	7.81	0.000	.7504759 1.252952
curcol	-.0330116	1.105084	-0.03	0.976	-2.198937 2.132914
colony	1.839038	.2539496	7.24	0.000	1.341306 2.33677
_cons	-28.11401	.6632369	-42.39	0.000	-29.41393 -26.81409
sigma_u	3.4555424				
sigma_e	2.5892708				
rho	.64042432	(fraction of variance due to u_i)			

```
-----
```



A.8 INDUSTRIAL V DEVELOPING COUNTRIES

This appendix presents the analysis that confirms the Subramanian & Wei Industrial v Developing Core Regression 5, page 25 of that paper.

Considering all trade

```
. xtreg lartrade im_i_b_wto im_iwto_nexp im_d_b_wto im_dwto_nexp gsp regional custrict ldi
> st lwgdp1 lwgdp2 lwgdp3 lwgdp4 comlang border landl island lareap comcol curcol co
> lony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =    12241
```

```
R-sq:  within = 0.0708                Obs per group:  min =     1
        between = 0.7199                avg =    11.5
        overall = 0.6551                max =     29
```

```
Random effects u_i ~ Gaussian          Wald chi2(20)    =   41560.50
corr(u_i, X) = 0 (assumed)            Prob > chi2      =     0.0000
```

lartrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
im_i_b_wto	.1921695	.056782	3.38	0.001	.0808788 .3034603
im_iwto_nexp	.4868055	.0591102	8.24	0.000	.3709517 .6026594
im_d_b_wto	-.0024156	.015127	-0.16	0.873	-.0320641 .0272328
im_dwto_nexp	.0235766	.0246895	0.95	0.340	-.0248138 .0719671
gsp	.2977995	.0285409	10.43	0.000	.2418604 .3537385
regional	.2557286	.0431676	5.92	0.000	.1711217 .3403355
custrict	.5225861	.142169	3.68	0.000	.24394 .8012321
ldist	-1.18925	.0237608	-50.05	0.000	-1.23582 -1.14268
lwgdp1	1.020339	.0107489	94.92	0.000	.9992715 1.041407
lwgdp2	.0940029	.0142228	6.61	0.000	.0661268 .121879
lwgdp3	.8018303	.0106059	75.60	0.000	.7810432 .8226175
lwgdp4	.0380936	.0159891	2.38	0.017	.0067555 .0694316
comlang	.4857938	.0431402	11.26	0.000	.4012405 .570347
border	.9633824	.1133599	8.50	0.000	.741201 1.185564
landl	-.4844187	.0349569	-13.86	0.000	-.5529329 -.4159045
island	.0498693	.0363403	1.37	0.170	-.0213563 .1210949
lareap	-.0757186	.0078624	-9.63	0.000	-.0911286 -.0603086
comcol	.6746416	.0618747	10.90	0.000	.5533693 .7959139
curcol	.0428044	.4501026	0.10	0.924	-.8393804 .9249893
colony	1.391612	.1235764	11.26	0.000	1.149406 1.633817
_cons	-19.16035	.3144937	-60.92	0.000	-19.77675 -18.54396
sigma_u	1.6884546				
sigma_e	1.0308372				
rho	.72847216	(fraction of variance due to u_i)			

Considering Manufactured Products

```
. xtreg lmrtrade im_i_b_wto im_iwto_nexp im_d_b_wto im_dwto_nexp gsp regional custrict ldi
> st lwgdp1 lwgdp2 lwgdp3 lwgdp4 comlang border landl island lareap comcol curcol co
> lony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =    12241
```

```
R-sq:  within = 0.0554                Obs per group:  min =     1
        between = 0.6020                avg =    11.5
        overall = 0.5131                max =     29
```

```
Random effects u_i ~ Gaussian          Wald chi2(20)    =   26039.04
corr(u_i, X) = 0 (assumed)            Prob > chi2      =     0.0000
```

lmrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
im_i_b_wto	.980513	.1238567	7.92	0.000	.7377583 1.223268
im_iwto_nexp	.2486206	.1314657	1.89	0.059	-.0090474 .5062887
im_d_b_wto	.3381327	.0386411	8.75	0.000	.2623975 .4138679
im_dwto_nexp	-.2358294	.0629261	-3.75	0.000	-.3591623 -.1124964
gsp	.2654705	.0665596	3.99	0.000	.135016 .3959249
regional	.1474931	.1098866	1.34	0.180	-.0678807 .3628669
custrict	2.407698	.3135478	7.68	0.000	1.793156 3.022241
ldist	-1.865313	.050264	-37.11	0.000	-1.963829 -1.766798
lwgdp1	2.086192	.0231854	89.98	0.000	2.04075 2.131635
lwgdp2	.0304091	.0304889	1.00	0.319	-.0293481 .0901663
lwgdp3	1.21905	.0229348	53.15	0.000	1.174099 1.264001
lwgdp4	-.1446214	.0346661	-4.17	0.000	-.2125658 -.0766771
comlang	1.220615	.0908599	13.43	0.000	1.042532 1.398697
border	1.305039	.2388161	5.46	0.000	.836968 1.77311
landl	-.0798927	.0739836	-1.08	0.280	-.2248979 .0651126
island	-.0102973	.0765243	-0.13	0.893	-.1602821 .1396876
lareap	-.3796071	.0167223	-22.70	0.000	-.4123823 -.3468319
comcol	.7716033	.1309804	5.89	0.000	.5148864 1.02832
curcol	-.024034	1.155422	-0.02	0.983	-2.28862 2.240552



colony	1.286039	.2591367	4.96	0.000	.7781402	1.793937
_cons	-43.67747	.6868815	-63.59	0.000	-45.02373	-42.3312
sigma_u	3.5009316					
sigma_e	2.7100836					
rho	.62529845	(fraction of variance due to u_i)				

Considering Commodity Products

```
. xtreg lcrtrade im_i_b_wto im_iwto_nexp im_d_b_wto im_dwto_nexp gsp regional custrict ldi
> st lwgdp1 lwgdp2 comlang border landl island lareap comcol curcol co
> lony
```

Random-effects GLS regression Number of obs = 141073
Group variable (i) : dirpair Number of groups = 12241

R-sq: within = 0.0184 Obs per group: min = 1
 between = 0.4939 avg = 11.5
 overall = 0.3928 max = 29

Random effects u_i ~ Gaussian Wald chi2(20) = 14312.77
corr(u_i, X) = 0 (assumed) Prob > chi2 = 0.0000

lcrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
im_i_b_wto	.0345593	.1209924	0.29	0.775	-.2025814	.2717001
im_iwto_nexp	.5039348	.1280462	3.94	0.000	.2529688	.7549008
im_d_b_wto	.0095101	.0369699	0.26	0.797	-.0629495	.0819697
im_dwto_nexp	.0235512	.0602326	0.39	0.696	-.0945026	.141605
gsp	.6856098	.0645232	10.63	0.000	.5591466	.8120729
regional	.2084936	.1052104	1.98	0.048	.0022849	.4147023
custrict	.2203791	.3059881	0.72	0.471	-.3793466	.8201048
ldist	-1.783335	.049291	-36.18	0.000	-1.879944	-1.686727
lwgdp1	1.195336	.0226869	52.69	0.000	1.15087	1.239801
lwgdp2	.0624249	.0298575	2.09	0.037	.0039053	.1209444
comlang	1.080181	.0224351	48.15	0.000	1.036209	1.124153
border	.0207571	.0339031	0.61	0.540	-.0456918	.0872059
landl	.7872034	.0891591	8.83	0.000	.6124548	.9619519
island	1.102636	.2343321	4.71	0.000	.6433537	1.561919
lareap	-.9487519	.0725503	-13.08	0.000	-1.090948	-.806556
comcol	.1972777	.0750944	2.63	0.009	.0500954	.3444601
curcol	-0.0343474	.0163907	-2.10	0.036	-.0664725	-.0022222
colony	1.008533	.1284373	7.85	0.000	.7568004	1.260266
_cons	-.0263435	1.10488	-0.02	0.981	-2.191869	2.139182
colony	1.814327	.2544543	7.13	0.000	1.315606	2.313048
_cons	-28.03896	.6710026	-41.79	0.000	-29.3541	-26.72382
sigma_u	3.4530689					
sigma_e	2.5886366					
rho	.64020732	(fraction of variance due to u_i)				



A.9 ROBUSTNESS CHECKS

This appendix presents the robustness checks.

The WTA Benchmark for Manufactured Products

```
. iis dirpair
. tis year

. xtreg lmrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdp3
> p2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   141073
Group variable (i) : dirpair           Number of groups =   12241
```

```
R-sq:  within = 0.0557                Obs per group:  min =    1
        between = 0.6002                avg   =   11.5
        overall = 0.5110                max   =   29
```

```
Random effects u_i ~ Gaussian          Wald chi2(18)    = 25939.67
corr(u_i, X) = 0 (assumed)            Prob > chi2      = 0.0000
```

lmrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	1.188457	.0864864	13.74	0.000	1.018946 1.357967
onein	.7434526	.0844617	8.80	0.000	.5779107 .9089944
gsp	.3380442	.0646437	5.23	0.000	.2113449 .4647435
regional	.1574927	.109901	1.43	0.152	-.0579094 .3728948
custrict	2.352701	.3143937	7.48	0.000	1.7365 2.968901
ldist	-1.901427	.050233	-37.85	0.000	-1.999881 -1.802972
lwgdp1	2.063049	.0230549	89.48	0.000	2.017862 2.108236
lwgdp2	.0423643	.0305496	1.39	0.166	-.0175118 .1022405
lwgdp3	1.20753	.0229225	52.68	0.000	1.162603 1.252457
lwgdp4	-.0506991	.0305928	-1.66	0.097	-.1106599 .0092616
comlang	1.220652	.0911529	13.39	0.000	1.041996 1.399309
border	1.300672	.2395246	5.43	0.000	.8312127 1.770132
landl	-.0613939	.0739475	-0.83	0.406	-.2063283 .0835405
island	.0063796	.0766904	0.08	0.934	-.1439308 .15669
lareap	-.3586178	.0165859	-21.62	0.000	-.3911257 -.3261099
comcol	.7048702	.1310922	5.38	0.000	.4479342 .9618061
curcol	-.0101134	1.155561	-0.01	0.993	-2.274972 2.254745
colony	1.372044	.2593863	5.29	0.000	.8636567 1.880432
_cons	-44.6074	.680372	-65.56	0.000	-45.9409 -43.27389
sigma_u	3.5149017				
sigma_e	2.7097272				
rho	.62722427	(fraction of variance due to u_i)			

Using the trade data pre 1992

```
. gen l91mrtrade = lmrtrade if year<1992
(112651 missing values generated)
```

```
. xtreg l91mrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdp3
> cap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   52339
Group variable (i) : dirpair           Number of groups =   10054
```

```
R-sq:  within = 0.0258                Obs per group:  min =    1
        between = 0.5823                avg   =    5.2
        overall = 0.5152                max   =   21
```

```
Random effects u_i ~ Gaussian          Wald chi2(18)    = 14893.77
corr(u_i, X) = 0 (assumed)            Prob > chi2      = 0.0000
```

l91mrtrade	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
bothin	.7178028	.1372727	5.23	0.000	.4487532 .9868523
onein	.3425942	.1309664	2.62	0.009	.0859048 .5992837
gsp	.5788509	.0789115	7.34	0.000	.4241873 .7335145
regional	.6064383	.2555494	2.37	0.018	.1055707 1.107306
custrict	3.557525	.4378558	8.12	0.000	2.699343 4.415706
ldist	-1.872898	.0607581	-30.83	0.000	-1.991982 -1.753814
lwgdp1	2.04739	.0288012	71.09	0.000	1.990941 2.10384
lwgdp2	.1399405	.0372911	3.75	0.000	.0668513 .2130297
lwgdp3	1.159564	.0286145	40.52	0.000	1.103481 1.215648
lwgdp4	-.1113443	.0376939	-2.95	0.003	-.1852229 -.0374657
comlang	1.234769	.1074108	11.50	0.000	1.024248 1.445291
border	1.263387	.2857953	4.42	0.000	.7032383 1.823535
landl	-.0329652	.090601	-0.36	0.716	-.2105399 .1446096
island	-.0241535	.0896398	-0.27	0.788	-.1998443 .1515373
lareap	-.3593412	.0198807	-18.07	0.000	-.3983066 -.3203758
comcol	.8597008	.1592804	5.40	0.000	.5475168 1.171885
curcol	-1.40309	2.745345	-0.51	0.609	-6.783866 3.977687
colony	1.610268	.288111	5.59	0.000	1.04558 2.174955
_cons	-43.43825	.8748557	-49.65	0.000	-45.15294 -41.72357



```
-----
sigma_u | 3.7199119
sigma_e | 2.6131153
rho     | .66958612 (fraction of variance due to u_i)
-----
```

Using the trade data post 1991

```
. gen l92mrtrade = lmrtrade if year > 1991
(70939 missing values generated)
```

```
. xtreg l92mrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdp3
> cap2 comlang border landl island lareap comcol curcol colony
```

```
Random-effects GLS regression           Number of obs   =   88734
Group variable (i) : dirpair           Number of groups =   11741

R-sq:  within = 0.0120                 Obs per group:  min =    1
        between = 0.5912                avg   =    7.6
        overall = 0.5122                max   =    22

Random effects u_i ~ Gaussian           Wald chi2(18)   =  17945.05
corr(u_i, X) = 0 (assumed)             Prob > chi2     =    0.0000
```

```
-----
l92mrtrade |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----+-----
bothin     |   .5757278   .1579525     3.64  0.000     .2661467   .8853089
onein      |   .4240869   .1558231     2.72  0.006     .1186792   .7294946
gsp        |   .6142494   .0780145     7.87  0.000     .4613437   .7671551
regional   |   .3547947   .1329441     2.67  0.008     .0942229   .6153604
custrict   |   1.977541   .3283705     6.02  0.000     1.333947   2.621136
ldist      |  -1.81108    .0521227    -34.74 0.000    -1.912959 -1.708641
lwgdp1     |   1.852891   .0247734     74.79 0.000     1.804336   1.901446
lwgdp2     |   1.422187   .0323626     4.39  0.000     .0787892   2.056481
lwgdp3     |   1.059679   .0246152     43.05 0.000     1.011434   1.107924
lwgdp3cap2 |  -.0084233   .0324565     -0.26 0.795    -.0720368   .0551903
comlang    |   1.198584   .0937482    12.79 0.000     1.014841   1.382327
border     |   1.333431   .2435324     5.48  0.000     .8561168   1.810746
landl      |  -.233613    .0766035     -3.05 0.002    -.3837532  -.0834728
island     |   .0511935   .0792127     0.65  0.518    -.1040606   .2064476
lareap     |  -.2706806   .0174321    -15.53 0.000    -.3048468  -.2365144
comcol     |   .6091645   .1369616     4.45  0.000     .3407248   .8776043
curcol     |   .0318831   1.175382     0.03  0.978    -2.271823   2.335589
colony     |   1.371117   .2638015     5.20  0.000     .8540757   1.888159
_cons      |  -39.37941   .7453481    -52.83 0.000    -40.84027  -37.91856
-----
sigma_u    |  3.5612677
sigma_e    |  2.3742406
rho        |  .69229654 (fraction of variance due to u_i)
-----
```

Cross Sectional 1995

```
. gen l85mrtrade = lmrtrade if year == 1985
(174046 missing values generated)
```

```
. reg l85mrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdp2 lwgdp3
> p2 comlang border landl island lareap comcol curcol colony
```

```
-----
Source |      SS       df       MS              Number of obs =   6827
-----+-----
Model  | 147310.778    18     8183.9321          F( 18, 6808) =  410.07
Residual | 135869.30   6808    19.9573002          Prob > F       =  0.0000
-----+-----
Total  | 283180.078   6826    41.485508          R-squared      =  0.5202
                                           Adj R-squared  =  0.5189
                                           Root MSE      =  4.4674
-----
```

```
-----
l85mrtrade |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
bothin     |   .8395849   .2559526     3.28  0.001     .3378377   1.341332
onein      |   .4683946   .2569397     1.82  0.068    -.0352876   .9720768
gsp        |   .7507518   .124687     6.02  0.000     .5063263   .9951772
regional   |   1.648569   .4245652     3.88  0.000     .8162884   2.480849
custrict   |   3.455627   .7421264     4.66  0.000     2.000828   4.910427
ldist      |  -1.902873   .0831582    -22.88 0.000    -2.065889 -1.739857
lwgdp1     |   2.086474   .0402996    51.77 0.000     2.007474   2.165474
lwgdp2     |   1.2322853  .0514956    24.11 0.000     1.131378   1.332327
lwgdp3     |   1.184568   .0396208    29.90 0.000     1.106899   1.262237
lwgdp3cap2 |  -.290023    .0519051    -5.59 0.000    -.3917733  -.1882727
comlang    |   1.297742   .1427601    9.09  0.000     1.017887   1.577596
border     |   1.193477   .3726121     3.20  0.001     .4630405   1.923913
landl      |  -.2562803   .1250235     -2.05 0.040    -.5013653  -.0111952
island     |  -.013661    .1189476     -0.11 0.909    -.2468355   .2195135
lareap     |  -.3566166   .0264295    -13.49 0.000    -.4084268  -.3048065
comcol     |   .7805785   .2270273     3.44  0.001     .335534   1.225623
curcol     |  -1.158113    3.181017    -0.36 0.716    -7.393901   5.077675
colony     |   1.568524   .3467473     4.52  0.000     .8887915   2.248257
_cons      |  -44.43272   1.221444   -36.38 0.000    -46.82713  -42.0383
-----
```



Cross Sectional 1999

```
. gen l99mrtrade = lmrtrade if year== 1999
(158431 missing values generated)
```

```
. reg l99mrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdpcap1 lwgdp2 lwgdpcap2
> p2 comlang border landl island lareap comcol curcol colony
```

Source	SS	df	MS	Number of obs =	19578
Model	307357.837	17	18079.8728	F(17, 19560) =	876.28
Residual	403572.246	19560	20.6325279	Prob > F =	0.0000
				R-squared =	0.4323
				Adj R-squared =	0.4318
Total	710930.083	19577	36.3145571	Root MSE =	4.5423

199mrtrade	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
bothin	-.3907749	.3069563	-1.27	0.203	-.9924354 .2108856
onein	-.5380439	.3112984	-1.73	0.084	-1.148215 .0721275
gsp	.3957468	.0847554	4.67	0.000	.2296189 .5618747
regional	1.50858	.2301259	6.56	0.000	1.057514 1.959647
custrict	1.867399	.363592	5.14	0.000	1.154728 2.580071
ldist	-1.658833	.0538192	-30.82	0.000	-1.764323 -1.553342
lwgdp1	1.999955	.0242713	82.40	0.000	1.952381 2.047529
lwgdpcap1	.0240014	.0305751	0.78	0.432	-.0359284 .0839311
lwgdpcap2	.8383081	.0242951	34.51	0.000	.7906876 .8859285
lwgdpcap2	.082001	.0307848	2.66	0.008	.0216602 .1423418
comlang	1.122249	.090398	12.41	0.000	.9450617 1.299437
border	.8863347	.2797651	3.17	0.002	.3379713 1.434698
landl	-.120597	.0726297	-1.66	0.097	-.2629575 .0217634
island	.1979076	.0761064	2.60	0.009	.0487326 .3470826
lareap	-.2699944	.0165274	-16.34	0.000	-.3023895 -.2375993
comcol	.6820274	.1351081	5.05	0.000	.4172039 .9468509
curcol	(dropped)				
colony	1.869915	.322226	5.80	0.000	1.238325 2.501505
_cons	-38.10001	.8298536	-45.91	0.000	-39.7266 -36.47343

Using Rose areg sandwich variance

```
. areg lmrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdpcap1 lwgdp2 lwgdpcap2
> 2 comlang border landl island lareap comcol curcol colony , robust cluster(dirpair) a(yea
> r)
```

Regression with robust standard errors

Number of obs = 141073
F(18,141040) = 1166.67
Prob > F = 0.0000
R-squared = 0.5149
Adj R-squared = 0.5148
Root MSE = 4.2552

(standard errors adjusted for clustering on dirpair)

lmrtrade	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]
bothin	.5130084	.2163669	2.37	0.018	.0889336 .9370833
onein	.3134612	.21504	1.46	0.145	-.108013 .7349355
gsp	.5218316	.0714979	7.30	0.000	.3816971 .6619661
regional	.9669761	.2229961	4.34	0.000	.529908 1.404044
custrict	3.040614	.3231561	9.41	0.000	2.407235 3.673994
ldist	-1.741271	.0497067	-35.03	0.000	-1.838695 -1.643846
lwgdp1	1.970562	.0244852	80.48	0.000	1.922572 2.018553
lwgdpcap1	.1243682	.0308335	4.03	0.000	.0639351 .1848013
lwgdpcap2	1.074965	.0238188	45.13	0.000	1.02828 1.121649
lwgdpcap2	-.0617267	.0312845	-1.97	0.048	-.1230438 -.0004097
comlang	1.245241	.085267	14.60	0.000	1.078119 1.412363
border	1.036749	.2079044	4.99	0.000	.62926 1.444237
landl	-.1431227	.0731736	-1.96	0.050	-.2865415 .0002961
island	.0094259	.0747041	0.13	0.900	-.1369926 .1558445
lareap	-.3080892	.0163047	-18.90	0.000	-.3400461 -.2761324
comcol	.7455895	.1505397	4.95	0.000	.4505346 1.040644
curcol	-.9680441	.9663719	-1.00	0.316	-2.862114 .9260262
colony	1.402686	.1917164	7.32	0.000	1.026926 1.778446
_cons	-41.69999	.7308507	-57.06	0.000	-43.13245 -40.26754

year | absorbed (15 categories)

Without year variables

```
. reg lmrtrade bothin onein gsp regional custrict ldist lwgdp1 lwgdpcap1 lwgdp2 lwgdpcap2
> comlang border landl island lareap comcol curcol colony , robust cluster(dirpair)
```

Regression with robust standard errors

Number of obs = 141073
F(18, 12240) = 1160.26
Prob > F = 0.0000
R-squared = 0.5138
Root MSE = 4.2598

Number of clusters (dirpair) = 12241

Robust

