NBER WORKING PAPER SERIES

DOES THE WTO MAKE TRADE MORE STABLE?

Andrew K. Rose

Working Paper 10207
http://www.nber.org/papers/w10207

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2004

B.T. Rocca Jr. Professor of International Business, Haas School of Business at the University of California, Berkeley, NBER Research Associate, and CEPR Research Fellow. This paper was inspired by a comment from James Harrison during a seminar at the European University Institute. I thank Richard Baldwin for comments, and the Monetary Authority of Singapore for hospitality. The data sets, sample output, and a current version of this paper are available at my website. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

Does the WTO Make Trade More Stable?
Andrew K. Rose
NBER Working Paper No. 10207
January 2004
JEL No. F13

ABSTRACT

I examine the hypothesis that membership in the World Trade Organization (WTO) and its predecessor the General Agreement on Tariffs and Trade (GATT) has increased the stability and predictability of trade flows. I use a large data set covering annual bilateral trade flows between over 175 countries between 1950 and 1999, and estimate the effect of GATT/WTO membership on the coefficient of variation in trade computed over 25-year samples, controlling for a number of factors. I also use a comparable multilateral data set. There is little evidence that membership in the GATT/WTO has a significant dampening effect on trade volatility.

Andrew K. Rose
Haas School of Business
University of California
Berkeley, CA 94720-1900
and NBER
arose@haas.berkeley.edu

Executive Summary/Introduction

In this short paper, I search for evidence that countries in the World Trade Organization (WTO) and its predecessor the General Agreement on Tariffs and Trade (GATT) experience more stable trade. I find no consistent substantial differences in trade volatility between GATT/WTO insiders and outsiders: membership does not appear to bring the privilege of predictability.

1: Motivation

This paper is motivated by the following statements, all taken from the website of the WTO (italics added):

> **"**The World Trade Organization (WTO) is the only international organization dealing with the global rules of trade between nations. *Its main function is to ensure that trade flows as smoothly, predictably and freely as possible.* The result is assurance…"[1]
>
> "*The multilateral trading system is an attempt by governments to make the business environment stable and predictable*."[2]
>
> "Non-discrimination is just one of the key principles of the WTO's trading system. Others include: transparency (clear information about policies, rules and regulations); *increased certainty about trading conditions* (commitments to lower trade barriers and to increase other countries' access to one's markets are legally binding) …"[3]
>
> "Just as important as freer trade — perhaps more important — are other principles of the WTO system. For example: non-discrimination, and *making sure the conditions for trade are stable, predictable and transparent*."[4]

[1] http://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr00_e.htm
[2] http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm
[3] http://www.wto.org/english/thewto_e/whatis_e/10ben_e/10b08_e.htm
[4] http://www.wto.org/english/thewto_e/whatis_e/10mis_e/10m02_e.htm

> "One important way in which countries can demonstrate their *commitment to policy stability, predictability and good governance* is through membership of the WTO."[5]

I test below whether membership in the GATT/WTO has actually been associated with decreased trade volatility, which I equate with an increase in the predictability of trade. That is, I ask: "Is membership in the GATT/WTO associated with more stable trade flows?" This topic is of intrinsic interest for businesses and countries involved in international trade. Since the WTO rationalizes its existence in part through its purported effect on trade stability, it should also of interest to international policymakers.

Though there is a small amount of related research, there is, to my knowledge, no previous work that addresses this issue. In Rose (2004), I ask an analogous question concerning the first-moment: "Does membership in the GATT/WTO affect the *level* of trade?" While I found the answer to be essentially negative, Subramanian and Wei (2003), hereafter "SW", dispute my conclusions. I now extend the debate to consider the stability of trade, taking special account of the salient criticisms of SW.

2: Empirical Methodology

Estimating Equation

I use a version of the conventional "gravity" model of bilateral international trade. Many economists have used the gravity model to estimate the effects of various institutions and policies and variables on bilateral trade flows; see e.g., Rose (2004) and SW. Though it was designed to study the level of trade flows rather than their volatility,

[5] Speech by WTO DG Moore, available at: http://www.wto.org/english/news_e/spmm_e/spmm86_e.htm

it seems a natural starting place to investigate second moments. In particular, I estimate versions of:

$$s(X_{ijt})_t / \mu(X_{ijt})_t = \gamma_i \mu(WTO_{it})_t + \gamma_j \mu(WTO_{jt})_t + ß_0 \mu(GSP_{ijt})_t + \beta_1 \mu(FTA_{ijt})_t + \beta_2 \mu(CU_{ijt})_t$$
$$+ \beta_3 \ln D_{ij} + \beta_{4,I} \mu(Y_{it})_t + \beta_{4,j} \mu(Y_{jt})_t + \beta_{5,i} s(Y_{it})_t + \beta_{5,j} s(Y_{jt})_t + \beta_{6,i} \mu(Pop_{it})_t + \beta_{6,j} \mu(Pop_{jt})_t$$
$$+ \beta_7 Lang_{ij} + \beta_8 Cont_{ij} + \beta_9 Landl_{ij} + \beta_{10} Island_{ij} + \beta_{11} \log(Area_i Area_j) + \beta_{12} ComCol_{ij}$$
$$+ \beta_{13} \mu(CurCol_{ijt})_t + \beta_{14} Colony_{ij} + \beta_{15} ComNat_{ij} + \Sigma_t \phi_t T_t + \varepsilon_{ijt}$$

where i denotes the exporter, j denotes the importer, t denotes a year, t denotes a time period (twenty-five years is the default), and the variables are defined as:

- $s(\bullet)_t$ and $\mu(\bullet)_t$ denote the standard deviation and mean operators, computed over period t, so that e.g., $\mu(Z_t)_t = (1/T)\ S_t Z_t$ for t in t,
- X_{ijt} denotes the natural logarithm of real exports from i to j at time t,
- WTO_i is a binary "dummy" that is one if i is a GATT/WTO member, and zero otherwise,
- GSP_{ij} is a binary variable that is one if i extends the GSP to j or *vice versa*,
- FTA is a binary variable that is unity if i and j both belong to the same regional trade agreement,
- CU is a binary variable which is unity if i and j use the same currency at time t,
- D is the distance between i and j,
- Y is the natural logarithm of real GDP
- Pop is log population,
- Lang is a binary "dummy" variable which is unity if i and j have a common language and zero otherwise,
- Cont is a binary variable which is unity 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,

- ComCol is a binary variable which is unity if i and j were ever colonies after 1945 with the same colonizer,
- CurCol is a binary variable which is unity if i and j are colonies at time t,
- Colony is a binary variable which is unity if i ever colonized j or *vice versa*,
- ComNat is a binary variable which is unity if i and j remained part of the same nation during the sample (e.g., France and Guadeloupe),
- $\{T_t\}$ is a comprehensive set of time "fixed effects",
- β and ϕ are vectors of nuisance coefficients, and
- ε_{ij} represents the omitted other influences on bilateral trade, assumed to be well behaved.

This is a reasonably conventional setup, with two differences from the traditional gravity model of trade. First, it is estimated over time periods of twenty-five years, rather than (say) annually. I do this since the question of interest to me concerns the determination of trade *volatility*, and volatility must be estimated over time. The second exception is related; the dependent variable is the coefficient of variation for the natural logarithm of real bilateral exports, not the (log of the) level of (real bilateral) trade.[6] My strategy is to regress this on period-averages of the gravity variables (and also the period-volatilities of output) in order to control for other potential determinants of trade instability, above and beyond GATT/WTO membership. I also use three other measures of trade volatility as robustness checks.

The two parameters of interest to me are γ_i and γ_j. The first coefficient measures the effect of *exporter* membership in the GATT/WTO on the stability of i's exports to j, while the second coefficient measures the effect of *importer* membership. If membership in the GATT/WTO is associated with more stable trade policy, then the coefficients should be

[6] An example may clarify things. I generate the variable by first computing the log of real bilateral exports from (say) Australia to (say) Austria, which is available annually between (say) 1950 and 1974. Using those twenty-five annual observations, I compute the sample standard deviation of (the log of real Australian) exports (to Austria between 1950 and 1974). I then scale this by the analogously-computed sample average of (the log of real Australian) exports (to Austria between 1950 and 1974), to arrive at the coefficient of variation.

negative, since membership would be associated with less volatile trade and hence a lower coefficient of trade variation.[7]

Estimation Technique

My equation is estimated using two mutually exclusive and jointly exhaustive twenty-five-year intervals (1950 through 1974, and 1975-1999), derived from fifty years of underlying annual data. I show below how my results vary when I use five- and ten-year periods instead of twenty-five-year periods.

I estimate my equation in a number of different ways. First, I use simple OLS on the pooled data set (denoted "pooled" below). SW, Anderson and van Wincoop (2003) and others have criticized this estimation technique, since it does not take into account fixed *country-specific* effects. Thus I follow SW in relying more heavily on estimates which include two comprehensive sets of *country*-specific intercepts, one each for exporters and importers ("fixed importer and exporter effects"). Third, I use conventional panel estimators, adding *country pair-specific* ("dyadic") fixed effects. Finally, as a sensitivity check, I also model the country pair-specific effects as being random rather than fixed. In terms of confidence, I follow the profession in placing most confidence in the fixed effects estimators; I have no clear ranking between country-specific and country pair-specific effects.

Throughout, I compute robust covariance matrices so as to account for heteroskedasticity (clustering with respect to dyads to account for this source of dependency), and I always include period-specific intercepts.

[7] SW argue that the effects of GATT/WTO membership on the levels of trade should be stronger for importers than exporters, so there may be reason to believe that $?_j$ can be more reliably expected to be negative.

Since countries joined the GATT/WTO over time, my fixed effects estimators show the effect of accession on trade volatility, holding constant all observed and unobserved country- or country-pair effects. A negative, economically and statistically significant estimate of ($?_i$, ?j) indicates that exporters and importers that have joined the GATT/WTO enjoy dampened trade volatility compared with their pre-accession days. When I pool my data across both time and countries without including fixed effects, I add variation across countries to this across-time variation. That is, the pooled regressions answer the question "Do countries outside the GATT/WTO experience different trade volatility from insiders?"

Data Sources

The trade data for the regressand comes from the "Direction of Trade" (DoT) CD-ROM data set developed by the International Monetary Fund (IMF). It covers bilateral merchandise trade between 178 IMF trading entities between 1950 and 1999 (with gaps). (Not all the trading entities are "countries" in the traditional sense of the word; I use the word simply for convenience.) I include all countries for which the IMF provides data, so that almost all global trade is covered. Bilateral trade on FOB exports and CIF imports is recorded in American dollars; I deflate trade by the American CPI for all urban consumers (1982-1984=100; taken from www.freelunch.com). An average value of bilateral exports between a pair of countries is created by averaging both of the measures potentially available (exports from i to j and imports into j from i).[8]

GATT/WTO membership is taken from the website of the WTO.[9] Population and real GDP data (in constant American dollars) have been obtained from standard sources: the Penn

[8] I also drop all observations where the coefficient of variation was either negative or greater than ten.
[9] Available at http://www.wto.org/english/thewto_e/gattmem_e.htm

World Table mark 6.1 wherever possible, otherwise the World Bank's *World Development Indicators*, and the IMF's *International Financial Statistics*. I exploit the CIA's *World Factbook* for a number of country-specific variables.[10] These include: latitude and longitude, land area, landlocked and island status, physically contiguous neighbors, language, colonizers, and dates of independence. I use these to create great-circle distance and the other controls. I add information on whether the pair of countries was involved in a currency union, using Rose (2004). I obtain data from the World Trade Organization to create an indicator of regional trade agreements, and include: ASEAN, EEC/EC/EU; US-Israel FTA; NAFTA; CARICOM; PATCRA; ANZCERTA; CACM, SPARTECA, and Mercosur.[11] My GSP data is taken from and described by Rose (2004).

Appendix 1 tabulates the countries covered in this data set, along with the date of GATT/WTO accession, while the second appendix provides descriptive statistics.

3: Results

Benchmark Estimates

Benchmark results are tabulated in Table 1. There are four sets of estimates, corresponding to the four estimation techniques (pooled, country-specific fixed effects for both exporters and importers, dyadic fixed effects, and dyadic random effects). None provides compelling evidence that GATT/WTO membership reduces trade volatility significantly.

The simplest and most straightforward estimation technique is shown on the left-hand side; OLS on the pooled data set. The good news is that exporters who are members of the GATT/WTO enjoy less volatile trade. This effect is statistically significant; the robust t-statistic

[10] Available at http://www.odci.gov/cia/publications/factbook/index.html
[11] Available at http://www.wto.org/english/tratop_e/region_e/region_e.htm

is 4.2. Still, it is puzzling that importers inside the GATT/WTO experience significantly *more* volatile trade (the t-statistic is 2.8). Further, the combined size of membership is small. If both the exporter and importer are GATT/WTO members, the coefficient of export variation falls from a sample average of .181 by (-.024+.015=) .009 to .172, an amount which is economically and statistically insignificant (the t-statistic for the combined effect is 1.1).

Still, it seems reasonable to place more weight on the estimates that include country-specific intercepts (for both exporters and importers, following SW). These results are even more puzzling; GATT/WTO membership for either the exporter or the importer *increases* volatility, albeit by economically small (but statistically significant) amounts.[12] Results which use dyadic effects – either fixed or random – deliver economically and statistically marginal reductions in trade volatility.[13]

Thus at first glance, it seems that membership in the GATT/WTO has no detectable strong effect on trade volatility; there is no clear sign of a significant reduction in the coefficient of variation for exports. Nevertheless, this message comes with two caveats. First, it should be noted that less than a fifth of the variation in the dependent variable is explained with the equation; that is, the model does not fit the data well. Indeed, none of the estimation techniques I examine explain much of the variation in trade volatility. Gravity is a model of trade flows, not trade volatilities. A better model of trade volatility could, in principle, deliver more positive results for GATT/WTO membership.

A second important caution concerns the questions that can be addressed by the data. It seems that countries that join the GATT/WTO do not experience more stable trade than they did

[12] If both the exporter and importer are GATT/WTO members, trade volatility is estimated to rise by .07, with a t-statistic of 3.1.

[13] Joint membership by both sides lowers trade volatility by .031 (t-statistic of 1.7) with fixed effects, and by .023 (t-statistic of 2.1) with random effects.

before accession. In principle, the system could still have increased stability, *if it has provided the public good of trade stability for both members and non-members equally*. Since the world has had the GATT/WTO since 1948, we do not have data from a world without the system. Thus the hypothesis that the very existence of the system has stabilized trade for all is untestable, and accordingly cannot be rejected.

Sensitivity Analysis

I now check the sensitivity of the (negative) results in Table 1 to a number of perturbations in the underlying methodology.

Table 2 checks the robustness of the results with respect to the exact sample of observations used to estimate the equation. As the sample changes, so do both the number of observations and the average value of the dependent variable; both are recorded on top of the coefficient estimates. For each sample, I provide results from all four estimation techniques (though the panel techniques can only be used when there are two time periods).

The first two rows tabulate results when the two periods are handled separately. Next I examine only intra-industrial country trade, and then only trade between a pair of developing countries.[14] The next perturbation removes all country-pair observations where either country acceded to the GATT/WTO during the period, so that it was a member for only part of the sample. I next drop all observations where the residual lies over three standard deviations from the mean, in order to reduce the role of outliers. Finally, recall that a number of the variables – including the dependent variable – are period-averages (standard deviations, ...) estimated over a maximum of twenty-five years from underlying annual observations. In my last check, I drop all

[14] I follow SW and classify as industrial countries: Australia; Austria; Belgium; Canada; Denmark; Finland; France; Germany; Greece; Iceland; Ireland; Italy; Japan; Luxembourg; Netherlands; New Zealand; Norway; Portugal; Spain; Sweden; Switzerland; UK: and USA. Developing countries are all others.

(dyad x period) observations which are derived from fewer than fifteen underlying annual observations.

None of these checks provide strong evidence that membership reduces trade volatility, with one potential exception. While the effect of membership on trade volatility is often estimated to be negative, the results are typically economically significant, statistically small, or conflicting in the sense that membership by e.g., the exporter reduces volatility but importer membership is estimated to increase volatility. The one possible exception is when only industrial countries are included in the sample (a group emphasized by SW). In this case, both the pooled and the dyadic random-effect estimators deliver negative coefficients for both exporter and importer membership. These effects are of only moderate statistical significance (indeed the hypothesis that both coefficients equal zero cannot be rejected at the 1% confidence level for any estimator). Still, the estimates are economically non-trivial, and imply large reductions in trade volatility. On the other hand, both the country- and country pair-fixed effects estimators (preferred by both me and SW) imply economically and statistically small effects on volatility.

Table 3 checks the sensitivity of the results by altering the specification of the equation. I first substitute three different regressands for the coefficient of variation. These are, in turn: a) the *maximal* absolute value (during the 25-year sample period) of the difference between the log of real exports and the sample average of exports, scaled by the sample average; b) the *mean* absolute value, again of the difference between exports and their sample average (again, scaled by average exports); and c) the standard deviation of the residual from a conventional gravity equation of exports in levels.[15] Another row tabulates results when I add a lag of the dependent

[15] To elaborate on the latter: I first run a conventional gravity equation, regressing the log of real exports on the log of distance, real GDP and population for both countries, GATT/WTO membership, and other controls. This

variable to the equation (which makes the equation only estimable for the second period). Finally, I drop all the economic controls, that is I set $ß_0 = ß_1 = \ldots = ß_{15} = 0$.

Table 3, like its predecessor, reveals no consistent indication that the negative benchmark results are insensitive to the exact measure of volatility. When dyadic fixed effects are included, the maximal deviation of trade falls by a statistical significant effect if both countries are GATT/WTO members, from a sample average of .313 to .239. This result is sensitive to the estimation technique; it is estimated to be positive but small when country-specific (as opposed to country pair-specific) fixed effects are included. But the effects of GATT/WTO membership on export volatility are otherwise economically small, statistically insignificant, and inconsistent across exporters and importers, or some combination thereof.

Table 4 takes a different tack, and examines the data chopped into more time periods of shorter duration. Dividing the data more finely over time has the advantages of requiring less stationarity in the data (since data moments can change more frequently), and allowing for more time-series variation. On the other hand, each of the (dyad x period) observations is estimated less reliably, since it is derived from fewer underlying observations. The first panel splits the data into five ten-year periods instead of two twenty-five year periods; the second examine ten five-year periods. There are again no reliable indications that membership reduces volatility. While some of the point estimates are negative, many are positive. The only time when both the exporter and importer point estimates are negative is when the data are estimated with the unreliable pooled OLS technique.

Multilateral Evidence

---

regression is run with year effects on annual data pooled across countries; it delivers entirely conventional results. I then use the residuals from this equation to generate period standard deviations for each country pair and time period.

A final way to check the sensitivity of my (non-) result is to move from the bilateral data set to a multilateral approach.

I estimate:

$$s(Z_{ij})_t / \mu(Z_{it})_t = \gamma\, \mu(WTO_{it})_t + \beta_1\, \mu(Y_{it})_t + \beta_2\, s(Y_{it})_t + \beta_3\, \mu(Pop_{it})_t + \beta_4\, s(Pop_{it})_t$$
$$+ \beta_5\, \mu(REMOTE_{it})_t + \beta_6 \mu(CU_{it})_t + \beta_7 \mu(PU_{it})_t$$
$$+ \beta_8 \log(Area_i) + \beta_9 Island_i + \beta_{10} Landl_{ij} + \Sigma_t \phi_t T_t + \varepsilon_{ijt}$$

where the notation is the same as above except that i denotes the country, and the new variables are defined as:

- Z_{it} denotes the natural logarithm of multilateral openness measured at current prices, that is the ratio of exports plus imports to GDP,
- $REMOTE_{it}$ is remoteness, the multilateral analogue to distance, measured as the (log) distance-weighted average of (log) GDP of the rest of the world, that is $S_j(Y_{it}/D_{ij})$;[16] and
- PU is a dummy variable denoting political union (e.g., between a colonizer and a colony).

I use openness data (as well as real GDP and population) from the Penn World Table Mark 6.1. This data set covers 168 countries from 1950 through 2000 (with gaps).

Table 5 provides five different estimates of the coefficient of interest, ?, which represents the effect of GATT/WTO membership on the coefficient of variation for multilateral openness. At the extreme left, I include a comprehensive set of country-specific intercepts as well as period (time) effects. I then successively drop the period effects, the country effects, and the auxiliary regressors (that is, I include country- and period-effects but set $ß_0 = ß_1 = \ldots = ß_{10} = 0$).

[16] Fiji and New Zealand were the most remote countries in 1990, while Austria and Hungary were the least remote.

Finally at the extreme right, I derive the dependent variable from openness measured in constant as opposed to current prices (again using data from PWT 6.1).

In all five perturbations, the effect of GATT/WTO membership on trade volatility is statistically insignificant at conventional levels (the largest absolute t-statistic for ? is 1.8, when country-effects are removed in the middle of the column). Further, two of the five estimates are positive. There is little clear evidence that joining or belonging to the GATT/WTO dampens multilateral trade volatility.

4: Summary and Conclusion

In this short paper I have searched for indications that membership in the World Trade Organization (WTO) and its predecessor the General Agreement on Trade and Tariffs (GATT) lowers trade volatility. My hunt has been unsuccessful; I find no reliable evidence that membership increases the predictability of trade flows. I use both bilateral and multilateral data sets that span over 175 countries and 50 postwar years. I use a number of different econometric techniques, relying extensively on estimators that include fixed effects, and control for a host of potential factors. Yet despite an extensive search and a number of robustness checks, I have not been able to find strong indications that the GATT/WTO makes trade flows more stable and predictable.

The WTO's goal of making trade flow more predictably for its members is laudable; it is hard to imagine many benefits of trade volatility. It is far from clear that the WTO has achieved this objective.

Table 1: GATT/WTO Membership and Bilateral Trade Stability

	Pooled	Fixed Importer, Exporter Effects	Country-Pair Fixed Effects	Country-Pair Random Effects
Exporter in GATT/WTO	-.024 (.006)	.038 (.016)	-.028 (.010)	-.026 (.006)
Importer in GATT/WTO	.015 (.006)	.036 (.015)	-.003 (.010)	.003 (.006)
GSP	-.105 (.005)	-.088 (.005)	-.041 (.010)	-.077 (.007)
Regional FTA	-.04 (.01)	-.02 (.02)	-.06 (.04)	-.072 (.028)
Monetary Union	-.02 (.01)	-.03 (.02)	.00 (.03)	-.00 (.03)
Log Distance	.051 (.003)	.055 (.003)		.061 (.003)
Mean Exporter GDP	-.052 (.002)	-.091 (.009)	-.044 (.007)	-.061 (.003)
Mean Importer GDP	-.039 (.002)	-.084 (.014)	-.029 (.007)	-.047 (.003)
Std.Dev. Exporter GDP	.014 (.018)	.055 (.014)	.037 (.016)	.022 (.014)
Std.Dev. Importer GDP	.011 (.016)	.081 (.017)	.027 (.016)	.014 (.014)
Mean Pop. Exporter	-.037 (.002)	.011 (.011)	-.017 (.013)	-.042 (.002)
Mean Pop. Importer	-.024 (.002)	-.020 (.012)	-.003 (.013)	-.028 (.002)
Language	-.014 (.005)	-.022 (.006)		-.020 (.011)
Border	-.02 (.01)	-.01 (.01)		-.01 (.03)
Landlocked	.025 (.006)	-.24 (.06)		.04 (.01)
Island	.007 (.005)	-.22 (.06)		.01 (.01)
Product Area	.004 (.001)	-.013 (.006)		.004 (.002)
Common Colonizer	-.06 (.01)	-.06 (.01)		-.06 (.01)
Current Colony	-.03 (.02)	-.05 (.03)	.02 (.06)	.01 (.05)
Ever Colony	-.02 (.01)	-.02 (.01)		-.03 (.03)
Common Country	-.05 (.04)	-.06 (.04)		-.08 (.26)
R^2	.11	.16	.07	.10

Number of Observations = 26,312.
Robust standard errors in parentheses. Time effects included in all regressions.
Regressand is coefficient of variation in log of real bilateral trade: standard deviation/mean. Sample average = .181.
Variables computed over non-overlapping 25-year intervals from annual data, 1950-1999.

Table 2: GATT/WTO Membership and Bilateral Trade Stability: Sample Sensitivity Analysis

	Pooled	Importer, Exporter Country Effects	Country-Pair Fixed Effects	Country-Pair Random Effects
Period 1, 1950-1974 (mean regressand= .111; 10,908 observations)				
Exporter in GATT/WTO	-.002 (.002)			
Importer in GATT/WTO	-.000 (.002)			
Period 2, 1975-1999 (mean regressand= .220; 19,922 observations)				
Exporter in GATT/WTO	-.043 (.009)			
Importer in GATT/WTO	.018 (.009)			
Only Industrial Countries (mean regressand= .042; 924 observations)				
Exporter in GATT/WTO	-.013 (.006)	-.001 (.008)	-.006 (.005)	-.011 (.004)
Importer in GATT/WTO	-.011 (.005)	.001 (.006)	-.004 (.005)	-.009 (.004)
Only Developing Countries (mean regressand=.235; 17,551 observations)				
Exporter in GATT/WTO	-.030 (.008)	.031 (.023)	-.045 (.017)	-.030 (.009)
Importer in GATT/WTO	.026 (.008)	.032 (.021)	-.009 (.018)	.012 (.009)
No Partial Sample GATT/WTO Members (mean regressand=.186; 18,673 observations)				
Exporter in GATT/WTO	-.035 (.008)	.156 (.062)	.013 (.153)	-.025 (.008)
Importer in GATT/WTO	.009 (.007)	.111 (.046)	.042 (.153)	.010 (.008)
Without 3-s outliers (mean regressand=.155; 26,065 observations)				
Exporter in GATT/WTO	-.010 (.002)	-.000 (.005)	-.020 (.004)	-.016 (.003)
Importer in GATT/WTO	.013 (.002)	.013 (.005)	-.002 (.004)	.005 (.003)
At least 15 underlying observations (mean regressand=.113; 16,191 observations)				
Exporter in GATT/WTO	-.019 (.003)	-.015 (.005)	-.016 (.004)	-.017 (.003)
Importer in GATT/WTO	.007 (.003)	.000 (.005)	.008 (.004)	.007 (.003)

Regressand is coefficient of variation in log of real bilateral trade: standard deviation/mean.
Same (unrecorded) controls as in Table 1; time effects always included.
Robust standard errors in parentheses.
Variables computed over non-overlapping 25-year intervals from annual data, 1950-1999.

Table 3: GATT/WTO Membership and Bilateral Trade Stability: Specification Sensitivity Analysis

	Pooled	Importer, Exporter Country Effects	Country-Pair Fixed Effects	Country-Pair Random Effects
Maximal Deviation as regressand (mean regressand= .313; 30,830 observations)				
Exporter in GATT/WTO	-.023 (.007)	.010 (.018)	-.056 (.013)	-.029 (.008)
Importer in GATT/WTO	.031 (.007)	.013 (.019)	-.018 (.013)	.014 (.008)
Mean Absolute Deviation as regressand (mean regressand= .140; 30,830 observations)				
Exporter in GATT/WTO	-.019 (.005)	.027 (.012)	-.024 (.008)	-.021 (.005)
Importer in GATT/WTO	.013 (.004)	.024 (.012)	-.004 (.008)	.002 (.005)
Standard Deviation of Gravity Residual as regressand (mean regressand=1.15; 25,857observations)				
Exporter in GATT/WTO	-.114 (.014)	.001 (.036)	-.123 (.028)	-.119 (.014)
Importer in GATT/WTO	.035 (.013)	.070 (.034)	.019 (.028)	.027 (.014)
Add lagged regressand to Period 2, 1975-1999 (mean regressand=.220; 19,922 observations)				
Exporter in GATT/WTO	.212 (.052)			
Importer in GATT/WTO	-.027 (.007)			
Without any controls (mean regressand=.181; 30,830 observations)				
Exporter in GATT/WTO	-.055 (.005)	.053 (.015)	-.045 (.009)	-.047 (.006)
Importer in GATT/WTO	.005 (.005)	.062 (.014)	.007 (.009)	.008 (.006)

Regressand is coefficient of variation in log of real bilateral trade: standard deviation/mean.
Same (unrecorded) controls as in Table 1; time effects always included.
Robust standard errors in parentheses.
Variables computed over non-overlapping 25-year intervals from annual data, 1950-1999.

Table 4: GATT/WTO Membership and Bilateral Trade Stability: Different Period Lengths

	Pooled	Importer, Exporter Country Effects	Country-Pair Fixed Effects	Country-Pair Random Effects
Ten-Year Periods (mean regressand=.125; 48,774 observations)				
Exporter in GATT/WTO	-.024 (.003)	.009 (.005)	-.009 (.003)	-.017 (.003)
Importer in GATT/WTO	-.002 (.003)	.004 (.005)	.009 (.003)	.001 (.003)
Five-Year Periods (mean regressand=.104; 88,084 observations)				
Exporter in GATT/WTO	-.018 (.003)	.004 (.003)	-.007 (.002)	-.012 (.002)
Importer in GATT/WTO	.000 (.002)	.006 (.003)	.007 (.002)	.004 (.002)

Regressand is coefficient of variation in log of real bilateral trade: standard deviation/mean.
Same (unrecorded) controls as in Table 1; time effects always included.
Robust standard errors in parentheses.
Variables computed over non-overlapping intervals from annual data, 1950-1999.

Table 5: GATT/WTO Membership and Multilateral Trade Stability

	Country Fixed Effects Period Effects	Country Fixed Effects	Period Effects	Country Fixed Effects Period Effects	Country Fixed Effects Period Effects Regressand in Constant Prices
Country in GATT/WTO	-.01 (.01)	-.01 (.01)	-.01 (.01)	.00 (.01)	.02 (.02)
Mean GDP	-.02 (.02)	-.02 (.02)	-.008 (.003)		-.04 (.02)
Std.Dev. GDP	.02 (.05)	.02 (.05)	.04 (.02)		.09 (.05)
Mean Population	.02 (.07)	.01 (.01)	.006 (.002)		.03 (.02)
Std.Dev. Population	.07 (.07)	.06 (.07)	.06 (.04)		-.03 (.07)
Remoteness	-.85 (1.39)	-.31 (.45)	-.09 (.13)		-1.9 (1.5)
Monetary Union	-.03 (.02)	-.03 (.02)	-.005 (.005)		-.01 (.03)
Political Union	-.00 (.02)	-.00 (.02)	.002 (.007)		.02 (.02)
Area			.001 (.001)		
Island			.005 (.006)		
Landlocked			-.004 (.005)		
Obs.	267	267	267	269	267
R^2	.68	.68	.24	.64	.99

Robust standard errors in parentheses.
Regressand is coefficient of variation in log of openness ((X+M)/Y) in current prices: standard deviation/mean.
Variables computed over non-overlapping 25-year intervals from annual data, 1950-1999.

References

Anderson, James and Eric van Wincoop (2003) "Gravity with Gravitas: A Solution to the Border Puzzle" *American Economic Review*, 170-192.

Rose, Andrew K. (2004) "Do We Really Know that the WTO Increases Trade?" forthcoming *American Economic Review*.

Subramanian, Arvind and Shang-Jin Wei (2003) "The WTO Promotes Trade, Strongly but Unevenly" NBER working paper #10,024.

Appendix 1: Countries Included in Bilateral Data Set

(Date of GATT/WTO accession for countries entering before 2000)

Albania
Algeria
Angola (1994)
Antigua and Barbuda (1987)
Argentina (1967)
Armenia
Australia (1948)
Austria (1951)
Azerbaijan
Bahamas
Bahrain (1993)
Bangladesh (1972)
Barbados (1967)
Belarus
Belgium (1948)
Belize (1983)
Benin (1963)
Bermuda
Bhutan
Bolivia (1990)
Botswana (1987)
Brazil (1948)
Bulgaria (1996)
Burkina Faso (1963)
Burma (Myanmar) (1948)
Burundi (1965)
Cambodia
Cameroon (1963)
Canada (1948)
Cape Verde
Central African Rep. (1963)
Chad (1963)
Chile (1949)
China
Colombia (1981)
Comoros
Congo, Dem. Rep. of (Zaire) (1971)
Congo, Rep. (1963)
Costa Rica (1990)
Cote d'Ivoire (Ivory Coast) (1963)
Croatia
Cyprus (1963)
Czech Republic (1993)
Denmark (1950)
Djibouti (1994)
Dominica (1993)
Dominican Rep. (1950)
Ecuador (1996)
Egypt (1970)
El Salvador (1991)
Equatorial Guinea
Estonia (1999)
Ethiopia
Fiji (1993)
Finland (1950)
France (1948)
Gabon (1963)
Gambia (1965)
Georgia
Germany (1951)
Ghana (1957)
Greece (1950)
Grenada (1994)
Guatemala (1991)
Guinea (1994)
Guinea-Bissau (1994)
Guyana (1966)
Haiti (1950)
Honduras (1994)
Hong Kong (1986)
Hungary (1973)
Iceland (1968)
India (1948)
Indonesia (1950)
Iran
Iraq
Ireland (1967)
Israel (1962)
Italy (1950)
Jamaica (1963)
Japan (1955)
Jordan
Kazakhstan
Kenya (1964)
Kiribati
Korea, South (R) (1967)
Kuwait (1963)
Kyrgyz Republic (1998)
Lao People's Dem. Rep.
Latvia (1999)
Lebanon
Lesotho (1988)
Liberia
Libya
Lithuania
Luxembourg (1948)
Macedonia
Madagascar (1963)
Malawi (1964)
Malaysia (1957)
Maldives (1983)
Mali (1993)
Malta (1964)
Mauritania (1963)
Mauritius (1970)
Mexico (1986)
Moldova
Mongolia (1997)
Morocco (1987)
Mozambique (1992)
Namibia (1992)
Nepal
Netherlands (1948)
New Zealand (1948)
Nicaragua (1950)
Niger (1963)
Nigeria (1960)
Norway (1948)
Oman
Pakistan (1948)
Panama (1997)
Papua N. Guinea (1994)
Paraguay (1994)
Peru (1951)
Philippines (1979)
Poland (1967)
Portugal (1962)
Qatar (1994)
Reunion
Romania (1971)
Russia
Rwanda (1966)
Samoa
Sao Tome & Principe
Saudi Arabia
Senegal (1963)
Seychelles
Sierra Leone (1961)
Singapore (1973)
Slovak Republic (1993)
Slovenia (1994)
Solomon Islands (1994)
Somalia
South Africa (1948)
Spain (1963)
Sri Lanka (1948)
St. Kitts & Nevis (1994)
St. Lucia (1993)
St. Vincent & Gren. (1993)
Sudan
Suriname (1978)
Swaziland (1993)
Sweden (1950)
Switzerland (1966)
Syria
Tajikistan
Tanzania (1961)
Thailand (1982)
Togo (1964)
Tonga
Trinidad & Tobago (1962)
Tunisia (1990)
Turkey (1951)
Turkmenistan
Uganda (1962)
Ukraine
United Arab Emirates (1994)
United Kingdom (1948)
United States (1948)
Uruguay (1953)
Uzbekistan
Vanuatu
Venezuela (1990)
Vietnam
Yemen, Republic of
Yugoslavia, Socialist Fed. R. (1966)
Zambia (1982)
Zimbabwe (1948)

Appendix 2: Descriptive Statistics for Bilateral Data Set

	Mean	Standard Deviation
Coefficient of Variation, Log Real Exports	.18	.35
Country in GATT/WTO	.65	.43
GSP Relationship	.17	.34
Regional Trade Arrangement	.01	.09
Monetary Union	.01	.11
Log Distance	8.11	.84
Mean GDP	8.39	1.02
Standard Deviation GDP	.27	.15
Mean Population	9.00	1.81
Common Language	.21	.40
Common Border	.03	.17
Number Landlocked	.28	.49
Number Island States	.34	.54
Log Area Product	23.6	3.54
Common Colonizer	.10	.30
Current Colony	.004	.061
Ever Colony	.02	.14
Common Country	.002	.043
Exports: Maximal Absolute Deviation, Scaled	.31	.48
Exports: Mean Absolute Deviation, Scaled	.14	.28
Standard Deviation of Export Gravity Residual	1.15	.88

Variables computed over non-overlapping 25-year intervals from annual data, 1950-1999.