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**Does the WTO Matter? A Non-parametric  
view**

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## Does the WTO Matter? A Non-parametric view

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### Abstract:

In this study, developing countries and least developed countries are put into two groups: those that are members of the *World Trade Organization* and those that are not. The distribution of trade, foreign direct investment, and patenting is compared between the two groups. In most cases, no statistically significant differences in distribution could be found between members and non-members of the WTO.

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## Introduction

Recent work by Rose (2004, p. 98) has uncovered a provocative finding: “. . . that membership in the GATT/WTO is not associated with enhanced trade, once standard factors have been taken into account.” This finding is puzzling because the very purpose of the *World Trade Organization* is to enhance the international exchange of goods and services, capital, and technology. In this paper, I report similar, but qualified, findings from another perspective. Such similar conclusions reached from different angles should stimulate further research into the sources of the limited real impacts of WTO membership.

Whereas Rose (2004) studies a longer period (1947-1999), a period which largely covers the pre-WTO era, I focus specifically on the WTO era (which officially began January 1st, 1995). This is important if the previous results were driven mostly by the GATT policy environment. Moreover, whereas Rose (2004) focuses exclusively on trade, I focus also on foreign direct investment and patenting, since the WTO covers multinational services as well as intellectual property rights. A study on the role of the WTO should go beyond trade since the WTO is a far-reaching agreement covering many areas. Indeed, three key multilateral agreements define the WTO: *General Agreement on Tariffs and Trade (GATT)*, *General Agreement on Trade in Services (GATS)*, and *Trade Related Aspects of Intellectual Property Rights (TRIPS)*. Signatories to the WTO accept all of these agreements as a single undertaking (i.e. as a package).<sup>1</sup> Finally, I focus on WTO membership among developing and least developed countries, especially since many of these countries had been persuaded that accession would lead to better access to markets and technologies.

Nonetheless, I find that in most cases the distribution of trade, FDI, and patenting among

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<sup>1</sup> For further details on the agreements and history, see WTO (2003).

members of the WTO does not significantly differ from that of non-members. I employ a non-parametric test (namely a rank-sum test) to analyze the effects of WTO membership. Of course, this type of test is no substitute for formal regression analyses.<sup>2</sup> However, the analysis of the raw data is suggestive and should be viewed as a launching point for a more formal inquiry into why, on the surface, WTO members do not have very different patterns of trade, FDI, and patenting.

The next section briefly describes the methodology. The section after that discusses the data, some sample statistics, and the results of the rank-sum tests. The last section provides some concluding thoughts.

### Methodology

The *rank-sum test* is based on comparing two independent samples.<sup>3</sup> One sample consists of countries that are members of the WTO. The other sample consists of non-members. (Conceptually, this methodology is analogous to treatment studies where one group receives “treatment” while the other does not.) The two samples are examined for differences in the distribution of trade, FDI, and patenting activity. An advantage of the test is that no specific assumptions are required about the form of the probability distribution from which the data come.

For illustration, let  $(x_1, \dots, x_m)$  represent the export levels of each of the  $m$  countries that are members of the WTO and  $(y_1, \dots, y_n)$  the export levels of each of the  $n$  countries that are not

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<sup>2</sup> For surveys of empirical work on trade, FDI, and innovation, see Smith (2001) and Fink and Maskus (2005).

<sup>3</sup> See Conover (1999) for details.

members, where  $m$  need not equal  $n$ . Our interest is to test whether the two samples are drawn from the same population. First, combine the observations  $(x_1, \dots, x_m)$  and  $(y_1, \dots, y_n)$ , and order the  $m + n$  observations in ascending order (e.g. lowest levels of exports to highest). Assign the lowest observation the number 1, the second lowest the number 2, and the largest the number  $m + n$ .<sup>4</sup> Let  $S_x$  denote the sum of the ranks of the  $x$  values and  $S_y$  the sum of the ranks of the  $y$  values. Since  $S_x$ ,  $S_y$  are linear functions of each other, the test can be based on either  $S_x$  or  $S_y$ .

Choosing  $S_x$ , if the distributions of the two samples are *identical*,  $S_x$  is normally distributed with *mean*  $S_x^* = m(m + n + 1)/2$  and *variance*  $\sigma^2 = mn(m + n + 1)/12$ . Thus if the actual value of  $S_x$  strays too far from its expected value, the assumption of identical distributions can be rejected. The test-statistic  $z = (S_x - S_x^*) / \sigma$  is compared to the standard normal probability distribution. Thus, if  $z$  is sufficiently large, the null hypothesis that the distributions are identical can be rejected; in this instance, WTO membership makes a difference. In the empirical analysis, I report the *probability value* (or p-value) associated with  $z$  – that is, the probability of falsely rejecting the assumption of identical distributions. Hence the higher the p-value the less likely the WTO makes a difference.

### Empirical Results

To implement the test, I obtained a sample of 158 developing and least developed countries.<sup>5</sup> I then put these countries in four groups: (1) developing nations that joined the WTO in 1995 and

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<sup>4</sup> Tied values are assigned the average of tied rankings.

<sup>5</sup> The classification of developed, developing, and least developed nations is based on the classification in the United Nations Conference of Trade and Development *Handbook of Statistics (2003)* (see [http://www.unctad.org/en/docs/tdstat28\\_enfr.pdf](http://www.unctad.org/en/docs/tdstat28_enfr.pdf), pp. x-xi).

1996, (2) developing nations that are not currently members of the WTO, (3) least developed nations that joined the WTO in 1995 and 1996, and (4) least developed nations that are not currently members of the WTO.<sup>6</sup>

The rank-sum tests are conducted separately for developing nations and for least developed nations. The tests, in particular, compare the distributions of the following variables: merchandise exports, merchandise imports, inward flows of FDI, outward flows of FDI, resident patent applications, and non-resident patent applications. This enables us to determine whether member states have different patterns of trade, FDI, and technology diffusion – all of which WTO agreements address and should in principle influence. Trade and FDI data are from the United Nations Conference on Trade and Development *Handbook of Statistics* and patent filings from the World Intellectual Property Office *Industrial Property Statistics*.

### *Sample Statistics*

Table 1 shows the sample means and standard deviations of the variables of interest by group (including, for comparison, the developed market countries), as well as the sample sizes of the groups. About two-thirds of the developing and least developed countries are members of the WTO. WTO members exhibit higher mean values of trade, FDI, and non-resident patenting (but not resident patenting in the case of developing countries). The issue is whether the “populations” from

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<sup>6</sup> In order to assess the effects of being a member of the WTO for as long a time period as the data would allow, I omit countries that joined after 1996. Membership increased from 129 countries in 1996 to 148 in 2005, with China joining in 2001. Countries that joined after 1996 are not in any of the four groups above.

which the data are drawn are identical or different.

Note that the least developed countries have higher mean levels of non-resident patent filings (i.e. patent applications from abroad) than the developing countries. This is most likely due to the international *Patent Cooperation Treaty (PCT)* system, which enables the same patent to be filed in multiple countries at less cost. Thus, if the same quantity of patents is more or less filed in both developing and least developed countries, the latter would have higher average non-resident filings since there are fewer of them.

### *Test Results*

Table 2 shows the results of the rank-sum tests on the variables of interest. To control for the influences of business cycles, the variables have been averaged over time. Consistent with Rose (2004), I find the distribution of trade (exports or imports) during the period 1996-1999 to be insignificantly different, statistically, between members and non-members of the WTO, for both developing and least developed countries. However, during 2000-2003, the distribution of trade is significantly different between developing countries in the WTO and those outside the WTO. Thus some differences in trade patterns have emerged over time. But among least developed countries, the distribution of trade remains insignificantly different between members and non-members.

The distributions of both inward FDI and outward FDI are insignificantly different between members and non-members of the WTO, for both developing and least developed countries. The result for inward FDI is somewhat puzzling since countries that joined the WTO should have attracted multinational firms to invest in their regions. The result for outward FDI may be somewhat

understandable since, for developing economies, outward FDI is a major undertaking compared to inward FDI (which mostly comes from the OECD). To engage in outward FDI, these economies need to penetrate well-established markets and compete with advanced economy producers. More productive effort is required (beyond changing laws and institutions to comply with WTO obligations) in order to increase the external FDI of these economies.

The distribution of resident patent filings between WTO members and non-members also fails to be significantly different, despite the strengthening of patent rights in member-states through the TRIPS agreement. The transitional arrangements (for implementation of TRIPS) may partly explain some lags in innovation response.

The strengthening of patent rights in developing regions should also affect the incentives for foreigners to bring their new patentable technologies to these regions. But again the results do not show a statistically significant difference in the distribution of non-resident patent filings between WTO members and non-members (for either developing countries or least developed countries).

## Conclusions

Many developing and least developed countries have been members of the WTO since 1995 or 1996. Using recently available data, this study examined whether the distributions of trade, FDI, and patenting significantly differ between members and countries that did not join at all. On one front, the distribution of trade has become noticeably different between developing country members and developing country non-members. For least developed countries, though, the distribution of trade is insignificantly different between members and non-members. Moreover, the distributions



of FDI and patenting are also insignificantly different between members and non-members.

A limitation of the methodology adopted here is that it does not control for factors other than membership in the WTO. Other factors could either reinforce *or offset* the effects of WTO membership on international exchange of goods, services, capital, and technology. Future work should explore the factors that could explain why membership in a large multilateral organization specifically designed to promote non-discriminatory exchange among members has not produced more discernible exchanges.

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Table 1. Sample Statistics 2000-2003

<u>By Group:</u>	<u>Exports</u>	<u>Imports</u>	<u>Inward FDI Flows</u>	<u>Outward FDI Flows</u>	<u>Resident Patent Filings</u>	<u>Non-Resident Patent Filings</u>
Developed Market Nations (Sample Size = 28)	\$143.5 (184.7)	\$166.4 (249.2)	\$25.7 (35.2)	\$29.8 (39.8)	29,427 (76,674)	139,963 (62,124)
Developing Nations (WTO members) (Sample Size = 73)	\$20.7 (39.4)	\$20.6 (39.3)	\$1.82 (4.42)	\$0.74 (3.38)	1,593 (9,614)	52,772 (43,886)
Developing Nations (Non-members) (Sample Size = 37)	\$8.98 (21.7)	\$6.75 (11.6)	\$0.77 (1.58)	\$0.45 (0.90)	1,767 (5,462)	43,960 (31,762)
Least Developed Nations (WTO members) (Sample Size = 29)	\$0.88 (1.72)	\$1.07 (1.58)	\$0.13 (0.25)	\$0.003 (0.009)	1.08 (1.53)	83,172 (57,847)
Least Developed Nations (Non-members) (Sample Size = 19)	\$0.67 (1.07)	\$0.66 (0.77)	\$0.13 (0.26)	\$0.003 (0.006)	1.0 (1.54)	52,525 (54,837)

*Notes: The figures represent the mean values for the respective group, with standard deviations in parentheses. Trade and FDI data are in billions of real 2000 U.S. dollars. Patent data are counts of applications. Due to data constraints, the sample period for the patent data is different (namely 1999-2002) and sample sizes smaller, namely 53 WTO-member developing countries, 18 non-member developing countries, 12 WTO-member least developed nations, and 6 non-member least developed nations.*

Table 2. Rank-sum Test Results

A. 1996-1999:

	Developing Countries <u>WTO Members vs. Non-members</u>	Least Developed Countries <u>WTO Members vs. Non-members</u>
<u>Distribution of:</u>		
Merchandise Exports	Insignificantly Different (p = 70%)	Insignificantly Different (p = 26%)
Merchandise Imports	Insignificantly Different (p = 23%)	Insignificantly Different (p = 15%)

B. 2000-2003:

	Developing Countries <u>WTO Members vs. Non-members</u>	Least Developed Countries <u>WTO Members vs. Non-members</u>
<u>Distribution of:</u>		
Exports	Significantly Different (p = 0.00%)	Insignificantly Different (p = 13%)
Imports	Significantly Different (p = 0.01%)	Insignificantly Different (p = 17%)
Inward FDI Flows	Insignificantly Different (p = 14%)	Insignificantly Different (p = 28%)
Outward FDI Flows	Insignificantly Different (p = 72%)	Insignificantly Different (p = 33%)
Resident Patent Filings	Insignificantly Different (p = 20%)	Insignificantly Different (p = 48%)
Non-Resident Patent Filings	Insignificantly Different (p = 42%)	Insignificantly Different (p = 39%)

*Notes: The null hypothesis is that no difference in distribution of the indicated variable exists between WTO members and non-members. The p-value is provided in parentheses. The values of the row variables were averaged over the specified time periods.*