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What Kinds of Countries Have More Free Trade Partner Countries? : Count Regression Analysis

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Jung Hur and Backhoon Song

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President

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Executive Summary

According to the WTO data for regional trade agreements (RTA), the number of RTA has been exponentially growing since the middle of the 1990s. As a result, many countries these days have had more than one free trade partner country. In this paper, we attempt to find out statistically important characteristics of countries that may explain the frequency of a country's RTA formations and as a result its total number of free trade partner countries. We find that the following country-specific variables are important: distance from equator, government effectiveness, and the low-middle income group countries and regional blocs that countries belong to. In contrast, the following variables are not statistically significant: geographical size of country; upper-middle or high-income group countries; languages and other institutional variables such as political aspects and the stability, law, regulation, and national corruption level. The important implication of the findings is that the current expansion of RTAs may not be linked to a global free trade system because of the peculiarity of countries having multiple RTAs.

Keywords: regional trade agreements; Poisson regression; negative binomial regression; cross section data

JEL Classification: F1

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1990년 중반부터, 지역무역협정의 수는 급속도로 늘어나기 시작했다. 1993년 북미자유무역협정(NAFTA)이 체결되면서 지역무역협정의 중요성이 한층 커졌으며, 1994년 우루과이 라운드가 타결되고 2001년 도하개발어젠다(DDA)가 시작하기 전까지 다자주의협상이 침체되는 등 시대적인 환경 변화도 영향을 주었을 것으로 판단된다.

지금까지의 연구는 자유무역협정 체결에 따른 비용편익분석 등에 의한 경제적 효과가 주를 이루었다. 하지만 무역패턴이 변화하고 있는 근본적 이유를 설명해주진 못했다. 본 논문에서는 경제적 효과보다는 이렇게 자유무역협정의 파트너 수를 늘리려는 이유를 지역무역협정 국가들의 공통된 특징에서 찾아보고자 하는 것이 주목적이다. 우리는 Poisson 회귀분석과 Negative Binomial 회귀분석을 분석의 틀로 사용한다.

분석의 결과, 적도로부터 멀리 떨어진 나라일수록 지역무역협정을 체결하려고 하며, 국가 소득측면에서는 저중소득(low-middle income) 국가가, 그리고 현재 지역무역협정에 가입하고 있는 국가, 즉 지역무역협정의 경험이 있는 국가일수록 추가적인 지역무역협정 체결에 적극적인 것으로 나타난다.

본 논문은 지역무역협정에 소극적인 나라와 적극적인 나라의 차이를 설명함에 있어 지역무역협정 체결국가의 특징을 보여주는 중요한 공헌을 한다. 본 논문이 발견한 중요한 시사점은 현재 늘어나고 있는 지역무역협정은 글로벌 자유무역 시스템과 연결되어 있지 않을 수 있다는 것이다. 다시 말하면, 지역무역협정은 다자주의 통상체제에 대한 디딤돌(building bloc)이 되는 것이 아니라 장애물(stumbling bloc)이 될 수도 있다.

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What Kinds of Countries Have More Free Trade Partner Countries? : Count Regression Analysis

Jung Hur* and Backhoon Song**

I. Introduction

Since the middle of 1990s, we have observed that the formation of regional trade agreements (RTA) among countries has been increasing exponentially. See the following figure for the number of RTAs reported to GATT/WTO since 1958 through 2005.¹⁾

The increasing trend of RTA formation makes the network of trade agreement complicated and many of the RTAs are overlapped. Recently, the phenomena of overlapping RTAs' expansions have been studied by some trade economists. First, economists working on computational general equilibrium (CGE) models have focused on the

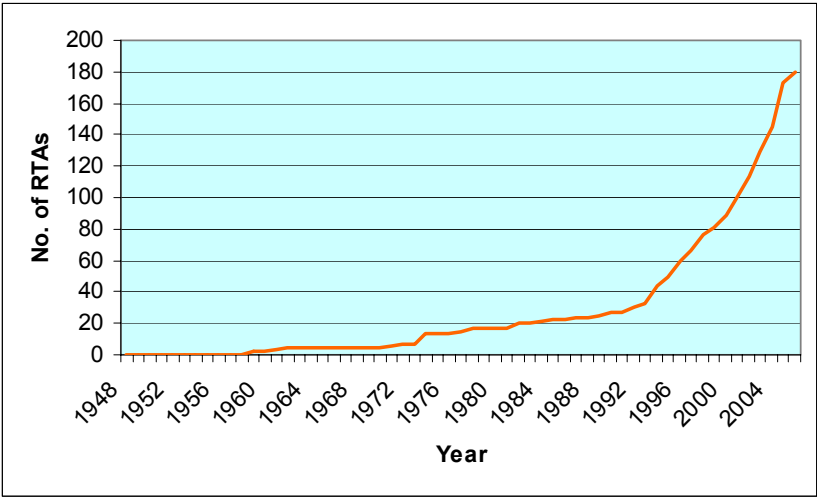
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1) See www.wto.org for more details about the RTAs. The RTAs that we use in our analysis are listed in Appendix A.

economic and welfare effect of hub-and-spoke (HAS) free trade systems. Past CGE studies on HAS systems were conducted by Brown, Kiyota, and Stern (2006), Chong and Hur (2007), Das and Andriamananjara (2006), and Zhai (2006). They calculate the economic benefits and costs of having hub status for a country in overlapping free trade networks. While these are counterfactual analyses, Hur and Alba (2007) empirically investigate the average treatment effect of a country being in a hub position in HAS systems using panel data for free trade agreements (FTAs). Second, there has been an attempt to find out the interdependence of FTAs. Egger and Larch (2006) examine the role of interdependencies of RTAs' membership in a large cross-sectional data set of 15,753 country-pairs. There are some related earlier works as well. For example, Baldwin (1995, 1997) introduced the so-called domino theory of regionalism and argued that countries have a political desire to participate in existing RTAs.

Figure 1. The cumulative numbers of RTA (1958-2005)



Krugman (1991) examined the welfare implications of size of symmetric RTAs. Frankel, Stein, and Wei (1995) contrasted RTA cases where countries within a continent are grouped with low trade costs to other RTA cases of countries across continents with high trade costs.

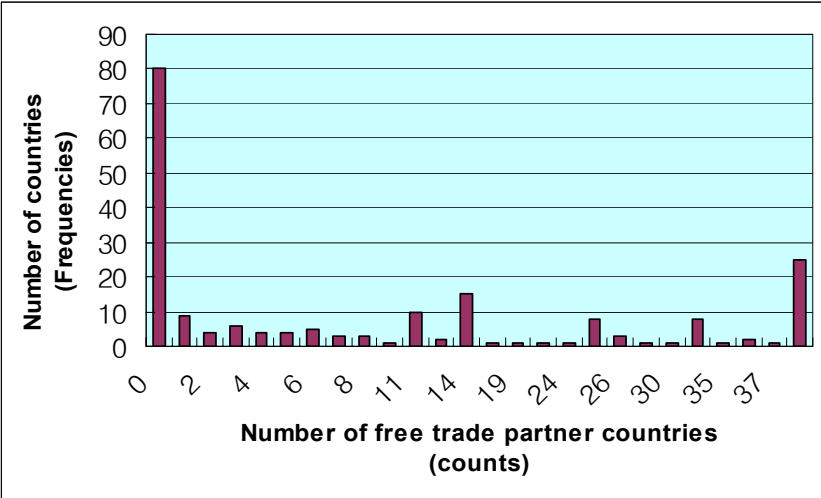
In this paper, unlike the above works where economic incentives of forming overlapping FTAs are considered, we look for a basic fact about the expansions of regional trade agreements. That is, we try to identify country-specific variables that explain a country's frequency of forming RTAs and thus the total number of free trade partner countries. We believe that our paper contributes to the literature on RTAs by providing an elementary but important fact about countries' characteristics which differentiate the countries having more than one free-trade partner country from those that do not. The important implication of the findings of this paper is that the current expansions of RTAs may not be evolved into a global free trade system due to the peculiarity of countries that have multiple RTAs. This means that our findings may support the view that RTAs are stumbling blocs, rather than building blocs.²⁾

To see the statistical facts about the frequency of a country's RTA formations, we can set up count data for a country's free-trade partner countries from the dataset on the WTO Website. That is, when a country forms an RTA with another country through either a bilateral/multilateral RTA or accession to an existing RTA, we count the partner country as one. Then we can easily verify that as of 2005, 120 countries have at least one free-trade partner country and the average number of the free-trade partner countries of a

2) Regarding the issue of regionalism versus multilateralism, see Krishna (1998).

country is 13.28. The following figure shows a clearer picture³⁾ of the count data.

Figure 2. The numbers of free trade partner countries (1958-2005)



First, this paper attempts to conduct an empirical analysis on the determinants of countries’ free-trade partnerships. In particular, we adopt count regression models such as the Poisson regression model and Negative Binomial regression model to examine mean effects on the number of free-trade partner countries that countries have had from 1958 to 2005. The reasons why we use the count regression models are as follows. As in Figure 2, zero event counts are dominant, giving to a skewed distribution. Because of the so-called *law of rare events*, we will use the Poisson regression model. Furthermore, we can

3) See note in Appendix B for the list of 200 countries used in making Figure 2.

easily imagine that there may be a large amount of unobserved heterogeneity in the individual event of the formation of RTAs. The unobserved heterogeneity leads to overdispersion, which means the actual variance of the process exceeds the nominal Poisson variance. The Negative Binomial regression model will take into account the problem of overdispersion.

We consider the following country-specific variables as explanatory variables geographic, institutional, and grouping variables such as income classification, language, and regional trading blocs. While this analysis may not provide the reason *why* countries have expanded their number of free trade partnerships, it certainly tells us *what* sorts of countries have formed RTAs with many partner countries.

We find that countries with the following characteristics tend to have more free trade partner countries: low-middle income group countries, those farther from the equator, those with higher-quality government effectiveness, and those with membership in a regional trading bloc. In contrast, we find that the following variables are not statistically significant: geographical size of country, upper-middle or high-income group countries, languages, and political aspects, and the stability, law, regulations, and national corruption level.

This paper is organized as follows. Section II describes our main econometric models such as the Poisson regression model and Negative Binomial regression model. Section III briefly summarizes the data set and the sources. Section IV discusses our main results from the two models. Section V concludes the paper and mentions some limitations of our approach.

II. Econometric Model: Count Data Models

Since our dependent variable is the number of free-trade partner countries, which is cross-country count data, the appropriate regression is a count regression. In this section, we briefly introduce the Poisson regression model and Negative Binomial regression models based on Cameron and Trivedi (1998) and Wooldridge (2002).⁴⁾

1. Poisson Regression Model

Suppose that y_i is the count variable where $y_i \in \{0, 1, 2, \dots\}$ without upper bound. The Poisson regression model specifies that y_i given explanatory regressors $X_i = \{1, x_{i1}, \dots, x_{ik}\}$ is Poisson distributed with density:

$$f(y_i | X_i) = \frac{\exp(-m_i)(m_i)^{y_i}}{y_i!} \quad \text{and} \quad E(y_i | X_i) = m_i = \exp(X_i' B)$$

This tells us conditional probability for any values of the explanatory variables by plugging estimates of $B = \{\beta_0, \beta_1, \dots, \beta_k\}$ into it.

Given the exponential functions and independent observation, $i \in \{1, \dots, n\}$, the log-likelihood is:⁵⁾

$$\ln L_i(B) = \sum_i^n \{y_i X_i' B - \exp(X_i' B) - \log(y_i!)\}$$

4) See pp. 645-678 in Wooldridge (2002) for more details.

5) Normally, in real estimation, the last term will be dropped for the purpose of computation.

The estimated parameters $B = \{\beta_0, \beta_1, \dots, \beta_k\}$ can be interpreted as follows. Assuming that x_j is continuous, the partial effect is as follows:

$$\frac{\partial E(y_i | X_i)}{\partial x_j} = \exp(X_i' B) \beta_j \rightarrow \beta_j = \frac{\partial E(y_i | X_i)}{\partial x_j} \frac{1}{E(y_i | X_i)}$$

That is, for one unit change of x_j , the percent change in $E(y | X)$ is $100\beta_j$. We will estimate the regression using maximum likelihood estimation.

The Poisson regression model relies on an assumption that the conditional variance and mean are equal as follows:

$$\text{Var}(y_i | X_i) = E(y_i | X_i)$$

This assumption, however, the so-called Poisson variance assumption, is too strong and often can be rejected in many empirical studies. A weaker assumption, the so-called Poisson generalized linear models (GLM) variance assumption is usually retained in real applications:

$$\text{Var}(y_i | X_i) = \delta^2 E(y_i | X_i)$$

This model with the relaxed assumption is called a negative binomial model, or NB1. We may have two possible cases. The first case is overdispersion (relative to the Poisson case) with $\delta^2 > 1$. This is when the variance is greater than the mean, which appears in many empirical applications. When there is overdispersion, the standard

errors for estimators should be inflated by the value of δ . This would reduce the significance level of the estimates. The second case is underdispersion with $\delta^2 < 1$. This is less common, but can be found in some applications.

In our analysis, instead of estimating the value of δ , we will conduct a most commonly used another variant of the negative binomial regression model, called NB2, which take into account the overdispersion problem.

2. Negative Binomial Regression Model

The model specifies that y_i given explanatory regressors $X_i = \{1, x_{i1}, \dots, x_{ik}\}$ is Gamma distributed with density:

$$f(y_i | X_i, \alpha) = \frac{\Gamma(y_i + \alpha^{-1})}{\Gamma(y_i + 1)\Gamma(\alpha^{-1})} \left(\frac{\alpha^{-1}}{\alpha^{-1} + m_i} \right)^{\alpha^{-1}} \left(\frac{m_i}{\alpha^{-1} + m_i} \right)^{y_i},$$

$$E(y_i | X_i) = m_i = \exp(X_i' B) \quad \text{and} \quad \text{Var}(y_i | X_i) = m_i(1 + \alpha m_i) \quad \text{with} \quad \alpha \geq 0.$$

Note that, if $\alpha = 0$, it reduces to the Poisson distribution density. The function Γ is the gamma function defined for r by $\Gamma(r) = \int_0^\infty z^{r-1} \exp(-z) dz$. Since y_i is an integer, we have:

$$\ln \left(\frac{\Gamma(y_i + \alpha^{-1})}{\Gamma(\alpha^{-1})} \right) = \sum_{j=0}^{y_i-1} \ln(j + \alpha^{-1})$$

Substituting this into the Gamma density function, the log-

likelihood function for exponential mean $E(y_i | X_i) = m_i = \exp(X_i' B)$ is,

$$\ln L_i(B, \alpha) = \sum_{i=1}^n \left\{ \sum_{j=0}^{y_i-1} \ln(j + \alpha^{-1}) - \ln(y_i!) - (y_i + \alpha^{-1}) \ln(1 + \alpha \exp(X_i' B)) + y_i \ln \alpha + y_i X_i' B \right\}$$

Using the STATA econometric software package, we will estimate the parameters $B = \{\beta_0, \beta_1, \dots, \beta_k\}$ and overdispersion parameter α .

III. Data

In this section, we briefly summarize the data and their sources used in our regression models.

1. Dependent Variable

We collect the numbers of free-trade partners for all countries (denoted by *totalpta*) during the period of 1958-2005 using the table of *Regional Trade Agreements Notified to the GATT/WTO and in Force By date of entry into force*, provided by WTO Website. The RTAs in our analysis are listed in Appendix A. The total number of countries in our analysis is 174, which are listed in Appendix B. We would like to investigate the determinants that affect the frequencies of countries having a free-trade partner country via the following explanatory variables: geographic variables, institutional variables, and groups that countries belong to. As control variables, we use some measures for economic size.

2. Geographic Variables

The geographic variables used are distance from the equator (*divequ*), using the latitude of countries and country-size by the radius (*rad*) of a circle in kilometers. The geographical variables are obtained from the CIA's *World Factbook*. We take natural log value for the economic and geographic variables in our regression.

3. Institutional Variables

We use the set of institutional variables constructed by Kaufmann, Kraay, and Mastruzzi (2007).⁶⁾ They are voice and accountability (*voice*), political stability (*polit*), government effectiveness (*goveff*), regulatory quality (*regular*), rule of law (*law*), and control of corruption (*corrupt*). *Voice and Accountability* measures the extent of citizen participation in political elections and the decision-making process, as well as in maintaining checks and balances among government institutions. It includes various aspects of political processes, civil liberties, political rights, and the independence of the media. *Political Stability* measures the resilience of government institutions to political shocks, domestic violence, and terrorism, which directly affect the continuity of policies. It includes perception of the possibility of an unconstitutional coup d'état as a result of, among other things, domestic violence and terrorism. *Government Effectiveness* measures the government's capacity to produce public goods, as well as to design and implement sound policies. It includes the quality of the

6) Using a large number of variables measuring perceptions on institutional governance, compiled from 25 separate data sources constructed by 18 different organizations, they estimate six dimensions of institutional governance covering more than 200 countries and territories since 1996. See their website for the data <http://info.worldbank.org/governance/wgi> 2007/home.htm. The point estimates of these measures of quality of institutions range from -2.5 to 2.5; the larger the number is, the higher the quality of institutions will be. Some recent works use these variables as well. Examples are Borrmann, Busse, and Newhous (2006), and Rose and Spiegel (2006).

bureaucracy and public service provision, credibility of the government's commitment to its policies, and the independence of the civil service from political pressures. *Regulatory Quality* measures the quality of various government policies such as market-friendliness. *Rule of Law* measures the fairness and predictability of rules of economic and social interaction, as well as the extent of property rights protection. It includes perceptions on the incidence of crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts. *Control of Corruption* measures perceptions of corruption alleviation in which corruption is defined as the exercise of public power for private gains.

4. Grouping Variables

We group countries based on income levels, language, and RTA blocs using dummy variables.⁷⁾ First, World Bank divides economies with populations of more than 30,000 into four income groups according to 2005 gross national income (GNI) per capita: low-income countries (*lincome*) with \$875 or less; low-middle-income (*lmincome*) with \$875-3,465; upper-middle-income countries (*umincome*) with \$3,466-10,726; and high-income countries (*hincome*) with \$11,116 or more. The low-income dummy is dropped in regression. Second, languages considered in regressions are *Arabic*, *Dutch*, *English*, *French*, *German*, and *Spanish*, based on the *CIA World Factbook*.⁸⁾ We do not consider other languages since they are too peculiar. Lastly, we use RTA blocs,

7) See the following website <http://www.worldbank.org/> for the country classification by income levels.

8) See the list of countries by language in Appendix C.

such as European Community (*ec*), European Free Trade Agreements (*efta*), Association of South East Asian Nations (*asean*), South Asian Preferential Trade Arrangement (*sapta*), North American Free Trade Agreement (*nafta*), Caribbean Community and Common Market (*caricom*), Southern Common Market (*mercosur*), Common Market for Eastern and Southern Africa (*comesa*), and South Pacific Regional Trade and Economic Cooperation Agreement (*sparteca*). The memberships of RTAs are available from the WTO Website and the country list is contained in Appendix D.

5. Control Variables

We use the following variables to control the effects arising from the economic size of countries. The economic size variables are per capita real GDP (*pcapgdp*) in millions of US dollars in 2006; percentages of agricultural sector (*gdpag*), industrial sector (*gdpin*) and service sector (*gdpser*) of 2006 real GDP; and agricultural labor force (*agpop*) as a percentage of total labor force. Since the sum of the shares is one, we drop the GDP share of agricultural sectors. These variables are available from the United Nations Commodity Trade Statistics (UN Comtrade) database.

IV. Main Results

The results from regressions are summarized in Table 1. Table 2 shows Wald tests for joint significance of estimates.

Table 1. Determinants of numbers of free trade partner countries

Explanatory Variables	Dependent Variable: totalpta			
	Poisson Regression Model		NB2 Model	
ln(divequ)	0.5622***	(0.0726)	0.6986***	(0.1877)
ln(rad)	- 0.0263	(0.0317)	0.0097	(0.1104)
voice	0.3572***	(0.0876)	- 0.1725	(0.2860)
polit	- 0.1825***	(0.0649)	- 0.2566	(0.2416)
goveff	0.8835***	(0.1737)	1.8297***	(0.6248)
regular	- 0.0200	(0.1234)	0.0300	(0.4199)
law	- 0.1884	(0.1703)	- 0.1726	(0.5808)
corrupt	- 0.4170***	(0.1325)	- 0.4956	(0.5356)
lmincome	0.8419***	(0.1805)	1.0766**	(0.5072)
umincome	0.9041***	(0.2304)	0.9984	(0.7165)
hincome	0.9393***	(0.2719)	1.0348	(0.9528)
arabic	0.7328***	(0.1299)	0.2147	(0.4361)
english	0.0624	(0.0769)	- 0.0939	(0.3422)
dutch	- 0.1226	(0.1043)	- 0.5598	(0.7132)
french	- 0.3341**	(0.1372)	- 1.3484***	(0.4616)
german	0.2177**	(0.1102)	- 0.0947	(0.6886)
spanish	- 0.0114	(0.1034)	- 0.1632	(0.3751)
ec	0.9131***	(0.0964)	1.1569***	(0.4299)
efta	0.0563	(0.1610)	- 0.1367	(0.7922)
asean	- 1.1951***	(0.3396)	- 1.3848*	(0.7546)
sapta	- 2.4473***	(0.7208)	- 2.4126***	(0.9157)
nafta	- 0.4571**	(0.2049)	0.1596	(0.7429)
caricom	0.5740***	(0.1263)	1.7773***	(0.4657)
mercosur	- 1.1011***	(0.3063)	- 0.4070	(0.6706)
comesa	0.4788***	(0.1277)	0.8050**	(0.3843)
sparteca	- 1.9754***	(0.3474)	- 1.8909***	(0.7325)
ln(pcapgdp)	- 0.1732*	(0.0975)	- 0.7554**	(0.3318)
ln(gdpin)	0.2373*	(0.1293)	0.3993	(0.4418)
ln(gdpser)	1.0039***	(0.2324)	1.5812**	(0.6754)
ln(agpop)	0.0750**	(0.0396)	- 0.0801	(0.1449)
alpha	-		1.0167***	(0.1699)
ln L	-676.5141		-470.2052	
n	174		174	
R2	0.7118		0.1480	

Note: See Section III for the explanatory variables. ln(x) indicates natural log value for x. Next to estimates, the values in parenthesis are standard errors. *, ** and *** indicate 10%, 5% and 1% levels of significance, respectively.

Table 2. Wald test for joint significance of estimates

Hypotheses: Coefficients of the following variables are jointly zero.	Wald Test	
	Poisson Regression Model	NB2 Model
ln(divequ), ln(rad)	Chi2(2) = 61.17 Prob>Chi2 = 0.0000	Chi2(2) = 14.14 Prob>Chi2 = 0.0000
voice, polit, goveff, regular, law, corrupt	Chi2(6) = 87.11 Prob>Chi2 = 0.0000	Chi2(6) = 21.05 Prob>Chi2 = 0.002
lmincome, umincome, hincome	Chi2(3) = 22.92 Prob>Chi2 = 0.0000	Chi2(3) = 5.53 Prob>Chi2 = 0.1371
arabic, english, dutch, french, german, spanish	Chi2(6) = 45.79 Prob>Chi2 = 0.0000	Chi2(6) = 10.08 Prob>Chi2 = 0.1213
ec, efta, asean, sapta, nafta, caricom, mercosur, comesa, sparteca	Chi2(9) = 284.32 Prob>Chi2 = 0.0000	Chi2(9) = 55.60 Prob>Chi2 = 0.0000
ln(pcapgdp), ln(gdpin), ln(gdpser), ln(agpop)	Chi2(4) = 28.69 Prob>Chi2 = 0.00	Chi2(4) = 9.73 Prob>Chi2 = 0.045

1. Poisson Regression Results

First, we use two geographic variables such as the distance from equator and the size of a country. We find that the distance from equator affects positively and significantly the total number of free-trade partner countries of a country on average. We estimate the coefficient as 0.5622 and this can be interpreted as follows: when a country is placed 100 kilometers from equator, it has 1.75 times⁹⁾

9) The incident rate ratio is calculated by $\exp(x)$ where x is an estimate of

more free trade partner countries than a country at the equator. For the other variable, although we find it insignificant, the size of a country affects negatively the total number of free trade partner countries on average. The two geographic variables are jointly significant according to the Wald test.

Second, we consider six different aspects of institutional quality as determinants for the mean of total number of free trade partnerships. We find that voice, accountability, and government effectiveness are important for a country to form RTAs. The estimated coefficients are 0.3572 and 0.8835 respectively, which implies that a country with a one-unit-higher quality of voice, accountability, and government effectiveness tends to have more than RTA countries by 1.43 times and 2.42 times, respectively.¹⁰⁾ In contrast, political stability and control of corruption negatively affect the mean of the total number of free-trade partner countries. The estimated coefficients are -0.1825 and 0.4170 respectively. This means that, on average, a country with a less-stable political situation or more corruption tends to have more free-trade partner countries. One way to interpret this result is that, when a country suffers domestic problems in implementing sound policies or there are conflicts among political parties, the government may try to solve the internal issues by forcing the country to tie itself to international arrangements such as free trade agreements. In this way, the government may facilitate its policy implementation and political stability. Unlike the above variables, regulatory quality and

coefficient.

- 10) Note that the degree of institutional variables is varied between -2.5 and 2.5. So, one-unit change in the variables is a big change across countries.

rule of law are not significant at all in determining the total number of free-trade partner countries, although the estimated coefficients are negative. The Wald test, however, shows that all of the institutional variables are jointly significant (Table 2).

Third, we sort the 174 countries by income level and find that all income grouping variables have significantly positive impact on the mean of the total number of free-trade partner countries. The Wald test shows that the variables are jointly significant as well. This implies that all countries, regardless of their income levels, have increased their number of free-trade partner countries.

Fourth, can language help to understand countries' total number of free-trade partner countries? To see this, we differentiate 174 countries by six languages: Arabic, English, Dutch, French, German, and Spanish (Appendix C).¹¹⁾ We find that the estimated coefficients for Arabic, French, and German are 0.7328, -0.3341, and 0.2177, respectively. We think that there is a very strong distortion effect from France and Germany since they are the members of the European Commission (EC) and their total number of free-trade partner countries is 54, while other French-speaking or German-speaking countries have few free-trade partner countries. In contrast, it is interesting to note that Arabic-speaking countries have a positive mean effect on the total number of free-trade partner countries. Indeed, countries such as Algeria (25), Egypt (25), Jordan (20), Lebanon (25), Morocco (19), Syria (25), and Tunisia (30) are quite active in forming RTAs, with their numbers of free-trade partner countries in parentheses. The Wald test, however, shows that all of

11) Other languages are too minor to capture sufficient number of countries in our analysis.

the language variables are jointly significant.

Fifth, many countries belong to regional trading blocs. Is there any difference between a country in a bloc and one outside of a bloc, in terms of the number of free-trade partner countries? Based on the estimated coefficients, we find that countries in the EC, EFTA, CARICOM, and COMESA tend to have more free-trade partner countries, by 2.49 times, 1.06 times, 1.77 times and 1.61 times, respectively, while countries in ASEAN, SAPTA, NAFTA, MERCOSUR, and SPARTECA tend to form RTAs less frequently than other countries. The estimated coefficients are significant at 1%. The EFTA case, which is statistically insignificant, is a little at odds because its members such as Iceland, Norway, and Switzerland have 26 free-trade partner countries at present. The Wald test shows that all of the regional bloc variables are jointly significant.

Lastly, the control variables of the economic size are important, at least a 10% level of significance. Per capita real GDP level has negative mean effects on the total numbers of a country's free-trade partnerships, while other variables have positive effects. Note that these results may suffer an endogeneity problem. To avoid this problem, we may need to do a panel count data analysis. However, our focus is not on the economic size variables as key explanatory variables, however, but on the non-economic variables such as geographical and institutional characteristics, and some classifications of countries. Nonetheless, we also did a Wald test for the joint significance of the variables and found that they are jointly significant (Table 2).

A more serious problem of the above Poisson regression model is the possibility of overdispersion, in which case the significance of key

estimates might be reduced. For this reason, as we mentioned in Section II, we provide here the results from the Negative Binomial regression model, which takes into account the overdispersion parameter. The results are summarized in Table 1, under the NB2 model, and the Wald tests are provide in Table 2.

2. Negative Binomial Regression Results

The parameter for overdispersion, α is estimated as 1.0167 and the hypothesis that it is zero is rejected.¹²⁾ So, we can verify that the Poisson regression model has the overdispersion problem, which reduces the significance level of estimated coefficients. For this result, we think that the results under NB2 are more reliable than those under the Poisson regression model.

First, unlike the Poisson model, only the distance from equator has a positive and significant impact on countries' formation of RTAs; however, the Wald test shows that the geographic variables are jointly significant. See Table 2 for the results.

Second, unlike the results under the Poisson model, most of the institutional variables lose their significance level, except for government effectiveness. government effectiveness is a highly significant variable. The estimated coefficient is 1.830 and it means that the number of free-trade partner countries for an average country increases by 6.23 times when the degree of variables increases by one unit. Although other variables are individually insignificant, the Wald test shows that the institutional variables are jointly significant.

12) LR test shows that $\chi^2(1)=412.62$ and $\text{Prob}>= \chi^2= 0.00$.

Third, we find that lower-middle-income countries have free-trade partner countries more than countries with other income levels. Higher levels of income grouping variables continue to have a positive impact, but their statistical significance levels are dropped dramatically. Furthermore, unlike the case of the Poisson regression model, the Wald test shows that the income classification variables are jointly insignificant.

Fourth, we find that the estimated coefficient for Arabic is insignificantly positive. This implies that, unlike the case of Poisson regression model, Arabic speaking countries do not necessarily have more free-trade partner countries than countries that speak other languages. We still have French as an important language, however, but we think that this is due to some France-biased effect. All other language estimates, except for French, lose their significance level dramatically. The Wald test also shows that language variables are jointly insignificant. Overall, the results from language variables seem not important in affecting the number of free-trade partner countries for an average country.

Fifth, many regional trading blocs continue to affect countries' total number of free-trade partner countries, although EFTA, NAFTA, and MERCOSUR lost their significance levels in the estimated coefficients. In general, from the results, we can still continue to say that belonging to a regional bloc makes the member countries to have more bilateral trade agreements, compared to countries that do not belong to any blocs. The Wald test shows that the regional bloc variables are jointly significant.

Last, per capita GDP shows an increase in the significance level to 5% and the estimate becomes -0.7554. This implies that, on average,

a country with a low per capita GDP tends to have more free-trade partner countries than one with a high GDP. This result from the NB2 model is consistent with the estimated coefficient of income grouping variables. We find that the estimated coefficient of the low-middle income group countries is 1.0766, which implies that they tend to have free-trade partner countries 2.93 times more than other income group countries. Interestingly, the estimated coefficient for the relative size of service sector out of total GDP is 1.5812 and statistically significant at the 5% level as well. The Wald test shows that the control variables for the effect of size are jointly significant, although the other two variables are individually insignificant.

In sum, we find that countries with the following characteristics tend to have free-trade partner countries more than other countries: low-middle income group countries, a greater distance from equator, with higher quality of government effectiveness, and a membership in a regional trading bloc. In contrast, the following variables are not statistically significant: geographical size of country, upper-middle or high-income groups, languages, political aspects and the stability, law, regulation, and national corruption level.

V. Conclusion

According to the WTO's data for RTAs, the number of RTAs has been exponentially growing since the middle of 1990s. As a result, many countries these days have had multiple RTA memberships. The trend started when the European Community was first established in 1958. As of 2005, 120 countries have at least one free-trade partner country.

In this paper, we asked a simple question: what are the country-specific determinants that explain the total number of free trade partner countries for an average country? To investigate this question, we relied on two count regression models: the Poisson regression and Negative Binomial regression. We find that the following country characteristics are important: distance from equator, government effectiveness, low-middle income level, and membership in regional blocs. In contrast, the following variables are not statistically significant: geographic size, upper-middle or high-income groups, language, and other institutional variables such as political aspects and stability, law, regulation, and national corruption level.

Our paper contributes to the literature on RTAs by providing an elementary but important fact about RTA countries' characteristics which differentiate the countries having more than one free-trade partner country from those that do not. The important implication of the findings is that the current expansions of RTAs may not be linked to a global free-trade system due to the peculiarity of countries having multiple RTAs. This means that our findings may support the view that RTAs are stumbling blocks, rather than building blocks.

While this finding may enable us to understand better the

descriptive types of countries that have been increasing their numbers of free-trade partner countries, our approach is quite limited in many ways. First, it does not provide any answer for *how or why* the countries expand the RTAs. The fact that countries have many free-trade partners implies that some of the countries may play the role of the so-called *hub* of an RTA network. Hub-and-Spoke RTAs can be counted as a structure of RTA expansion with which some countries can continue to increase their numbers of free-trade partner countries. We are not able to see the effect of this structural movement of RTA formation in this paper. Second, given the fact that there are so many RTAs formed around the world, we think of the case in which one RTA influences neighboring countries to form their own RTAs in the future. That is, there is the possibility of interdependence among RTAs. We believe that these two questions are worth answering because RTAs have been both overlapping and spreading spatially.

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Appendix

A: List of Regional Trade Agreements (132 Agreements)

- 1958: European Community (EC)
- 1960: European Free Trade Association (EFTA)
- 1961: Central American Common Market (CACM)
- 1970: EFTA accession of Iceland
- 1971: EC-Overseas Countries and Territories (OCTs)
- 1973: EC-Switzerland and Liechtenstein; EC accession of Denmark, Ireland and United Kingdom; EC-Iceland; EC-Norway; Caribbean Community and Common Market (CARICOM)
- 1976: EC-Algeria
- 1977: Agreement on Trade and Commercial Relations Between the Government of Australia and the Government of Papua New Guinea (PATCRA); EC-Syria
- 1981: EC accession of Greece
- 1983: Closer Trade Relations Trade Agreement (CER)
- 1985: United State-Israel
- 1986: EC Accession of Portugal and Spain
- 1991: EC-Andorra: Southern Common Market (MERCOSUR)
- 1992: EFTA-Turkey
- 1993: EFTA-Israel; Armenia-Russian Federation; Kyrgyz Republic-Russian Federation; EC-Romania; EFTA-Romania; Faroe Islands-Norway; Faroe Islands-Iceland; EFTA-Bulgaria; EC-Bulgaria
- 1994: North American Free Trade Agreement (NAFTA); Georgia-Russian Federation
- 1995: Romania-Moldova; EC accession of Austria, Finland and Sweden; Faroe Islands-Switzerland; Kyrgyz Republic-Armenia;

- Kyrgyz Republic-Kazakhstan; Armenia-Moldova
- 1996: EC-Turkey; Georgia-Ukraine; Armenia-Turkmenistan; Georgia-Azerbaijan; Kyrgyz Republic-Moldova; Armenia-Ukraine
- 1997: EC-Faroe Islands; Canada-Israel; Turkey-Israel; EC-Palestinian Authority; Canada-Chile; Eurasian Economic Community (EAEC); Croatia-Former Yugoslav Republic of Macedonia (FYROM)
- 1998: Kyrgyz Republic-Ukraine; Romania-Turkey; EC-Tunisia; Kyrgyz Republic-Uzbekistan; Mexico-Nicaragua; Georgia-Armenia
- 1999: Bulgaria-Turkey; Central European Free Trade Agreement (CEFTA) accession of Bulgaria; EFTA-Palestinian Authority; Georgia-Kazakhstan; Chile-Mexico; EFTA-Morocco
- 2000: Georgia-Turkmenistan; EC-South Africa; Bulgaria-FYROM; EC-Morocco; EC-Israel; Israel-Mexico; EC-Mexico; Southern African Development Community (SADC); Turkey-FYROM
- 2001: Croatia-Bosnia and Herzegovina; New Zealand-Singapore; EFTA-FYROM; EC-FYROM; Romania-Israel; EFTA-Mexico; India-Sri Lanka; United States-Jordan; Armenia-Kazakhstan
- 2002: Bulgaria-Israel; EFTA-Jordan; EFTA-Croatia; Chile-Costa Rica; EC-Croatia; EC-Jordan; Chile-El Salvador; Albania-FYROM; FYROM-Bosnia and Herzegovina; Canada-Costa Rica; Japan-Singapore
- 2003: EFTA-Singapore; EC-Chile; CEFTA accession of Croatia; EC-Lebanon; Panama-El Salvador; Croatia-Albania; Turkey-Bosnia and Herzegovina; Turkey-Croatia; Singapore-Australia; Albania-Bulgaria; Albania-UNMIK (Kosovo); Romania-Bosnia and Herzegovina
- 2004: Romania-FYROM; Albania-Romania; China-Macao, China;

China- Hong Kong, China; United States-Singapore; United State-Chile; Republic of Korea-Chile; Moldova-Bosnia and Herzegovina; EU Enlargement; Bulgaria-Serbia and Montenegro; EC-Egypt; Croatia-Serbia and Montenegro; Romania-Serbia and Montenegro; Moldova-Serbia and Montenegro; Albania- Serbia and Montenegro; Moldova-Croatia; Albania-Moldova; Bulgaria-Bosnia and Herzegovina; Moldova-FYROM; Moldova-Bulgaria; Albania-Bosnia and Herzegovina; EFTA-Chile

2005: Thailand-Australia; US-Australia; Japan-Mexico; Turkey-PLO; EFTA-Tunisia; Thailand-New Zealand; Turkey-Tunisia

B: List of Countries (174 countries)

Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Aruba, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Central African Rep., Chad, Chile, China, Colombia, Comoros, Costa Rica, Croatia, Cuba, Cyprus, Czech Rep., Denmark, Djibouti, Dominica, Dominican Rep., Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea- Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Kuwait, Kyrgyzstan, Lao People's Dem. Rep., Latvia, Lebanon, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands,

New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Rep. of Korea, Rep. of Moldova, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia and Montenegro, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, Somalia, South Africa, Spain, Sri Lanka, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Tajikistan, TFYR of Macedonia, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, United Kingdom, United Rep. of Tanzania, Uruguay, USA, Uzbekistan, Vanuatu, Venezuela, Viet Nam, Yemen, Zambia, Zimbabwe

Note: We use 200 countries for Figure 2, which includes the following 26 countries to the above list: American Samoa, Andorra, Anguilla, Bahamas, Bermuda, Cayman Islands, China, Hong Kong SAR, China, Macao SAR, Congo, Cook Islands, Cote d'Ivoire, Democratic People's Rep. of Korea, Faeroe Islands, Falkland Islands (Malvinas), French Polynesia, Gambia, Gibraltar, Greenland, Guam, Mayotte, Montserrat, Nauru, Neth. Antilles, New Caledonia, Saint Lucia, Saint Vincent and the Grenadines

C: Country by Language

Arabic: Algeria, Bahrain, Comoros, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, and Yemen.

Dutch: Belgium, Netherlands, Suriname.

English: Australia, Barbados, Belize, Canada, Fiji, Ghana, Guyana, India, Ireland, Jamaica, Kenya, Kiribati, Liberia, Malta,

Malawi, Mauritius, New Zealand, Nigeria, Papua New Guinea, Philippines, Saint Kitts and Nevis, Seychelles, Sierra Leone, Solomon Islands, South Africa, Trinidad and Tobago, Uganda, UK, USA, Zambia, Zimbabwe.

French: Benin, Burkina Faso, Burundi, Cameroon, Central African Rep., Chad, France, Gabon, Guinea, Haiti, Madagascar, Mali, Niger, Rwanda, Senegal, Togo.

German: Austria, Germany, Switzerland.

Spanish: Bolivia, Chile, Colombia, Costa Rica, Cuba, Dominican Rep., El Salvador, Equatorial Guinea, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, Spain, Uruguay,

D: Country by Regional Trading Blocs

European Community: Austria, Belgium, Cyprus, Czech Rep., Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovak Rep., Slovenia, Spain, Sweden, Netherlands, UK.

European Free Trade Agreements: Iceland, Liechtenstein*, Norway, Switzerland.

Association of South East Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

South Asian Preferential Trade Arrangement: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka.

North American Free Trade Agreement: Canada, Mexico, USA.

Caribbean Community and Common Market: Antigua and Barbuda, Bahamas*, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat*, Trinidad and Tobago, Saint Kitts and Nevis,

Saint Lucia*, Saint Vincent and the Grenadines*, Surinam.

Southern Common Market: Argentina, Brazil, Paraguay, Uruguay.

Common Market for Eastern and Southern Africa: Angola, Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, Zimbabwe.

South Pacific Regional Trade and Economic Cooperation Agreement: Australia, Cook Islands*, Fiji, Kiribati, Marshall Islands, Micronesia*, Nauru*, New Zealand, Niue*, Papua New Guinea, Solomon Islands, Tonga, Tuvalu*, Vanuatu, Western Samoa*.

Note: * indicates omitted countries in Appendix A.

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