Trade-creating regime-wide rules of origin: a quantitative analysis[+]

Sangkyom Kim,[*] Innwon Park,[**] and Soonchan Park[***]

Abstract

Regime-wide rules of origin (ROO), such as diagonal cumulation, de minimis, and self-certification requirement, can be applied to reduce additional administrative and compliance costs for verifying restrictive ROO. However, empirical evidence related to the trade effect of various regime-wide ROOs is very few. We quantitatively investigate the trade effect of regime-wide ROOs by estimating the modified gravity equation with panel data on 36,238 country pairs covering 151 countries for 16 years from 1990 through 2005 at 5 year intervals. From our empirical experiments, we find that implementation of regime-wide ROOs such as diagonal cumulation and de minimis generate more trade between members of free trade agreements (FTAs). However, we also find that certification requirement does not produce positive trade effects. In addition, we confirm the effectiveness of the Poisson Pseudo-Maximum Likelihood estimator dealing with the zero trade issue and the presence of heteroskedasticity compared to the traditional log-linearized model estimation.

Keywords: Free trade agreements, Rules of origin, Zero trade, Poisson pseudo-maximum likelihood

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[*] Vice President and Senior Research Fellow, Korea Institute for International Economic Policy, Seoul, Korea; Email: skim@kiep.go.kr.

[**] Corresponding Author: Professor, Division of International Studies, Korea University; 5-1 Anam-dong, Sungbuk-gu, 136-701 Seoul, Korea; Tel: 82-2-3290-2406; Fax: 82-2-929-0402; Email: iwpark@koerea.ac.kr.

[***] Associate Professor, Department of Economics and International Trade, Kongju National University, Kongju, Korea; Email: spark@kongju.ac.kr.

I. Introduction

Rules of origin (ROO) are necessary for discriminatory free trade agreements (FTAs) to determine the eligibility of members for preferential treatment. However, currently proliferating and overlapping FTAs can result in high costs for verifying ROO. The restrictive ROO can be a serious impediment to the successful utilization of FTAs. The administrative and compliance costs for verifying ROO and the resulting trade diversion effect may offset the initial welfare gains from freer trade. To reduce the trade diversion effect from strict ROOs; regime-wide ROOs such as diagonal cumulation, de minimis, and self-certification requirement; can be applied to complement the restrictive ROO.

Brown et al. (2001), Baldwin (2006), Gasiorek et al. (2007), Harris (2008), and Estevadeordal et al. (2008) carefully evaluate ROO-related costs and suggest that FTAs could be compatible with multilateralism through the simplification or harmonization of ROOs. In particular, Estevadeordal and Suominen (2003), Augier et al. (2005), Gasiorek et al. (2007), Bombarda and Gamberoni (2008), and Park and Park (2009) find that cumulation of ROO significantly increases intra-bloc trade.

However, empirical evidence related to the trade effect of various regime-wide ROOs is very few. Estevadeordal and Suominen (2003) represent an exception. They investigate the trade effect of various regime-wide ROOs by estimating modified gravity equations. But in doing so, they apply simple OLS and TOBIT estimation techniques without considering the zero trade issue. Moreover, their cross-section study covering one year in 2001 is simply not very compelling.

Recognizing the limitations in existing studies, we conduct a quantitative analysis of regime-wide ROOs on trade by using a modified gravity equation. We use panel data on 36,238 country pairs covering 151 countries for 16 years from 1990 through 2005 at 5 year intervals. In order to deal with the zero trade issue, we adopt both the Poisson Pseudo-Maximum Likelihood (PPML) estimation and the standard log-linearized model estimation both with and without zeros in the sample.[1] Results from the two different estimation techniques are compared to check the robustness. Moreover, we control bilateral linkages by applying dyadic fixed effects and "multilateral trade resistance" in Anderson and van Wincoop (2003) through application of time-varying exporter and importer fixed effect. Section 2 describes the methodology, Section 3 summarizes the empirical findings and concludes the research.

II. Methodology

Model specification and estimation technique

We employ a modified gravity model of bilateral trade flows to estimate the trade effects of FTAs with different ROOs as specified in Equation 1.

[1] PPML estimation technique introduced by Santos Silva and Tenreyo (2006) has been applied to solve the zero trade issue and the presence of heteroskedasticity. In contrast, Head et al. (2010) and Martin and Pham (2008) criticize the biased estimates by the PPML when there is a large number of zero trade (17.6% in our case) and they drop observations that are recorded as zero bilateral trade instead of adopting the PPML. However, Santos Silva and Tenreyo (2011) empirically prove that the PPML estimation is well behaved, especially for constant elasticity models such as the gravity model, even when the proportion of zero trade in the data set is very large.

Equation 1.

$$\ln(Trade_{ijt}) = \alpha_{ij} + \alpha_1 \ln(GDP_{it}) + \alpha_2 \ln(GDP_{jt}) + \alpha_3 \ln(DIST_{ij}) + \beta' X' + \gamma_1 CU_{ijt} + \gamma_2 FTA_{ijt} + \gamma_3 ROO^k_{ijt} + \delta Year_t + \varepsilon_{ijt}$$

where *i* and *j* denote particular countries, and *t* denotes time

- *Trade* denotes the value of the bilateral trade,
- *GDP* is real GDP,
- *DIST* is the bilateral distance,
- *X'* is a set of control variables that includes the *Border, Colony*, and *Common Language* dummy,
- *CU* is a binary variable which is unity if *i* and *j* belong to the same customs union,[2]
- *FTA* is a binary variable which is unity if *i* and *j* belong to the same free trade area,
- *ROO* is a set of regime-wide ROO: $k \in$ {*Bilateral Cumulation, Diagonal Cumulation, Public Certification, Self Certification, and De Minimis*},
  - *Bilateral Cumulation (Diagonal Cumulation)* is a binary variable which is unity if *i* and *j* belong to an FTA formed with bilateral (diagonal, respectively) cumulation,
  - *Public Certification (Self Certification)* is a binary variable which is unity if *i* and *j* belong to an FTA formed with public (self, respectively) certification requirement,
  - *De Minimis* is a binary variable which is unity if *i* and *j* belong to an FTA formed with De Minimis,
- *Year* denotes a set of binary variables which is unity in the specific year *t*.

[2] CU is included as an independent dummy to avoid the problem of selection bias and because CU is not subject to ROO.

The country-pair fixed effect (α_{ij}) in Equation 1 controls factors that are specific to the country pair, such as distance, border, common language, and unobserved ties. As country-pair fixed effect controls bilateral resistance, multilateral resistance should be controlled by dealing with the time-varying exporter and importer fixed effects (α_{it} and α_{jt}) in the following Equation 2.[3] Due to time-varying dummies included, *DIST*, *GDP*, and *Year* variables are dropped from Equation 1.

Equation 2.

$$\ln(Trade_{ijt}) = \alpha_{ij} + \alpha_{it} + \alpha_{jt} + \gamma_1 CU_{ijt} + \gamma_2 FTA_{ijt} + \gamma_3 ROO^k_{ijt} + \varepsilon_{ijt}$$

Data description

We use panel data on 36,238 country pairs covering 151 countries for 16 years from 1990 through 2005 at 5 year intervals. The trade flow data comes from the *Direction of Trade Statistics* provided by the International Monetary Fund. The nominal value of bilateral trade is measured by the sum of the bilateral exports. Data on country pair specific variables, such as distance, colonial ties, common land border, and common languages, are obtained *from Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)*. Data for FTAs by different types of ROOs come from Estevadeordal and Suominen (2003). We extend the data by including the FTAs recently in force using the WTO FTA database.

[3] See Baldwin and Taglioni (2006), Baier and Bergstrand (2007), and Magee (2008). For the PPML estimation, we applied exporter and importer fixed effect which is not time-varying because of the failure of convergence; but the time-varying effect is controlled by including the year dummy.

III. Empirical Results and Conclusion

We apply both the traditional log-linearized model and PPML estimation to Equation 2[4]. We expect positive coefficients for γ_1 and γ_2 that measure the trade-creating effect of CU and FTA, respectively. The coefficient γ_3 measures additional trade-creating effects of a specific ROO. Thus, the sum of γ_2 and γ_3 measures total trade-creating effects of FTA formed with a specific ROO. Table 1 summarizes the estimation results and Table 2 calculates percentage change in bilateral trade according to the coefficients estimated in Table 1.

Trade Effect of Regime-wide ROOs

From trade effects estimated in Tables 1 and 2, we find that (i) the CU is more desirable than FTA[5]; (ii) bilateral cumulation is harmful because of verification costs of restrictive ROO; (iii) diagonal cumulation and de minimis are beneficial, as they complement restrictive ROO; and (iv) certification requirement, either public or self, is irrelevant.

Zero trade issues and robustness

When we compare the PPML estimates with those obtained from standard log-linearized model estimates in Tables 1 and 2, we find that the two different estimation methodologies dealing with zero trade show similar results with respect to the sign and

[4] We only report results from the dyad fixed effect estimation. We conducted the Hausman test (Hausman, 1978) and found that the null hypothesis, where the individual effects are not correlated with other regressors in the model, has been rejected. However, from the random effect estimation, we found that the conventional gravity variables *(X'* in Equation 1*)* representing the transaction costs behave the way the model predicts and the estimated coefficients are statistically significant but not reported.

[5] Confirms the findings from Park and Park (2009) and supports the better trade-creating effect of full cumulation to other alternative methods.

statistical significance but the magnitude is different. Whether zero trade is included in the sample or not, the size of the estimates by PPML is still much smaller than those from the standard log-linearized model.[6] We also find that ignoring the zero trade may lead to inconsistencies in estimating the trade effects when we apply the standard log-linearized model estimation. However, the PPML estimates with zero trade are shown to be almost the same as those without zero trade.[7] This result strongly supports the robustness of the PPML.

We conclude that implementation of regime-wide ROOs such as diagonal cumulation and de minimis create more trade between FTA members by reducing the verifying cost of restrictive ROO. In addition, the effectiveness of the PPML estimator dealing with the zero trade issue and the presence of heteroskedasticity is confirmed as in Santos Silva and Tenreyro (2006, 2011) as opposed to the traditional log-linearized model estimation.

[6] Confirms the findings from Santos Silva and Tenreyro (2006) that criticize biased estimates by log-linearization in the presence of heteroskedasticity.

[7] It is because zero trade pairs would be estimated to trade close to zero and it results in residuals close to zero (Santos Silva and Tenreyro, 2006).

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Table 1. Trade Effect of FTA with Regime-wide ROOs: Estimation Results

Without "Zero" Trade	Standard Log-Linearized Model: $\ln(T_{ijt})$: 28,548[a]					PPML: $T_{ijt}>0$: 27,492[a]				
	Cumulation		Certification		De Minimis	Cumulation		Certification		De Minimis
	Bilateral	Diagonal	Public	Self		Bilateral	Diagonal	Public	Self	
CU(γ_1)	0.567 (0.116)***	0.629 (0.118)***	0.469 (0.115)***	0.469 (0.115)***	0.623 (0.119)***	0.459 (0.102)***	0.470 (0.105)***	0.394 (0.084)***	0.394 (0.084)***	0.461 (0.112)***
FTA(γ_2)	0.498 (0.075)***	0.101 (0.058)*	0.250 (0.234)	0.209 (0.056)***	-0.260 (0.111)**	0.219 (0.082)***	0.062 (0.124)	0.213 (0.327)	0.050 (0.062)	-0.205 (0.127)
ROO(γ_3)	-0.432 (0.075)***	0.583 (0.097)***	-0.040 (0.238)	0.040 (0.238)	0.638 (0.130)***	-0.166 (0.076)**	0.182 (0.085)**	-0.163 (0.336)	0.163 (0.336)	0.366 (0.180)**
With "Zero" Trade	Standard Log-Linearized Model: $\ln(1+T_{ijt})$: 36,238[a]					PPML: T_{ijt}: 32,984[a]				
	Cumulation		Certification			Cumulation		Certification		
	Bilateral	Diagonal	Public	Self	De Minimis	Bilateral	Diagonal	Public	Self	De Minimis
CU(γ_1)	0.594 (0.064)***	0.666 (0.065)***	0.530 (0.063)***	0.530 (0.063)***	0.595 (0.065)***	0.459 (0.102)***	0.469 (0.105)***	0.394 (0.084)***	0.394 (0.084)***	0.461 (0.112)***
FTA(γ_2)	0.398 (0.040)***	0.133 (0.031)***	0.335 (0.132)**	0.215 (0.030)***	0.049 (0.056)	0.218 (0.002)***	0.062 (0.124)	0.212 (0.328)	0.050 (0.062)	-0.206 (0.127)
ROO(γ_3)	-0.263 (0.040)***	0.478 (0.053)***	-0.121 (0.134)	0.121 (0.134)	0.239 (0.067)***	-0.166 (0.077)**	0.181 (0.085)**	-0.163 (0.336)	0.163 (0.336)	0.366 (0.180)**

Notes: "a" denotes number of observations.

Dyad fixed effects and time varying exporter and importer fixed effects are applied.

Standard errors are in parentheses.

Intercept is included but not reported.

*, **, and *** indicate that the estimated coefficients are statistically significant at 10 percent, 5 percent, and 1 percent, respectively.

Table 2. Trade Effect of FTA with Regime-wide ROOs: % Change in Bilateral Trade[a]

Without "Zero" Trade	Standard Log-Linearized Model: $\ln(T_{ijt})$					PPML: $T_{ijt}>0$				
	Cumulation		Certification		De Minimis	Cumulation		Certification		De Minimis
	Bilateral	Diagonal	Public	Self		Bilateral	Diagonal	Public	Self	
CU(γ_1)	76.3***	87.6***	59.8***	59.8***	86.5***	58.2***	60.0***	48.3***	48.3***	58.6***
FTA(γ_2)	64.5***	10.6*		23.2***	-22.9**	24.5***				
ROO(γ_3)	-35.1***	79.1***			89.3***	-15.3**	20.0**			44.2**
FTA+ROO ($\gamma_2+\gamma_3$)[b]	29.5	89.8		23.2	66.4	9.2	20.0			44.2
With "Zero" Trade	Standard Log-Linearized Model: $\ln(1+T_{ijt})$					PPML: T_{ijt}				
	Cumulation		Certification			Cumulation		Certification		
	Bilateral	Diagonal	Public	Self	De Minimis	Bilateral	Diagonal	Public	Self	De Minimis
CU(γ_1)	81.1***	94.6***	69.9***	69.9***	81.3***	58.2***	59.8***	48.3***	48.3***	58.6***
FTA(γ_2)	48.9***	14.2***	39.8***	24.0***		24.4***				
ROO(γ_3)	-23.1***	61.3***			27.0***	-15.3**	19.8**			44.2**
FTA+ROO ($\gamma_2+\gamma_3$)[b]	25.8	75.5	39.8	24.0	27.0	9.1	19.8			44.2

Notes: a. Since $\exp^{0.567}=1.763$, an increase from zero (no membership) to one (membership) in the dummy variable raises bilateral trade by 76.3 percent.

b. For the total trade effect, we only consider the statistically significant estimates over 10 percent.

*, **, and *** indicate that the estimated coefficients are statistically significant at 10 percent, 5 percent, and 1 percent, respectively.