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In this paper, by employing the threshold regression method, we estimate the average tariff equivalent of fixed costs for the use of a free trade agreement (FTA) among all existing FTAs in the world. It is estimated to be 3.2%. This global estimate serves as a reference rate in the evaluation of each FTA's fixed costs.

Keywords: FTA, gravity equation, threshold regression
JEL classification: F15, F53

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Measuring Fixed Costs for Firms' Use of a Free Trade Agreement: Threshold Regression Approach

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Abstract: In this paper, by employing the threshold regression method, we estimate the average tariff equivalent of fixed costs for the use of a free trade agreement (FTA) among all existing FTAs in the world. It is estimated to be 3.2%. This global estimate serves as a reference rate in the evaluation of each FTA's fixed costs.

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1. Introduction

Some kind of fixed costs play an important role in firms' trading under a free trade agreement (FTA) scheme. The main component of those costs is administrative costs for securing certificates of origin (COO), which certify that the exported goods were locally produced. In order to secure the COO for the goods they export, firms must prepare all documents required by the investigating authorities. Firms choose to use an FTA scheme if and only if the gain in operating profit from the use of FTA rates is greater than the fixed costs. The gain in operating profit depends particularly on the difference between FTA preferential rates and general tariff rates, which are mostly most-favored nation rates (MFN rates). Such a difference is often called 'tariff margin'. Since a larger tariff margin leads to a larger gain from the use of FTA rates, firms exporting products with a larger tariff margin are more likely to use FTA rates. Since the FTA rates are mostly zero, it might be simply said that FTA rates are used by firms whose exporting products have sufficiently high general tariff rates.

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The purpose of this paper is to estimate the tariff equivalent of fixed costs for FTA use. There are some previous papers estimating those costs: Herin (1986) for EFTA and EC and Anson et al. (2003) and Carrere and de Melo (2004) for NAFTA. Based on the estimates in these previous studies, Medvedev (2010) concludes that 'for tariff lines where the MFN duty rate is relatively low (between 0% and 3%-6%), the costs of satisfying the rules-of-origin requirements are likely to exceed the value of preferences in those lines and hence the preferences will remain unutilized'. Also, the questionnaire survey of Japanese affiliates operating in South Asia, Southeast Asia, and Oceania, which was conducted by the Japan External Trade Organization in 2008 shows that those Japanese affiliates would be most likely to consider using an FTA with a preferential tariff margin at least in the 3% to 5% range or in the 5% to 7% range. In contrast to these previous estimates, this paper presents the average tariff equivalent of fixed costs for *all* existing FTAs in the *world* by estimating the well-known gravity equation. Such a global estimate serves as a reference rate in the evaluation of each FTA's fixed costs.

The rest of this paper is organized as follows. The next section briefly explains our empirical methodology, and Section 3 reports our estimation result. Section 4 concludes this paper.

2. Empirical Methodology

As mentioned above, we estimate the gravity equation, of which the recent standard specification is given by:

$$\ln X_{ijt} = \beta_1 \ln \text{Distance}_{ij} + \beta_2 \text{Language}_{ij} + \beta_3 \text{Colony}_{ij} + \beta_4 \text{Contingency}_{ij} + \beta_5 \text{FTA}_{ijt\text{-}1} + u_{it} + u_{jt} + \varepsilon_{ijt}. \quad (1)$$

X_{ijt} represents bilateral exports of country i to country j in year t. Distance is geographical distance between the most important cities/agglomerations in exporting and importing countries (in terms of population). Language is a dummy variable taking unity if a language is spoken by at least 9% of the population in both countries. Colony is a dummy variable indicating whether the two countries have had a colonial relationship. Contingency is a dummy variable indicating whether the two countries are contiguous. $\text{FTA}_{ijt\text{-}1}$ is a binary variable taking unity if countries i and j conclude an FTA in year t-1 and zero otherwise. To avoid the simultaneity issue between FTA and trade to some extent, we use the one-year lagged FTA dummy variable. Its coefficient β_5 represents trade creation effects. In order to account for multilateral resistance terms, this equation includes time-varying exporter and importer fixed effects (Anderson and

van Wincoop 2003).

In order to estimate fixed costs for FTA use, we apply the threshold regression approach developed by Hansen (2000) in this gravity equation. As mentioned before, if the MFN rates are low enough, there are not any benefits from use of FTA because it becomes difficult to cover the fixed costs. The trade creation effects emerge if the MFN rates are high enough to enable coverage of those costs. Thus, the point at which MFN rates quantitatively change trade creation effects (i.e. β_5) could be interpreted as indicating the tariff equivalent of fixed costs for FTA use.[1] In order to estimate this critical point of MFN rates, we modify the above gravity equation as:

$$\ln X_{ijt} = \beta_1 \ln \text{Distance}_{ij} + \beta_2 \text{Language}_{ij} + \beta_3 \text{Colony}_{ij} + \beta_4 \text{Contingency}_{ij} + \beta_5 \text{FTA}_{ijt\text{-}1} I(\text{Tariff}_{jt\text{-}1} < T) + \beta_6 \text{FTA}_{ijt\text{-}1} I(\text{Tariff}_{jt\text{-}1} \geq T) + u_{it} + u_{jt} + \varepsilon_{ijt}. \quad (2)$$

$I(\bullet)$ is an indicator function. $\text{Tariff}_{jt\text{-}1}$ denotes general tariff rates at importer j in year t-1. This equation divides the observations into two regimes depending on whether general tariff rates are smaller or larger than the threshold level T. Hansen (2000) developed the method of joint estimation of the threshold level T and the coefficients β_5 and β_6; the test procedures for the hypothesis H_0: $\beta_5 = \beta_6$; and the asymptotic distribution of the coefficients. This model allows an endogenous test for the existence and significance of threshold levels of general tariff rates in trade creation effects.[2][3]

Data sources are as follow. Our unbalanced panel data include 91 countries and 7 years (2000-2006). Data on international trade values in total manufacturing (SITC Revision 2, 5 + 6 + 7 + 8 less 68) have been obtained from UN Comtrade. The CEPII website provides us with the data on four dummy variables: Distance, Language, Colony, and Contingency. The simple average of MFN tariffs in total manufacturing (Tariff) is obtained from the UNCTAD Handbook of Statistics Online. We construct an FTA dummy by using a list of FTAs provided on the WTO website. Our FTA dummy includes FTAs notified based on not only GATT Article XXIV but also on the Enabling Clause.[4]

3. Estimation Results

[1] We assume that FTA rates are zero. Thus, the tariff margin is equivalent to the MFN rates.
[2] We conducted a grid search by 0.1% from zero percent to 35% (maximum rates in sample).
[3] We add one to trade values before taking their log.
[4] There is a concern over endogeneity bias in the estimates of the FTA coefficient in a gravity equation. Baier and Bergstrand (2007) suggest the application of the gravity equation to panel data with fixed effects in order to draw strong and reliable inferences about the impacts of the FTA. To the best of our knowledge, however, the threshold regression method has not been developed yet for the unbalanced-panel data. Thus, in this paper, we do not take care of this issue.

This section reports our estimation results. Column (I) in Table 1 shows the result for equation (1). All of the independent variables have significant coefficients with the expected signs. The result of introducing the interaction term of importer's MFN tariff rates into this basic model is reported in column (II) in Table 1. As is consistent with our expectation, its coefficient is estimated to be significantly positive: trade creation effects are larger when exporting to countries with higher MFN rates.

We also experiment with the specification assuming that the relationship between trade creation and tariffs is quadratic. This result is provided in column (III) in Table 1. There is an inverse-U-shaped relationship. The coefficient for the interaction term of the FTA dummy with the square term of MFN rates is estimated to be negatively significant. The calculation of the maximum point of trade creation effects against MFN rates indicates that the trade creation effects begin to decline in size once MFN rates exceed the critical level of 30%. However, since this is near the maximum MFN rate in our sample (35%), this result is not much more informative than the result of the simple linear model.

The result of the threshold regression model, which is the more flexible functional form, is reported in column (IV) in Table 1. The point estimate of the threshold T is 3.2%. Its corresponding 99% confidence interval is [3.0%, 3.5%]. We can also show its 99% confidence interval in Figure 1, which is a graph of the log-likelihood sequence as a function of the threshold of MFN tariff rates (the 99% asymptotic critical value calculated by Hansen (2000) is 10.59). Taking a look at the magnitude of coefficients, while exports to FTA members with MFN rates less than 3.2% are 174% (=exp(1.008)-1) larger than those to non-members, trade values become 714% larger when exporting to FTA members with MFN rates greater than 3.2%. Such discontinuous trade creation effects should be due to the existence of fixed costs for FTA use, indicating that their tariff equivalent is 3.2%.

4. Concluding Remarks

In this paper, by employing the threshold regression method, we estimate the tariff margin required for FTA use, which should be the tariff equivalent of fixed costs for FTA use. It is estimated to be 3.2%. In the previous studies, which analyse a restricted sample, the necessary tariff margin is estimated to be 3% to 7%. Thus, our estimate for the global sample falls into the lower bound. Since our estimate is the average tariff equivalent of fixed costs for all FTAs in the world, we can say that the tariff equivalent is around 3% not only for NAFTA, EFTA, and the EC but also for other

FTAs.

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Table 1. Estimation Results

	(I)	(II)	(III)	(IV)
Distance	-0.492***	-0.509***	-0.519***	-0.528***
	[0.021]	[0.022]	[0.022]	[0.053]
Language	2.319***	2.317***	2.301***	2.296***
	[0.051]	[0.051]	[0.051]	[0.057]
Colony	0.444***	0.422***	0.410***	0.385***
	[0.120]	[0.120]	[0.120]	[0.080]
Contingency	1.972***	1.959***	1.917***	1.926***
	[0.111]	[0.111]	[0.111]	[0.127]
FTA	1.703***	1.385***	0.802***	
	[0.045]	[0.068]	[0.089]	
FTA * Tariff		4.098***	22.306***	
		[0.650]	[1.911]	
FTA * Tariff2			-83.998***	
			[8.293]	
FTA [Tariff < T]				1.008***
				[0.097]
FTA [Tariff ≥ T]				2.097***
				[0.066]
Tariff at maximum			30%	
Thresshold tariff				3.2%***
Observations	59,166	59,166	59,166	59,166
R-squared	0.7388	0.7390	0.7394	0.7395

Notes: ***, **, and * indicate 1%, 5%, and 10% significance, respectively. Figures in brackets represent the standard error.

Figure 1. Likelihood Ratio Sequence