THE IMPACT OF THE ASIA-PACIFIC ECONOMIC COOPERATION MUTUAL RECOGNITION ARRANGEMENT FOR CONFORMITY ASSESSMENT OF TELECOMMUNICATIONS EQUIPMENT ON TRADE: EVIDENCE FROM TAIWAN

Chun-Chieh Wang, National Sun Yat-Sen University
Chyi-Lu Jang, National Sun Yat-Sen University

ABSTRACT

We use Taiwanese trade data from 2009 to 2012 to examine the impacts of the Asia-Pacific Economic Cooperation Mutual Recognition Arrangement for Conformity Assessment of Telecommunications Equipment on trade. The results show that Asia-Pacific Economic Cooperation Mutual Recognition Arrangement for Conformity Assessment of Telecommunications Equipment can increase Taiwan's exports of cellular phones and laptop computers to other Asia-Pacific Economic Cooperation members. We also provide evidence that a mutual recognition agreement can reduce the non-tariff barriers caused by technological regulations and standards in some cases.

JEL: F14, F53, F15

KEYWORDS: APEC, Mutual Recognition Agreement, Trade, Gravity Equation

INTRODUCTION

Although the World Trade Organization (WTO) Doha round negotiation, begun in 2001, has yet to conclude, trade barriers caused by tariffs have been lowered due to several sets of negotiations before and after the establishment of the WTO; however, non-tariff barriers continue to impede the flow of goods between countries. The different types of non-tariff barriers are varied and complicated, and hence, it is difficult to reach a consensus to eliminate non-tariff barriers in negotiations. Quotas, a type of quantitative constraint, are one formerly popular form of non-tariff barrier, but more recently, technical standards have overtaken quotas to become the major cause of disputes over non-agriculture goods in the WTO (Santana and Jackson, 2012). Among the various WTO trade agreements, the Technical Barriers to Trade (TBT) and the Sanitary and Phytosanitary (SPS) agreements are conceptually similar. Seeking to protect the safety of human being and living things, these two agreements empower WTO members to set non-discriminatory regulations on the technical standards for goods (TBT) and animals, plants, and food (SBS). Clearly, different technical standards and SPS measures can create trade barriers among the WTO members by creating extra examination costs for exporters.

Harmonization and mutual recognition are two major methods used to alleviate the unnecessary trade barriers caused by technical standards and SPS measures, especially in European countries (Brenton, Sheehy, and Vancauteren, 2001). Harmonization means that trade partners coordinate to apply the same technical standards or SPS measures to products. Due to sovereignty concerns, most countries reserve the right to set the standards or measures to protect their citizens, although suggestions from international organizations such as the Codex Alimentarius Commission will be considered. In most cases, mutual recognition is more important to alleviate this type of non-tariff trade barrier. Indeed the mutual recognition agreements (MRAs) between the United States, European Commission, and other countries are studied in the literature, such as Amurgo-Pacheco(2006).

Under the arrangement of mutual recognition, the tests or certifications for export goods can be preceded in the exporters' countries, thus avoiding duplicate testing and shortening the time to market for new products. Further, the required technical standards and SPS measures will be more transparent. It is expected

that MRAs between trade partners can alleviate trade barriers and promote trade flows. This paper will examine this theoretical prediction by exploring Taiwanese trade data. The Asia-Pacific Economic Cooperation Mutual Recognition Arrangement for Conformity Assessment of Telecommunications Equipment (APEC Tel MRA) is the targeted MRA in this paper. APEC Tel MRA was endorsed in 1998 and commenced in 1999. The scope of the conformity assessments covered by APEC Tel MRA includes electromagnetic compatibility (EMC) and electrical safety. Many of Taiwan's major export goods, such as laptop computers and cellular phones, need to pass the conformity assessments covered by APEC Tel MRA before they can be exported to other APEC members, which is the reason we have chosen to analyze APEC Tel MRA in this paper.

APEC Tel MRA provides the members of APEC with a framework in which participation is voluntary. Currently, there are three sets of procedures for the implementation of APEC Tel MRA: Phase I Procedures, Phase II Procedures, and MRA for Equivalence of Technical Requirements for Telecommunications Equipment (MRA-ETR). MRA-ETR was endorsed in 2010, later than Phase I and Phase II. Descriptions of these three procedures can be found as follows. 1.) Phase I Procedures: mutual recognition of testing laboratories as Conformity Assessment Bodies and mutual acceptance of test reports. 2.) Phase II Procedures: mutual recognition of certification bodies as Conformity Assessment Bodies and mutual acceptance of equipment certifications. 3.) MRA-ETR: mutual recognition of equivalent standards or technical requirements.

Indeed, MRA-ETR adopts a method similar to harmonization to alleviate trade barriers caused by different standards between trade partners. To date, no APEC members have signed MRA-ETRs with each other; Taiwan has agreed to adopt Phase I procedures with Australia, Singapore, Hong Kong, United States, and Canada and to adopt Phase II procedures with Canada. Taiwan's trade volume was ranked 18th in the world in 2012. Excepting the European Union, its most important trade partners are all APEC members. APEC members include Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, Taiwan, Thailand, the United States, and Vietnam. Furthermore, electronic products are Taiwan's most important export commodity. In 2012, the exports of electric commodities accounted for 27.70% of Taiwan's total exports. Hence, Taiwan is a good case study for exploring the impact of the APEC Tel MRA on trade. In this paper, we will examine Taiwanese trade data to see whether APEC Tel MRA can foster trade flows between Taiwan and other APEC members, and the paper is organized in the following way. A review of related literature is provided in the section of "Literature Review." The "Data and Methodology" describes the data and the econometric model used in this paper. The estimation results are presented in the next section. Finally the improvement which can be done in the future can be found in the section of "Concluding Comments."

LITERATURE REVIEW

In essence, APEC Tel MRA is a trade agreement, and it regulates the requirements for commodities imported from one signed member to another. While the direct economic benefit stemming from APEC Tel MRA is a lower fixed cost when a product enters new markets (Baller, 2007; Hogan and Hartson LLP, 2003), a benefit that is difficult to measure, it is still reasonable to expect that a trade agreement has a significant impact on trade flows. The impacts of trade agreements such as APEC Tel MRA and free trade agreements (FTAs) can be examined by using micro or macro data. Simply examining impacts with micro data, for example, the trade volume of a specific good before and after the validation of trade agreements, may lead to misleading or confusing conclusions. A drop in trade volume between trading partners after an FTA is signed does not necessarily indicate that the FTA has a negative impact; we aim to discover the actual factors contributing to the lower trade volume. Similarly, when trade volume rises after an FTA is signed, we cannot conclude that the FTA is cause without isolating the influence of other factors.

In the literature, many researchers directly study the impacts of trade agreements on trade flow between trade partners using a set of macro data. Most studies, however, focus on free trade agreements or regional trade agreements (RTAs) rather than MRAs. Indeed, very few studies, such as Chen and Mattoo(2008) and

Jang (2009), discuss the economic effects of MRAs using econometric models, a gap this paper seeks to fill. However, because MRAs, as mentioned above, are a type of trade agreement, there is no need to develop new econometric models or methods. Ever since Tinbergen (1962), gravity equations are widely used to study trade flows. After Anderson (1979) and Bergstrand (1985) provide the microfundation, gravity equations are not simply an econometric model. Further, inserting the dummy variables of FTAs or RTAs into the gravity equations to estimate the impact on trade volume has been the standard research method in related literature. For example, Frankel, Stein, and Wei (1995) use this method to study the impact of North American Free Trade Agreement, the Andean Pact, and Mercado Común del Sur (MERCOSUR) on trade flows among countries in the Americas. Zarzoz and Lehmann (2003) also study the trade flows between MERCOSUR and European Union by gravity equations. In addition to trade in commodities, Walsh (2006) and Kimura and Lee (2006) also use gravity equations to study trade in services.

DATA AND METHODOLOGY

APEC Tel MRA is a sectoral agreement, however, and does not cover as many goods as FTAs or RTAs. Further, APEC Tel MRA may be influential only when an importing country requires compulsory tests to be performed in the importing country. Because this paper focuses on the impact of APEC Tel MRA on Taiwan's exports to other APEC members, we modify the original gravity equation model as below:

$$\ln T_{it} = \beta_0 + \beta_1 \ln X_t + \beta_2 \ln M_{it} + \beta_3 \ln D_i + \beta_4 C_i + \beta_5 C_i \times MRA_i + \beta_6 other\ variables. \tag{1}$$

T_{it} is Taiwan's exports to Member i at Time t; X_t is Taiwan's total exports at Time t; M_{it} is Member i's total imports at Time t; D_i is the distance between Taiwan and Member i; C_i is a dummy variable and is equal to 1 when Member i requires that compulsory tests are performed in Member i; MRA_i is a dummy variable and is equal to 1 when Taiwan signs APEC Tel MRA with Member i; other variables include Member i's tariffs, the log of GDP, and the log of GDP *per capita*. There is one thing about the variable MRA_i to address. Although Taiwan has agreed to adopt Phase II procedures with Canada, Phase II procedures are applied in very few cases. Hence, we do not distinguish Canada from other countries that have agreed to adopt Phase II procedures with Taiwan.

Variables added to Equation (1) can capture the impacts of other factors that may cause fluctuations in trade flows and help to ensure that the impact of APEC Tel MRA is estimated correctly. Variable X_t can capture Taiwan's export competency at Time t; M_{it} represents Member i's market capacity for imported goods at Time t; the log of GDP and the log of GDP per capita can capture the effects of Member i's economics scale and income level. The real subject of interest in this paper, however, is the sign of β_5. When an importing country requires compulsory tests to be performed in that country, the testing cost is necessarily higher and testing is more time consuming. Hence, it is expected that the sign of β_4 will be negative, that is, the trade volume will become smaller when compulsory tests must be performed in the importing country. A positive β_5, however, shows that MRA can counter or dilute the negative impacts on trade flows. Although the data used here is both cross-importer and cross-time, we can neither add more dummy variables to the model nor estimate Equation (1) with the fixed effect model as Baier and Bergstrand (2007) and Egger (2000) suggest because there is only one exporter and the data does not cover a long enough time period. The data will be treated as pooled data and Equation (1) will be estimated by the ordinary least squares method. In this paper, we use 5 products to analyze the impacts of APEC Tel MRA on exports to other APEC members from Taiwan. The 5 products—Cellular Phone, Set-Top-Box, Navigation Instrument, Router, and Laptop Computer—are selected from Taiwan's top 100 exported goods in 2012 that are covered by APEC Tel MRA. Table 1 lists the products analyzed in this paper and their HS codes. Due to the lack of available data, we only analyze data from 2009 to 2012.

Table 1: The Selected Products in the Analysis and the HS Codes

6-digit HS Code	HS851712	HS852871	HS852691	HS851762	HS7130
Main Product	Cellular Phone	Set-Top-Box	Navigation Instrument	Router	Laptop Computer

This table lists the products analyzed in this paper and their HS codes.

RESULTS

The export volume of each product sent from Taiwan to other APEC members and the total exports were retrieved from the website of Taiwan's Bureau of Foreign Trade, Ministry of Economic Affairs. Other APEC members' total imports and the tariffs applied to each product are downloaded from the Trade Map, International Trade Map. The distances between Taiwan and other APEC members are provided by Mayer and Zignago (2011). APEC members' GDP and GDP *per capita* are retrieved from the database of the World Development Indicator, but Taiwan's data can only be found on the website of Taiwan's Directorate General of Budget, Accounting and Statistics. Finally, according to an interview with the Taiwan Accreditation Foundation, among APEC members, only Canada, China, Japan, Korea, and United States require compulsory product testing in the importing country.

We estimate Equation (1) one by one for each product selected. Table 2 shows the estimation results of Equation (1). The adjusted R-squares of most products (except one) are more than 0.6, with the highest value at 0.8860. Clearly, the selected explanatory variables can explain the variance of the trade flows quite well. The problem of omitted variables cannot be serious. If the coefficients are significantly different from zero, most of the signs are in line with the predictions. For example, when Taiwan's export competency (the total export volume) is higher, Taiwan exports more goods to other APEC members. The distance between Taiwan and other APEC members discourages imports from Taiwan. APEC members with higher incomes or a larger scale purchase more electronic products from Taiwan. In this paper we pay more attention to the coefficients of the variables compulsory and phacom because we are studying the impact of MRAs on trade. The variable phacom is the product of two variables, compulsory and MRA. It is found that the compulsory product testing requirement in the importing countries did have significant negative impacts on trade flows for some products, such as cellular phones and laptop computers. However, we also can see that the APEC Tel MRA alleviates the negative impacts for those two products. Further, the signs of the coefficients of the variable phacom are significantly positive only when the coefficient of the variable compulsory is significantly negative. In other words, APEC Tel MRA can reduce the non-tariff barriers caused by technical regulations or standards when compulsory tests are required to be performed in importing countries.

Table 2: The Estimation Results of the Modified Gravity Equation

Product	HS 851712	HS 852871	HS 852691	HS 851762	HS 847130
ln(imports)	-1.106*	0.108	0.005	0.628*	0.254
	(0.546)	(0.246)	(0.177)	(0.122)	(0.205)
ln(exports)	-0.724	-4.998	0.103	0.473	0.339*
	(0.911)	(4.113)	(2.128)	(0.277	(0.146)
ln(distance)	-3.752**	-2.339**	-1.113**	-0.776*	-1.110*
	(0.609)	(0.422)	(0.196	(0.124	(0.157
compulsory	-7.607**	-0.877	-1.100	0.502	-1.042
	(1.603)	(1.207)	(0.609)	(0.283)	(0.501
Phacom	7.097**	2.043	0.441	-0.597	3.058**
	(2.110)	(1.777)	(0.833)	(0.402)	(0.665)
ln(GDP *per capita*)	2.715**	0.874**	0.675*	0.117	0.817**
	(0.375)	(0.269)	(0.196)	(0.078)	(0.145)
ln(GDP)	2.664**	0.547	0.443*	-0.014	0.816**
	(0.374)	(0.292	(0206)	(0.080)	(0.143)
constant	-21.642	67.190	-2.497	-5.201	-23.357**
	(17.017)	(55.402)	(21.229)	(3.923)	(3.417
$\bar{R}^2$	0.675	0.597	0.650	0.886	0.857

This table presents the estimation of Equation (1). The first figures in each cell are estimated coefficients for each product. The figures in the parenthesis are the standard errors. ∗ and ∗∗ represent the significance level at 5% and 1%, respectively.

It is noted that the sign of the variable ln(exports) is not stable. The coefficients in two equations are negative, although not significantly, and are thus in opposition to the prediction. Although we can add more dummy variables to control the effects of other factors, due to the limit of data availability it is not possible to add as many types of dummy variables in this paper as Cheng and Wall (1999) suggest. Because Taiwan's overall exports ln(exports) only vary in terms of years, we use yearly dummy variables to replace ln(exports) and re-estimate all equations to ensure the robustness of our estimation. Table 3 presents the estimation results after we replace ln(exports) with yearly dummy variables. Most coefficients of the yearly dummy variables are not significantly different from zero, with the exception of Year 2012 in the equation for HS847130. It seems that the yearly dummy variables have very little explanatory power over the trade flows. Indeed, the estimation results in Tables 2 and 3 are very similar. It is fair to say that our estimation results are robust.

Table 3: The Estimation Results of the Modified Gravity Equation with Yearly Dummy Variables

Product	HS 851712	HS 852871	HS 852691	HS 851762	HS 847130
Year 2010	-0.090	1.654	-0.523	-0.381	0.338
	(1.164)	(0.984)	(0.474)	(0.234)	(0.358)
Year 2011	-1.167	1.149	0.049	-0.197	-0.119
	(1.109)	(0.952)	(0.462)	(0.226)	(0.347)
Year 2012	-0.576	0.034	-0.254	-0.122	0.782*
	(1.086)	(0.940)	(0.457)	(0.223)	(0.342)
ln(imports)	-1.178*	0.096	0.004	0.626**	0.187
	(0.561)	(0.244)	(0.179)	(0.125)	(0.200)
ln(distance)	-3.772**	-2.383**	-1.109**	-0.775**	-1.128**
	(0.615)	(0.419)	(0.198)	(0.126)	(0.155)
compulsory	-7.498**	-1.244	-1.084	0.514	-1.164*
	(1.631)	(1.295)	(0.618)	(0.292)	(0.501)
phacom	7.075**	2.251	0.419	-0.393	3.123**
	(2.130)	(1.770)	(0.844)	(0.418)	(0.656)
ln(GDP *per capita*)	2.703**	0.963**	0.675**	0.115	0.823**
	(0.379)	(0.274)	(0.198)	(0.081)	(0.143)
ln(GDP)	2.640**	0.648*	0.444*	-0.016	0.830**
	(0.380)	(0.298)	(0.208)	(0.081)	(0.141)
constant	-30.021*	-4.449	-1.023	1.435	-20.606**
	(12.773)	(9.448)	(5.033)	(2.582)	(3.266)
$\bar{R}^2$	0.669	0.607	0.641	0.882	0.863

This table presents the estimation results after we replace ln(exports) with yearly dummy variables. The first figures in each cell are estimated coefficients for each product. The figures in the parenthesis are the standard errors. ∗ and ∗∗ represent the significance level at 5% and 1%, respectively.

The estimation results in Tables 2 and 3 provide evidence that Taiwan's exports of cellular phones and laptop computers benefit from APEC Tel MRA. Several issues are worth addressing here. First, among the 5 selected products and based on the data available, only cellular phones and laptop computers benefit from APEC Tel MRA. As mentioned, an MRA only can lower the fixed costs of introducing new models or products into markets. It is reasonable that MRA provide greater benefits to products with short life cycles, as is the case for cellular phones and laptop computers compared to other selected products. Our results are in line with the predictions. Second, precisely speaking, APEC Tel MRA especially benefits Taiwan's exports to the United States and Canada. Among APEC members that have signed APEC Tel MRA with Taiwan, only the United States and Canada require compulsory testing of imported goods to be completed in the importing country.

CONCLUDING COMMENTS

APEC Tel MRA was endorsed in 1998 and some APEC members adopted mutual APEC Tel MRA procedures in early 2000s. Since then, the progress of APEC Tel MRA has been sluggish. Instead, very few APEC members have adopted mutual APEC Tel MRA procedures in recent years. Lack of evidence that APEC Tel MRA is beneficial to trade between APEC members is one important reason for its slow progress. Very few studies in the literature address the impacts of MRAs on trade. This paper can fill the gap in the literature and show evidence that APEC Tel MRA is beneficial in some cases. We modify the gravity equation to estimate the impact of APEC Tel MRA on Taiwan's exports of cellular phones, set-top-boxes, navigation instruments, routers, and laptop computers. Using trade data from 2009 to 2012, we find that

APEC Tel MRA can benefit Taiwan's exports of cellular phones and laptop computers to other APEC members, possibly because in comparison with the other selected products, cellular phones and laptop computers have shorter life cycles. MRAs such as APEC Tel MRA can lower the fixed costs of introducing a new model or product into markets but cannot alter variable costs. MRA cannot harm the signatories' exports, but its benefits may not be explicitly revealed by a direct examination of trade data, especially for those products with a long life cycle. Hence, although we do not find evidence proving that APEC Tel MRA benefits the exports of set-top-boxes, navigation instruments, and routers, it is not appropriate to conclude that APEC Tel MRA has no or negative impacts   on those products. Micro data may help to justify the benefits brought by APEC Tel MRA to these sectors.

In addition to the exporting sectors, MRAs impact other sectors, especially testing laboratories. After MRAs are signed, the compulsory tests that originally had to be performed in importing countries can be performed in exporting countries, bringing testing laboratories more local business while also causing them to lose orders from foreign manufacturers. The net impacts of MRAs on testing laboratories are controversial and worthy of future exploration. In the future, there are at least two ways to provide more deliberate estimation. First, we may follow the suggestions in Linders and De Groot (2006) to correct the error caused by zero trade volume by sample selection model. Second, Magee (2003) suggests that preferential trade agreements should be treated as endogenous. Hence, we may need to examine the endogeneity of MRAs in the gravity equations.

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BIOGRAPHY

Dr. Chun-Chieh Wang serves as an Assistant Professor at Department of Political Economy, National Sun Yat-Sen University. He can be contacted at No. 70 Lian-Hai Rd., Kaohsiung City, 804, Taiwan. Phone: +886-7-5252000 ext 5591. Email: cxw359@mail.nsysu.edu.tw.

Dr. Chyi-Lu Jang serves as an Assistant Professor at Department of Political Economy and Associate Dean at College of Social Sciences, National Yat-Sen University. He can be contacted at No. 70 Lian-Hai Rd., Kaohsiung City, 804, Taiwan. Phone: +886-7-5252000 ext 5589. Email: cjang@mail.nsysu.edu.tw.