ELSEVIER
www.elsevier.com/locate/worlddev

World Development Vol. 38, No. 8, pp. 1105–1113, 2010

0305-750X/$ - see front matter

doi:10.1016/j.worlddev.2010.02.009

Effects of Hub-and-Spoke Free Trade Agreements on Trade: A Panel Data Analysis

JUNG HUR
Sogang University, Seoul, Republic of Korea

JOSEPH D. ALBA
Nanyang Technological University, Singapore

and

DONGHYUN PARK *
Asian Development Bank, Philippines

Summary. — We use panel data consisting of 96 countries and covering the period 1960–2000 to investigate the effects of free trade agreements (FTAs) and hub-and-spoke systems of FTA on exports. Our empirical results imply an annual growth rate of 5.57% in exports and hence a doubling of exports after 12.4 years between FTA partners. Non-overlapping FTAs account for 4.12%, while hub-and-spoke FTAs account for 1.45% of the estimated export growth rate. This indicates that, in addition to the direct trade liberalizing effect of FTAs, the hub-and-spoke nature of FTAs has an additional positive effect on trade.

Key words — free trade agreement, hub and spoke, world bilateral trade data, panel data analysis, fixed effect, average treatment effect

1. INTRODUCTION

An interesting stylized fact of global trade is the proliferation of regional trade agreements and *the overlapping of free trade agreements*. As of December 31, 2008, GATT/WTO has been notified of 243 regional trade agreements (RTAs), out of which about 60% were free trade agreements (FTAs).[1] If the 65 service agreements and the 27 partial agreements are excluded, the proportion of FTAs rises to 91%.[2] Many of the FTAs overlap one another and allow some countries to become a hub in the network of FTAs.[3] On the one hand, relative to non-hub countries, an FTA-hub country gains preferential access to more markets and thus enjoys improved export competitiveness. To the extent that such an advantage translates into more exports, the hub-and-spoke feature of overlapping FTAs will have a positive effect on trade.[4] On the other hand, as Lloyd and MacLaren (2004) point out, in an FTA-hub country exporters and importers face multiple sets of rules of origin (RoO), which can lead to costs related to the verification of rules of origin. Such additional costs can, in turn, restrain trade creation. Therefore, being an FTA hub within the network of FTAs does not necessarily have a positive effect on exports.

The hub-and-spoke nature of FTA has been analyzed at length in the trade literature. Early country-specific studies on the hub-and-spoke system include an analysis of Canadian FTA policy by Wonnacott (1975, 1982). Kowalczyk and Wonnacott (1992) investigated the hub-and-spoke systems within the context of North American Free Trade Agreement (NAFTA). More recent studies include, among others, De Benedictis, De Santis, and Vicarelli (2005) on the EU-15 and CEEC countries; Deltas, Desmet, and Facchini (2006) on Israel; and Chong and Hur (2008) on Singapore, Japan and USA. For our purposes, the most relevant study is Lee, Park, and Shin (2008), which empirically examined the trade effect of what they term "overlapping RTAs" using Rose's (2004) dataset. They built a panel dataset comprising 175 countries from 1948 to 1999 and used an augmented gravity model with dummies representing several features of overlapping RTAs. They estimated the trade diversion and creation effects of overlapping RTAs and showed that the overlapping RTAs are ultimately undesirable for global trade due to the dominance of the trade diversion effect. Our results and approaches are different from Lee et al. (2008) in a number of ways, as explained in the following paragraphs.

Our estimation results show that an FTA has a positive effect on the FTA-hub country's exports. More precisely, we found that under a hub-and-spoke FTA the exports of an FTA-hub country grows by 5.57% per year and doubles after 12.4 years. The intuition behind the result can be explained through a simple framework as follows. Consider a three-country trade model where countries A, B and C trade with one another for all products. Suppose that A and B form an FTA. This will increase A and B's trade with each other owing to the preferential tariff treatments. Now, suppose that A forms another FTA with C and thus becomes an FTA hub. How does A's new hub status affect its exports to B and C? First, A's exports to C would increase due to the removal of tariffs between A and C. Second, there would be two simultaneous opposing effects on A's export to B. On the one hand, A's exports to B may decline because more of A's exports

* We are grateful to Andrew Rose, Kamal Saggi, and three anonymous referees for their useful comments. This research is supported by the Sogang University Research Grant. Alba is grateful for research funding from Nanyang Technological University. The usual disclaimer applies. Final revision accepted: January 4, 2010.

would be diverted to C as a result of the new FTA between A and i. On the other hand, A's exports to B may increase because the same FTA would divert C's exports from B to A. This is because C has an FTA with A but not with B. Thus, A would gain a higher export market share in B.

Our empirical results show that on average A's exports to B and C rise when A becomes an FTA hub, forming FTAs with both B and C. Note that what we estimate in our regressions is not trade diversion effect or trade creation effect that A may experience in its trade with B. Instead, what we estimate is the average effect of A's FTA-hub position on its exports to both spoke countries B and C. Therefore, even if there is such a big trade diversion effect that A's net exports to B decline, A's average exports to both spoke countries can be still higher if the increase in its exports to C is larger than the reduction in its exports to B.[5]

In contrast to Lee et al. (2008), our econometric approach accounts for multilateral resistance in a gravity model with the country-and-time fixed effect. The importance and implications of multilateral resistance in a gravity model have been investigated by Anderson and van Wincoop (2003) and Baier and Bergstrand (2007), Baier and Bergstrand (2009). Anderson and van Wincoop (2003) show that trade depends not only on bilateral trade barriers between the two countries involved but also on multilateral resistance from other trade partners in the rest of the world. They argue that theoretically consistent gravity model should consider multilateral resistance terms such as exporter and importer price indices which are the functions of bilateral resistance or trade barriers.[6] Otherwise, the estimators will suffer from omitted variable bias. To account for multilateral resistance, they use a customized non-linear least square procedure to obtain unbiased estimators. Baier and Bergstrand (2007) extend Anderson and van Wincoop (2003) model to a panel setting and propose a country-and-time fixed effect model to consider unobservable time-varying multilateral resistance terms. The proposed method is useful because it is computationally less burdensome and avoids measurement errors due to the omission of multilateral resistance terms. Baier and Bergstrand (2009) suggest a third method to estimate multilateral resistance, a method which could generate theoretically motivated general equilibrium comparative statics. They use a simple ordinary least square regression of a first-order log-linear Taylor series expansion of the multilateral resistance terms in the Anderson and van Wincoop (2003) system of equations, and show that their estimators are virtually identical to those of Anderson and van Wincoop (2003).

In our paper, we follow Baier and Bergstrand's (2007) framework which uses panel data methods with country-and-time dummy variables to account for multilateral resistance. We incorporate the FTA-HUB variable into Baier and Bergstrand's model. We run pooled ordinary list squares (OLS) regression and test for serial correlation and violation of strict exogeneity assumption. We show that the error terms of pooled OLS regression are serially correlated and the assumption of strict exogeneity is violated. This could be evidence of endogeneity between FTA and time-invariant variables in the pooled OLS regression. Since the endogeneity problem could be handled by using panel data methods, we estimate the model using fixed effect and first differenced regressions as outlined in Baier and Bergstrand (2007). We also test for serial correlation and strict exogeneity in both fixed effects and first differenced regressions. We show that neither the fixed effect nor the first differenced regressions suffer from serially correlated error terms and violation of the strict exogeneity assumption. This confirms Baier and Bergstrand's contention that panel data methods solve the endogeneity problem in pooled OLS regressions.

The rest of this paper is organized as follows. Section 2 defines and discusses the hub-and-spoke feature of overlapping FTAs, and provides evidence about FTA hubs and spokes in the real world. Section 3 discusses the data and methodology we use for our empirical analysis. The section also explores the fixed effects (FE) and first differenced (FD) models. Section 4 examines the main results which emerge from our empirical analysis. We compare the results from the pooled OLS regressions, FE regressions and FD regressions. Section 5 concludes with some final observations.

2. FEATURES AND EXAMPLES OF FTA HUBS AND SPOKES

In this section, we define hub country and spoke country in a world of overlapping FTAs, discuss the potential effect of hub-and-spoke FTAs on trade among FTA member countries, and examine the extent to which hub-and-spoke FTAs are a feature of real world trade.

(a) *Features of hub-and-spoke FTAs*

Here, we define hub and spoke as given in the following paragraph. Note that it is theoretically possible for two countries to be each other's hub and spoke at the same time if both countries belong to more than two FTAs.

Definition of Hub-and-Spoke of FTAs: *Suppose that country i has bilateral FTAs with m countries (m is strictly greater than one) and country j is one of the m countries. Country j is defined as a spoke country if it has bilateral FTAs with $m-2$ or less countries among the m countries which have bilateral FTAs with country i. Country i is defined as a hub country if it has at least two spokes.*

We provide a simple trade structure in Appendix A where there are three symmetric countries trading with each other under three different FTA structures—No FTA, one FTA and two FTAs—and compare the different FTA structures in terms of their impact on welfare and exports of each country. Note that, in the model, we assume no trade diversion effect of FTAs in order to focus upon our primary issue of interest—that is, whether being an FTA hub rather than an FTA spoke would be beneficial in terms of welfare level and exports performance. If so, a country would have the incentive to sign multiple FTAs and become the hub of an FTA network.

The following simple real-world example of an FTA network, which is based on a more general setting than the one in Appendix A, is useful for giving the reader a more intuitive understanding of the hub-and-spoke concept. The US entered into NAFTA with Mexico on January 1, 1994 and into a bilateral FTA with Australia on January 1, 2005. Since Mexico and Australia do not have an FTA with each other, the US is clearly the hub country while Mexico and Australia are the spoke countries. Let us consider the exports of the hub country to the spoke countries. First, regarding the exports of the US toward its new FTA partner-Australia, the US would enjoy a price advantage in its exports to Australia *vis-à-vis* Mexico because its exports receive preferential treatment in Australian markets whereas Mexican exports do not in Australian markets. The preferential treatment takes the form of lower tariffs and non-tariff barriers which reduce the prices of US exports relative to those of Mexican exports. Second, there are two opposing effects with respect to the exports of