

Evaluating the Trade and Welfare Effects of Developing RTAs*

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Abstract

Many recent papers have pointed to ambiguous trade effects of developing regional trade agreements (RTAs henceforth), calling for a reassessment of the economic merits of these agreements. We focus on six of them currently in force in Sub-Saharan Africa, Asia and Latin America to estimate their trade as well as welfare impacts. A gravity model is combined with kernel and bootstrap estimation techniques to investigate the trade and welfare profile along with the number of years their members participated over the period 1960-1996, and the framework proposed by Inters (1997) is extended to connect these trade profiles to welfare effects. “Younger” RTAs appear to be rewarded by a positive welfare effects during first years of existence, while “older” RTAs depict more volatile welfare effects.

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1 Introduction

Any country involved in a regional trade agreement (RTA henceforth) expects a welfare gain. This expectation is so strong that most engage in many different agreements leading to what Bhagwati called the “spaghetti bowl” phenomenon, that is the crisscrossing of many regional agreements differing in their schedules of phasing out tariffs, rules of origin and excluded products. Viner (1950) proposed a way to assess the welfare effect of an RTA by developing the notions of trade creation and trade diversion. Meade (1955) extended Viner’s approach by including demand elasticities that shape post custom union trade flows in addition to cost structures. Balassa (1967) proposed a “gross trade creation” measure as a computable version of Viner’s trade creation and trade diversion notions, and Aitken (1973) formulated a gravity model including RTA dummy variables to estimate Balassa’s measures.

The recent literature on developing RTA trade impact shows that different studies come out with different trade effects for the same RTAs, as depicted in Table 1, in which for instance AFTA, LAIA and MERCOSUR appear to have been net trade creating in some studies and net trade diverting in others.

In defense of these papers, let us mention that they use different estimation methods, different databases and focus on different time periods to measure these trade effects. However, they all focus on the number of years these RTAs have existed to estimate their trade impact. An alternative and interesting approach is to evaluate the participation effect of each member in the RTA: for a given RTA, we want to estimate its trade and welfare effects on any of its member after a given period of participation, whatever the official date of accession of this member. Such an estimation will characterize the RTA under consideration and help to see if it a successfull one or not according to our framework and methodology. We first propose a new RTA measure that takes into account the number of years of participation of each member, then combine a non-parametric estimation method

with the traditional gravity model to figure out potential non-monotonicities in the induced trade effects, and finally derive a connection between trade and welfare effects so as to interpret the estimated trade profiles in terms of welfare effects. This connection is based on the neoclassical framework proposed by Winters (1997) and combine common sense in regional trade theory and the supply/demand law.¹

Table 1: Trade impact of some developing RTAs

	Net trade creation	Net trade diversion
AFTA/ASEAN	Carrère (2004) Elliott & Ikemoto (2004) Gosh & Yamarik (2004) Cernat (2001)	Dee & Gali (2003) Soloaga & Winters (2000)
LAFTA/LAIA	Dee & Gali (2003) Gosh & Yamarik (2004) Soloaga & Winters (2000)	Carrère (2004) Soloaga & Winters (2000)
MERCOSUR	Gosh & Yamarik (2004) Cernat (2001) Soloaga & Winters (2000)	Carrère (2004) Dee & Gali (2003) Krueger (1999)

The paper focuses on six developing RTAs covering Subsaharan Africa (ECOWAS and SADC), Asia (AFTA) and Latin America (CACM, CAN and MERCOSUR) over the period 1960-1996, and two developed ones (EU and NAFTA) for the sake of comparison.² With this new approach, we find that the trade and welfare impacts of developing and developed RTAs evolve non-monotonically over time. The results on “younger” RTAs seem to indicate that the first years of participation to an RTA are rewarded by a positive welfare effect for the members, and sometimes

¹We acknowledge the extreme simplicity of this framework, but it has the merit of being coherent with economic theory instead of pure speculation.

²Appendices 1 and 2 describe these RTAs.

for the ROW too. The results on “older” RTAs seem to depict more volatile trade and welfare profiles over time. We also find that the trade and welfare effects of most RTAs under consideration were anticipated between one and five years before the official date of entry into force.

The remainder of the paper contains a theoretical and an empirical part. In the theoretical part (section 2), we first describe our specific measure of RTAs, then present the estimation approach combining a gravity model with kernel and bootstrap techniques to measure RTA trade impacts, and finally specify the connection between RTAs’ trade and welfare effects. In the empirical part (section 3), we estimate and discuss the trade and welfare effects of the selected developing RTAs and compare them to the results of the two developed RTAs included. Section 4 concludes the paper.

2 Theoretical investigation

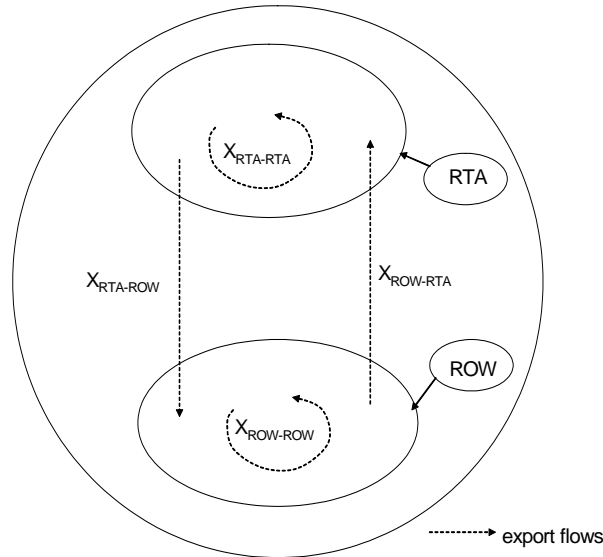


Figure 1: A geography of world trade flows

To properly measure RTA trade and welfare effects, we focus on export flows of

the trading partners in a general equilibrium framework as described in Figure 1. The subset RTA comprises the member countries of one of the eight RTAs under consideration and the subset ROW represents all the remaining countries in the world.

2.1 A new RTA measure

In this paper, we propose a new measure of RTA that focuses on the number of years each member has participated instead of using the usual RTA dummy variables. Such a measure combines the expansion dimension of an RTA (the evolution of the membership over time) and the cumulative cooperation experience of the members over time. For instance, let us consider the membership of the Central American Common Market: El Salvador, Guatemala, Honduras, Nicaragua created this RTA in 1960 and Costa Rica joined in 1962. Let call $YP(i, t)$ the number of years of participation of member country i in the RTA at date t . Table 3 illustrates CACM member participation in 1988, 1990 and 1992.

Table 3: Number of years CACM members have participated

	Years of participation: $YP(i, t)$			Year: t
	1988	1990	1992	
El Salvador	29	31	33	
Guatemala	29	31	33	
Honduras	29	31	33	
Nicaragua	29	31	33	
Costa Rica	27	29	31	
Member: i				

To compute the RTA variable, we have to distinguish between the exporter (country i) and the importer (country j). Each RTA is characterized by three

variables representing respectively export flows from a member to a non-member ($V_{RTA-ROW}$), export flows from a non-member to a member ($V_{ROW-RTA}$), and export flows between members ($V_{RTA-RTA}$).³ These variables depend on i , j and t :

$$V_{RTA-ROW}(i, j, t) = YP(i, t) \text{ if } i \text{ belongs to RTA, 0 otherwise} \quad (1)$$

$$V_{ROW-RTA}(i, j, t) = YP(j, t) \text{ if } j \text{ belongs to RTA, 0 otherwise} \quad (2)$$

$$V_{RTA-RTA}(i, j, t) = \min \{YP(i, t), YP(j, t)\} \text{ if } i \text{ and } j \text{ belongs to RTA, 0 otherwise} \quad (3)$$

To take into account the anticipation effects from the beginning of the negotiation of an RTA to the end of the first year of existence, we can anticipate each member first year of participation by a certain number of years; we arbitrarily choose ten years, a time period we assume sufficient enough to figure the anticipation. Under this hypothesis of a ten-year anticipation effect, the RTA variables become:

$$V_{RTA-ROW}(i, j, t) = YP(i, t) + 10 \text{ if } i \text{ belongs to RTA, 0 otherwise} \quad (4)$$

$$V_{ROW-RTA}(i, j, t) = YP(j, t) + 10 \text{ if } j \text{ belongs to RTA, 0 otherwise} \quad (5)$$

³Carrère (2004) shows that a proper evaluation of RTAs trade effects requires to distinguish between these three trade flows.

$$V_{RTA-RTA}(i, j, t) = \min \{YP(i, t), YP(j, t)\} + 10 \text{ if } i \text{ and } j \text{ belongs to RTA, } 0 \text{ otherwise} \quad (6)$$

These measures help to take into account the variation in membership and the cumulative cooperation effect over time of the RTA.

2.2 A new estimation approach

Another novelty of this paper is to combine a non-parametric estimation of these RTA variables with a gravity model so as to capture non-linear evolution. We proceed in three steps.

First, we estimate a bilateral trade model. Following Aitken (1973), the usual tool used by trade economists to evaluate RTA trade effects is to run a gravity model including dummy variables specifying these RTAs. Different theoretical foundations have been invoked to justify the use of the gravity model. Deardorff (1995) shows that both neoclassic and monopolistic competition frameworks lead to a gravity formulation of bilateral trade models. We will use the simple formulation derived in Feenstra (2003) as follows:⁴

$$\ln X_{ijt} = \left[\begin{array}{l} \alpha_0 \ln Dist_{ij} + \alpha_1 \ln GDP_{it} + \alpha_2 \ln GDP_{jt} + \beta_1 \ln POP_{it} + \beta_2 \ln POP_{jt} \\ + \theta_1 \ln RER_{it} + \theta_2 \ln RER_{jt} + \gamma t + \delta_0 + FE_i + FE_j + FE_t + \varepsilon_{ijt} \end{array} \right] \quad (7)$$

where X_{ijt} is country i 's export to country j at period t , $Dist_{ij}$ is the distance between country i and j , GDP_{it} is the GDP of country i in year t , POP_{it} is the population of country i in year t , RER_{it} is the real exchange rate of country i in

⁴This book presents a complete theoretical and empirical literature review of the gravity model. Equation (7) is based on equation (5.14) on page 145 of the book.

year t , t is the time trend so that γ measures the long term effect of time on trade flows, δ_0 is an intercept common to all years and country-pairs, FE_i and FE_j are respectively exporter and importer fixed effects common to all, FE_t is year fixed effects, and ε_{ijt} is an error term.⁵

Including separately FE_i and FE_j is theoretically the well suited approach as emphasized by Anderson and van Wincoop (2003) and Baier and Bergstrand (2002) among others. However, Cheng and Wall (2005) demonstrate that empirically, it is rather better to include country-pair fixed effects FE_{ij} . The alternative gravity model to be considered is thus:

$$\text{Ln}X_{ijt} = \left[\begin{array}{l} \alpha_1 \text{Ln}GDP_{it} + \alpha_2 \text{Ln}GDP_{jt} + \beta_1 \text{Ln}POP_{it} + \beta_2 \text{Ln}POP_{jt} \\ + \theta_1 \text{Ln}RER_{it} + \theta_2 \text{Ln}RER_{jt} + \gamma t + \delta_0 + FE_{ij} + FE_t + \varepsilon_{ijt} \end{array} \right] \quad (8)$$

where FE_{ij} is a country-pair fixed effect (with $FE_{ij} \neq FE_{ji}$) common to all years used to replace the exporter and importer fixed effects FE_i and FE_j . We can notice that equation (8) does not contain a distance variable. This is due to the fact that when including country-pair fixed effects, any regressor that is specific to country-pairs, such as bilateral distance is absorbed in the country-pair fixed effects and thus drops out of the estimated equation. Martinez-Zarzoso and Nowak-Lehmann (2003) and Cheng and Wall (2005) among others propose a two-stage estimation procedure to address this problem: the first stage is a country-pair fixed effects model and in the second stage, the estimated fixed effects are used as the dependent variable and the regressors include all the country-pair specific variables dropped in the first stage. In this paper, we will use equations (7) and (8) for the sake of comparison.

The estimated residuals of these two equations are extracted and used in the

⁵We use the real exchange rate variable formulation of Soloaga and Winters (2000) defined as: $RER_{it} = e \times \Pi_{US,t} / \Pi_{i,t}$ where e is the value of 1 US \$ evaluated in the currency of country i and Π is the GDP deflator.

second step, which consists in estimating the dependency of the estimated residuals from equations (7) and (8) on the three RTA variables described above by using a kernel regression.⁶ This non-parametric method allows for a more direct inspection of the impact of the RTA variables on trade residuals.

Let us consider a scatterplot (x_i, y_i) to be approximated by a non-parametric relation $f(x) = y$. In our case, x will be one of the three RTA variables and y will be the estimated trade residual. The idea behind the kernel regression is to use this scatterplot (x_i, y_i) to estimate the function $f(\cdot)$ from a fraction of the x values sample that is “near” to x by choosing a band including x . Inside this band, more weight is given to points near x and less is given to those far away by using a kernel function denoted $K(\cdot)$. Let us call h the bandwidth of the band including x ; the kernel estimate of the function $f(\cdot)$ is:

$$\hat{f}(x) = \frac{\sum_{i=1}^n K(x_i) y_i}{\sum_{i=1}^n K(x_i)} \quad (9)$$

where n is the number of observations. There are many possible choices for the kernel function, which should be positive and integrate to unity over the band. It should also be symmetric around zero, so that points below x are weighted equally as those equally distanced above, and it should be decreasing in the absolute value of its argument. The literature claims that the choice of the kernel function is not critical (e.g. Deaton, 1997, and Fox, 2004 among others). We will choose the tricube weight function defined as follows:

$$K(x_i) = \left[1 - \left(\frac{|x_i - x|}{h} \right)^3 \right]^3 \quad \text{for } \frac{|x_i - x|}{h} < 1$$

$$K(x_i) = 0 \quad \text{for } \frac{|x_i - x|}{h} \geq 1.$$

More important is the choice of the bandwidth that controls the trade-off between bias and variance of the estimated trade effects. Since the x variable is the

⁶ Another possibility is to use the LOWESS function but the kernel approach is relevant and easier to apply in our case: we have a large number of observations and the dependant variable (i.e. number of years each RTA member has participated) is equally distributed (year by year). Deaton (1997) discuss this issue.

number of years of participation, we choose a bandwidth $h = 1$ so as to smooth trade effects over a one-year period. This kernel method is used to evaluate the relationship between estimated trade residuals and each of the three RTA variables:

$$E(\varepsilon_{ijt}|V_{RTA-ROW}(i,j,t)) = \hat{f}(V_{RTA-ROW}(i,j,t)). \quad (10)$$

$$E(\varepsilon_{ijt}|V_{ROW-RTA}(i,j,t)) = \hat{f}(V_{ROW-RTA}(i,j,t)). \quad (11)$$

$$E(\varepsilon_{ijt}|V_{RTA-RTA}(i,j,t)) = \hat{f}(V_{RTA-RTA}(i,j,t)). \quad (12)$$

The third step of our estimation approach is to compute the 95% confidence interval of these non-parametric estimations by using bootstrap techniques. Following Redding and Venables (2001) who adapt Efron and Tibshirani (1993) bootstrap estimations method to the international trade context, we generate 200 samples by re-sampling over our initial database.⁷ Then we estimate for each of these samples the gravity equation, extract the residuals and run a kernel regression on each of the RTA variables as described above in the second step. These 200 kernel estimations are used to construct the 95% confidence interval of the estimated trade effects.

2.3 The welfare effects of RTAs

Many empirical papers have addressed the issue of RTA trade effects, but it is difficult to infer welfare effects on RTA members and non-members from these studies, as pointed out by Tovias (1982), Pelkmans (1983) and Winters (1987) among others. Trade economists now recognize that there is no clear mapping between the

⁷Each bootstrap replication re-samples the 24,806 country-pair observations in the database. According to Efron and Tibshirani (1993), the conventional number of bootstrap replications to be used to estimate a standard error is between 50 and 200. We choose the maximum (200 replications) to obtain a rigorous estimation of the 95% confidence interval.

trade effects of an RTA and its welfare effects. Most of the papers on this topic only speculate on the welfare impact of RTAs. Welfare is a complex notion that may take into account the availability of differentiated goods for consumers who love varieties and also the supply of public goods financed by taxes and custom duties. However, some papers rigorously explore the issue of RTAs welfare effects within some specific frameworks. The papers by Frankel, Stein and Wei (1993) and Spilimbergo and Stein (1996) deal with the welfare effect of RTAs in a Computable General Equilibrium framework. The paper by Winters (1997) deals with the welfare effect of an RTA on non-members building on the competitive neoclassical model used by Kemp and Wan (1976). Milner, Morrissey and McKay (2005) use a partial equilibrium method to measure the short term welfare effects of economic partnership between RTAs.

In this paper, we build on the regional integration theory and the paper by Winters (1997) to propose a connection between trade and welfare effects on members and non-members. Let us insist again on the fact we acknowledge the extreme simplicity of the approach, that however have the merit of coherence with our general modelling framework.

Winters (1997) demonstrates that “the two measures that show the direct, necessary and sufficient connection to non-members welfare are non-members imports and non-members terms of trade”, building on Figure 2. Winters goes on to: “... consider the slope of the welfare surface around the initial equilibrium, E . An increase in imports, shown by vector a , is unambiguously welfare-improving, whereas an (unrequited) increase in exports (b) is welfare-worsening, as is a balanced increase in exports and imports valued at the initial terms of trade (c)...”

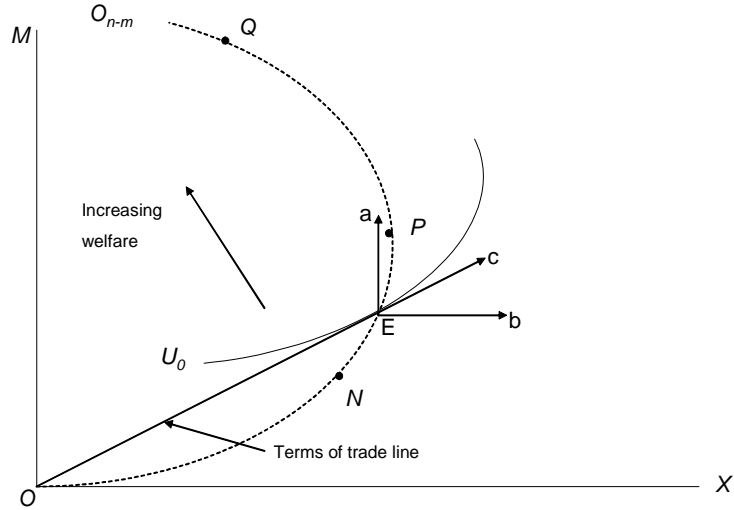


Figure 2: Non-members welfare: deviations from the initial equilibrium

In the regional trade theory, the welfare impact on the RTA's members depends on the intra-RTA export flows and the RTA's imports from the ROW: increasing intra-RTA exports combined with increasing imports from the ROW is welfare improving while increasing intra-RTA exports combined with decreasing imports from the ROW leads to an ambiguous welfare effect. We do not consider the case of a negative variation in intra-RTA export flows that is inconsistent with the regional integration theory. Such an outcome could be due to very distorting non-tariff barriers, or cumbersome rules of origin leading to a "counter-productive" RTA or simply a matter of inaccurate trade statistics.

In Winters (1997) model, the welfare impact on the ROW depends on the ROW imports from the RTA and its terms of trade. Increasing imports from the RTA are good for the ROW's welfare while decreasing imports from the RTA are welfare worsening for the ROW. However, we have to take into account the movement of the terms of trade line (see Figure 2). Since the slope of the ROW terms of

trade line is the ROW exports price index divided by the ROW imports price index (P_X/P_M), the Supply and Demand law helps us to infer on the rotation of the terms of trade line building on the trade flows $X_{RTA-ROW}$ (exports from a member to a non-member which also represents imports of a non-member from a member) and $X_{ROW-RTA}$ (exports from a non-member to a member, which also represent imports of a member from a non-member). An increase in $X_{RTA-ROW}$ and $X_{ROW-RTA}$ suggest a decrease in the imports and exports price index faced by the ROW, hence an ambiguous rotation of the terms of trade line. An increase in $X_{RTA-ROW}$ and a decrease in $X_{ROW-RTA}$ suggest a decreasing imports price index and an increasing exports price index, hence an upward rotation of the terms of trade line, corresponding to a welfare improvement for the ROW. A decrease in $X_{RTA-ROW}$ combined with an increase in $X_{ROW-RTA}$ suggest an increasing imports price index and a decreasing exports price index, hence a downward rotation of the terms of trade line corresponding to a welfare deterioration for the ROW. For decreasing $X_{RTA-ROW}$ and $X_{ROW-RTA}$, the rotation of the terms of trade line is ambiguous, hence an ambiguous welfare impact on the ROW.

Table 2 combines these results to propose a connection between trade and member and non-member welfare. The question mark (?) indicates an ambiguous effect, the symbol (-) indicates a negative effect, the symbol (+) indicates a positive effect and the symbol (0) indicates a null effect.

Let us comment some of the configurations in this Table. In line 3, the ROW imports from the RTA does not vary while the terms of trade line moves down, hence a negative welfare effect on the ROW.⁸ For the RTA, increasing intra-regional export flows combined with increasing imports from the ROW induce a positive welfare effect on the RTA members.

⁸Here, the ROW exports to the RTA increase, which implicitly supposes a decreasing exports price index, while the ROW imports from the RTA do not vary (no change in the imports price index), hence a downward rotation of the terms of trade line.

Table 2: The connection between trade and welfare effects

	Trade effects			Welfare effects	
	$X_{RTA \rightarrow ROW}$	$X_{ROW \rightarrow RTA}$	$X_{RTA \rightarrow RTA}$	RTA	ROW
1	+	+	+	+	?
2	-	+	+	+	-
3	0	+	+	+	-
4	+	-	+	?	+
5	-	-	+	?	?
6	0	-	+	?	+
7	+	0	+	+	+
8	-	0	+	+	-
9	0	0	+	+	0
10	+	+	0	+	?
11	-	+	0	+	-
12	0	+	0	+	-
13	+	-	0	-	+
14	-	-	0	-	?
15	0	-	0	-	+
16	+	0	0	0	+
17	-	0	0	0	-
18	0	0	0	0	0

In line 5, the ROW imports from the RTA decrease but the terms of trade line moving is ambiguous, hence an ambiguous welfare effect on the ROW. Concerning the RTA, increasing intra-regional imports are combined with decreasing imports from the ROW, hence an ambiguous welfare effect on the RTA members. In line 16, the ROW imports from the RTA increase while the terms of trade line moves up,

which corresponds to a welfare improvement for the ROW. Concerning the RTA, since intra and extra-regional imports do not change, there is no impact on the members' welfare.

Table 2 helps us to evaluate the welfare impact of the developing RTAs under consideration. However, let us mention that these welfare results hold only in the neoclassical framework used by Winters (1997).

3 Empirical Analysis

In this section, we present and discuss the data and estimation methods used to evaluate the trade and welfare effects of the six developing RTAs under consideration. We comment these effects and compare them to the effects of the two developed RTAs included for the sake of comparison.

3.1 Data and estimation issues

Our database comes from Rose (2003). We have bilateral export flows among 179 countries over the period 1960-1996.⁹ The panel is unbalanced but since we are dealing with fixed effects, the estimators will not be biased because of that. However, we perform the Huber/White estimator of the variance to correct for the potential heteroscedasticity problem due to unbalanced structure of the data. Furthermore, the existence of zero export flows in the data raises a selection problem that can be handled by the Heckman two-step approach, which transforms a selection bias problem into an omitted variable issue by including the Mills ratio as a regressor.¹⁰

⁹In fact, the bilateral trade flows in Roses (2003) that comes from the IMF DOTS database runs until the year 2000 but the volatility of the data is very high after 1996. We tried to correct this problem by including crisis dummy variables, continent dummy variables, regional dummy variables and interaction of all these variables but none of these attempts appeared relevant to correct for this high volatility. This is why we are restricted to the period 1960-1996.

¹⁰4,340 observations over 143,783 (3%) depict a zero trade flow. For equation (1), the selection equation explains the dummy variable (1 if non-zero trade flows and 0 if zero trade flows) with all the regressors included in equation (1) and includes the product of the surface area of the two trading partners, while for equation (2), we include in addition to the regressors of equation (2) the surface area of each trading partners separately. We then run the heckman two-step procedure

A statistically significant coefficient for the Mills ratio confirms and corrects for the selection bias.

The gravity equations to be estimated in the first step become:

$$LnX_{ijt} = \left[\begin{array}{c} \alpha_0 LnDist_{ij} + \alpha_1 LnGDP_{it} + \alpha_2 LnGDP_{jt} + \beta_1 LnPOP_{it} + \beta_2 LnPOP_{jt} + \\ \theta_1 LnRER_{it} + \theta_2 LnRER_{jt} + \eta Mills_Ratio_{ijt} + \gamma t + \delta_0 + FE_i + FE_j + FE_t + \varepsilon_{ijt} \end{array} \right] \quad (13)$$

and

$$LnX_{ijt} = \left[\begin{array}{c} \alpha_1 LnGDP_{it} + \alpha_2 LnGDP_{jt} + \beta_1 LnPOP_{it} + \beta_2 LnPOP_{jt} + \theta_1 LnRER_{it} \\ + \theta_2 LnRER_{jt} + \eta Mills_Ratio_{ijt} + \gamma t + \delta_0 + FE_{ij} + FE_t + \varepsilon_{ijt} \end{array} \right] \quad (14)$$

The estimation of these equations are reported in Appendix 3.¹¹ Specification 1 corresponds to equation (13) including exporter/importer fixed effects and Specification 2 corresponds to equation (14) including country-pair fixed effects. In the results presented in Appendix 3, a parameter with an upper index *a* is significant at the 1% level, that with an upper index *b* is significant at the 5% level and that with an upper index *c* is significant at the 10% level.

Both specifications yield a significant and negative coefficient for the Mills ratio, indicating that without including this variable would under-estimate the importance of some trading partners. The real exchange rate variables that measure the competitiveness of the trading partners over time indicate a slight decrease in competitiveness among the trading partners over the period 1960-1996.

In the second step, we extract the estimated trade residuals from equations (13) and (14) and run a kernel regression with the tricube weighted function as described

and estimate the Mills ratio variable.

¹¹We do not report export/importer or country-pair fixed effects and year fixed effects to save space.

in Section 2.2. The bandwidth is set to $h = 1$ so as to smooth trade effects year by year and the number of years each RTA member participated are re-scaled into a 100-grid point scale.

In the third step, we generate 200 samples by bootstrapping the database, and then re-estimate the gravity equations and extract the trade residuals for each of these 200 new databases. Then we re-evaluate the kernel regressions (second step described in Section 2.2): for each of the 100 grid points representing the number of years each RTA member participated, we obtain 200 estimations of the trade effects. For each grid point, we use these 200 estimated trade effects to compute the standard deviation (σ) of the trade effects. Finally, we use these standard deviations σ to compute the 95% confidence interval of the trade effects defined as $\pm 1.96 \times \sigma$.

The results are presented in Appendix 4. The specification using exporter/importer fixed effects yields relatively high intra-RTA trade flows, suggesting a bias of the estimated trade effects. This is probably due to the fact that equation (13) does not include all the relevant bilateral variables mentioned in the literature (common language, common border, common coloniser, etc.). This problem is corrected in equation (14) including a country-pair fixed effects that control for all these bilateral variables. The trade effects obtained are more stable, which is in line with Cheng and Wall (2005). The following comments restrict on the specification with country-pair fixed effects.

3.2 The trade and welfare effects of some developing RTAs

The ASEAN Free Trade Agreement (AFTA) was created in 1992 by six members of the Association of South East Asian Nations (Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore and Thailand), four other members joined subsequently (Vietnam in 1995, Laos and Myanmar in 1997, Cambodia in 1999). Figure

3 of Appendix 4 plots the estimated trade residuals against the AFTA membership evolution over time: the top panel focuses on intra-AFTA trade residuals ($X_{AFTA-AFTA}$), the middle panel focuses on AFTA residual imports from the ROW ($X_{ROW-AFTA}$) and the bottom panel focuses on AFTA residual exports to the ROW ($X_{AFTA-ROW}$). The dashed lines represent the estimated 95% confidence interval. These graphs clearly show an anticipation effect for AFTA members which started increasing their imports from and exports to the ROW five years before the official year of creation of this RTA. The welfare implication of AFTA corresponds to line 10 in Table 2, which implies a positive welfare impact on its members and an ambiguous welfare impact on the ROW. This means that as the number of years of participation in AFTA increases, AFTA members enjoy an improvement of welfare, a result that suggests a positive impact of this RTA.

The Central American Common Market (CACM), was created in 1960 by El Salvador, Guatemala, Honduras, Nicaragua. Costa Rica joined in 1962. It is notified at the WTO as a customs union. Figure 4 of Appendix 4 plots the estimated trade residuals against the number of years of each CACM member's participation. Two years before its creation until seven years after, the intra-CACM export flows were negative, which corresponds to the "abnormal" case we did not include in Table 2.¹² This configuration also appears around the 31st year of participation. Abstracting from these cases, Figure 4 depicts two interesting configurations corresponding to lines 6 and 3 of Table 2. Between the seventh and the thirtieth years of participation, the CACM induces an ambiguous welfare impact on its members combined with a positive welfare impact on the ROW. After the thirty-second year of its members' participation, this RTA starts inducing a positive welfare impact on its members,

¹²In fact, the CACM collapsed in 1969 after a five-day war that had been known as the "soccer war" between El Salvador and Honduras. After this episode, the partners tried to slowly re-establish their collaboration. This may explain the "abnormal" trade effects observed. We may also notice that in Figure 4 of appendix 4, the CACM trade flows are limited to two years before the official date of entry into force (1962 for Costa Rica) because the database used is limited on the period 1960-1996.

and a negative welfare impact on the ROW.

The Andean Community (CAN) is a preferential agreement signed in 1988 by Bolivia, Colombia, Ecuador, Peru and Venezuela. Figure 5 of Appendix 4 plots the estimated trade residuals against the number of years of member participation. There is no clear anticipation effect depicted on these graphs, but the creation of the CAN seems to have had a clear impact on its members trade flows. The improvement of the intra-RTA trade flows was however associated with a continuous decrease in their imports from and exports to the ROW. Figure 5 reveals the sequence of two configurations corresponding to lines 4 and then 1 of Table 2. After five years, the CAN appeared to have induced an ambiguous welfare impact on its members, combined with a positive welfare impact on the ROW. However, after this fifth year of participation, CAN members started enjoying a positive welfare impact while the ROW was facing an ambiguous welfare effect.

The Economic Community of West African States (ECOWAS) is a political association created in 1975 by fifteen members (Mauritania withdrew in 1999): Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo. Figure 6 of Appendix 4 plots the estimated trade residuals against the number of years these countries have participated in ECOWAS. These graphs indicate a slight anticipation effect on the intra and extra import flows of ECOWAS members five years before the official date of creation. We then observe a sequence of four configurations corresponding to lines 10, 3, 14 and finally 18 of Table 2. For ECOWAS members, this suggests a positive welfare effect followed by a negative and finally a null welfare effect, while for the ROW, this corresponds to a succession of ambiguous and negative welfare effects. It seems that after a good start, the ECOWAS induced a global negative welfare effect along with an increase in the number of years each member participated.

The Southern Common Market (MERCOSUR) was established in 1991 between

Argentina, Brazil, Paraguay and Uruguay. Figure 8 of Appendix 4 plots the estimated trade residuals against the number of years of member participation and indicates that MERCOSUR members were very involved in intra-trade at least five years before the official RTA's date of implementation. Figure 8 reveals a sequence of three configurations corresponding to lines 7, 3 and then 1 of Table 2. This result suggests that MERCOSUR has had a positive welfare impact on its members as their years of participation kept increasing, while the positive welfare effect initially induced on the ROW later became negative and finally ambiguous.

The last developing RTA considered is the South African Development Community (SADC), which is a political association created in 1992 by fourteen members: Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe. Figure 10 of Appendix 4 plots the estimated trade residuals against the number of years of SADC member participation. As in the other Figures mentioned in this section, the top panel focuses on intra-SADC trade residuals ($X_{SADC-SADC}$), the middle panel focuses on SADC residual imports from the ROW ($X_{ROW-SADC}$) and the bottom panel focuses on SADC residual exports to the ROW ($X_{SADC-ROW}$). Figure 10 reveals an anticipation effect of SADC members depicted by a continuous increase in the intra-SADC trade flows more than five years before the official implementation date. This RTA depicts a sequence of configuration corresponding to lines 8 and 5 in Table 2, a result that suggests a positive and then ambiguous welfare impact on its members coupled with a negative and then ambiguous welfare effect on the ROW.

For the sake of comparison, we also consider two developed RTAs: the EU and the NAFTA. Figures 7 and 9 of Appendix 4 plot the trade impact of these RTAs against the number of years their members participated. Figures 7 and 9 indicate an anticipation effect of both the EU and the NAFTA since their members seemed

to be very involved in intra-regional trade before their official date of accession to these RTAs. The EU depicts a sequence of configuration corresponding to lines 3, then 7 and 3 again while the NAFTA is represented by line 2 only. These results suggest a positive welfare impact for the EU and the NAFTA on their members combined with a negative welfare effect on the ROW.

4 Conclusion

This paper proposes three contributions to the ex-post evaluation of RTAs. First, we use a new set of measures to evaluate RTA trade impacts that take into account the number of years each member has participated. Second, we combine traditional gravity regressions with non-parametric estimation techniques that help to investigate the trade effects without imposing structural forms in advance. Finally, we build on the paper by Winters (1997) and the regional integration theory to propose a broad connection between trade and welfare effects.

We focused on a panel of six developing RTAs covering Africa, Asia and Latin America since these regions are more concerned with trade-related policies in their development process. As a general result from this empirical exercise, the “younger” developing RTAs (AFTA, CAN, MERCOSUR, NAFTA and SADC) seem to indicate that first years of participation are rewarded by a positive trade and welfare effects for the members, and sometimes for the ROW too, while the “older” ones (CACM, ECOWAS and EU) seem to depict a more volatile trade and welfare profiles as the number of years of participation of the members keep increasing. The results also reveal that most of the RTAs under consideration were anticipated five years before the official date of implementation.

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APPENDIX

Appendix 1: A panel of developing RTAs

Agreement	Full name	Membership evolution	Type
ECOWAS	Economic	1975: Benin	Political
	Community of	1975: Burkina Faso	Association
	West Africa	1975: Cape Verde	
	States	1975: Cote d'Ivoire	
		1975: Gambia	
		1975: Ghana	
		1975: Guinea	
		1975: Guinea Bissau	
		1975: Liberia	
		1975: Mali	
		1975: Niger	
		1975: Nigeria	
		1975: Senegal	
		1975: Sierra Leone	
	1975: Togo		

Agreement	Full name	Membership evolution	Type
CAN	Andean	1988: Bolivia	Preferential
	Community	1988: Colombia	Arrangement
		1988: Ecuador	
		1988: Peru	
		1988: Venezuela	

Agreement	Full name	Membership evolution	Type
SADC	South African Development Community	1992: Angola 1992: Botswana 1992: D. R. Congo 1992: Lesotho 1992: Malawi 1992: Mauritius 1992: Mozambique 1992: Namibia 1992: Seychelles 1992: South Africa 1992: Swaziland 1992: Tanzania 1992: Zambia 1992: Zimbabwe	Political Association

Agreement	Full name	Membership evolution	Type
AFTA	ASEAN Free Trade Agreement	1992: Brunei Darusalam 1992: Indonesia 1992: Malaysia 1992: Philippines 1992: Singapore 1992: Thailand 1995: Vietnam 1997: Laos 1997: Myanmar 1999: Cambodia	Political Association

Agreement	Full name	Membership evolution	Type
CACM	Central American Common Market	1960: El Salvador	Customs
		1960: Guatemala	Union
		1960: Honduras	
		1960: Nicaragua	
		1962: Costa Rica	

Agreement	Full name	Membership evolution	Type
MERCOSUR	Southern Common Market	1991: Argentina	Customs
		1991: Brazil	Union
		1991: Paraguay	
		1991: Uruguay	

Appendix 2: EU and NAFTA

Agreement	Full name	Membership evolution	Type
NAFTA	North American Free Trade Agreement	1994: Canada	Free
		1994: Mexico	Trade
		1994: USA	Agreement

Agreement	Full name	Membership evolution	Type
EU	European Union	1957: Belgium	Customs
		1957: Luxembourg	Union
		1957: France	
		1957: Germany	
		1957: Italy	
		1957: Netherlands	

Agreement	Full name	Membership evolution	Type
EU	European Union	1971: Denmark 1971: Ireland 1971: United Kingdom 1981: Greece 1986: Portugal 1986: Spain 1995: Austria 1995: Finland 1995: Sweden	Customs

Appendix 3: Country-pair and time fixed effects model estimation

	Dep var: $\ln X_{ijt}$	
	1	2
$\ln(Dist_{ij})$	-1.33 ^a	
$\ln(GDP_{it})$	1.43 ^a	1.37 ^a
$\ln(GDP_{jt})$	1.00 ^a	1.03 ^a
$\ln(POP_{it})$	-2.14 ^a	-1.47 ^a
$\ln(POP_{jt})$	-1.07 ^a	-0.45 ^a
$\ln(Real\ Exchange\ Rate_{it})$	-0.00	-0.004 ^c
$\ln(Real\ Exchange\ Rate_{jt})$	-0.009 ^a	-0.01 ^a
t	0.04 ^a	0.03 ^a
Mills ratio	-3.91 ^a	-1.99 ^a
Constant	17.33 ^a	-10.05 ^a
N	143,783	143,783
R ²	0.48	0.35
P-value	0.00	0.00

Appendix 4: Figures

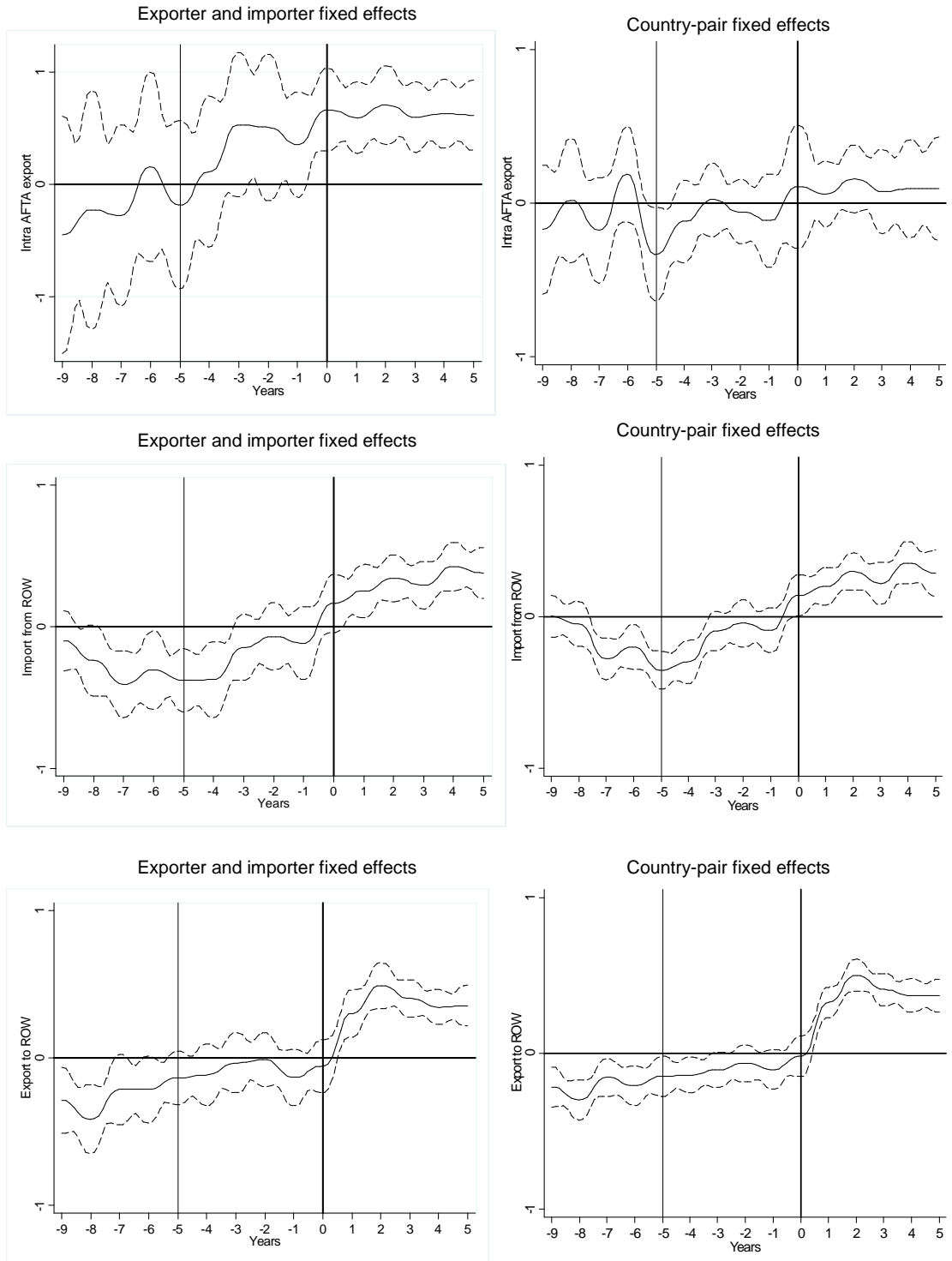


Figure 3: AFTA trade effects

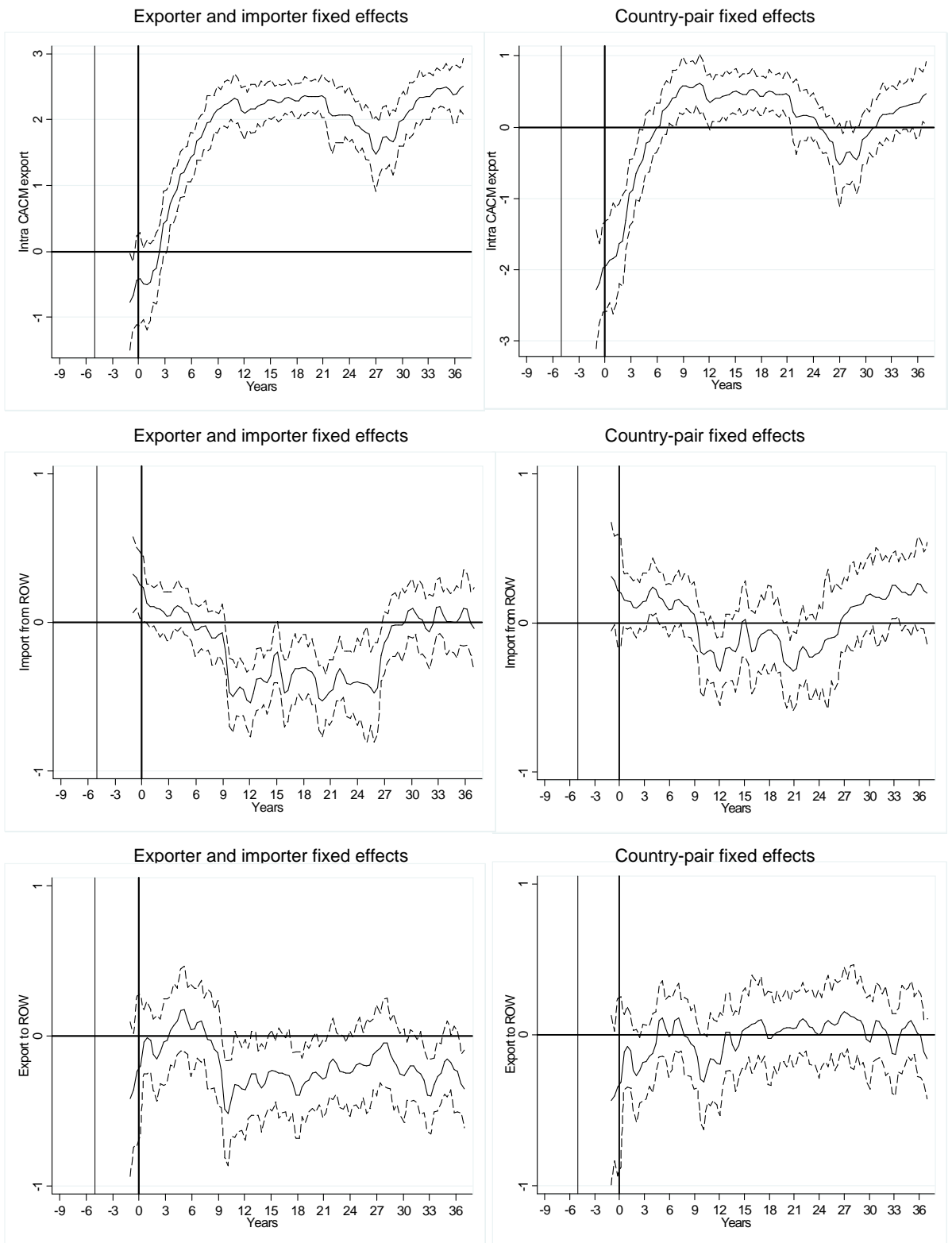


Figure 4: CACM trade effects

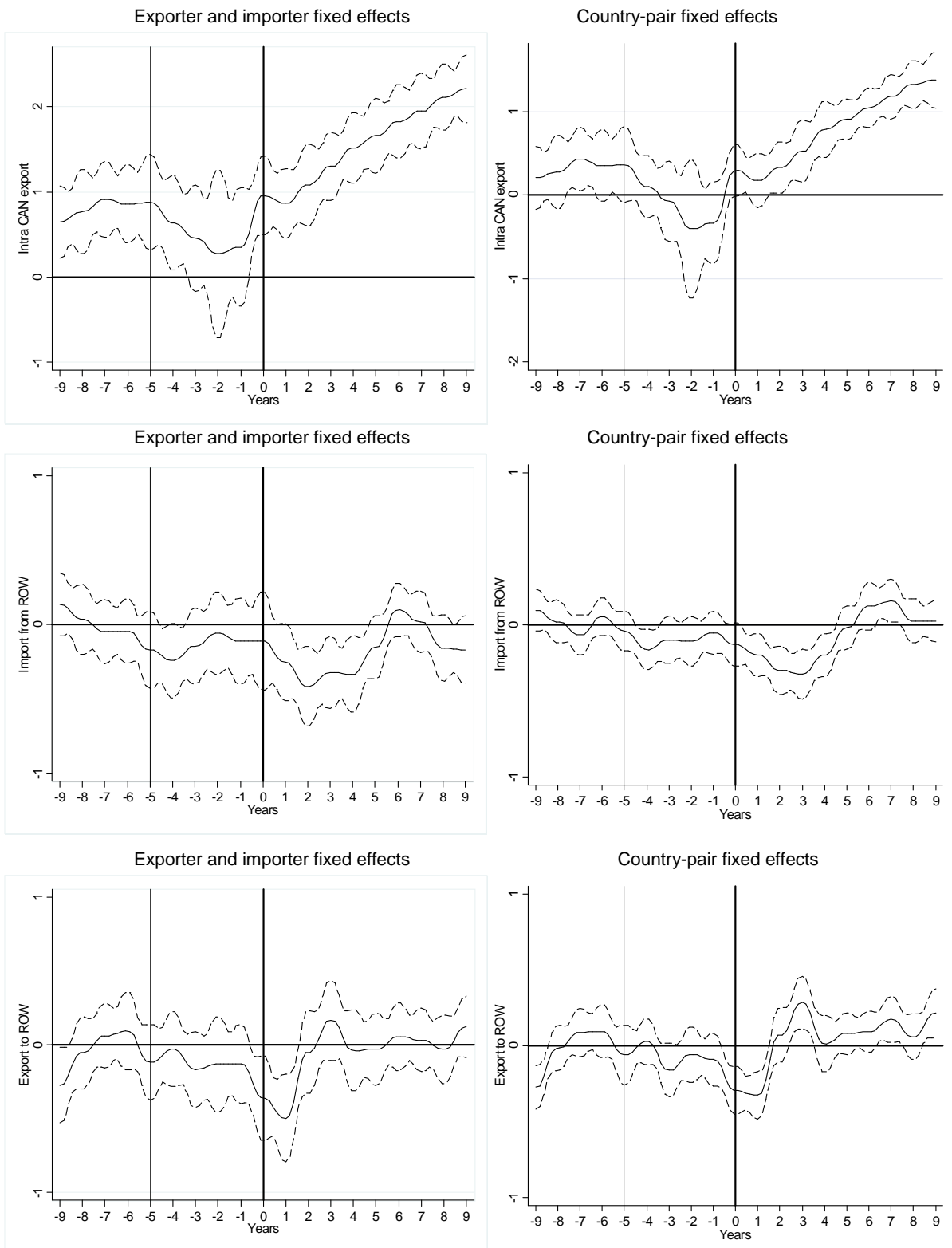


Figure 5: CAN trade effects

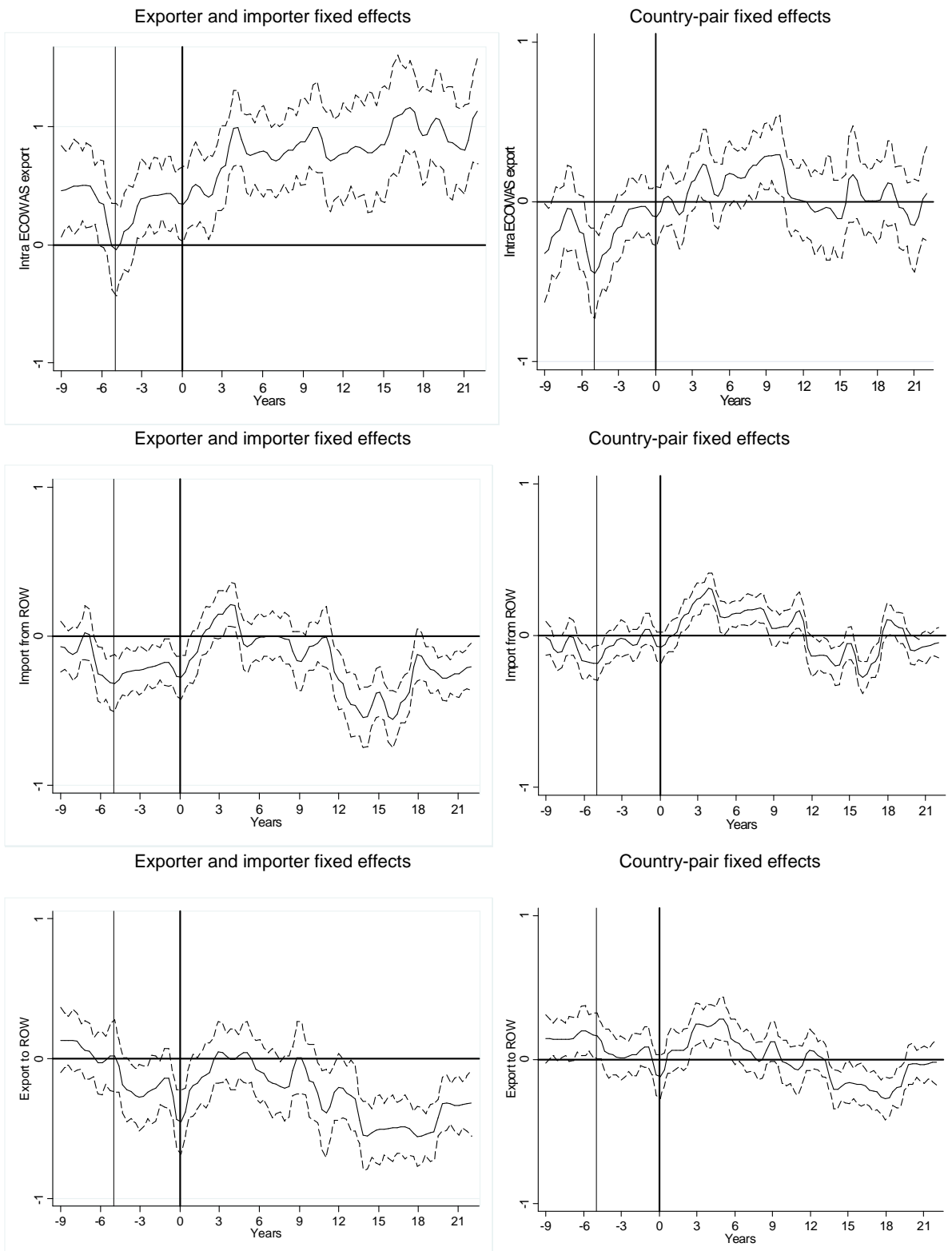


Figure 6: ECOWAS trade effects

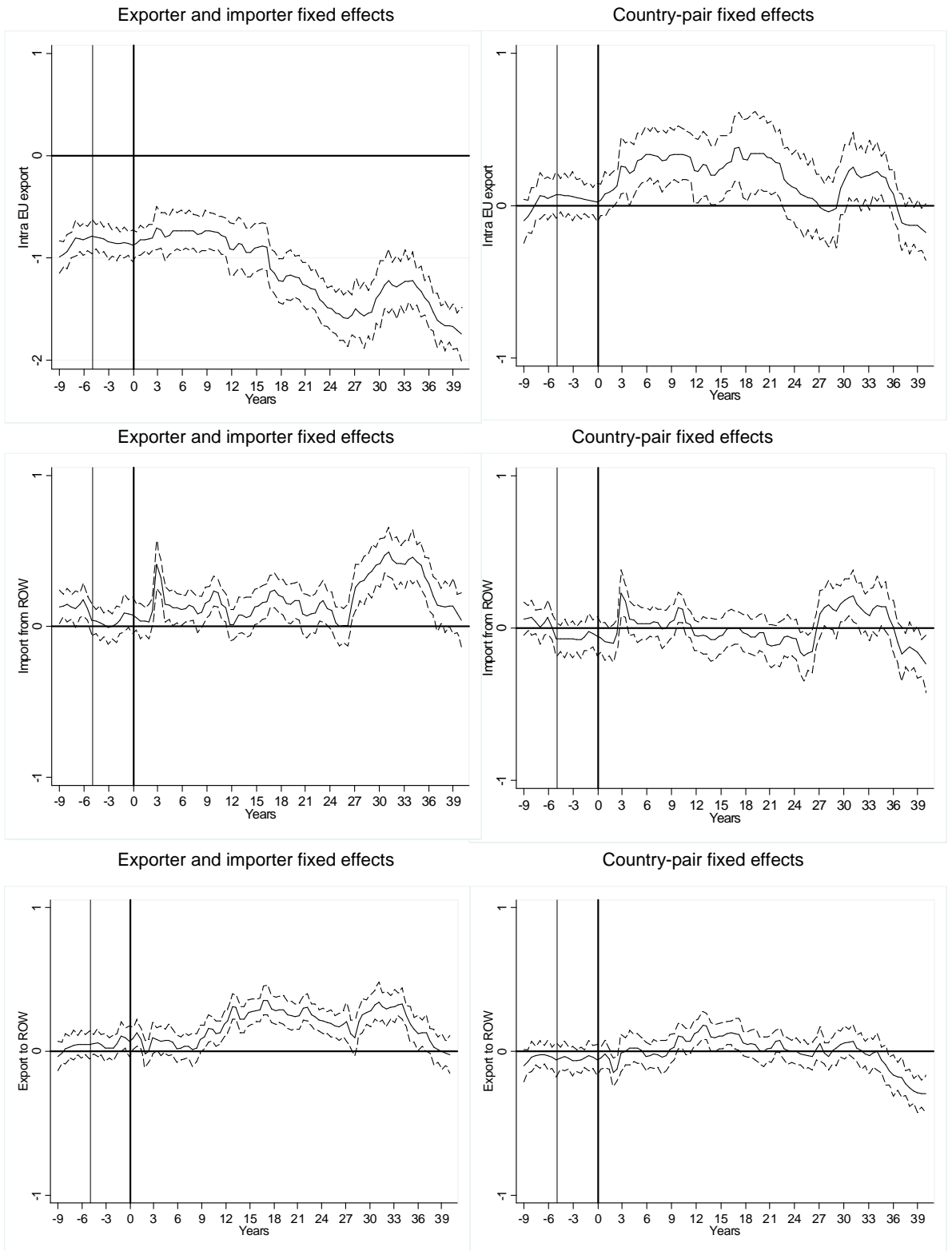


Figure 7: EU trade effects

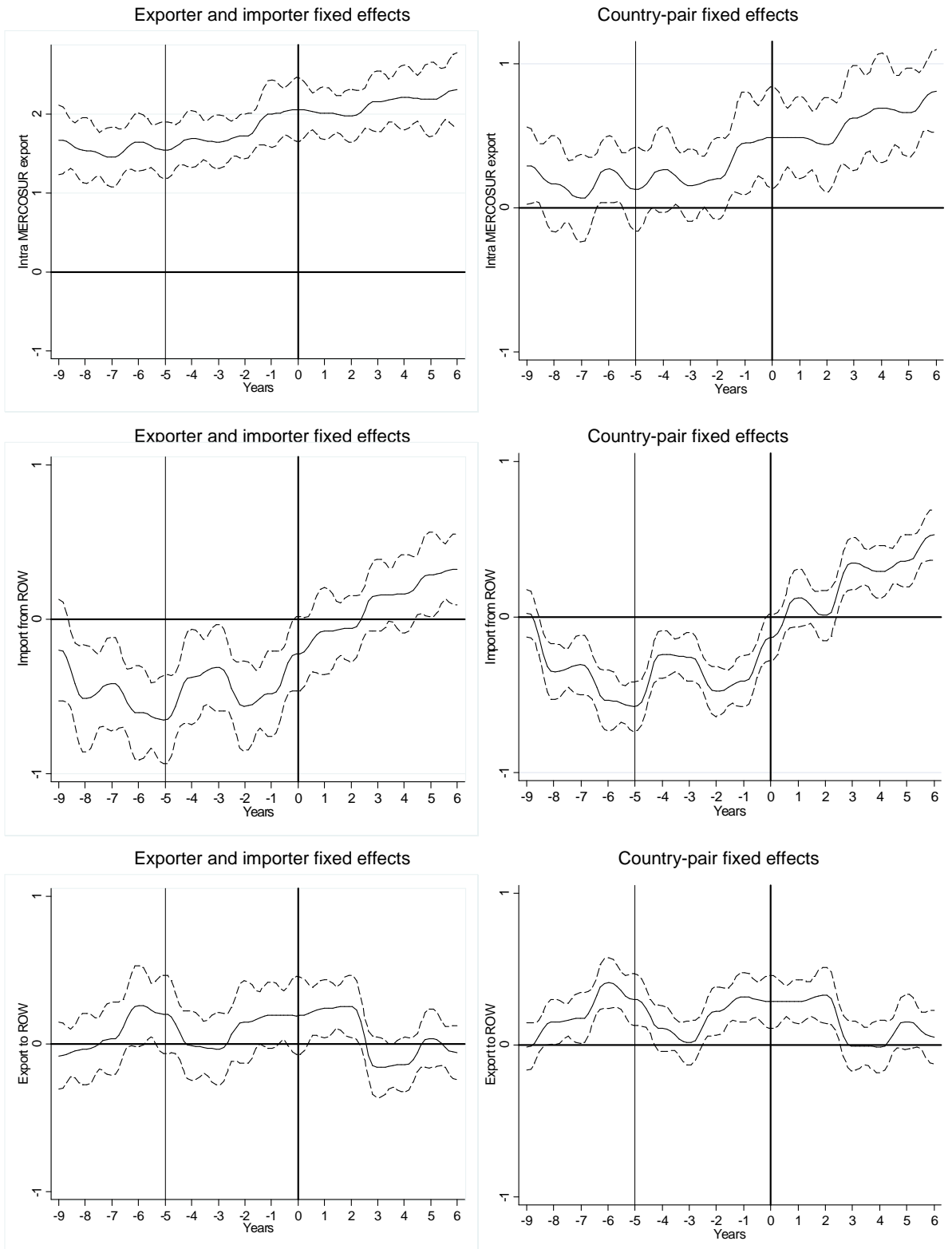


Figure 8: MERCOSUR trade effects

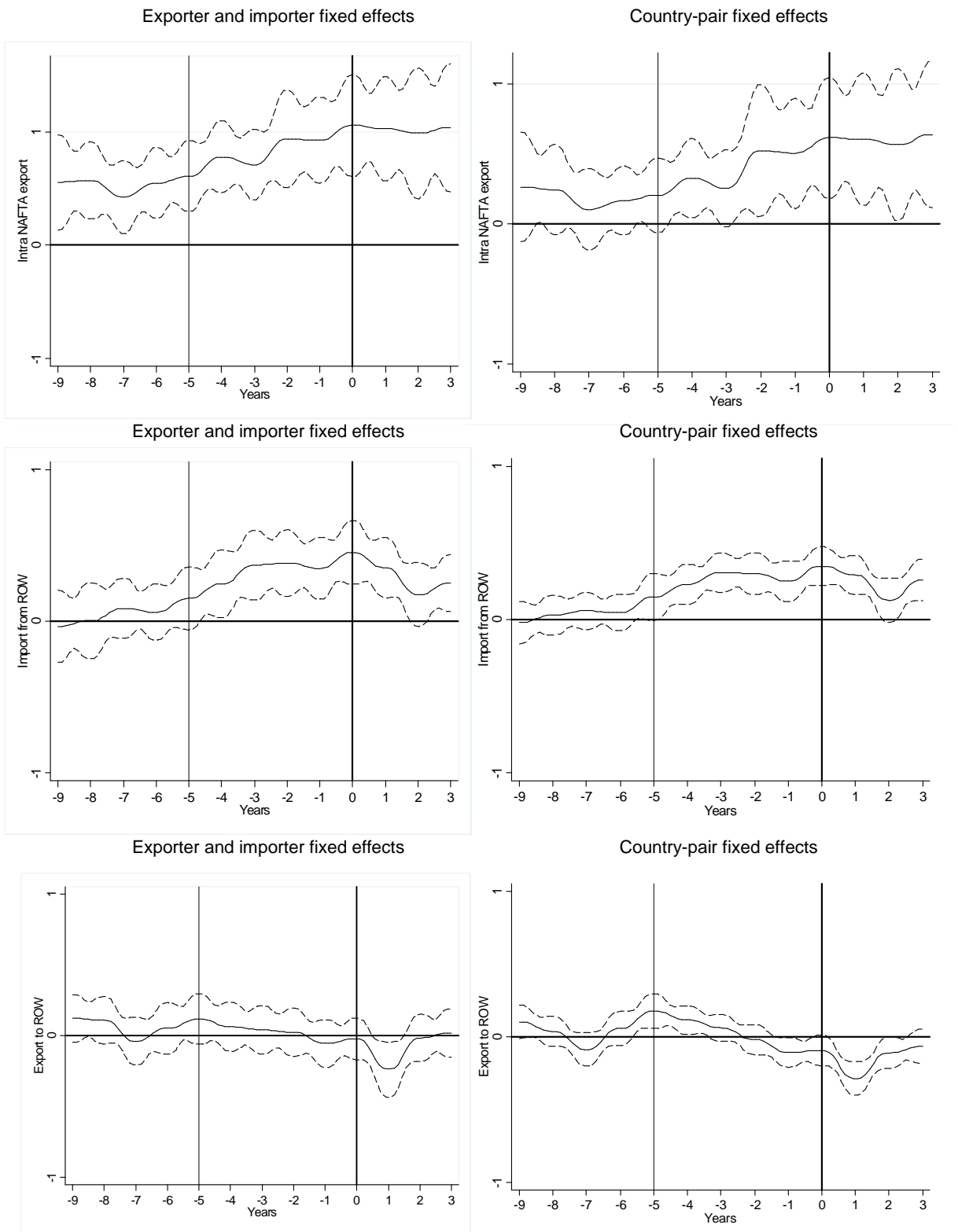


Figure 9: NAFTA trade effects