Evaluating the Trade and Welfare Effects of Developing RTAs*

Souleymane Coulibaly+

DEEP-HEC, University of Lausanne and TEAM, University of Paris 1

Pantheon-Sorbonne

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Abstract

Many recent papers have pointed to ambiguous trade effects of developing regional trade agreements, calling for a reassessment of their economic merits. We focus on six such agreements currently in force in Sub-Saharan Africa, Asia and Latin America, estimating their impacts on trade flows and welfare. We combine a gravity model with kernel and bootstrap estimation techniques so as to capture the non-monotonic trade effects while imposing minimal structure. Instead of the usual dummy variables for RTAs, we propose a new variable, capturing the number of years of a country's RTA membership, and we adapt the framework proposed by Winters (1997) to relate trade effects to their welfare implications. The results indicate that only AFTA and MERCOSUR have induced positive trade and welfare effects. The remaining RTAs have produced mixed effects for their members.

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+BFSH1 1015 Lausanne (Switzerland), Tel: +41 21 692 3474, Fax: +41 21 692 3365, E-mail: souleymane.coulibaly@unil.ch

1 Introduction

According to official rhetoric, countries involved in a regional trade agreement (RTA henceforth) expect 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. Recent studies of trade effects of developing RTAs come to different conclusions, sometimes for the same RTAs, as depicted in Table 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)

For instance, AFTA, LAIA and MERCOSUR appear to have been net trade creating in some studies and net trade diverting in others. These studies use different estimation methods, different databases and different dynamic specifications to measure trade effects, and they 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: for a given RTA, 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 is. We therefore propose a new RTA variable taking into account the number of years of participation of each member. In addition, we combine a non-parametric estimation method with the traditional gravity model to detect potential non-monotonicities in the induced trade effects. Finally, we establish a connection between trade and welfare effects where possible. This connection is based on the neoclassical framework proposed by Winters (1997), adapted to our framework by using some key results of the related models of regional integration.[1]

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 RTAs (EU and NAFTA) for the sake of comparison.[2] We find that the trade and welfare impacts of developing and developed RTAs can evolve non-monotonically over time. The results on RTAs created in the 1990s seem to indicate that the first years of participation to an RTA are rewarded by a positive welfare effect for the members, and sometimes for the ROW too. RTAs created in the 1970s and before seem to depict more varied trade and welfare profiles over time. We also find that the trade and welfare effects of most RTAs under consideration preceded the official date of entry into force by one to five years.

The remainder of the paper contains a theoretical and an empirical part. In the theoretical part (section 2), we first propose a new variable to represent the impact of RTAs, taking into account the number of years of participation of each member, then we present our estimation approach combining a gravity model with

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

[2] Appendices 1 and 2 describe these RTAs.

kernel and bootstrap techniques to measure the trade impacts of RTAs, and finally we employ analysis of RTAs' trade and welfare effects proposed by Winters (1997) as a base for the interpretation of our results. 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 obtained for developed-country RTAs. Section 4 concludes the paper.

2 Theoretical investigation

To measure RTA trade and welfare effects properly, 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.

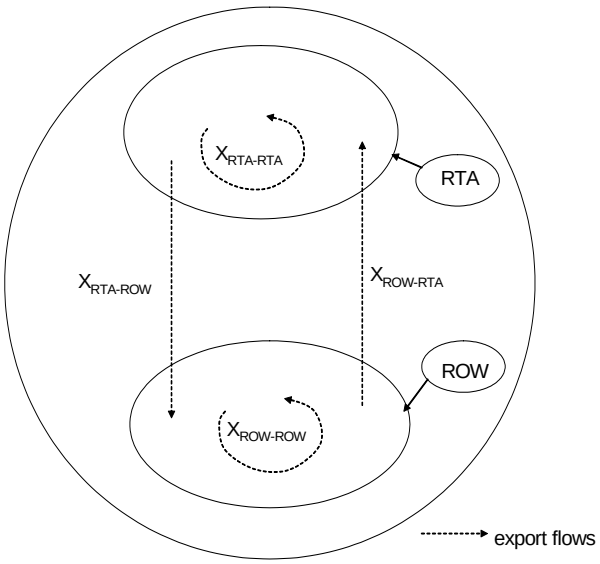

Figure 1: A geography of world trade flows

2.1 A new RTA variable

In this paper, we propose a new variable designed to pick up the effect of RTAs. This variable is a count of 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 (CACM): El Salvador, Guatemala, Honduras and Nicaragua created this RTA in 1960, and Costa Rica joined in 1962. Let us 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: $YP(i,t)$			
	1988	1990	1992	Year: t
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:

$$V_{RTA-ROW}(i,j,t) = YP(i,t) \text{ if } i \text{ belongs to RTA and } j \text{ does not, 0 otherwise} \tag{1}$$

$$V_{ROW-RTA}(i,j,t) = YP(j,t) \text{ if } j \text{ belongs to RTA and } i \text{ does not, 0 otherwise} \tag{2}$$

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

To take account of anticipation effects from the beginning of the negotiation of an RTA to the end of the first year of existence, we can start the analysis a certain number of years ahead of the entry into force of the RTA. We arbitrarily choose ten years, a time period we assume sufficient to capture the effects of anticipation. Under this hypothesis, the RTA variables become:

$$\widetilde{V}_{RTA-ROW}(i,j,t) = YP(i,t)+10 \text{ if } i \text{ belongs to RTA and } j \text{ does not, 0 otherwise} \tag{4}$$

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

$$\widetilde{V}_{ROW-RTA}(i,j,t) = YP(j,t)+10 \text{ if } j \text{ belongs to RTA and } i \text{ does not, 0 otherwise} \tag{5}$$

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

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

Viner (1950) has proposed a way to assess the welfare effect of an RTA by developing the concepts 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.

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

First, we estimate a bilateral trade model. 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]

$$LnX_{ijt} = \left[\begin{array}{c} \alpha_0 LnDist_{ij} + \alpha_1 LnGDP_{it} + \alpha_2 LnGDP_{jt} + \beta_1 LnPOP_{it} + \beta_2 LnPOP_{jt} \\ +\theta_1 LnRER_{it} + \theta_2 LnRER_{jt} + \gamma t + \delta_0 + FE_i + FE_j + FE_t + \varepsilon_{ijt} \end{array} \right] \tag{7}$$

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 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:

$$LnX_{ijt} = \left[\begin{array}{c} \alpha_1 LnGDP_{it} + \alpha_2 LnGDP_{jt} + \beta_1 LnPOP_{it} + \beta_2 LnPOP_{jt} \\ +\theta_1 LnRER_{it} + \theta_2 LnRER_{jt} + \gamma t + \delta_0 + FE_{ij} + FE_t + \varepsilon_{ijt} \end{array} \right] \tag{8}$$

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

[4] This 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.

[5] We 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.

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 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 $f(.)$ 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 $K(.)$. Let us call h the bandwidth of the band including x; the kernel estimate of the function $f(.)$ is:

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

where n is the number of observations. There are many possible choices for 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.

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:

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

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

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 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:

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

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

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

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

[7] Each 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

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 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, Morrisey 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.

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.

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)..."

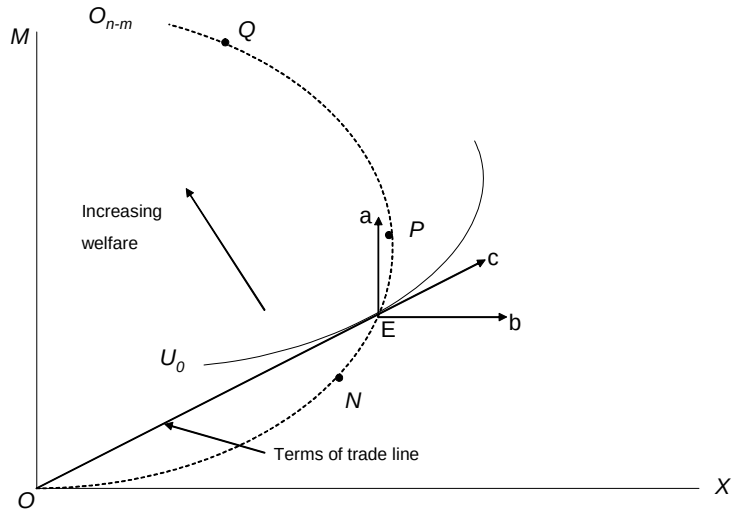

Figure 2: Non-members welfare: deviations from the initial equilibrium

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 form 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.

Table 2: The connection between trade and welfare effects

	Trade effects			Welfare effects	
	$X_{RTA \to ROW}$	$X_{ROW \to RTA}$	$X_{RTA \to RTA}$	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

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

[8] Here, 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.

flows combined with increasing imports from the ROW induce a positive welfare effect on the RTA members.

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,

[9] In 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.

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] 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:

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

and

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

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.

[10] 4,340 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 and estimate the Mills ratio variable.

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

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 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 colonizer, 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]

[12] In 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

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, 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

the official date of entry into force (1962 for Costa Rica) because the database used is limited on the period 1960-1996.

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 variable to evaluate RTA trade impacts that takes 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 theory of regional integration to propose a broad connection between trade and welfare effects.

We focus on a panel of six developing RTAs covering Africa, Asia and Latin America. Developing RTAs created in the 1990s (AFTA, CAN, MERCOSUR, NAFTA and SADC) generally exhibit positive trade and welfare effects during the first years of participation for the members, and sometimes for the ROW too. RTAs created in the 1970s and before (CACM, ECOWAS and EU) appear to have had

alternating positive and negative trade and welfare effects as the number of years of participation of the members increased. More specifically, AFTA and MERCOSUR appear to have induced positive and increasing trade and welfare effects for their members. The results also suggest that most of the RTAs under consideration were anticipated some 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 Community of West Africa States	1975: Benin 1975: Burkina Faso 1975: Cape Verde 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	Political Association

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

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 1960: Guatemala 1960: Honduras 1960: Nicaragua 1962: Costa Rica	Customs Union

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

Appendix 2: EU and NAFTA

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

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

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

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
$\ln\big(Real\ Exchange\ Rate_{jt}\big)$	-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

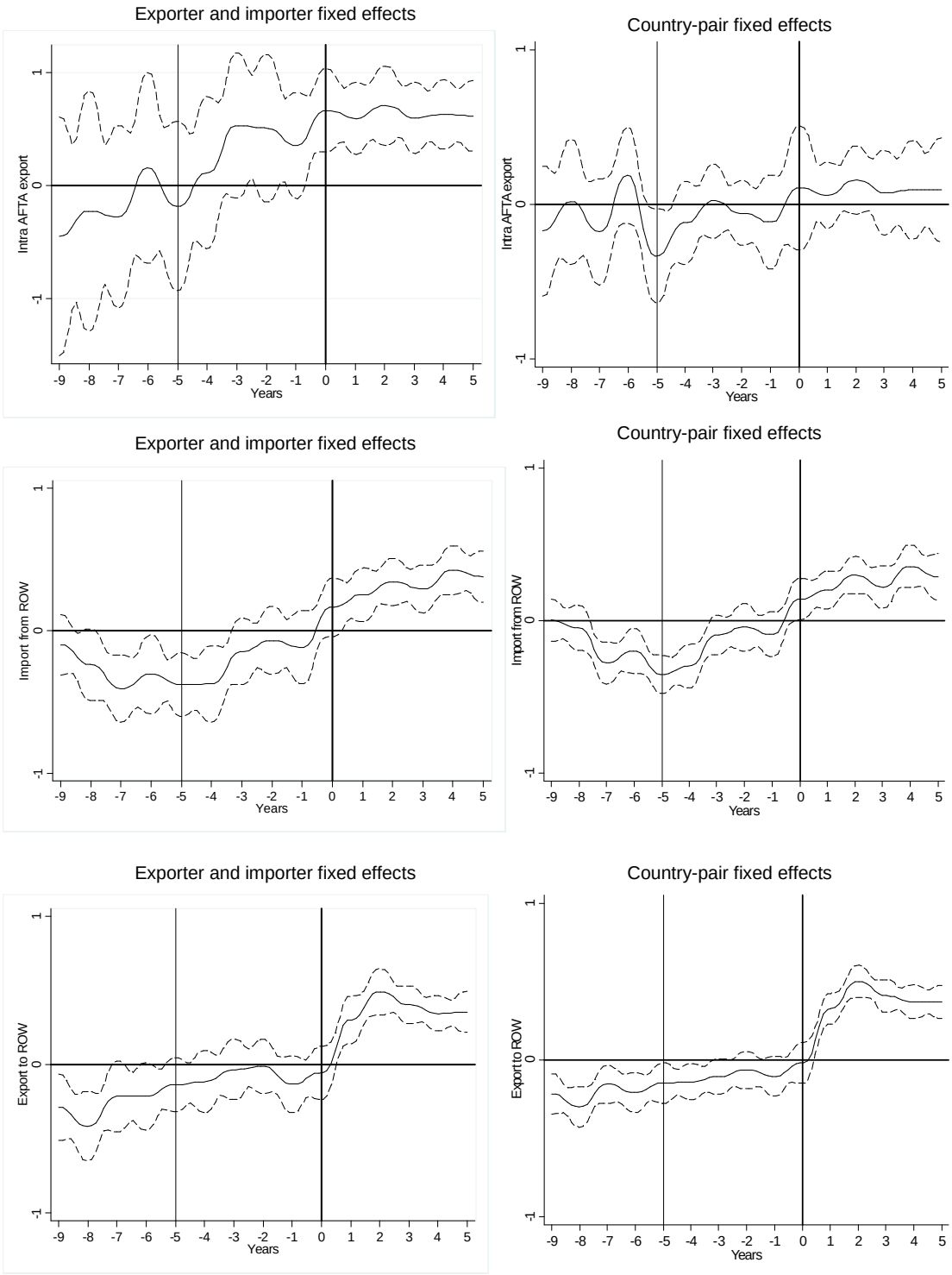

Figure 3: AFTA trade effects

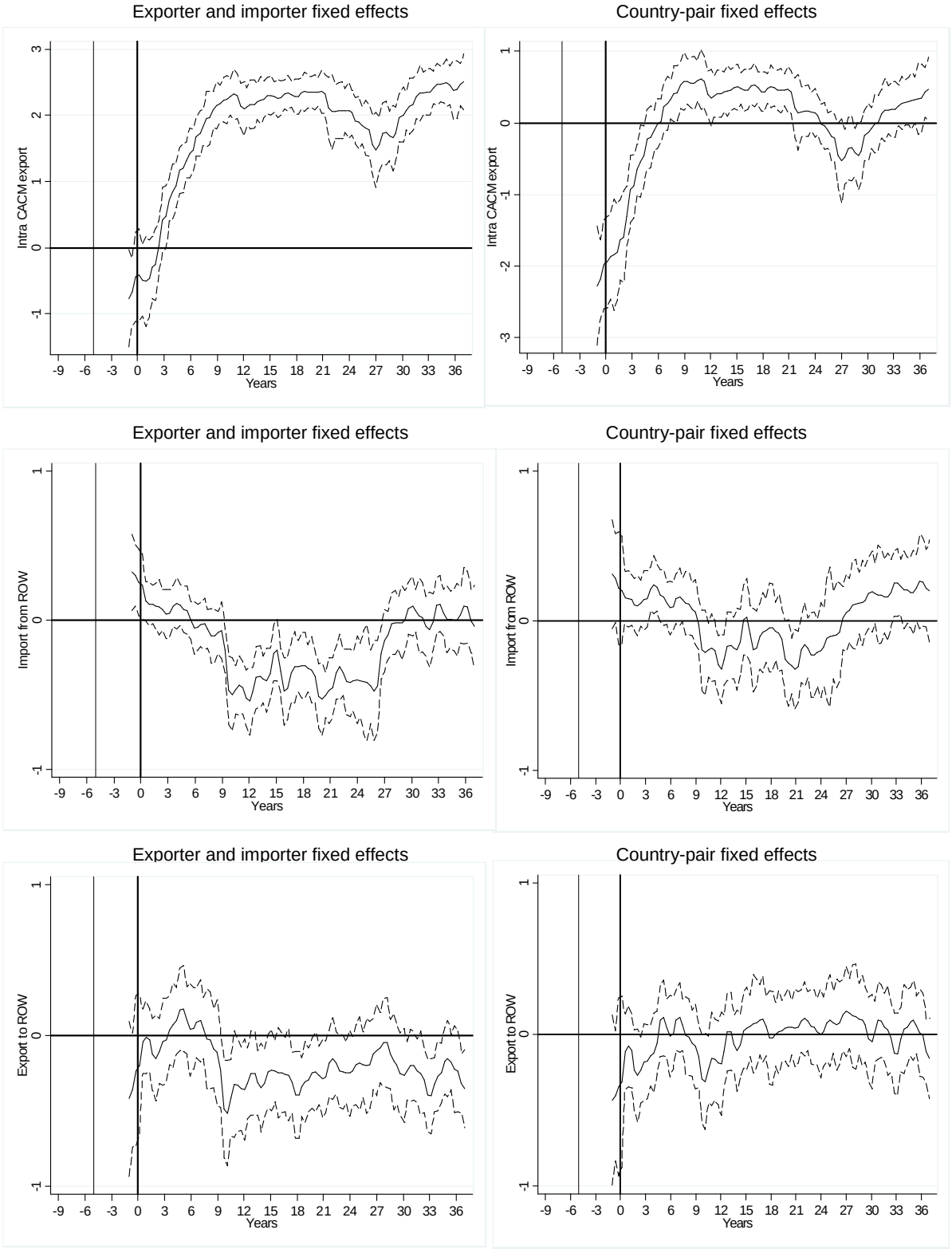

Figure 4: CACM trade effects

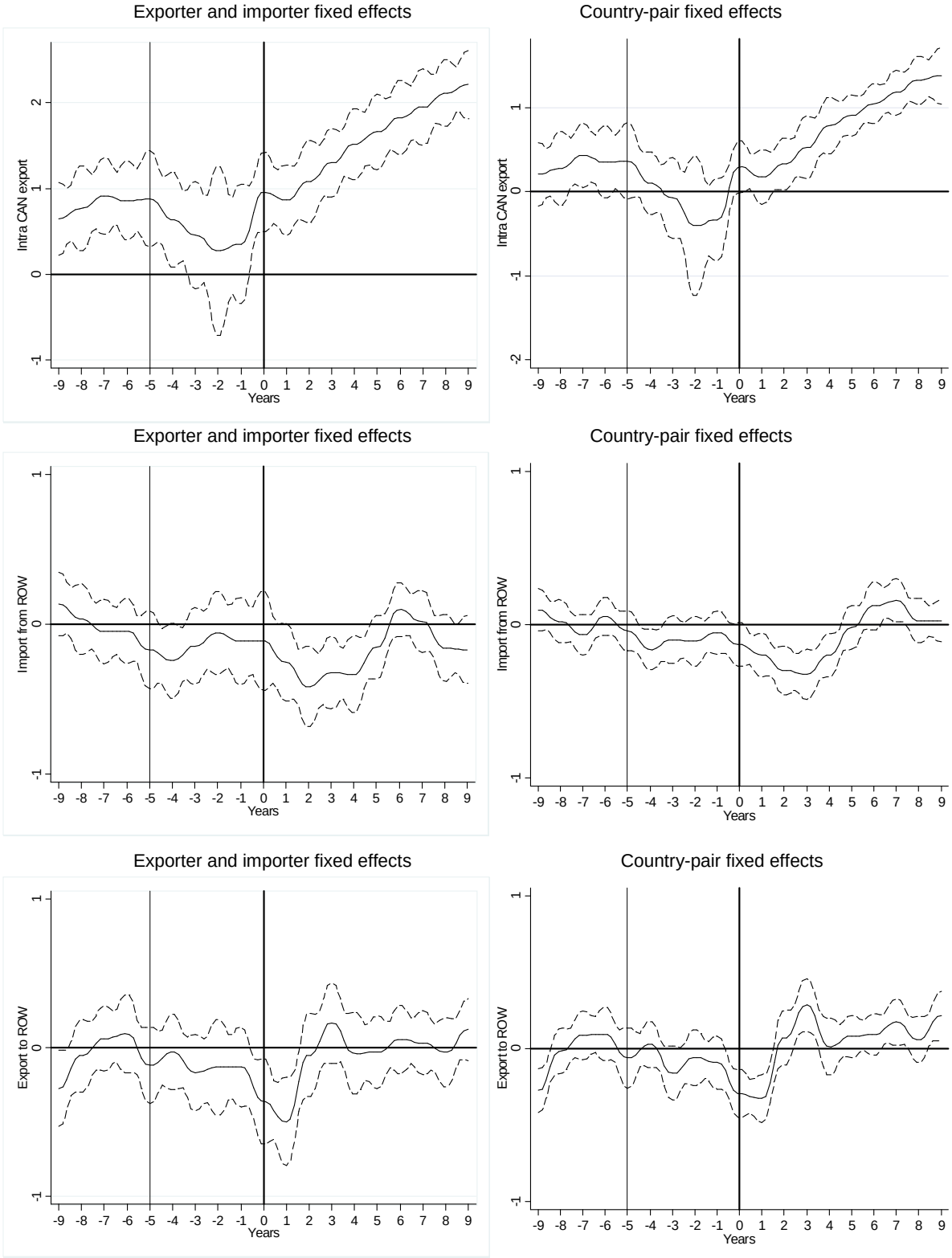

Figure 5: CAN trade effects

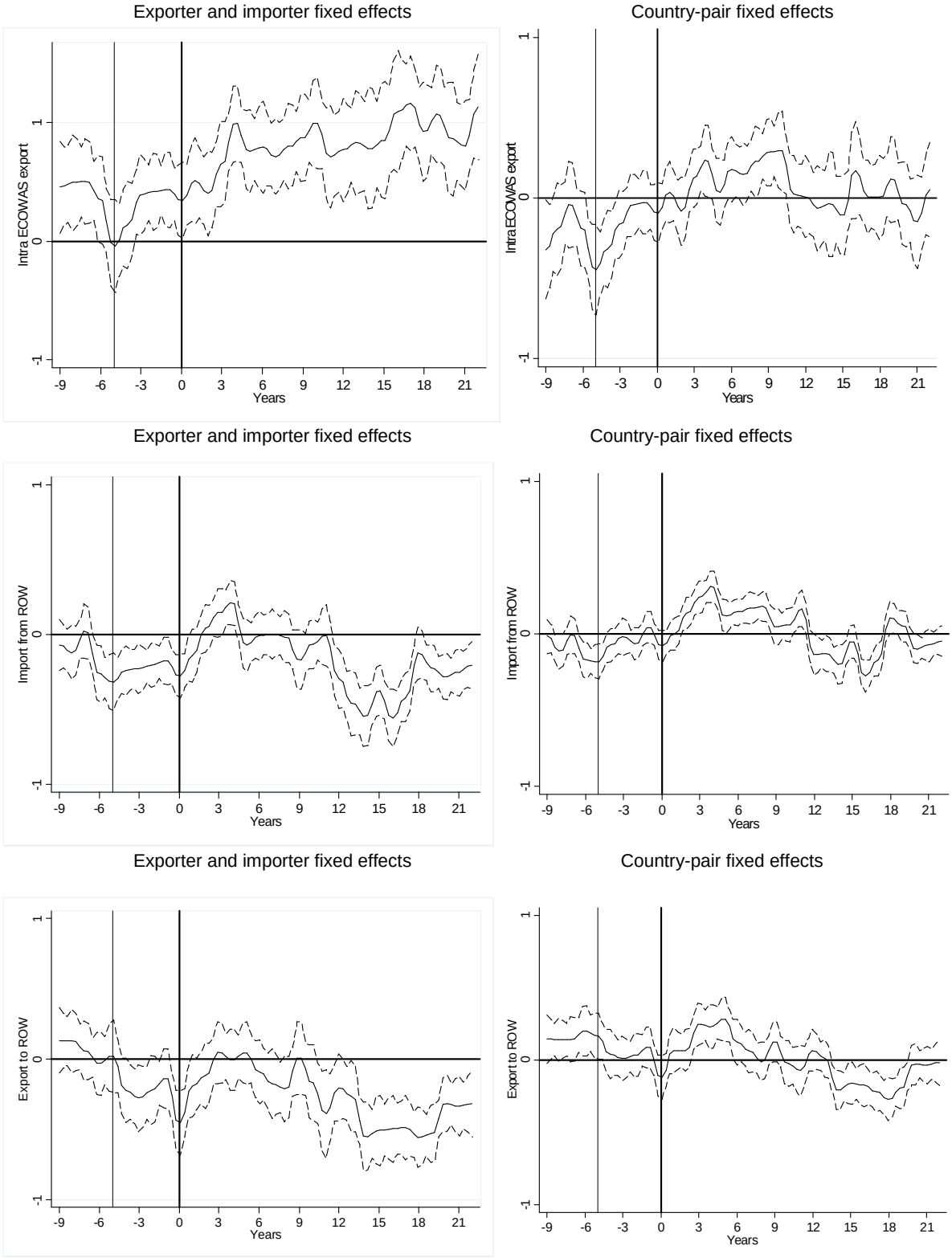

Figure 6: ECOWAS trade effects

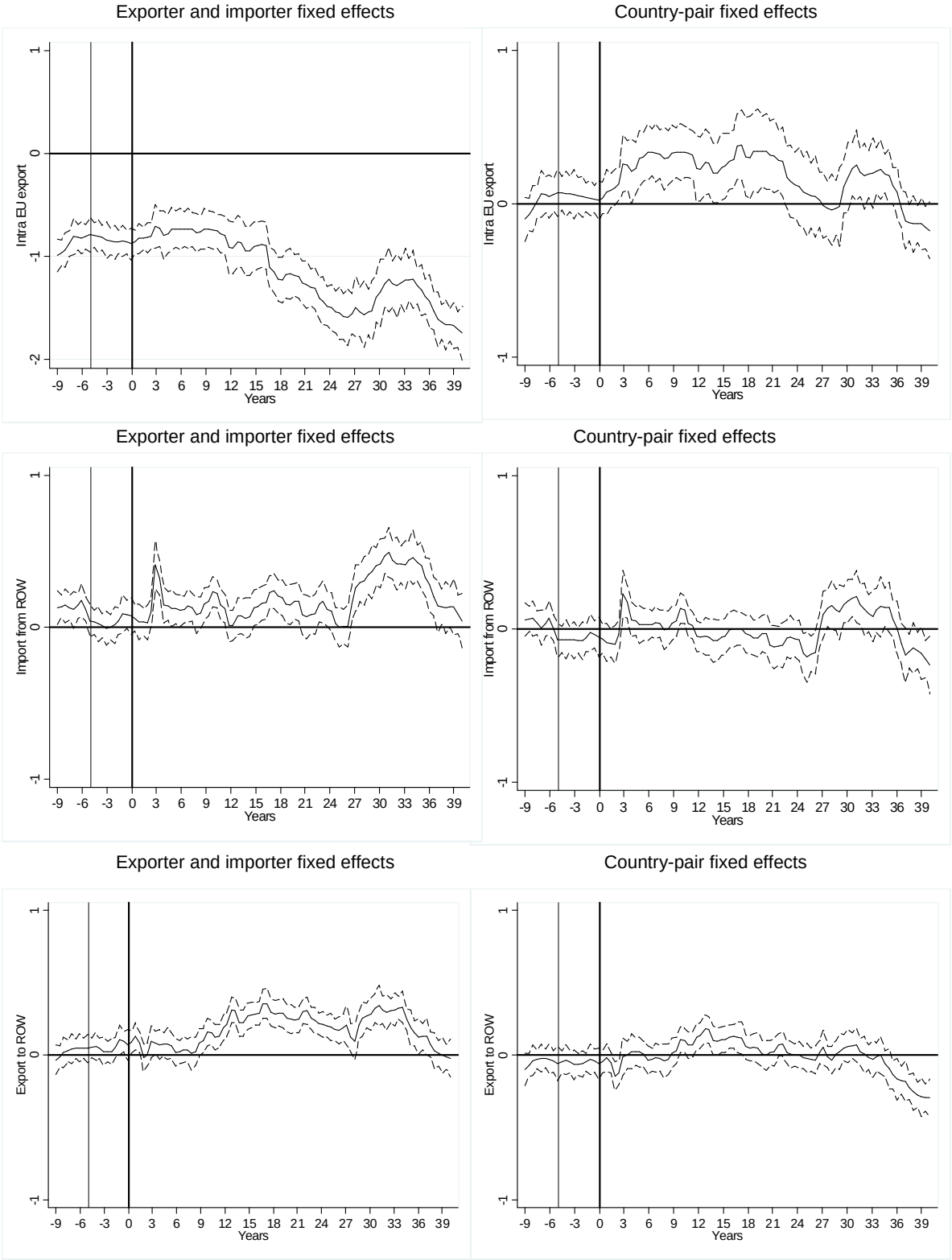

Figure 7: EU trade effects

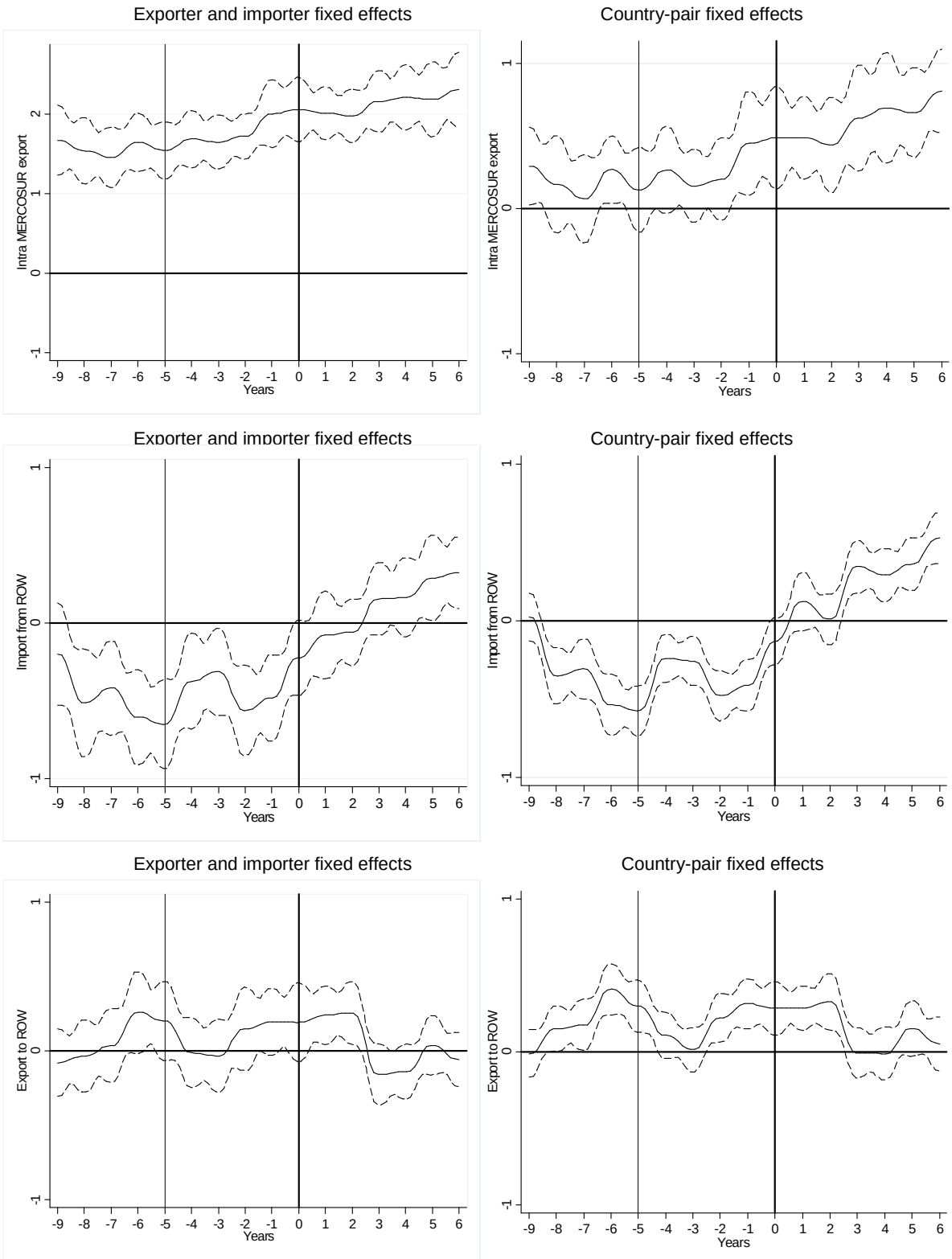

Figure 8: MERCOSUR trade effects

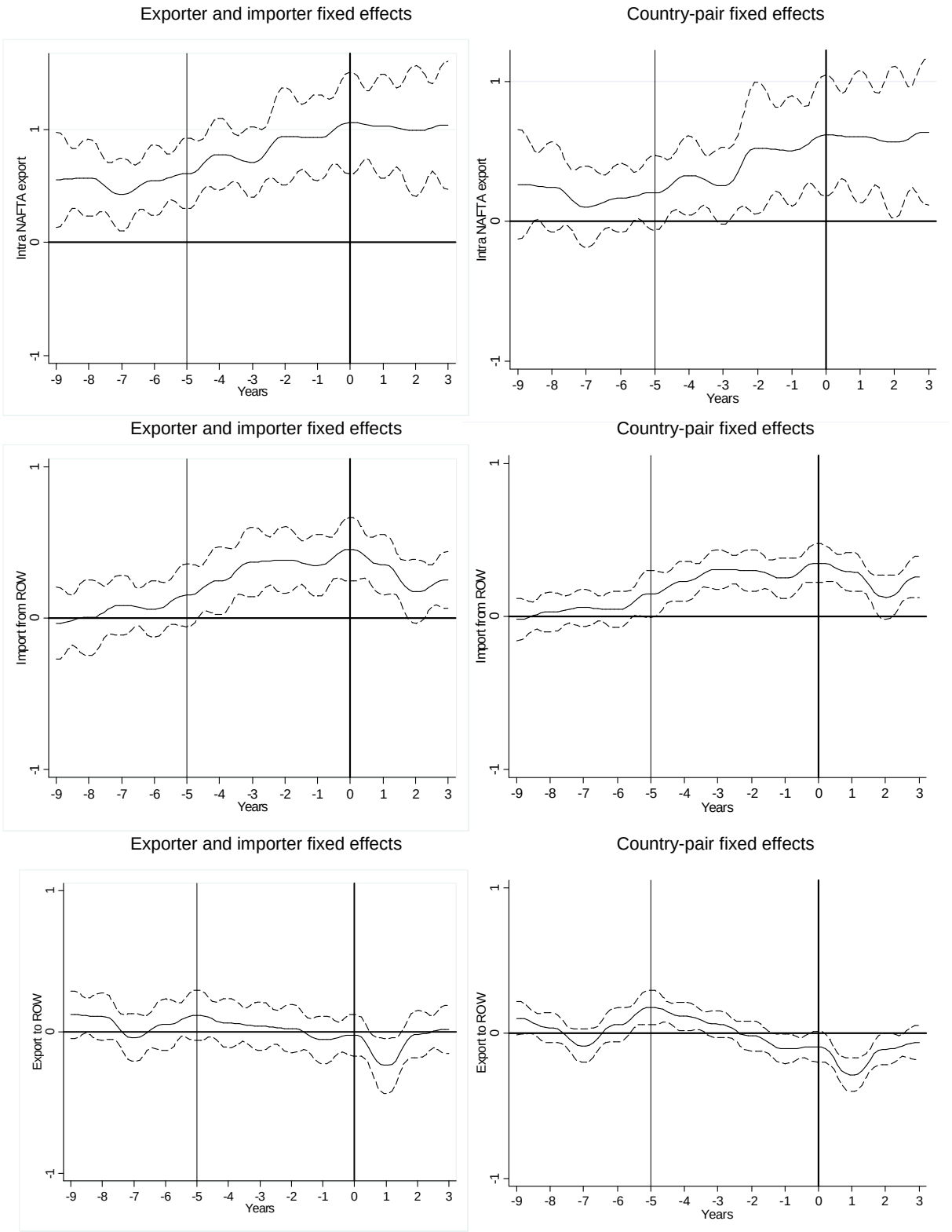

Figure 9: NAFTA trade effects