Anatomy of the trade-effect of regional trade agreements and agenda for future research

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Anatomy of the trade-effect of regional trade agreements and agenda for future research

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1 Are the estimate interval sensitive?

Trade agreements between countries existed long before the advent of the World Trade Organization or even the General Agreement on Tariff and Trade (GATT). Nevertheless, regional trade agreements have been proliferating rapidly over past few decades. As of 2020, the number of cumulative number of RTAs in force reaches to 307. There has been renewed interest in RTAs in the two decades especially after the Doha round talks stalled. In response to the proliferation of RTAs, there has been a growing literature focused on the trade impact of economic integration.

For empirical estimation of the trade-effect economic integration agreements on bilateral trade flows, gravity trade model has been a common approach. Earlier gravity literature is mostly consisted of cross sectional, and since 1990s studies shifted to apply panel econometric techniques. These studies applied estimation of annual trade data over consecutive years. However, it is logical to expect that the adjustment of trade flows in response to trade policy changes will not be instantaneous. Given this, discouraged trade estimations pooled over consecutive years. Given this, Trefler (2004) discouraged trade estimations pooled over consecutive years. Moreover, as noted by Cheng, Wall, et al. (2005), "Fixed-effects estimations are sometimes criticized when applied to data pooled over consecutive years on the grounds that dependent and independent variables cannot fully adjust in a single year's time." Woolridge (2009) shows the reduction in standard errors of coefficient estimates using changes over longer periods of time than using year-to-year changes (p.459). Furthermore, Olivero and Yotov (2012) provides empirical evidence that gravity estimates obtained with 3-year and 5-year interval trade data are very similar, while estimations performed with panel samples pooled over consecutive years produce suspicious estimates of the trade cost elasticity parameters.

Following this, researchers have used panel data with intervals instead of data pooled over consecutive years. Table 1 presents a few studies which involve estimation of the impact of economic integration using year intervals. In general, the studies with relatively shorter time series chose a shorter interval size.

Table 1: Some studies using interval data

Study	Time Period	Interval
Anderson and Yotov (2020)	1988-2006 & 2000-2014	3-year
Freeman and Pienknagura (2019)	1965-2010	5-year
Admassu (2019)	1970-2010	5-year
Oberhofer and Pfaffermayr (2018)	1994-2012	3-year
Gil-Pareja, Llorca-Vivero, and Martínez-Serrano (2017)	1960-2008	4-year
Anderson and Yotov (2016)	1990-2002	4-year
Bergstrand, Larch, and Yotov (2015)	1990-2002	4-year
Kohl (2014)	1950-2010	5-year
Baier and Bergstrand (2007)	1960-200	5-year
Trefler (1993)		3-year

The current study analyzes the impact of trade agreements on bilateral exports using gravity trade model is applied with Poisson pseudo maximum likelihood estimator. The study investigates whether the estimation remain unchanged with different interval sizes, or in other words, are the estimates interval sensitive? For this, annual data is analyzed using 3-year, 4-year, and 5-year intervals. It is found that trade agreements positively affect bilateral exports. However, the estimates are inconsistent across model specifications that vary in terms of interval size.

1.1 Method and data

Among others, Anderson (1979), Anderson and Van Wincoop (2003), Baldwin and Taglioni (2006) and Baier and Bergstrand (2007) present major developments in the gravity trade model. To empirically estimate the impact of economic integration agreements, the equation given in the following include exporter-time, importer-time and country pair fixed effects - the structural gravity model commonly applied [1]. To account for zero exports and heteroscedasticity, the model is estimated using Poisson pseudo maximum likelihood (PPML) estimator as suggested by Tenreyro and Silva (2006) and Silva and Tenreyro (2011) [2].

$$\text{Exports}_{ijt} = \exp\left(\alpha_{it} + \beta_{jt} + \gamma_{ij} + \delta_0 + \delta \boldsymbol{EIAs}_{ijt}\right) + \epsilon_{ijt} \tag{1}$$

In the equation, the subscripts i, j and t denote exporting country, importing country, and time in years, respectively. The dependent variable, bilateral exports, is taken in levels, whereas the variables of various economic integration agreements are binary in nature.

[1] Leads and lags of the integration variables, and intra-national trade is not included.

[2] Stata command "ppmlhdfe" is applied because of its fast convergence properties. For more on this, see Correia, Guimarães, and Zylkin (2019).

Data on trade is taken from the Direction of Trade database managed by International Monetary Fund. The data comprise annual bilateral exports of goods in USD. The GATT and WTO membership data came from WTO website. The information on trade agreements sourced from Bair Bergstrand database (Baier & Bergstrand, 2015).

1.2 Results

Estimates are shown in Table 2. In the analysis, 3-year, 4-year and 5-year intervals are used for comparison of estimates, as given in the second row of the table. For instance, 97(3)12 is a shortened expression for 1997(3)2012 that means a time period over 1997–2012 with 3-year intervals. It is noteworthy that all missing values of exports are taken as zero.

Table 2: Comparison of estimates with various interval size

	(1) 96(3)12	(2) 96(4)12	(3) 96(5)12	(4) 87(3)12	(5) 87(4)12	(6) 87(5)12	(7) 72(3)12	(8) 72(4)12	(9) 72(5)12
WTO	0.138*	0.123	−0.040	0.051	0.061	−0.082	−0.067	−0.065	−0.197**
	(0.077)	(0.084)	(0.090)	(0.072)	(0.083)	(0.101)	(0.066)	(0.073)	(0.091)
NRPTA	−0.004	−0.026	−0.014	−0.044	−0.036	0.020	−0.029	−0.021	0.024
	(0.042)	(0.043)	(0.042)	(0.042)	(0.042)	(0.042)	(0.039)	(0.038)	(0.043)
PTA	−0.057	−0.027	−0.101**	0.005	0.030	−0.005	0.057	0.081*	0.041
	(0.036)	(0.039)	(0.042)	(0.043)	(0.043)	(0.045)	(0.042)	(0.041)	(0.043)
FTA	0.046	0.034	0.026	0.057*	0.055	0.053	0.127***	0.126***	0.119***
	(0.033)	(0.034)	(0.037)	(0.034)	(0.035)	(0.037)	(0.033)	(0.034)	(0.035)
CU	0.071	0.055	0.026	0.177***	0.217***	0.190***	0.330***	0.393***	0.351***
	(0.114)	(0.125)	(0.120)	(0.056)	(0.059)	(0.058)	(0.051)	(0.050)	(0.050)
CM	0.064	0.160***	0.054	0.187***	0.251***	0.186***	0.425***	0.502***	0.415***
	(0.055)	(0.061)	(0.060)	(0.050)	(0.056)	(0.056)	(0.049)	(0.054)	(0.053)
ECU	0.116*	0.127*	0.104	0.204***	0.212***	0.204***	0.432***	0.460***	0.425***
	(0.068)	(0.071)	(0.072)	(0.063)	(0.069)	(0.068)	(0.063)	(0.066)	(0.065)
Constant	23.095***	23.175***	23.336***	23.033***	23.105***	23.213***	22.926***	23.009***	23.131***
	(0.070)	(0.077)	(0.083)	(0.066)	(0.076)	(0.093)	(0.061)	(0.067)	(0.083)
N	179,890	145,554	113,438	253,757	194,119	160,546	353,510	270,271	217,472

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

It is found that trade agreements positively affect bilateral exports in general, however, estimates are inconsistent across model specifications that vary in terms of interval size. The kind of "interval bias" is more prominent in case of relatively shorter time series. The finding implies that reliability of the estimation may be undermined.The interval data approach on one hand yield unreliable estimates. On the other hand, it misses out important information required to analyze the trade effect of an RTA. As the trade effect of an RTA may not be just instantaneous, it is rather spread over time. Therefore, the consecutive data should be used for a proper analysis of the impact of RTAs on bilateral trade.

2 Some insights into the RTAs' trade-effect

Starting with a linear model for the trade-effect of an RTA, Figure 1 show two curves. The curve AB shows a time-invariant effect which is rather unrealistic as it assumes that adjustment of trade flows in response to a policy change is absolutely instantaneous. On the other hand, curve AC shows a time-invariant effect. That mean, the same RTA observed at time t, $t+1$ and $t+2$ yield trade-effect y'_t, y'_{t+1} and y'_{t+2}, respectively. The fact that $y'_t \neq y'_{t+1} \neq y'_{t+2}$ is the underlying reason of the interval-sensitivity of the trade-effect.

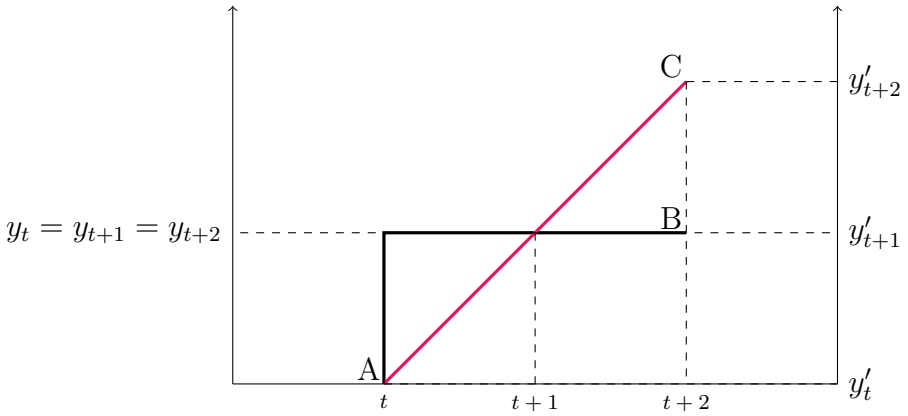

Figure 1: Time invariant versus time variant trade-effect of an RTA

The trade-effect of RTAs is actually nonlinear. Any variation in trade flow occurs as firms response to a policy change. The adjustments may include construction of marketing channels in the destination market where sales are expected to expand, training, product redesigning to meet local tastes etc.

The firms' response may be assumed to be normally distributed. That is, firms which are relatively more informed, more efficient in terms of change management, and more risk friendly will lead adjustment process, followed by other firms. In other words, there are fewer early adopters, and fewer laggards, and majority of firms fall in between the two extremes. In this way, the trade-effect of an RTA can be shown as the cumulative response, as show in Figure 2. Over time, more and more firms get involved, and each firm involved to a larger

extent. Therefore, the trade-effect increases over time as a result of firm adjustment to policy change. In the figure, the dashed vertical line show the demarcation between trade-effect increasing at an increasing rate and it increasing but at a decreasing rate. Normally, tariffs reduction under trade agreements occurs in a gradual manner. Somewhere in the midway, while adjustment by firm is proceeding, and tariffs are further lowered down, these two factors overlap resulting into considerably increase in the trade effect during this phase.

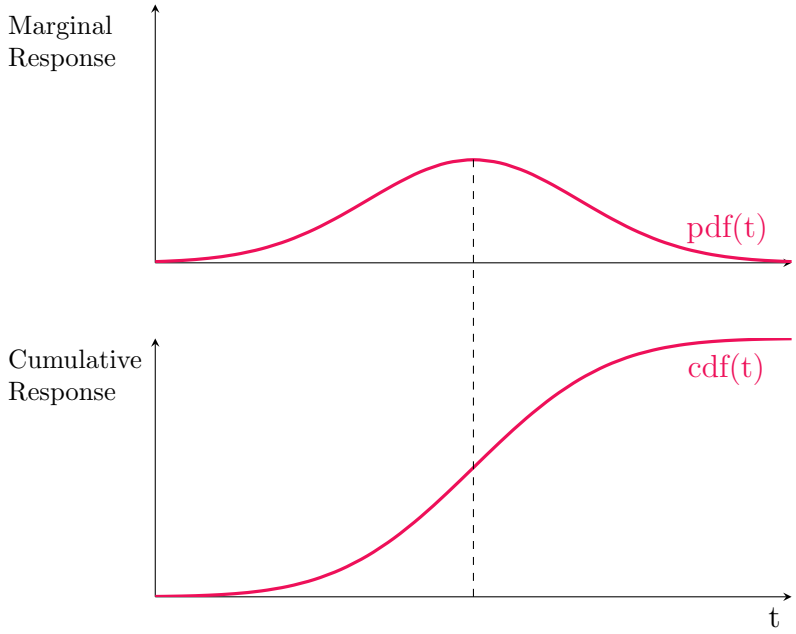

Figure 2: Theoretical curve of the trade-effect of an RTA

Let's suppose a simple world consisted of four countries A, B, C and D. Here, we can denote the bilateral exports of country A to country B as X_{AB}, bilateral exports of country B to country A as X_{BA}, and so on. There is a uniform tariff level τ_0 between each country pair, the value of bilateral exports between each country pair is 10 units. In this way, the world trade is 120 units. We do not account for intra-national trade for simplicity. This is the baseline, as depicted by the panel (a) of the Figure 3.

Now, we assume that an RTA is implemented between country A and country B resulting into a new level of tariff τ_{RTA} between the country pair such that $\tau_{RTA} < \tau_0$, shown by the panel (b) of the figure. As a result of the lowered tariff, more firms from country A could access export market of country B, and hence X_{AB} increases from 10 units to 12 units. Similar change we see for X_{BA}. As a total of 4 units of trade is created by the RTA, the world trade in this scenario is 124 units.

Practically, trade creation as well as trade diversion may be resulted by the implementation of an RTA, depicted the panel (c) of the figure. In this scenario, X_{AB} is 14 units: 2 units of trade creation and two unit of trade diversion. Similar change we see for X_{BA}. In this case, the trade-effect of the RTA between country A and country B may be called the "internal effect", and the trade-effect along X_{AC}, X_{AD}, X_{BC}, and X_{BD} may be called "lateral effect".

Furthermore, there can be "external effect" as a result of the increased trade between country C and country D due to their decreased trade with country A and country B.

Clearly, in the real world involving large number of trade partners, the lateral effect of the RTA may not be much pronounced as the trade diversion is distributed over several countries; and even less visible would be the external effect. However, the internal, lateral and external (or the primary, secondary and tertiary) effects of RTAs may be more important for trade policy, for instance, in the case of a disaggregate trade analysis under oligopoly.

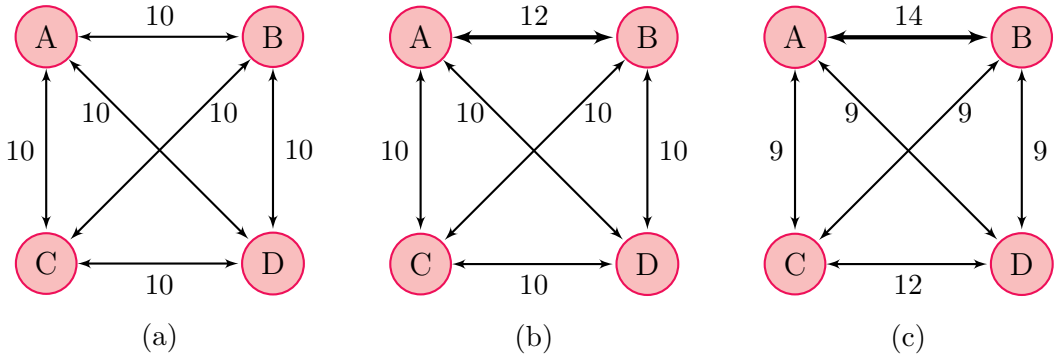

Figure 3: Internal, lateral and external trade-effects of an RTA

Suppose an RTA is being into force at time t. Firms in the member countries may start adjustment to their exports already as they expect the RTA at time $t-a$, the adjustment process conclude at time $t+m$ as the RTA reaches it maturity level. As shown in the Figure 4, D_1 depicts the duration to reach the full trade-effect while D_1' is the anticipatory part of the duration. Similarly, D_2 is the depth of the trade-effect, and D_3 denote the diversion of the trade effect as a result of the implementation of another RTA in the neighborhood. The relative strength of each of the two RTAs, the sequence of entering into force, and the spacing between them will determine the cumulative trade-effect. In this way, a negative impact on the trade flow may occur for a "suppressed" RTA overridden by the diversion effect of the other RTA.

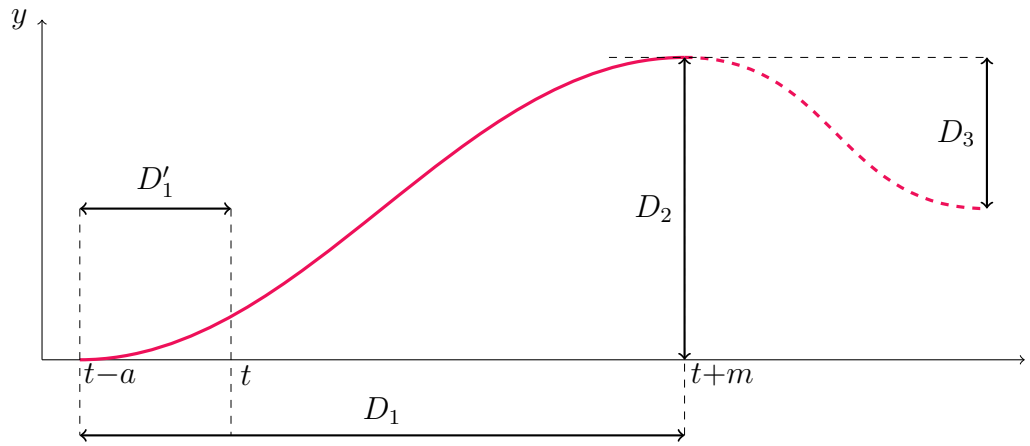

Figure 4: Duration, depth, and diversion of the trade-effect of an RTA

3 Further research on the RTAs' trade-effect

In general, the research must emphasize on the question of "How do agreements affect trade?" in addition to the rather simple question of "Do agreements affect trade?" using consecutive data. That is in other words, the interplay on agreements along time as well as across countries in order to explicitly analyze the pathway of trade effect. It would be interesting to see how the trade-effect curve of a specific RTA, or a group of RTAs deviates from the theoretical curve or the curve for the cumulative effect of all RTAs in force worldwide. The attributes D_1', D_1, D_2, and D_3 can be important in this context.

In general, there is a time gap between the RTAs are signed and they enter into force. Even before the signing of an RTA, negotiations are officially launched. Based on such factors, firms may start adjustment process as they anticipate the implementation of an RTA in future, and as a result, a trade-effect be observed already before the RTA enters into force. RTAs may vary in terms of anticipatory phase due to multiple factors: (a) the relative importance of the prospective RTA. For instance, an RTA with the EU can be more attractive than with some country/region of lesser economic importance; (b) the gap between the date of signature, or even the date of launch to negotiations, and date of entry into force; and (c) the economic environment more conducive to firm adjustment process. Related to this, it might be interesting to analyze the impact of the "unborn" RTAs which were only announced or signed but never implemented. Similar would be the case of RTAs announced in the recent past, say last three years but not yet implemented.

Similarly, RTAs may vary in terms of the duration to reach the full effect level. The adjustment process by firms may be faster for the product with lower destination-specificity. We may hypothesize that the pace of adjustment in response to the implementation of an RTA may vary for raw materials and intermediate goods as compared to consumption goods, ceteris paribus. The difference of non-tariff barriers such as technical barriers to trade (TBT) and sanitary or phytosanitary (SPS) regulations across destinations matters here.

In terms of depth, for instance, the trade-effect of the FTAs is expected to be deeper as compared to that of the PTAs. However, not every RTA may reach to its potential depth in case of the diversion effect by a new RTA. This would be more pronounced in case of a "week" RTA is followed by a "strong" RTA, the later will override the trade-effect. In this regard, it can be interesting to see the interaction between the RTA of a country with the EU and the other RTAs of that country implemented shortly earlier.

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