Independence Status of Territories and the Estimated Trade Effects of Regional Trade Agreements

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Abstract

Almost 150 new sovereignties came into existence since 1945, which is about two times the amount of independent countries by then. New individuals are included by panel datasets based on country level data. In this paper I investigate the impact of panel unbalancedness related to independence status of territories on the estimation of trade effects of regional trade agreements. I first find that the inclusion or exclusion of newly independent countries affects estimation of interest significantly, so future empirical studies using country level data are recommended to verify more seriously about why including some newly independent countries or dependent territories but not others in their samples. Second, although changing independence status of territories raises up the question of interpreting trade data as "domestic" or "international" to (previous) governing countries (Greaves, 1954), I find that both ways of interpreting trade data yield similar estimates of most regional trade agreements. Third, it is shown that unless we are particularly interested in the trade effects of regional trade agreements formed before 1990, we should not include observations before this time into the sample. At last, the Monte-Carlo simulation shows that panel unbalancedness caused by emergence of new countries has different impact on the estimation of interest from missing at random or missing at minimum values.

Keywords: Regional trade agreements · Panel unbalancedness
JEL codes: F15; F53; C18

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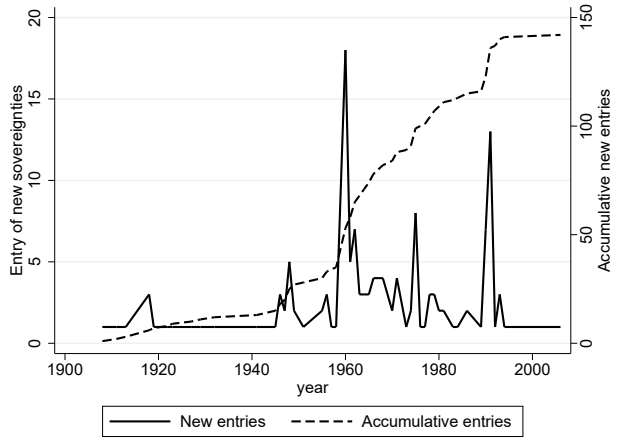
1 Introduction

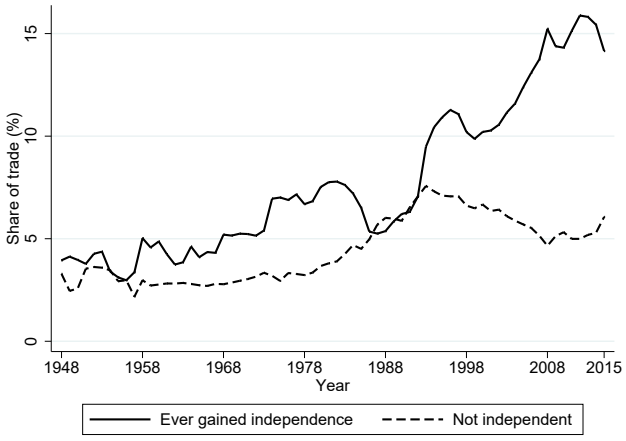
While the United Nations currently has 193 member states, almost 150 new sovereignties came into existence only after 1940. In the year of 1960 and 1991 alone, 18 and 13 countries with sovereignty were formed respectively (Figure 1a). According to trade data compiled by Direction of Trade Statistics, DOTS, those newly formed countries account for more than 15 percent of international trade in 2015, which could have either been accounted as "intra-" national trade with their colonizers or "inter-" national trade of their (previously) colonizers with other countries, had they not been independent (solid line in Figure 1b). Furthermore, the share of trade involved non-independent regions account for around 5 percent of the so-called world trade since the beginning of 1990s (dashed line in Figure 1b).

Figure 1: Entry of New Sovereignties and the Share of Trade

(a) Entry of new sovereignties



(b) Share of international trade



Note: The data for figure 1a is collected from online information. The international trade data is retrieved from DOTS deposited at International Monetary Fund. In figure 1b, the solid line represents trade share of country pairs involving at least one country gained independence during 1962-2015. The long dashed line represents trade share of country pairs of which both are still not independent in 2015.

This generates at least two issues for consideration when we use country level panel data on international trade. While external trade involving (previous) non-independent territory may largely serve the purpose of its governor country, it is up to evidence about whether we should interpret it as international trade of this territory or as part of international trade of its governor country. The other issue is to consider whether the emergence of newly independent countries has caused unbalancedness of relevant panel datasets and what are its empirical implications. This paper sheds light on these two issues in the context of trade effects of regional trade agreements (hereafter, RTAs).

The issue of interpretation of trade data is minor but has a rather long history. As raised up by Greaves (1954) almost 70 years ago in a study of British colonial trade, the production of British colonies has been heavily subject to the need of

England, so that "...statistics of colonial imports and exports have been inaccurately incorporated into totals of international trade and interpreted with corresponding inaccuracy." (p.2 Greaves, 1954).[1] Such a concern has seldom been addressed by studies afterwards.[2] In this study I examine whether the interpretation of trade statistics of (previous) colonies affect the estimated trade effects of RTAs.

The investigation of the potential panel unbalancedness issue constitutes the core of this paper. There are two ways in which panel unbalancedness might be related to the independence status of countries. First, newly independent countries increase the number of distinguished individuals of the panel data. If we use the number of observations in 2015 as the base for country pair-year data, the more countries becoming independent before 2015, the more pair id is generated. As we almost exclusively see new countries coming into existence rather than old countries exiting, we see a consistent increase in the number of country pairs over time which leads to a stronger unbalancedness of panel data for earlier periods. The second way is related to statistic compilation capacity affected by a given territory's independence status. For example, trade statistic of a given territory can be compiled more often and more accurate before its independence for reasons like more support from its governing country. Or reversely, there could be more observations after this territory's independence due to an independent statistic department. It is also possible that there are more missing values around the year of its independence due to the lack of efforts of compiling trade data during transitory times. When such an unbalancedness cannot be completely captured by independence dummy of countries, it will affect the unbiasedness of estimates of RTAs' trade effects.

Consequently, depending on how profound the above mentioned situations might have been, panel unbalancedness may be non-random and serious enough to affect the empirical results when we evaluate policies of interest, as pointed out by many econometric textbooks or academic papers on unbalanced panel (such as Baltagi and Song, 2006; Baltagi et al., 2002; Kyriazidou, 1997; Nijman and Verbeek, 1992).

To address these issues, I first describe panel unbalancedness patterns of country-pair-year level data on bilateral trade and RTAs to show its relevance to the change of different territories' independence status. Then, I compare key estimates derived from different samples with various country and time coverages to show the impact of such panel unbalancedness on estimation of interest.

The choice of country coverage is determined by whether a country is newly independent during a given sample period or not. The attention devoted to sample

[1] A more detailed citation of Greaves (1954) is that "...if we recognized the difference in the economic significance of the external trade of colonial territories and of other countries. The result of ignoring this difference has been that...statistics of colonial imports and exports have been inaccurately incorporated into totals of international trade and interpreted with corresponding inaccuracy." (p.2 Greaves, 1954).

[2] For example, in the study of colonial trade by Head et al. (2010), the authors treat trade statistics of (previous) colonies and another country as international trade, without addressing this potential issue at all.

periods originates from the fact that there were only 50 RTAs in force in 1990 while more than 280 in 2017. Since the year of 1990 is almost overlapped with the last wave of independence of new countries in modern time, we may not need observations from too early to study trade effects of most RTAs in order to avoid dealing with the panel unbalancedness issue investigated by this paper. I show that a sample dated back to 1992 is enough for estimating trade effects of RTAs. To raise up minimum caution of scholars in determining country coverage of related samples in future studies, I also derive estimates when using samples of Baier and Bergstrand (2007) and Baier et al. (2019).

In the next step, I investigate how different are the estimates when trade data for new countries is treated as "domestic" or "international" trade to (previous) colonizers. Furthermore, I conduct regression analysis when allowing (previous) colonizers' RTAs to regulate the trade of their corresponding colonies until the colonies' independence. Compared with benchmark results that treat the trade of (previous) colonies as if the territories were always independent, the estimates do not change significantly for most RTAs. It means that interpreting trade of (previous) colonies either as international trade or domestic trade of their governors does not matter significantly unless we are interested in trade effects of some particular RTAs. This implies that the concern of Greaves (1954) is not too relevant in the context of trade effects of RTAs.

At last, I conduct Monte-Carlo simulations to show how do the estimates of RTAs change when panel unbalancedness of trade data is generated by different patterns of the emergence of new countries, compared with missing at random and missing at minimum values. It can be seen that missingness caused by occurrence of new countries leads to biased estimation of trade effects of most RTAs. The magnitude of the bias is similar to the bias caused by random missing pattern, when the PPML estimator is applied.

This paper is nested in studies of trade effects of RTAs. Since the early use of gravity equation in international trade (Tinbergen, 1962), RTAs has been one of the few "visible" variables to proxy trade cost. Since then, the attention to RTAs has never ceased to popularity, especially from 1990s on when RTAs start to increase more greatly. However, there is still no agreement on either the overall trade effects of RTAs or the disaggregated trade effects of individual agreements.

For example, Ghosh and Yamarik (2004) summarize that most studies until then have found significant trade creating effects of RTAs (such as Aitken, 1973; Soloaga and Wintersb, 2001, among many others), but the two authors find that the positive coefficients of most regional trade agreements are fragile by applying the extreme bound analysis to different specifications of the gravity equation. Nevertheless, more recent studies such as Baier et al. (2018) and Baier et al. (2019) apply rigorous empirical strategies to study the heterogeneous trade effects of individual regional

trade agreement and find significant effects of RTAs on trade. Overall, there seems to be a common sense on the overall positive effects of RTAs on trade, but it is also commonly accepted that the estimated trade effects of RTAs can vary a lot by types of agreements, items covered by agreements or different samples or data.[3]

One finding in the meta-analysis of Cipollina and Salvatici (2010) provides interesting insights for this paper. It shows that using more recent sample periods is significantly associated with lower estimated trade effects of RTAs. The authors only briefly relate it to the fact that more recent RTAs are more "deep" and thus play a stronger role on trade through behind-the-border reforms not captured by RTA dummies. However, the reason for why sample period matters also reflects an impact of a time-varying pattern in panel unbalancedness due to change in independence status of different territories.

This study is along the strand of literature which addresses the improvement of methodologies on estimating trade effects of RTAs. Among many others, Egger et al. (2011) propose an instrument variable where the preferential treatment agreement (PTA) is a function of other determinants to handle the endogeneity issue of trade to PTA. Kohl (2014) propose a first-differencing technique on improving previous findings and Kharel (2019) propose a two-step approach of a constrained ANOVA-type estimation method to account for the endogeneity bias.

Due to the focus on panel unbalancedness of country level data, this paper is also broadly nested in studies on missing values (Pampaka et al., 2016; Pasteels, 2013) and sample selections (e.g. Bruno, 2005; Semykina and Wooldridge, 2010; Verbeek and Nijman, 1992). A more closely related paper is Helpman et al. (2008), which deals with the sample selection issue caused by missing trade flows. However, they do not investigate further about what causes those missing values.

The rest of the paper is structured as follows. Section 2 describes the data and patterns of panel unbalancedness related to change of independence status of territories. Section 3 presents the regression results. Section 4 describes results from Monte-Carlo simulations when the independence processes of new countries, and consequently missing value patterns in trade data, are specified differently. The last section concludes.

[3]Papers cited here are only very few examples of a lot more empirical studies on trade effects of RTAs. Among them, we should be aware of the criticism on what regional trade agreements can really do as highlighted by Rodrik (2018). He gives examples of the negotiation process of NAFTA among others and some specific items covered by the agreements, such as how the trade-related intellectual property rights (TRIPs) entered the Uruguay Round. The narrative evidence is convincing enough to show that regional trade agreements might purely lead to "...redistributive outcomes under the guise of 'freer trade'" (p.89), which prone to rent-seekers, special interest and politically well-connected firms, such as international banks and pharmaceutical companies.

2 Data

2.1 Data source

Data on international goods trade is retrieved from IMF Direction of Trade Statistics (DOTS) database. The observations date back to 1948 the earliest, which is much earlier than another commonly used dataset on international trade (United Nations Comtrade database). Table A.4 in Head et al. (2010) on metropolis, colonies, and independence events is used as the main reference for the independence data in this analysis. I also use online information such as official websites of history of some territories for cross-checking. Data on regional trade agreements is compiled from the World Trade Organization RTA database. Data on other gravity variables is from CEPII. The benchmark sample period in the empirical part is 1962-2015 to avoid potentially higher inaccuracy of data for earlier sample period and to be comparable with any results derived from Comtrade data which can only date back to 1962.

I construct a set of RTA dummies in the following way. First, each individual multilateral agreement among all member countries is entitled with a dummy, which indicates the membership of different multilateral RTAs. Second, all bilateral agreements between individual countries are entitled with the same bilateral RTA dummy to indicate the membership of bilateral RTAs. Third, all agreements documented by the WTO dataset as bilateral between a multilateral RTA as a whole and other individual countries are classified as the same dummy. For example, the agreement between European Free Trade Association (EFTA) and Bulgaria is documented as a bilateral RTA between these two parties and the same for the agreement between EFTA and Croatia. As a result, any country pair involving a EFTA member country and Bulgaria or Croatia are coded as a dummy of EFTA and others.

After these steps, I divide bilateral agreements into those formed before 1993 and those formed afterwards to match the year when many countries gained independence. In addition, I keep dummies for a few individual RTAs, including ASEAN (ASEAN Free Trade Area), EU (European Union), GCC (Gulf Cooperation Council Custom Union), NAFTA (Northern America Free Trade Agreement) and MERCOSUR (Southern Common Market). Except for these individual RTAs and EFTA (European Free Trade Association), EEC (European Economic Community) and EU, I aggregate all other multilateral agreements into categories of currency union (CU), free trade agreement (FTA), partial scope agreement (PSA), FTA & EIA (economic integration agreements), CU & EIA and those not active any more to avoid issues related to too disaggregated classification of RTAs such as higher sensitivity to measurement errors of trade data. It should be bear in mind that individual RTAs are only formed among independent countries. More details about the specification of RTAs can be found in Table A1 in the appendix.

2.2 The unbalancedness of country-pair-year panel data

Figure 2 presents the number of observations related to independence status of DOTS trade data for 1948-2015. I follow Head and Mayer (2014) to use larger value of export reported by the exporter (export FOB) and import reported by the importer (import IMF) as the export value for a given transaction. A 10% mark up of FOB export is added to the export value if the exporter reported data is used.

It is apparent from Figure 2a that the number of non-missing trade data increases over time, no matter for which country pair type. The contrast between the solid line and the dash line is interesting. Suppose a country pair is formed only among countries which were independent before 1962 (old independent countries), the number of those distinguished country pairs should be constant over 1948-2015. As a result, the constant increase in the number of observations for such country pair type (solid line in Figure 2a) implies that the average number of trade partners of old independent countries have increased gradually over time. Or, it may also be that those independent countries is lack of records of trade statistics more severely in earlier times.

If this is also the case for country pairs involving countries which gained independence only in 1962 or later, we should see similar patterns of the dash line. However, since the dash line is more steep from the beginning of 1990s on, it may indicate that old independent countries start to trade with newly independent countries more than with other old independent countries during this period. Alternatively, the soaring increase from 1990s on as shown by the dash line may just reflect an increase of number of trade statistics related to newly independent countries for this period. The latter case is the panel unbalancedness related to independence status of new countries, and it is likely this case as the sudden increase of observations overlaps with the the time when many new countries came into existence.

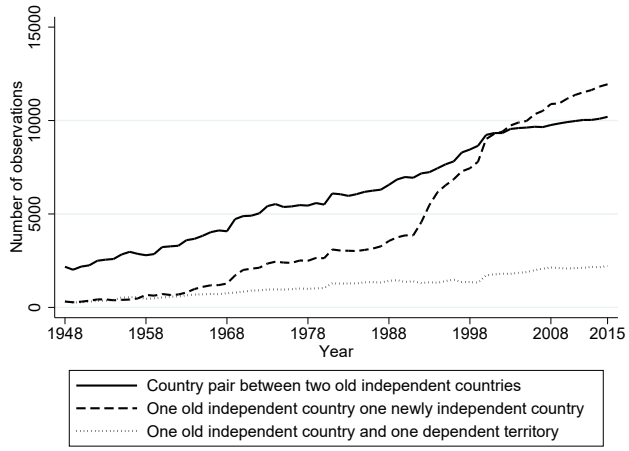
Figure 2b disaggregates the number of observations by independence status for type 2 country pairs, which are composed of one old independent country and one newly independent country. The number of observations is presented as the ratio of number of non-missing observations to number of all distinguished country pairs in each year. Once the number of independent countries is given for a year, the number of distinguished country pairs is determined correspondingly, which is the number of distinguished combination of any two independent countries. As more countries gain independence in more recent yearly, the number of such combinations increases over time.

The solid line in Figure 2b displays the share of number of observations if the newly independent country of a given country pair has not yet been independent, while the dash line shows the share of number of observations for country pairs when the newly independent country has gained independence. The short-dash line in the second axis shows the ratio of the number of observations of country pairs

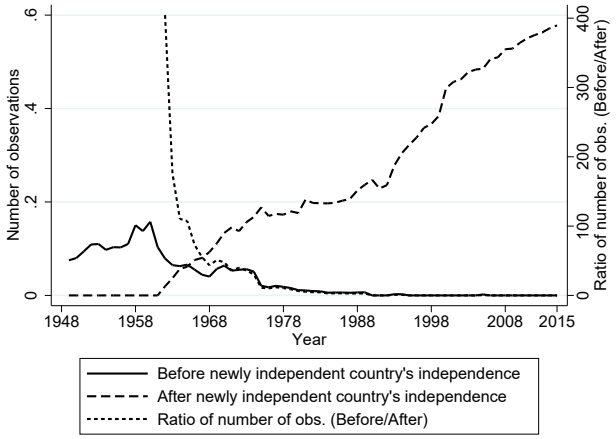
before independence to the number of observations after independence. Until 1960, the number of observations involving dependent territories composes of about 20% of number of all distinguished country pairs formed between independent countries.

Figure 2: Number of Observations in DOTS Related to independence Status

(a) Number of observations by country pair types



(b) Share of number of observations before/after independence



Note: In panel (a) country pair has three types. The first type is formed between two countries which were independent (old independent countries) before 1962 (solid line). The second type is formed between one old independent country and one country which gained independence during 1948-2015 (newly independent country). The last type is formed between one old independent country and one territory still dependent in 2015 but is included as statistic unit in DOTS. In panel (b), only country pairs of the second type are considered. Their number of observations is further disaggregated by their independence status. The solid line shows the number of observations if the newly independent country of a given country pair is not yet independent, while the dash line shows the number of observations for country pairs after the newly independent country's independence. The short-dash line in the second axis shows the ratio of the previous two numbers of observations for each year.

Table 1 describes the number of observations and the mean of export and multilateral RTA membership by independence status of countries/territories. If either one of a given country pair has ever been colonized but gained independence during 1962-2015 then it is indicated by the variable "new" equal to 1. Panel A describes the summary statistics of the complete sample by this ever independence indicator. As can be seen, the number of observations for country pairs involving new countries account for about 40.6% of the total number of observations for the whole sample. Also, the average export value and membership in Bilateral agreements formed before 1993, PSA, FTA& EIA, PSA& EIA are smaller for country pairs involving new countries than those not. The average export value of the former country pair type is only 19.3% of the average export value of the latter type. Panel B displays similar patterns after dropping those territories not independent at all even in 2015. There is no big change in RTA memberships. Only the number of observations for export, bilateral agreements formed since 1993, FTA decreases a little.

In panel C, I drop country pairs not involving newly independent countries. The dummy variable "Pre-independence" indicates a given observation of a country pair

in a given year involves a newly independent country before its independence, while "Post-independence" indicates the observation occurring after the newly independent country' independence. As can be seen, the number of observations for the pre-independence period is much less than post-independence period, with 6% as the ratio of number of observations of export in the first case to the second case. Unexpectedly, the average export value for the former is about 1.5 times of the value for the latter, which could be driven by many different reasons. For example, countries start to record trade statistics regardless of how low it is after they gained independence but not before their independence.

It is clear that the independence of more countries brings more observations for more recent time period, which leads to higher ratio of missing values for early periods. This unbalancedness of panel data related to independent status may further lead to a bias in the estimation of trade effects of RTAs. Appendix A provides more details on data preparation, summary statistics on RTA memberships, independence information, and coverage of countries. I start the analysis with the sample covering all the countries/territories as indicated by Table A2 in the appendix.

Table 1: Distribution of Export and RTA Membership by independence Status

	Statistics	Export (1000 USD)	Bilateral Old	Bilateral New	CU	FTA	PSA	FTA&EIA	PSA&EIA	CU&EIA
Panel A: Ever Independence										
New = 1	Obs	338,563	176	2,201	4,589	10,154	1,889	160	0	4,275
	Mean	100678.4	0.0005	0.0067	0.0136	0.0300	0.0056	0.0005	0.0000	0.0126
New = 0	Obs	494,565	635	1,949	4,521	2,681	11,032	1,716	738	481
	Mean	521147.7	0.0013	0.0041	0.0091	0.0054	0.0223	0.0035	0.0015	0.0010
Panel B: Drop Dependent										
New = 1	Obs	320,457	176	2,199	4,589	10,097	1,889	160	0	4,275
	Mean	102,983	0.0006	0.0070	0.0143	0.0315	0.0059	0.0005	0.0000	0.0133
New = 0	Obs	436,583	635	1,776	4,521	2,681	11,032	1,716	738	481
	Mean	555,648	0.0015	0.0042	0.0104	0.0061	0.0253	0.0039	0.0017	0.0011
Panel C: Drop Not New										
Pre-independence == 1	Obs	18,300	0	0	0	61	0	0	0	129
	Mean	149,702	0.0000	0.0000	0.0000	0.0033	0.0000	0.0000	0.0000	0.0070
Post-independence == 1	Obs	320,263	176	2,201	4,589	10,093	1,889	160	0	4,146
	Mean	97,877	0.0006	0.0069	0.0143	0.0315	0.0059	0.0005	0.0000	0.0129

Note: If either one of a given country pair has ever been colonized but gained independence during 1962-2015, then it is indicated by the variable "new" equal to 1. "Bilateral Old" refers to bilateral agreements between two old countries, while "Bilateral New" refers to bilateral agreements involving at least one newly independent country. Panel A describes the summary statistics of the whole sample by the dummy of country pairs involving newly independent countries or not. Panel B displays similar patterns after dropping those territories not independent at all even in 2015. In panel C, I drop country pairs not involving new countries. According to the RTA database, a few RTAs involve non-independent states, such as the Caribbean Community and Common Market. So the number of observations of RTAs in panel C for "Pre-independence" == 1 is not always zero.

3 Empirical Evidence

3.1 Including new countries into the sample or not?

To estimate trade effects of the RTAs, I use the structural gravity equation as follows (Anderson and Van Wincoop, 2003; Baldwin and Taglioni, 2007; Head and

Mayer, 2014, among others):

$$X_{ijt} = \boldsymbol{\theta} * \mathbf{RTAs}_{ijt} + Independence_{ijt} + \{\lambda_{it}\} + \{\psi_{jt}\} + \{\delta_{ij}\} + \epsilon_{ijt} \quad (1)$$

where $\boldsymbol{\theta}$ is the vector of coefficients of our interest. $\mathbf{RTAs}_{ijt}$ is a vector of different types of RTAs. Each element of $\mathbf{RTAs}_{ijt}$ equals to 1 if country i, j are both in the corresponding RTA at time t. X_{ijt} is the nominal bilateral export from i to j at time t. $Independence_{ijt}$ is the country-pair-time varying indicator of both being independent or not dummy. It is used to capture any non-random missing pattern related to independence status. λ_{it} and ψ_{jt} are sets of time-varying exporter and importer dummy variables. δ_{ij} controls for country fixed effects. I apply the poisson pseudo maximum likelihood (PPML) estimator, proposed by Silva and Tenreyro (2006), for the estimation.

If panel unbalancedness to this paper's concern does indeed affect the estimated trade effects of RTAs, we should expect different coefficients of RTAs when we use samples covering different newly independent countries even after we control country's independence indicators. This is a consequence of non-randomness in missing values of trade data related to the change of independent status of different countries.

Table 2 compare coefficients derived from samples covering different newly independent countries and reveals a large variation in coefficients of different RTAs. Results in column 1 provide a benchmark, where a sample covering all countries as given by DOTS dataset is used. Only some types of RTAs have significantly positive effects on export. Given 99% confidence level, CU, PSA, ASEAN, NAFTA, MERCOSUR, EU and RTA between EEC and other countries have strongly positive impact on trade, with the magnitude ranging from 18% ($e^{0.166}-1$) to 203% ($e^{1.109}-1$). FTA only has positive effects on trade at lower confidence level. Although European Union has boosted trade significantly among member countries, trade agreement between EU members as one party and other non-member countries is shown to decrease trade significantly by about 11% at 99% confidence level. Besides, bilateral agreements formed after 1992 also discourages trade by about 13% at 90% confidence level.

Given our concern of more missing values for country pairs involving newly independent countries, column 2 of Table 2 shows results derived from a sample only covering countries with non-missing observations in both 1962 and 2015, which indicates that the included countries should have effective statistic department regardless of their independence status since 1962. As can be seen, there is an inflation of the magnitude of many coefficients, while the significance of them almost stays the same.

The estimated trade effect of CU& EIA increase the most, which is about 8.1 times of the corresponding coefficient in column 1. The magnitude of positive trade effects

of FTA, PSA, ASEAN, EU and negative trade effects of CU and RTA between EU and other countries increases by a range of 1%-12%. Trade effect of RTAs between EEC and other countries is about 2% lower. This first piece of evidence shows a non-negligible role of including observations related to newly independent countries on the estimates of interest, especially for CU, FTA, EU and RTA between EU and other countries.

In column 3, the sample covers countries which have been independent since 1962 and also have the highest number of trade observations until the 134th place.[4] Compared with column 1, there is a change of magnitude of coefficients for similar RTA dummies as in column 2. The estimated trade effect of CU is 147%, which is about 56% lower than the corresponding coefficient in column 1. Trade effects of PSA and EU become even larger, which are about 3% and 7% higher than the corresponding coefficient in column 1. The negative trade effect of RTA between EU and others is also about 4% stronger than the result in column 1, similar as the result in column 2.

The most interesting result is the coefficient of ASEAN and NAFTA. As only countries not yet independent until 1962 and not belonging to any individual RTA as specified in the regression table are excluded for the third sample, change in coefficients of ASEAN and NAFTA reflects that variation in countries of control group according to independent status affects the estimates. As can be seen, it is likely that trade effect of ASEAN has been underestimated if we do not consider the panel unbalancedness issue caused by independent status of countries, while trade effect of NAFTA has been overestimated. Overall, the estimated trade effect of most aggregated-level RTAs has likely been underestimated.

In spite of some variation in coefficients in the first three columns, such variation can be considered as rather stable compared with the variation in the number of observations as can be seen in the second last row. It confirms the reliability of estimated coefficients. Furthermore, we may say certain observations are not necessary to infer trade effect of RTAs. However, it does not mean that we can include or exclude countries/territories in the sample less carefully, as we can see from the rest columns in the table.

The fourth column shows the results when using a sample of developing countries. It is for the purpose of providing reference for analysis using certain country groups. We can see clearly that the magnitude and significance of most coefficients is largely different from those in column 1. This fact casts doubt on empirical inference from samples only composed of developing countries, especially when many of them became independent more recently.

[4]Most countries with fewer number of trade observations only become independent after 1962. Observations involving Bahrain, Brunei, Qatar, Singapore, United Arab Emirates are never dropped for the first four columns even they became independent after 1962, since they joined individual RTAs including ASEAN and GCC.

In the last three columns, I use two studies of Baier and his coauthors as references to determine the coverage of countries. The coverage of countries for column 5 is the same as Baier et al. (2019), which studies the determinants of RTAs by identifying heterogeneous trade effects of individual RTAs. Compared with column 1, the effect of PSA almost loses its significance and its magnitude decreases from 47% to 30%. Apart from this, the trade effects of FTA & EIA and GCC become significantly negative from insignificance, with a magnitude of around 171% and 45% respectively. The magnitude of CU, ASEAN, NAFTA, MERCOSUR, RTAs between EU and others and between EEC and others either increases or decreases by around 4%-20%, compared with the corresponding coefficient in column 1.

Baier et al. (2019) derive a large set of 908 unique estimates of trade effects of individual RTAs, without any discussion on why they include some countries formed in 1960s such as Kenya or Mauritius but not other countries independent since 1950s (such as Parkistan, Saudi Arabia and so on) in their sample, or why they even include areas which do not have political sovereignty such as Macau but not others, for example. Given that the coverage of countries of samples matters for estimation, such a discussion will be helpful to indicate how robust the results are, especially when too disaggregated RTAs are involved.

In column 6, I exclude those not independent in 1962 from the sample of Baier et al. (2019), as it seems to be a bit arbitrary why Baier et al. (2019) include some but not other countries/territories in their sample. The magnitude of a few coefficients is quite different to the results in column 5. The estimated trade effects of CU now become weaker to 133% compared with 152% in column 5, and the significance level also decreases to 95% confidence level. After excluding newly independent countries and non-independent territories from the Baier et al. (2019) sample, the positive trade effects of ASEAN is about 19% lower ($e^{0.308} - e^{0.441}$), that of NAFTA is about 3% higher. The negative effect of RTA between EU and others is 3% weaker. The last column presents results when the sample of Baier and Bergstrand (2007) is used. We can see significant changes in coefficients of many RTAs, no matter compared with results in column 1 or column 5.

The most important implication we can draw from Table 2 is that whether and how many newly independent countries to include into the sample affects the estimation of trade effects of RTAs significantly. The estimated trade effects of CU, FTA, PSA and ASEAN are particularly sensitive to such inclusion or exclusion. The estimation of trade effects of PSA, EU, RTA between EU and others is less sensitive but the change of magnitude can not be ignored. The second implication is that we should be particularly careful with the panel unbalancedness issue of interest when conducting analysis on trade effects of RTAs on different groups of countries/territories such as developed, developing or least developed countries.

At last, it is recommended to all future studies to include a minimum discussion

of reasons for determining the coverage of countries when using country level data, since there is a large variation in coefficients derived from samples defined in different ways. Especially, we should devote minimum effort in explaining why including some but not other newly independent countries or dependent territories into the analysis for a given study for the purpose of transparency and awareness, since the inclusion or exclusion of these territories affects the estimated trade effects of some RTAs significantly.

Table 3 displays four statistics for each sample in Table 2: the number of observations involving newly independent countries; the ratio of this number to the number of all observations in a given sample; the mean of export of country pairs involving newly independent countries; the ratio of this mean to the mean of export country pairs not involving newly independent countries. Since samples for column 3 and 6 in Table 2 do not involve country pairs with newly independent countries, the statistics are excluded.

As can be seen, the two samples with the same coverage of countries as in Baier et al. (2019) and Baier and Bergstrand (2007) have the lowest ratio of country pairs involving newly independent countries. However, this does not help to derive coefficients less affected by issue of change of independence status, since the estimates change much when newly independent countries are excluded from the sample of Baier et al. (2019). The mean of export for country pairs involving newly independent countries is rather similar for the first three samples, while the number of observations of them vary a lot.[5] Results estimated from the LSDV estimator are presented in Table A4 in the appendix.

3.2 Had they not independent

In this section, I address the concern of Greaves (1954) directly in the context of trade effects of RTAs. That is, whether the classification of trade statistics of colonies has significant impact on the estimation of coefficient of interest. I extend the idea of Greaves (1954) to treat all trade of colonies/dependent territories as "domestic" trade of (previous) colonizers before their independence. For example, since Angola gained independence from Portugal only in 1975, any trade between Angola and a third country before 1975 is treated as trade between Portugal and the third country. Such a classification has practical importance as Eurostat, which is the official deposit of statistics on European Union countries, compiles trade data of Spain with the inclusion of Canary Islands from 1997 and of France with the inclusion of Saint Barthélemy untile 2012, for example.

Table A5 in the Appendix presents PPML estimates of RTA dummies on trade by

[5]There are 21 countries covered by all samples. The number of countries covered by each sample is 216, 148, 104, 103, 66, 58, 91, respectively. The list of countries covered by each sample is available upon request.

Table 2: PPML Estimates from Samples with Different Coverage of Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Whole	Spreading 55 years	Independent since 1962	Developing	Same as Baier et al. (2019)	Excluding new	Same as Baier and Bergstrand (2007)
Bilateral (<1993)	0.077	0.082	0.077	-0.604**	0.117*	0.127*	0.105
	(1.275)	(1.356)	(1.247)	(-2.098)	(1.778)	(1.955)	(1.644)
Bilateral (≥1993)	-0.127*	-0.155**	-0.151**	-0.310***	-0.178**	0.024	-0.163**
	(-1.718)	(-2.012)	(-2.016)	(-3.723)	(-2.244)	(0.542)	(-2.129)
CU	1.109***	0.931***	0.903***	0.735***	0.925***	0.848**	0.952***
	(7.717)	(6.787)	(5.374)	(2.939)	(4.759)	(2.352)	(5.965)
FTA	0.172**	0.288***	0.267**	0.345***	-0.161	-0.181	0.064
	(2.109)	(2.782)	(2.492)	(2.828)	(-1.177)	(-1.297)	(0.525)
PSA	0.388***	0.396***	0.405***	0.209	0.262*	0.310**	0.353***
	(3.310)	(3.441)	(3.516)	(0.954)	(1.929)	(2.351)	(2.935)
CU & EIA	0.151*	1.217***	1.352**	1.461***			1.188***
	(1.650)	(3.514)	(2.116)	(3.108)			(2.648)
FTA & EIA	0.134	0.356	0.388	-0.271	-0.996***		0.385
	(0.541)	(1.454)	(1.613)	(-0.817)	(-5.174)		(1.562)
PSA & EIA	0.093	0.096	0.102	-0.023	0.119	0.041	0.105
	(0.936)	(0.935)	(0.975)	(-0.218)	(1.057)	(0.380)	(0.905)
ASEAN	0.384***	0.391***	0.400***	0.344***	0.441***	0.308***	0.420***
	(4.449)	(4.492)	(4.617)	(3.527)	(4.805)	(3.279)	(4.613)
NAFTA	0.208***	0.208***	0.187**	0.544***	0.256***	0.277***	0.226***
	(2.701)	(2.713)	(2.472)	(2.770)	(3.347)	(3.776)	(2.995)
EFTA	-0.017	-0.059	-0.054	-0.336**	-0.060	-0.116**	-0.051
	(-0.289)	(-0.907)	(-0.826)	(-2.417)	(-0.900)	(-2.079)	(-0.745)
GCC	-0.102	-0.133	-0.112	-0.187	-0.371***		-0.269***
	(-0.874)	(-1.105)	(-0.938)	(-1.455)	(-3.414)		(-4.805)
MERCOSUR	0.514***	0.511***	0.517***	0.462**	0.441***	0.446***	0.507***
	(3.348)	(3.321)	(3.344)	(2.575)	(4.618)	(4.817)	(3.221)
EU	0.397***	0.427***	0.440***		0.362***	0.376***	0.410***
	(9.518)	(9.014)	(9.029)		(7.312)	(7.448)	(8.379)
EU and others	-0.108***	-0.135***	-0.132***	0.372*	-0.157***	-0.134***	-0.153***
	(-3.032)	(-3.465)	(-3.306)	(1.829)	(-3.546)	(-3.026)	(-3.616)
EC and others	-0.007	-0.040	-0.038	-1.485***	-0.013	-0.010	-0.019
	(-0.297)	(-1.458)	(-1.366)	(-3.434)	(-0.450)	(-0.333)	(-0.661)
EEC and others	0.166***	0.148***	0.151***		0.241***	0.247***	0.175***
	(3.163)	(2.851)	(2.869)		(4.717)	(4.790)	(3.381)
Inactive RTAs	0.034	0.065	0.055	0.063	0.097**	0.097**	0.076
	(0.726)	(1.301)	(1.109)	(0.286)	(1.977)	(1.989)	(1.538)
Independence	0.147	0.611***	0.330	-0.150	0.557**	-0.090	0.861***
	(0.885)	(3.191)	(1.311)	(-0.564)	(2.158)	(-0.153)	(3.869)
N	804496	580224	391297	219204	187367	149233	307364
R^2	0.97	0.97	0.97	0.96	0.97	0.97	0.97

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The headings of each column indicate the coverage of countries for each sample. "Whole" means the sample covers all countries and territories as given by the dataset. "Spreading 55 years" means the sample covers countries whose non-missing trade value spreads over the whole sample period. In column 3, the sample covers countries which have been independent since 1962 and also have the highest number of trade observations until the 134th place. Observations involving Bahrain, Brunei, Qatar, Singapore, United Arab Emirates are never dropped for the first four columns even they became independent after 1962, because they are covered by individual RTAs including ASEAN and GCC. In column 4, a sample of developing countries as defined by UN UNCTAD is applied. "Same as Baier et al. (2019)" uses a sample with the same coverage of countries or territories as in Baier et al. (2019). In column 6, those not independent in 1962 in the sample of Baier et al. (2019) are excluded. In the last column, a sample with the same coverage of countries or territories as in Baier and Bergstrand (2007) is used. In the next table, the coverage of countries for each sample is defined in the same way.

classifying trade statistics in the above-mentioned way. The regression is conducted for the same samples as in the benchmark results. When comparing results in the first three columns in Table A5 to the corresponding columns in Table 2, we do not see too much difference in the magnitude and significance of the coefficients. In

Table 3: Summary Statistics for Samples with Different Coverage of Countries

	(1)	(2)	(3)	(4)	(5)
New == 1	Whole	Spreading 55 years	Developing	Same as Baier et al. (2019)	Same as Baier Bergstrand (2007)
Obs.	338,563	150,231	83,256	28,725	43,262
Ratio of the No. of Obs.	40.64	25.73	39.79	15.33	14.08
Mean of Export	100678.4	121745.7	134846.9	336787.3	217720.9
Ratio of Mean of Export	0.19	0.23	0.21	0.28	0.28

Note: The four statistics as indicated by the most left column are the number of country pairs involving newly independent countries; the ratio of this number to the number of all country pairs; the mean of export of country pairs involving newly independent countries; the ratio of this mean to the mean of export country pairs not involving newly independent countries.

particular, the estimated trade effects of ASEAN, NAFTA and EU is almost identical in the two tables. The difference in the magnitude of all other coefficients occurs mainly for the second sample. Compared with column 2 in the benchmark table, treating newly independent countries as if they were not independent increases the estimated trade effects of CU by 49.7% and makes the impact of CU & EIA insignificant. These two RTAs display the most outstanding change in coefficients in this counter-factual exercise. The estimated trade effects of FTA, PSA and EU decrease by 14.5%, 2.1% and 4.2%, respectively, when the sample composed of countries with observations spreading for 55 years is applied. For the rest columns, changes in coefficients of RTAs are negligible.

It is then safe to say that treating trade of colonies/dependent territories as "domestic" trade of (previous) colonizers has rather insignificant impact on the estimates of interest. However, whether such a conclusion is applicable to other topics related to international trade is not clear. At the end, most RTAs are formed after 1990, when most previous colonizers have gained independence and thus the issue of classification of trade statistics is not so related.

To examine further whether the issue of appropriate classification of trade statistics of (previously) colonizers matters or not, I also treat trade involving newly independent countries or dependent territories as part of the trade of their (previous) colonizers through the whole sample period (Table A6 in the Appendix). This situation makes sense if after-independence trade of newly independent countries is still strongly entangled with previous colonizers' economic activities. The coefficients vary more than Table A5.

A rather relevant issue of interpreting statistics related to independence of new sovereignties is about how to specify RTA dummies correctly. Take the membership of France and United Kingdom (UK) in European Community as one example. France is one initial member country in 1953 when the Community was created. The UK joined in 1973. Given the fact that Zimbabwe is independent from the UK in 1980 and Vanuatu is independent from France in 1980, it is not clear whether trade relationship between Zimbabwe and Vanuatu back before their independence

has been affected by the European Community membership between the UK and France as well. If the impact is de-facto significant, then our commonly used way of specifying RTA dummies is not correct.

Table A7 in the appendix presents results when RTA dummies are specified differently. That is, the European Community membership is entitled to Zimbabwe and Vanuatu for the period of 1973-1979 as well in the preceding context, due to their colonial relationships with the UK and France. The results are indicated by columns headed with "Colonizers' RTA". The analysis is conducted for the sample covering all territories as given by DOTS and the sample covering territories with observations spreading for 1962-2015. In the first column of each sample, the results are estimated without the new assignment of RTAs, but with an additional control variable to capture whether a given governor has experienced a split of its colonies or not in a given year. In the third column of each sample, the split dummy is not controlled after the assignment of new RTA membership.

As can be seen from the Table, the estimated trade effects of all RTAs are almost identical to the corresponding results in the benchmark table. It means the way of treating RTA dummies for (previously) colonizers and dependent territories does not affect the estimated trade effects of them. This finding is especially surprising for RTAs like EU, EU and others, EEC and others, since back 1960-1970s, many territories were still under control in some of EU member countries. Had European colonizers shared EU trade agreements does not change the estimated trade effects of the related RTAs.

3.3 More appropriate sample period

After the second World War, there have been two waves of independence of new countries. One is in 1960 during which 18 countries mostly from Africa gained independence, while the other is in 1991 when 13 countries gained independence mainly due to the dissolution of Soviet Union. Emergence of many new countries at once causes a large increase of number of distinguished country pairs in a given year. To make a panel sample covering the watershed years balanced, we need observations for those new country pairs for earlier years as well. Thus, we can expect a stronger impact of panel unbalancedness due to emergence of new countries on estimation of interest if we use a sample dated back to earlier than 1991 or 1960.

Consequently, a too long sample period may also bring the problem of panel unbalancedness to this paper's concern, even though a longer sample period can generally provide more information. More importantly, it is not necessary for studies of trade effects of RTAs to include data dated back to too long time ago. The development of RTAs tells us that more than 80% of currently existing RTAs were formed after 1990. There were only 50 RTAs in force in 1990, while this number is more than 280 in 2017. Unless we are interested in the effects of RTAs formed

earlier in particular, a sample dated back to 1990 the earliest should be enough. One additional benefit of this shorter sample period is to avoid possibly worse data quality of observations from earlier times.

Table 4 presents the estimated trade effects when the sample period is selected in a more defined way. The independence control variable is dropped for it does not have significant effect on the estimates of RTAs. The first three columns show the results when the sample is dated back to 1992, from which year on only very few country have changed their independence status. The year is chosen also because the formation of large amount of RTAs has not yet started as described before. The other two sets of sample period is 1986-2005 and 1962-2000, which follow Baier et al. (2019) and Baier and Bergstrand (2007), respectively. For a given sample period, the regressions are run for samples covering all possible countries excluding dependent territories in DOTS, countries included by Baier et al. (2019) and countries included by Baier and Bergstrand (2007) for comparison as before.

Since some aggregated RTAs are specified to include multiple individual agreements which may be dated back to earlier than 1992, it makes more sense to compare coefficients of agreements which are formed after 1991 with the corresponding coefficients in Table 2. In particular, two aggregated RTAs, FTA and FTA& EIA, only contain individual agreements which are formed during 1992-2015. Four individual agreements under consideration are ASEAN (1992.01), NAFTA (1994.01), MERCOSUR (1991.11) and GCC (2003.01). Among them, the estimated trade effects of FTA, ASEAN, MERCOSUR and NAFTA have the most obvious change as shown by the first three columns.

More specifically, the trade effect of FTA becomes significantly negative to 21%-32% and rather stable across samples of different country coverage. ASEAN is estimated to increase trade by 38%, 9% lower than the effect estimated by using the sample dated back to 1962. When the country coverage of Baier et al. (2019) and Baier and Bergstrand (2007) is used, ASEAN is also shown to have about 9% weaker positive effect on trade than the corresponding estimated effect in Table 2. As for the trade effect of MERCOSUR, it loses significance when using shorter samples, no matter which coverage of countries is used. In addition, trade effect of GCC is estimated to be 20% when sample covering the same countries as Baier and Bergstrand (2007) is used, compared with -31% shown in column 7 in Table 2.

One astonishing contrast is the estimated trade effects of NAFTA. While the agreement is estimated to increase trade by 23% when the sample covering the period 1962-2015 is used, it does not have significant effect on trade any more when only 1992-2015 data is used. Such a contrast is consistent with what Cipollina and Salvatici (2010) find that using more recent sample periods is significantly associated with lower estimated trade effects of RTAs. Given large amount of observations on the increase of trade among the the three member countries after

the formation of NAFTA, one potential explanation for the insignificance is that the NAFTA dummy cannot capture the effect of behind-the-border reforms given the insignificant estimate is valid as Cipollina and Salvatici (2010) suggest. Alternatively, if trade creation effect has happened before the time of official effective data, then a sample beginning with the year of 1992 might not be enough to capture the true effect of NAFTA.

Combining results in first three columns in Table 4 and the corresponding results in Table 2, we can see that the estimated trade effects of FTA, ASEAN, NAFTA and MERCOSUR are more sensitive to the choice of sample period, rather than the choice of country coverage. This can be inferred from the similarity of coefficients for each of the RTA dummies across the three columns in Table 4 and the variation in coefficients between Table 4 with the corresponding ones in Table 2. Instead, the estimated trade effect of GCC is more sensitive to the choice of country coverage.

Table 4: PPML Estimates Derived from Samples Covering Different Periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	1992-2015			1986-2005			1962-2000		
	Whole	Same as Baier et al. (2019)	Baier and Bergstrand (2007)	Whole	Same as Baier et al. (2019)	Baier and Bergstrand (2007)	Whole	Same as Baier et al. (2019)	Baier and Bergstrand (2007)
Bilateral (<1993)	-0.119	-0.146	-0.115	-0.006	0.010	0.007	0.075	0.120**	0.113**
	(-1.196)	(-1.330)	(-1.093)	(-0.116)	(0.183)	(0.137)	(1.485)	(2.243)	(2.131)
Bilateral (≥1993)	0.064*	0.030	0.041	-0.006	-0.011	-0.016	0.010	0.056	0.051
	(1.835)	(0.773)	(1.087)	(-0.118)	(-0.181)	(-0.274)	(0.240)	(0.856)	(0.821)
CU	0.666***	0.036	0.798***	0.640***	0.448***	0.433***	1.109***	1.191***	1.265***
	(3.547)	(0.175)	(3.754)	(6.038)	(2.879)	(4.233)	(11.296)	(5.204)	(11.058)
FTA	-0.188***	-0.276***	-0.195**	-0.007	-0.489***	-0.113	0.100	-1.147***	-0.696**
	(-3.056)	(-3.021)	(-2.451)	(-0.103)	(-5.341)	(-0.837)	(0.658)	(-5.573)	(-2.291)
PSA	-0.055	-0.143	-0.123	0.655**			0.749***	0.812***	0.811***
	(-0.475)	(-1.100)	(-0.961)	(2.211)			(9.549)	(7.371)	(9.729)
CU and EIA	-0.309		-0.323	-0.535		-0.571	1.264***		1.520***
	(-1.579)		(-0.663)	(-1.503)		(-1.465)	(5.216)		(5.431)
FTA and EIA	0.178	-0.770***	0.508*						
	(0.631)	(-3.528)	(1.847)						
PSA and EIA	-0.008	-0.005	-0.011	0.147**	0.141*	0.139*	0.393*	0.654***	0.695***
	(-0.082)	(-0.045)	(-0.096)	(2.222)	(1.916)	(1.870)	(1.791)	(2.807)	(3.112)
ASEAN	0.324***	0.374***	0.356***	0.294**	0.311**	0.294*	0.531***	0.592***	0.581***
	(3.800)	(4.044)	(3.893)	(2.070)	(1.982)	(1.888)	(4.562)	(4.739)	(4.732)
NAFTA	-0.039	-0.047	-0.028	0.183***	0.221***	0.211***	0.262***	0.300***	0.285***
	(-0.407)	(-0.448)	(-0.278)	(2.917)	(3.342)	(3.305)	(4.121)	(4.512)	(4.423)
EFTA	-0.030	-0.108	-0.071	-0.077	-0.097	-0.092	-0.027	-0.028	-0.029
	(-0.392)	(-1.281)	(-0.791)	(-1.243)	(-1.414)	(-1.332)	(-0.547)	(-0.554)	(-0.571)
GCC	-0.143	-0.359***	-0.181***	-0.257**	-0.873*				
	(-1.168)	(-3.912)	(-4.692)	(-2.220)	(-1.671)				
MERCOSUR	0.356*	0.155	0.354*	0.405***	0.364***	0.387***	0.674***	0.659***	0.654***
	(1.880)	(1.556)	(1.868)	(5.021)	(3.768)	(4.506)	(8.281)	(10.524)	(9.411)
EU	0.240***	0.230***	0.244***	0.111***	0.092**	0.102**	0.343***	0.279***	0.322***
	(5.536)	(4.747)	(4.980)	(2.958)	(2.064)	(2.298)	(5.955)	(4.565)	(5.441)
EU and others	-0.041	-0.080*	-0.074*	-0.024	-0.031	-0.044	0.104***	0.094**	0.103**
	(-1.153)	(-1.770)	(-1.699)	(-0.617)	(-0.721)	(-1.116)	(2.682)	(2.280)	(2.384)
EC and others	-0.013	-0.038	-0.031	0.090***	0.096***	0.092***	0.099***	0.082***	0.083***
	(-0.544)	(-1.276)	(-1.041)	(3.319)	(2.776)	(2.741)	(3.298)	(2.678)	(2.643)
Inactive RTAs	-0.557***	-0.980***	-0.888**	0.125***	0.145***	0.138***	0.142***	0.172***	0.154***
	(-2.779)	(-4.104)	(-2.025)	(3.584)	(3.762)	(3.648)	(4.373)	(5.221)	(4.677)
EEC and others							0.179***	0.251***	0.205***
							(3.872)	(5.204)	(4.278)
N	489248	91280	161361	314813	71844	122914	387994	118335	193235
R^2	0.97	0.97	0.97	0.98	0.99	0.99	0.99	0.99	0.99

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.4 Optimal composition of the sample

Previous discussions indicate that there might be an optimal composition of sample for the study of trade effects of RTAs, in the presence of emergence of many newly independent countries. On one hand, excluding some newly independent countries or dependent territories with too few observations and with no RTA membership from the sample may help to alleviate the impact of panel unbalancedness issue related to those territories. On the other hand, a sample dated back to too long time ago is not necessary for the estimation of trade effects of most RTAs while it can avoid dealing with the issue of panel unbalancedness of interest, since most newly independent countries have gained independence by the beginning of 1990s.

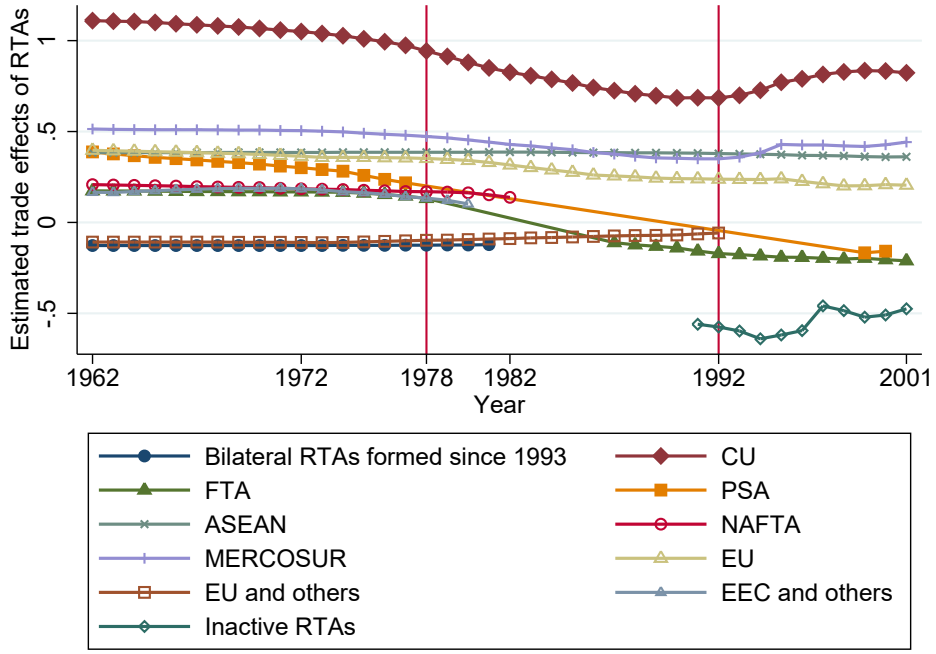
Figure 3 extends the analysis of section 3.3. It shows the estimated coefficients of all RTAs under discussion from samples covering different periods, beginning from the year as indicated by x-axis value until 2015. Any insignificant coefficient is deleted by the Figure and shown as missing values. In addition, if most coefficients of a given RTA are insignificant, the distribution of them is not shown in the Figure either.

Considering RTAs which are formed during 1992-2015 period (FTA and FTA& EIA, ASEAN, NAFTA, MERCOSUR, GCC), sample period dated back to 1992 is necessary as more recent samples deliver increasing (MERCOSUR) or decreasing (FTA, ASEAN) coefficients. If we use samples dated back to earlier until some time around 1978, the coefficients of these RTAs still experience variation. However, as I have mentioned before, since those RTAs were formed rather recently and the beginning of 1990s is overlapped with another wave of emergence of newly independent countries, we can use sample dated back to 1990 the earliest to derive more reliable coefficients for these RTAs.

Considering those RTAs formed earlier, it is interesting to see a change of pattern of coefficients around 1992. For example, the estimated trade effects of CU has increased obviously if we use samples only dated back to 1992, compared with samples dated back to earlier until around 1978. One immediate explanation is that the 1991 dissolution of Soviet Union causes a great increase of countries and thus number of country pairs as the individual base of panel data, which affects the estimation of trade effects of CU. Apart from this, it is under discussion about why samples dated back to the beginning of 1970s or even earlier deliver rather constant estimates of most RTAs.

Based on information provided by Figure 3, I use 1975 and 1992 as two critical thresholds to determine the sample period. With a sample of 1975-2015, I investigate trade effects of all RTAs as specified in this paper. With a sample of 1992-2015, I pay more attention to estimated trade effects of RTAs formed more recently. For both samples, I exclude territories still dependent in 2015 and those were not yet independent in 1975 or 1992 for the two corresponding sample periods. Since treat-

Figure 3: Estimated Trade Effects of RTAs with Samples Dated Back to Different Years



ing trade involving newly independent countries or dependent territories as part of trade of their (previous) colonizers does not affect the estimation much, I do not treat trade statistics of relevant territories in the counterfactual way. Table A8 in the appendix shows the results.

Given the sample period, a sample excluding only dependent territories delivers slightly different coefficients from a sample excluding also countries not yet independent in 1975 or 1992. It is more reasonable to trust coefficients derived from a sample excluding both dependent territories and those not yet independent, since a territory not independent yet is not committed to any given RTA as specified in this study. For RTAs formed later, results derived from the sample covering 1992-2015 is more reliable. Overall, we can see from column 2 in Table A8 that Bilateral RTAs have no significant trade effects. The significantly trade effects of CU, PSA, ASEAN, EU, RTA between EEC and others are 165% ($e^{0.974}-1$), 39% ($e^{0.327}-1$), 37% ($e^{0.315}-1$), 50% ($e^{0.407}-1$) and 15% ($e^{0.142}-1$), respectively. In contrast, FTA and RTA between EU and others decrease trade significantly by 22% ($e^{0.197}-1$) and 12% ($e^{0.112}-1$) respectively at 99% confidence level. Other RTAs only have insignificant or lowly significant effects on trade.

4 Monte-Carlo Simulation

4.1 Design of the simulation

As outlined in the introduction, panel unbalancedness can be related to the change of independent status in two ways. One way is the change of number of individuals over time. The other way is the change of data compilation capacity related to a territory's independence status. Both channels may likely generate panel unbalancedness pattern quite different from random missing or missing from other processes. While last section discusses several specific issues related to independence status of territories on the evaluation of trade effects of RTAs, this section studies more generally the impact of panel unbalancedness caused by independence status of territories on the estimates of interest.

More specifically, I compare coefficients derived from samples when missing values in trade are caused by non-existence of some countries before their independence and coefficients derived from samples with other missing processes in a Monte-Carlo (MC) simulation exercise. To avoid too long time of convergence, I use samples for the period of 1986-2005 in the MC study, the same as Baier et al. (2019). To mimic the process of emergence of new countries, I assume some countries are independent in different years randomly. Once they are independent, they are never ceased to be dependent.

To capture the impact of different waves of independence of territories, the following experiments are conducted: (1) 10 countries are randomly selected to be independent in the year of 1990, 10 in 1995 and 10 in 2000, respectively; (2) 10 countries are randomly selected to be independent in the year of 1990, 10 in 1995 and 30 in 2000; (3) 10 countries are randomly selected to be independent in the year of 1990, 30 in 1995 and 30 in 2000. Several countries are never drawn as newly independent countries.[6] Before the independence of a given country, bilateral trade between a country pair involving this country is assumed to be missing.

Given a total number of 216 independent countries as in the year of 2015, the ratio of missing values caused by non-existence of new countries is 11.9%, 23.1% and 29.3%, respectively for the above three experiments. Corresponding to each experiment, I also draw samples with random missing and missing at minimum values for the corresponding ratio of 0.119, 0.231 and 0.293 of the calibrated bilateral trade flows. When one unbalanced panel is caused by random missingness, we should expect negligible effect of such unbalancedness on estimates according to Head and Mayer (2014) when using LSDV estimator. I conduct the MC simulation for 200 times for each experiment.

I follow the structural gravity model as in Head and Mayer (2014) to generate

[6]These countries are Australia, Belgium, Denmark, France, Germany, Mexico, Netherlands, New Zealand, Portugal, Spain, United States, United Kingdom.

the calibrated bilateral trade flows. First, we should use the LSDV estimator with country-year and country pair fixed effects on real trade data to derive the error terms. Second, the error terms are applied as the stochastic term to the following equation to construct trade cost value between two countries:

$$\phi_{ni} = exp(-lnDist_{ni} + \boldsymbol{\beta}\mathbf{RTAs}_{nit})\eta_{ni},$$

where η_{ni} is a log-normal random term derived from the first step. ϕ_{ni} is the trade cost exporting from country *i* to country *n*. $Dist_{ni}$ refers to distance between country *i* and *n*. $\mathbf{RTAs}_{nit}$ is a set of RTA dummies as specified in Section 3.4. $\boldsymbol{\beta}$ is a vector of coefficients for RTA dummies. The values for each RTA parameter is set to follow the results in Section 3.4 and are listed in Table A9 in the appendix. The third step is to recover multilateral resistance terms Φ_n and Ω_i as indicators for accessibility-weighted sum of the exporter capabilities for all countries of country *n* and market potential or access for all countries of country *i*. The last step is to generate bilateral trade flows using information from previous steps and the structural gravity equation $X_{ni} = \frac{Y_i}{\Omega_i}\frac{X_n}{\Phi_n}\phi_{ni}$, where Y_i is the value of production and X_n is the value of importer's expenditure on all source countries. Once we get the calibrated bilateral trade flows, we can generate missing values based on the processes described in the previous paragraph and estimate trade effects of RTA dummies correspondingly.

4.2 Simulation results

Table 5 presents the MC results derived from the PPML estimator. Values in rows without any bracket is the mean of estimates based on 200 repetitions. Values in rows with "( )" are the mean of standard errors from each regression for the corresponding variable. Values in rows with "[ ]" are the standard errors of estimates. Since some RTA dummies are dropped due to collinearity in the simulation process, Table 5 only reports coefficients for RTA dummies of CU, FTA, PSA, ASEAN, EU and RTA between EU and others. Based on estimations in Section 3.4, the parameter values of those dummies are set to be 0.97, -0.2, 0.33, 0.32, 0.41 and -0.11, respectively.

Given (10,10,10) countries independent in (1990,1995,2000) respectively, only 17205 (C^2_{186}), 19110 (C^2_{196}), 21115 (C^2_{206}), 23220 (C^2_{216}) country pairs existed for the period of 1986-1989, 1990-1994, 1995-1999, 2000-2005, respectively. If all countries had been independent since 1986, there would have been 23220 (C^2_{216}) country pairs through 1986-2005. The ratio of missing values caused by such process of independence is then 0.119 for 1986-2005.

From panel A, the biggest deviation of estimates to the true parameter shows up for the coefficient of ASEAN, regardless of missing processes. The gap in the estimates and true parameter is about 21% for the first two missing processes and

26.5% for the missingness at minimum value process. Missingness caused by occurrence of new countries causes the largest bias of coefficients of FTA and RTA between EU and others, compared with the other two missing processes. More specifically, the bias is about 5.5% for FTA and 2% for RTA between EU and others. The bias is the least for PSA, ASEAN and EU from the missing process of our main interest, compared with bias from the other two missing processes.

Such a bias pattern also holds when inspecting the other two panels. In the second experiment, the number of country pairs for the period of 1986-1989, 1990-1994, 1995-1999, 2000-2005 is 13695, 15400, 17205, 23220, respectively. The ratio of missing values is 0.231. In the third experiment, the number of country pairs for the four time periods is 10585, 12090, 17205, 23220, respectively. Thus, only 146 countries were independent for the period of 1986-1989, (10,30,30) countries independent in (1990, 1995, 2000) in the last experiment. The ratio of missing values is 0.293.

Overall, missingness caused by occurrence of new countries leads to biased estimation of trade effects of most RTAs, especially of ASEAN. The magnitude of the bias is similar as bias caused by random missing pattern, which is not negligible when the PPML estimator is applied. In contrast, missingness at minimum values causes the biggest bias in all three experiments.

We have one additional observation from comparing results in panel B and panel C. That is, the increase of ratio of missing values does not necessarily yield bigger bias. In particular, the coefficients of FTA and PSA are even closer to the true parameters in the third experiment, no matter which missing process we generate. This holds for results when the LSDV estimator is applied. The reason why this is the case is open for future research. Table A10 presents results when the LSDV estimator is applied.

5 Conclusion

In this paper, I study the impact of unbalancedness caused by emergence of new countries on the evaluation of trade effects of regional trade agreements. I mainly deal with the following two issues. First, should we interpret trade statistics of non-independent territories as "international" trade, given trade data for those territories may date back to their pre-independence period? Second, how does the panel unbalancedness of country level data related emergence of new countries affect the estimation of trade effects of RTAs?

I find that treating trade of colonies as part of trade of their colonizers does not affect the coefficients of RTAs very much, compared to treating them as "international" trade of colonies. In addition, the exclusion of those countries with fewer observations does not affect the estimates of most types of RTAs, although we

Table 5: Effects of Missing Values Caused by Occurrence of New Countries

Method	CU	FTA	PSA	ASEAN	EU	EU and Others
Panel A: (10,10,10) independent in (1990,1995,2000)						
Occurrence of	0.924	-0.135	0.338	0.155	0.379	-0.088
New Countries	(0.137)	(0.148)	(0.277)	(0.442)	(0.222)	(0.166)
	[0.157]	[0.182]	[0.359]	[0.804]	[0.279]	[0.202]
Random	0.928	-0.142	0.261	0.137	0.34	-0.101
Missing	(0.132)	(0.149)	(0.286)	(0.467)	(0.168)	(0.140)
	[0.154]	[0.167]	[0.383]	[0.791]	[0.194]	[0.178]
Missing of Min. Values	0.920	-0.143	0.260	0.106	0.330	-0.105
	(0.124)	(0.142)	(0.269)	(0.451)	(0.157)	(0.133)
	[0.140]	[0.160]	[0.343]	[0.741]	[0.186]	[0.168]
Panel B: (10,10,30) independent in (1990,1995,2000)						
Occurrence of	0.921	-0.162	0.316	0.2	0.371	-0.131
New Countries	(0.148)	(0.16)	(0.299)	(0.457)	(0.237)	(0.169)
	[0.145]	[0.202]	[0.363]	[0.848]	[0.333]	[0.214]
Random	0.919	-0.162	0.273	0.117	0.339	-0.093
Missing	(0.137)	(0.158)	(0.292)	(0.448)	(0.177)	(0.149)
	[0.174]	[0.188]	[0.415]	[0.746]	[0.228]	[0.196]
Missing of Min. Values	0.891	-0.151	0.292	0.137	0.329	-0.106
	(0.123)	(0.141)	(0.264)	(0.439)	(0.156)	(0.133)
	[0.151]	[0.162]	[0.350]	[0.704]	[0.200]	[0.171]
Panel C: (10,30,30) independent in (1990,1995,2000)						
Occurrence of	0.931	-0.190	0.336	0.204	0.384	-0.093
New Countries	(0.154)	(0.158)	(0.292)	(0.433)	(0.232)	(0.171)
	[0.185]	[0.181]	[0.396]	[0.854]	[0.322]	[0.215]
Random	0.922	-0.161	0.320	0.112	0.342	-0.114
Missing	(0.145)	(0.161)	(0.302)	(0.467)	(0.185)	(0.152)
	[0.174]	[0.188]	[0.392]	[0.812]	[0.227]	[0.196]
Missing of Min. Values	0.869	-0.165	0.307	0.092	0.335	-0.116
	(0.125)	(0.140)	(0.260)	(0.45)	(0.159)	(0.131)
	[0.151]	[0.170]	[0.331]	[0.676]	[0.193]	[0.160]

Note: Values in rows without any bracket is the mean of estimates based on 50 repetitions. Values in rows with "( )" are the mean of standard errors for the corresponding variables. Values in rows with "[ ]" are the standard errors of estimates. The ratio of missing values is set to be 0.109, 0.212 and 0.238 according to the setting of independence of countries.

should not select the coverage of countries arbitrarily. The investigation of optimal sample periods shows that a sample dated back to 1992 is cost efficient for estimating trade effects of RTAs, given the stronger wave of emergence of new countries in 1991 and earlier.

The Monte-Carlo simulation results show that missing values of trade caused by independence of new countries cause bias of the estimates of RTAs. The magnitude of the bias is more similar to bias caused by random missingness. Moreover, such a bias is not linear with the ratio of missing values. One interesting finding from the MC study is that the LSDV estimator performs better when missing is caused by independence of new countries than two other missing processes.

The main implications of findings of this paper include: (1) the interpretation of trade of (previous) colonies or dependent territories does not affect the evaluation of trade policies that much, at least not much in the context of trade effects of RTAs; (2) we should verify the coverage of countries more diligently when country level data is applied; (3) we can choose the coverage of countries and sample periods in a more defined way and a sample dated back to 1992 is good enough to estimate trade effects of most RTAs; (4) the magnitude of bias of the key coefficients caused by independence status of new countries is similar to that caused by random missingness when the PPML estimator is applied.

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Appendix A: Data Preparation and Summary Statistics

Table A1: The Specification of RTAs

RTA	Abbreviation	Name	Entry into force
CU	CAN	Andean Community	1988.05
	COMESA	Common Market for Eastern and Southern Africa	1994.12
	EAC	East African Community	2000.07
	CEMAC	Economic and Monetary Community of Central Africa	1999.06
	ECOWAS	Economic Community of West African States	1995.08
	WAEMU	West African Economic and Monetary Union	2000.01
PSA	ECO	Economic Cooperation Organization	1992.02
	LAIA	Latin American Integration Association	1981.03
	MSG	Melanesian Spearhead Group	1994.01
	PTN	Protocol on Trade Negotiations	1973.02
PSA&EIA	APTA	Asia Pacific Trade Agreement	1976.06
CU&EIA	CARICOM	Caribbean Community and Common Market	1973.08
	EAEU	Eurasian Economic Union	2015.01
Inactive RTAs	AFRICM	African Common Market	1963.07-1998.12
	ARABCM	Arab Common Market	1965.01-1998.12
	ARUSHA	Arusha Agreement	1971.01-1976.04
	CARIFTA	Caribbean Free Trade Association	1968.05-1973.08
	ESTLATLIT	Estonia - Latvia - Lithuania	1994.04-2004.05
	EAEC	Eurasian Economic Community	1997.10-2015.01
	LAFTA	Latin American Free Trade Association	1961.06-1980.01
	TRIPARTITE	Tripartite Agreement	1968.04-1990.12
	YAOUNDE1	Yaoundé I	1964.01-1971.01
	YAOUNDE2	Yaoundé II	1971.01-1976.04
FTA	AGADIR	Agadir Agreement	2007.03
	CEFTA	Central European Free Trade Agreement	2007.05
	CEZ	common economic zone	2004.05
	CIS	Commonwealth of Independent States	1994.12
	PICTA	Pacific Island Countries Trade Agreement	2003.04
	PAFTA	Pan-Arab Free Trade Area	1998.01
	SAFTA	South Asian Free Trade Agreement	2006.01
	SADC	Southern African Development Community	1992
FTA&EIA	TPSEP	Trans-Pacific Strategic Economic Partnership	2006.05
	GUAM	The GUAM Organization for Democracy and Economic Development	2006.05
ASEAN		ASEAN Free Trade Area	1992.01
GCC		Gulf Cooperation Council: Custom Union	2003.01
MERCOSUR		Southern Common Market	1991.11
NAFTA		North American Free Trade Agreement	1994.01
EC and others			1964-2007
EU and others			1973-
EEC and others			1962-1981
EFTA		European Free Trade Association	1960.05
EU		European Union	1958.01

Table A2: Countries/Territories Covered by the Whole Sample

Country	Country	Independent Year	Country	Independent Year	Country	Independent Year
Australia	Yugoslavia, SFR		Cabo Verde	1975	Malawi	1964
Austria			Mozambique	1975	Tanzania	1964
Belgium-Luxembourg	Papua New Guinea	1975	São Tomé & Príncipe	1975	Zambia	1964
Canada			Timor-Leste, Dem. Rep. of	2002	Gambia, The	1965
Switzerland	Burundi	1962			Barbados	1966
Chile	Rwanda	1962	Finland	1917	Botswana	1966
China, P.R.: Mainland			Lithuania	1990	Guyana	1966
Colombia	Faroe Islands	0	Armenia, Republic of	1991	Lesotho	1966
Costa Rica	Greenland	0	Azerbaijan, Republic of	1991	Yemen, P.D. Rep.	1967
Cuba	Iceland	1944	Belarus	1991	Mauritius	1968
Germany			Estonia	1991	Eswatini, Kingdom of	1968
Denmark	French Territories: New Caledonia	0	Georgia	1991	Fiji	1970
Dominican Republic	French Territories: French Polynesia	0	Kazakhstan	1991	Tonga	1970
Ecuador	Lebanon	1943	Kyrgyz Republic	1991	United Arab Emirates	1971
Spain	Syrian Arab Republic	1946	Latvia	1991	Bahrain, Kingdom of	1971
Ethiopia	Cambodia	1953	Moldova	1991	Qatar	1971
France	Lao People's Democratic Republic	1954	Tajikistan	1991	Bahamas, The	1973
United Kingdom	Vietnam	1954	Turkmenistan	1991	Grenada	1974
Eastern Germany	Morocco	1956	Ukraine	1991	Seychelles	1976
Gibraltar	Tunisia	1956	Uzbekistan	1991	Dominica	1978
Greece	Guinea	1958			Solomon Islands	1978
Guatemala	Benin	1960	Namibia	1990	Tuvalu	1978
Honduras	Burkina Faso	1960			Kiribati	1979
Haiti	Central African Republic	1960	Equatorial Guinea	1968	St. Lucia	1979
Hungary	Côte d'Ivoire	1960			St. Vincent and the Grenadines	1979
Iran, Islamic Republic of	Cameroon	1960	South Sudan	2005	Zimbabwe	1980
Italy	Gabon	1960			Antigua and Barbuda	1981
Japan	Madagascar	1960	Anguilla	0	Belize	1981
Korea, Republic of	Mali	1960	Bermuda	0	St. Kitts and Nevis	1983
Kosovo, Republic of	Mauritania	1960	Montserrat	0	Brunei Darussalam	1984
Liberia	Niger	1960	South Africa	1910	Nauru	1968
Luxembourg	Senegal	1960	Afghanistan, Islamic Republic of	1919	Somalia	1960
Mexico	Chad	1960	Ireland	1921		
Myanmar	Togo	1960	Egypt	1922	Guam	0
Mongolia	Algeria	1962	Iraq	1932	Philippines	1946
Nicaragua	Comoros	1975	Jordan	1946	Micronesia, Federated States of	1979
Netherlands	Djibouti	1977	Bangladesh	1947	Marshall Islands, Republic of	1986
Norway	Vanuatu	1980	India	1947	Palau	1994
Nepal			New Zealand	1947		
Oman	Eritrea	1941	Pakistan	1947	Slovenia	1991
Panama	Libya	1951	Israel	1948	Bosnia and Herzegovina	1995
Peru			Sri Lanka	1948		
Poland	Aruba	0	Sudan	1956	Argentina	1816
Portugal	Netherlands Antilles	0	Ghana	1957	Bolivia	1825
Paraguay	Curaçao	0	Malaysia	1957	Belgium	1830
Romania	Sint Maarten	0	Cyprus	1960	Bulgaria	1908
Russian Federation	Indonesia	1949	Nigeria	1960	Albania	1913
Saudi Arabia	Suriname	1975	Kuwait	1961	Vatican	1929
Serbia and Montenegro			Sierra Leone	1961	Bhutan	1949
El Salvador	Samoa	1962	Jamaica	1962	Congo, Democratic Republic of	1960
San Marino			Trinidad and Tobago	1962	Congo, Republic of	1960
Sweden	Yemen, Republic of	1990	Uganda	1962	Croatia	1991
Thailand			Kenya	1963	Czech Republic	1993
Turkey	Brazil	1822	Singapore	1963	Slovak Republic	1993
Uruguay	Guinea-Bissau	1974	Maldives	1964	Montenegro	2006
United States	Angola	1975	Malta	1964	Serbia, Republic of	2006
Venezuela						

Table A3: Countries/Territories Coverage of Other Samples

Covered by All	Hong Kong	Burkina Faso	Kenya	Yugoslavia, SFR	Nauru	Poland	Dominican Republic
Argentina	Honduras	Bulgaria	Cambodia	South Africa	Oman	Portugal	Algeria
Bolivia	Haiti	Bahrain	Kuwait	Zimbabwe	Pakistan	Qatar	Spain
Brazil	Hungary	Bahamas	Laos	***Developing***	Peru	Romania	Ethiopia
Canada	Ireland	Belize	Lebanon	Aruba	Palau	Senegal	Finland
Chile	Iraq	Bermuda	Liberia	Anguilla	Papua New Guinea	Singapore	France
China	Iceland	Barbados	Libya	Netherlands Antilles	Paraguay	Sweden	Gabon
Cameroon	Israel	Brunei Darussalam	Macao	United Arab Emirates	French Polynesia	Tanzania	United Kingdom
Colombia	Italy	Central African Republic	Madagascar	American Samoa	Qatar	United States	Ghana
Costa Rica	Jamaica	Switzerland	Mali	Antigua and Barbuda	Saudi Arabia	South Africa	Gambia, The
Ecuador	Jordan	CIS	Malta	Azerbaijan	Singapore	***Excluding new***	Guinea-Bissau
Egypt	Japan	Côte d'Ivoire	Myanmar	Bahrain	El Salvador	Australia	Greece
Indonesia	Cambodia	Congo, Demo. Rep.of	Mongolia	Belize	Suriname	Austria	Guatemala
India	Kuwait	Congo, Republic of	Mozambique	Barbados	Sint Maarten	Bulgaria	Guyana
Iran	Lebanon	Cabo Verde	Mauritania	Brunei Darussalam	Seychelles	Switzerland	Hong Kong
Korea, Republic of	Liberia	Czechoslovakia	Mauritius	Botswana	Syrian Arab Republic	Cyprus	Honduras
Sri Lanka	Libya	Cuba	New Caledonia	Côte d'Ivoire	Turkmenistan	Germany	Haiti
Morocco	Madagascar	Cyprus	Niger	Congo, Republic of	Tonga	Denmark	Hungary
Mexico	Mali	Germany	Nicaragua	Cabo Verde	Taiwan	Spain	Ireland
Malaysia	Myanmar	Djibouti	Netherlands	Cuba	St. Vincent and the Grenadines	Finland	Israel
Nigeria	Mauritania	Denmark	Norway	Curaçao	Venezuela	France	Italy
Panama	Nicaragua	Dominican Republic	Nauru	Dominica	Vietnam	United Kingdom	Jamaica
Philippines	Netherlands	Algeria	New Zealand	Dominican Republic	Samoa	Greece	Japan
Thailand	Norway	Spain	Oman	Algeria	South Africa	Hungary	Kenya
Trinidad and Tobago	New Zealand	Ethiopia	Pakistan	Estonia	Zimbabwe	Ireland	Madagascar
Tunisia	Oman	Finland	Peru	Ethiopia	***Same as Baier et al. (2019)***	Iceland	Mali
Turkey	Pakistan	Fiji	Papua New Guinea	Fiji	Australia	Israel	Mozambique
Uruguay	Peru	Falkland Islands	Poland	Micronesia	Austria	Italy	Mauritania
Independent since 1962	Poland	France	Portugal	Gabon	Bulgaria	Jordan	Mauritius
Afghanistan	Portugal	Faroe Islands	Paraguay	Ghana	Switzerland	Japan	Niger
Albania	Paraguay	Gabon	French Polynesia	Equatorial Guinea	Cyprus	Kuwait	Nicaragua
Australia	Romania	United Kingdom	Qatar	Grenada	Germany	Myanmar	Netherlands
Austria	Saudi Arabia	Ghana	Romania	Guatemala	Denmark	Niger	Norway
Bulgaria	Sudan	Gibraltar	Saudi Arabia	Guam	Spain	Netherlands	New Zealand
Switzerland	Senegal	Guinea	Sudan	Guyana	Finland	Norway	Pakistan
Côte d'Ivoire	Sierra Leone	Gambia, The	Senegal	China	France	Poland	Peru
Congo, Demo. Rep.c of	El Salvador	Guinea-Bissau	Singapore	Honduras	United Kingdom	Portugal	Poland
Congo, Republic of	Sweden	Equatorial Guinea	Sierra Leone	Iraq	Greece	Romania	Portugal
Czechoslovakia	Syrian Arab Republic	Greece	El Salvador	Jamaica	Hong Kong	Senegal	Paraguay
Cuba	Togo	Greenland	Somalia	Jordan	Hungary	Sweden	Romania
Cyprus	Uganda	Guatemala	São Tomé & Príncipe	Kenya	Ireland	United States	Saudi Arabia
Germany	United States	Guam	Suriname	St. Kitts and Nevis	Iceland	South Africa	Sudan
Denmark	Venezuela	Guyana	Sweden	Kuwait	Israel	***Same as Baier and Bergstrand (2007)***	Senegal
Dominican Republic	Vietnam	Hong Kong	Syrian Arab Republic	Lebanon	Italy	Angola	Singapore
Algeria	Yugoslavia, SFR	Honduras	Chad	Libya	Jordan	Albania	Sierra Leone
Spain	South Africa	Haiti	Togo	St. Lucia	Japan	Australia	El Salvador
Ethiopia	***Spreading 55 years***	Hungary	Taiwan	Macao	Kenya	Austria	Sweden
Finland	Afghanistan	Ireland	Tanzania	Maldives	Kuwait	Burkina Faso	Syrian Arab Republic
France	Angola	Iraq	Uganda	Marshall Islands	Macao	Bulgaria	Uganda
Gabon	Albania	Iceland	United States	Mongolia	Malta	Switzerland	United States
United Kingdom	Netherlands Antilles	Israel	Venezuela	Montserrat	Myanmar	Côte d'Ivoire	Venezuela
Ghana	United Arab Emirates	Italy	Vietnam	Mauritius	Mauritius	Congo, Republic of	Zimbabwe
Guinea	Australia	Jamaica	Vanuatu	Namibia	Niger	Cyprus	
Greece	Austria	Jordan	Samoa	New Caledonia	Netherlands	Germany	
Guatemala	Benin	Japan	Yemen, Republic of	Nicaragua	Norway	Denmark	

Table A4: LSDV Estimates from Samples with Different Coverage of Countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Whole	Spreading 55 years	Independent since 1962	Developing	Same as Baier et al. (2019)	Excluding new	Same as Baier and Bergstrand (2007)
Bilateral (<1993)	0.046	0.134	0.049	-0.086	-0.029	-0.031	-0.054
	(0.301)	(0.790)	(0.261)	(-0.265)	(-0.204)	(-0.226)	(-0.316)
Bilateral (≥1993)	-0.199***	-0.151**	-0.101	-0.207**	-0.039	0.043	-0.117*
	(-4.060)	(-2.347)	(-1.601)	(-2.376)	(-0.550)	(0.573)	(-1.862)
CU	1.148***	1.011***	1.122***	0.856***	1.147***	0.957***	0.995***
	(13.817)	(10.741)	(8.355)	(4.908)	(4.757)	(3.275)	(7.881)
FTA	0.714***	0.770***	0.643***	0.906***	0.507***	0.493***	0.510***
	(9.069)	(7.884)	(6.141)	(7.543)	(3.288)	(2.771)	(3.061)
PSA	0.457***	0.440***	0.344***	0.059	0.288***	0.304***	0.300***
	(5.782)	(5.403)	(4.239)	(0.509)	(2.969)	(3.121)	(3.647)
CU and EIA	0.931***	1.120***	1.246***	1.773***	0.000	0.000	1.617***
	(5.688)	(5.355)	(3.444)	(5.918)	(.)	(.)	(5.984)
FTA and EIA	-0.753***	-0.216	-0.242*	-0.276	-0.378**	0.000	-0.286**
	(-3.556)	(-1.390)	(-1.723)	(-0.767)	(-2.110)	(.)	(-1.973)
PSA and EIA	-0.561*	-0.425	-0.629	-0.713*	-0.454	-0.515	-0.644
	(-1.960)	(-1.221)	(-1.457)	(-1.739)	(-1.007)	(-1.123)	(-1.458)
ASEAN	0.037	0.057	0.121	0.510	-0.431*	-0.490*	-0.777***
	(0.135)	(0.213)	(0.451)	(1.213)	(-1.721)	(-1.959)	(-3.127)
NAFTA	-0.030	0.008	0.036	0.314	0.252*	0.274**	0.140
	(-0.231)	(0.059)	(0.287)	(1.303)	(1.812)	(1.983)	(1.093)
EFTA	0.033	0.035	0.021	0.346	0.002	-0.004	-0.117*
	(0.641)	(0.603)	(0.369)	(1.337)	(0.048)	(-0.080)	(-1.940)
GCC	-0.390**	-0.418**	-0.372**	-0.358*	-0.409*	0.000	-0.569***
	(-2.148)	(-2.242)	(-1.972)	(-1.932)	(-1.922)	(.)	(-3.849)
MERCOSUR	0.340*	0.338*	0.302*	0.346	0.081	0.086	0.343**
	(1.948)	(1.938)	(1.785)	(1.565)	(0.606)	(0.646)	(2.004)
EU	0.907***	0.969***	0.959***	0.000	0.667***	0.801***	0.920***
	(17.281)	(14.168)	(13.916)	(.)	(10.806)	(12.240)	(13.452)
EU and others	0.089***	0.074*	0.058	0.390*	0.010	0.037	0.051
	(2.626)	(1.787)	(1.331)	(1.681)	(0.221)	(0.739)	(1.114)
EC and others	0.059*	0.079**	0.076**	-1.344	0.119***	0.109***	0.038
	(1.903)	(2.272)	(2.178)	(-1.387)	(3.498)	(3.175)	(1.051)
EEC and others	0.454***	0.436***	0.372***	0.000	0.227**	0.187	0.379***
	(3.952)	(3.650)	(3.126)	(.)	(2.090)	(1.620)	(3.090)
Inactive RTAs	-0.071	-0.049	-0.091	0.098	0.245***	0.273***	0.126*
	(-1.207)	(-0.773)	(-1.213)	(0.708)	(2.837)	(2.878)	(1.771)
Independence	0.098	0.174*	0.005	0.052	-0.098	0.636*	0.184
	(1.316)	(1.911)	(0.029)	(0.408)	(-0.514)	(1.661)	(1.132)
Constant	7.393***	7.835***	8.814***	7.239***	9.951***	10.131***	8.896***
	(299.887)	(321.638)	(209.961)	(142.692)	(273.496)	(169.999)	(264.373)
N	802280	578828	389468	217068	187357	149227	307268
R^2	0.87	0.86	0.88	0.85	0.91	0.91	0.89

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The headings of each column indicate the coverage of countries for each sample. "Whole" means the sample covers all countries and territories as given by the dataset. "Spreading 55 years" means the sample covers countries whose non-missing trade value spreads over the whole sample period. In column 3, the sample covers countries which have been independent since 1962 and also have the highest number of trade observations until the 134th place. Observations involving Bahrain, Brunei, Qatar, Singapore, United Arab Emirates are never dropped for the first four columns even they became independent after 1962, because they are covered by individual RTAs including ASEAN and GCC. In column 4, a sample of developing countries as defined by UN UNCTAD is applied. "Same as Baier et al. (2019)" uses a sample with the same coverage of countries or territories as in Baier et al. (2019). In column 6, those not independent in 1962 in the sample of Baier et al. (2019) are excluded. In the last column, a sample with the same coverage of countries or territories as in Baier and Bergstrand (2007) is used. In the next table, the coverage of countries for each sample is defined in the same way.

Table A5: Had They Not Been Independent: PPML Estimator

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Whole	Spreading 55 years	Independent since 1962	Developing	Same as Baier et al. (2019)	Excluding new	Same as Baier and Bergstrand (2007)
Bilateral (<1993)	0.090	0.090	0.091	-0.875	0.117*	0.127*	0.107*
	(1.445)	(1.444)	(1.429)	(-1.347)	(1.776)	(1.956)	(1.669)
Bilateral (≥1993)	-0.126*	-0.127*	-0.151**	-0.325***	-0.178**	0.024	-0.163**
	(-1.709)	(-1.714)	(-2.010)	(-3.558)	(-2.245)	(0.542)	(-2.129)
CU	1.112***	1.111***	0.902***	0.736***	0.926***	0.848**	0.951***
	(7.701)	(7.697)	(5.370)	(2.944)	(4.769)	(2.352)	(5.959)
FTA	0.173**	0.173**	0.266**	0.310***	-0.161	-0.181	0.065
	(2.107)	(2.108)	(2.478)	(2.649)	(-1.178)	(-1.297)	(0.534)
PSA	0.386***	0.388***	0.405***	0.208	0.262*	0.310**	0.351***
	(3.277)	(3.306)	(3.519)	(0.944)	(1.928)	(2.352)	(2.924)
CU & EIA	0.149	0.150	1.336**	1.442***			1.247***
	(1.623)	(1.635)	(2.053)	(2.753)			(2.590)
FTA& EIA	0.135	0.134	0.389	-0.964***	-0.996***		0.385
	(0.541)	(0.540)	(1.617)	(-3.753)	(-5.159)		(1.563)
PSA & EIA	0.093	0.093	0.102	-0.031	0.119	0.041	0.105
	(0.935)	(0.936)	(0.976)	(-0.299)	(1.057)	(0.380)	(0.905)
ASEAN	0.384***	0.385***	0.401***	0.343***	0.441***	0.309***	0.420***
	(4.447)	(4.448)	(4.617)	(3.458)	(4.805)	(3.279)	(4.612)
NAFTA	0.212***	0.211***	0.189**	0.530***	0.256***	0.278***	0.228***
	(2.737)	(2.719)	(2.487)	(2.708)	(3.346)	(3.777)	(3.020)
EFTA	-0.007	-0.018	-0.055		-0.060	-0.116**	-0.050
	(-0.111)	(-0.307)	(-0.831)		(-0.906)	(-2.079)	(-0.740)
GCC	-0.102	-0.102	-0.112	-0.189	-0.371***		-0.269***
	(-0.871)	(-0.874)	(-0.941)	(-1.498)	(-3.414)		(-4.804)
MERCOSUR	0.515***	0.515***	0.518***	0.463**	0.441***	0.446***	0.507***
	(3.355)	(3.351)	(3.344)	(2.572)	(4.620)	(4.818)	(3.221)
EU	0.379***	0.399***	0.441***		0.361***	0.376***	0.410***
	(8.275)	(9.602)	(9.062)		(7.308)	(7.448)	(8.376)
EU and others	-0.114***	-0.108***	-0.132***	0.371*	-0.157***	-0.134***	-0.153***
	(-3.195)	(-3.043)	(-3.298)	(1.819)	(-3.546)	(-3.026)	(-3.613)
EC and others	-0.013	-0.008	-0.039	-0.199	-0.013	-0.010	-0.019
	(-0.517)	(-0.338)	(-1.409)	(-0.186)	(-0.450)	(-0.333)	(-0.653)
EEC and others	0.176***	0.169***	0.154***		0.240***	0.247***	0.174***
	(3.307)	(3.178)	(2.899)		(4.708)	(4.790)	(3.359)
Inactive RTAs	0.036	0.038	0.057	0.049	0.098**	0.097**	0.076
	(0.750)	(0.796)	(1.145)	(0.220)	(1.980)	(1.989)	(1.539)
Independence	-0.465**	-0.704***		0.996			
	(-2.037)	(-3.688)		(1.382)			
N	773153	772914	388892	194744	186570	149207	304374
R^2	0.97	0.97	0.97	0.97	0.97	0.97	0.97

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Had They Not Been Independent: Replacement for the Whole Period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Whole	Spreading 55 years	Independent since 1962	Developing	Same as Baier et al. (2019)	Excluding new	Same as Baier and Bergstrand (2007)
Bilateral (<1993)	0.123*	0.126*	0.122*	-0.875	0.132*	0.131**	0.133**
	(1.871)	(1.908)	(1.812)	(-1.341)	(1.922)	(2.015)	(2.019)
Bilateral (≥1993)	-0.145*	-0.183**	-0.177**	-0.431***	-0.210**	0.024	-0.186**
	(-1.743)	(-2.096)	(-2.139)	(-5.160)	(-2.345)	(0.530)	(-2.122)
CU	0.882***	0.881***	0.879***	0.712***	0.896**	0.847**	0.952***
	(5.589)	(5.602)	(5.134)	(2.732)	(2.487)	(2.349)	(5.423)
FTA	0.047	0.181	0.189	0.387***	-0.143	-0.179	0.070
	(0.534)	(1.542)	(1.604)	(2.875)	(-1.011)	(-1.284)	(0.577)
PSA	0.342***	0.343***	0.358***	0.318	0.204	0.307**	0.314**
	(2.764)	(2.817)	(2.952)	(1.401)	(1.444)	(2.325)	(2.510)
CU & EIA	0.030						
	(0.313)						
FTA & EIA	-0.283	-0.284	-0.265				-0.274
	(-1.166)	(-1.235)	(-1.102)				(-1.094)
PSA & EIA	0.066	0.068	0.079	-0.082	0.106	0.043	0.101
	(0.679)	(0.673)	(0.774)	(-0.803)	(0.964)	(0.397)	(0.876)
ASEAN	0.282***	0.285***	0.300***	0.178*	0.362***	0.310***	0.356***
	(2.953)	(2.976)	(3.091)	(1.712)	(3.571)	(3.286)	(3.583)
NAFTA	0.275***	0.277***	0.252***	0.579***	0.294***	0.278***	0.255***
	(3.360)	(3.389)	(3.115)	(2.913)	(3.610)	(3.795)	(3.266)
EFTA	0.057	0.016	0.007		-0.013	-0.113**	-0.006
	(0.908)	(0.238)	(0.095)		(-0.193)	(-2.008)	(-0.090)
GCC	0.487	0.389	0.366	0.170			
	(1.562)	(1.249)	(1.181)	(0.655)			
MERCOSUR	0.497***	0.494***	0.502***	0.507***	0.436***	0.444***	0.503***
	(3.261)	(3.239)	(3.281)	(2.758)	(4.559)	(4.800)	(3.198)
EU	0.352***	0.395***	0.414***		0.354***	0.375***	0.386***
	(6.960)	(7.438)	(7.634)		(6.489)	(7.422)	(7.521)
EU and others	-0.020	-0.032	-0.032	0.389*	-0.066	-0.130***	-0.084*
	(-0.394)	(-0.590)	(-0.580)	(1.798)	(-1.010)	(-2.926)	(-1.773)
EC and others	0.087***	0.079**	0.066**	-0.080	0.060*	-0.005	0.040
	(3.012)	(2.421)	(2.028)	(-0.089)	(1.825)	(-0.161)	(1.366)
EEC and others	0.121**	0.098**	0.106**		0.212***	0.250***	0.135***
	(2.521)	(2.042)	(2.177)		(4.374)	(4.831)	(2.682)
Inactive RTAs	-0.022	0.008	0.002	0.006	0.043	0.094*	0.045
	(-0.454)	(0.154)	(0.030)	(0.024)	(0.813)	(1.925)	(0.912)
Independence	-0.327	-0.166		1.911***			
	(-1.341)	(-0.272)		(2.855)			
N	507014	386075	326275	111480	154265	144994	242723
R^2	0.97	0.97	0.97	0.98	0.97	0.97	0.97

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Trade involving newly independent countries or dependent territories is as part of the trade of their (previous) colonizers through the whole sample period. Coverage of countries for each column is specified the same as in Table A4.

Table A7: Colonies Share RTA Memberships of Their Colonizers/Governers

	(1)	(2)	(3)	(4)	(5)	(6)
	Whole			Spreading 55 years		
	Split	Colonizers' RTA	No split	Split	Colonizers' RTA	No split
Bilateral (<1993)	0.075	0.075	0.075	0.076	0.076	0.076
	(1.245)	(1.240)	(1.245)	(1.255)	(1.253)	(1.257)
Bilateral (≥1993)	-0.127*	-0.127*	-0.127*	-0.155**	-0.155**	-0.155**
	(-1.719)	(-1.718)	(-1.718)	(-2.014)	(-2.013)	(-2.013)
CU	1.109***	1.110***	1.111***	0.930***	0.930***	0.931***
	(7.719)	(7.727)	(7.728)	(6.783)	(6.787)	(6.789)
FTA	0.174**	0.172**	0.172**	0.291***	0.289***	0.289***
	(2.125)	(2.109)	(2.111)	(2.805)	(2.788)	(2.789)
PSA	0.388***	0.387***	0.388***	0.395***	0.394***	0.394***
	(3.308)	(3.300)	(3.301)	(3.437)	(3.427)	(3.428)
CU & EIA	0.152*	0.149	0.149	1.288***	1.231***	1.231***
	(1.663)	(1.640)	(1.642)	(3.783)	(3.696)	(3.696)
FTA & EIA	0.134	0.134	0.134	0.355	0.355	0.355
	(0.540)	(0.540)	(0.540)	(1.450)	(1.449)	(1.449)
PSA & EIA	0.093	0.093	0.093	0.096	0.096	0.096
	(0.936)	(0.936)	(0.936)	(0.934)	(0.934)	(0.934)
ASEAN	0.384***	0.385***	0.385***	0.391***	0.392***	0.391***
	(4.450)	(4.453)	(4.453)	(4.495)	(4.498)	(4.496)
NAFTA	0.207***	0.208***	0.208***	0.206***	0.206***	0.207***
	(2.691)	(2.698)	(2.702)	(2.689)	(2.696)	(2.700)
EFTA and others	-0.017	-0.014	-0.014	-0.059	-0.055	-0.056
	(-0.289)	(-0.238)	(-0.239)	(-0.911)	(-0.861)	(-0.861)
GCC and others	-0.103	-0.103	-0.103	-0.134	-0.134	-0.134
	(-0.879)	(-0.876)	(-0.876)	(-1.115)	(-1.111)	(-1.111)
MERCOSUR	0.514***	0.514***	0.514***	0.511***	0.511***	0.511***
	(3.347)	(3.349)	(3.349)	(3.318)	(3.320)	(3.320)
EU	0.397***	0.394***	0.393***	0.427***	0.424***	0.423***
	(9.518)	(9.455)	(9.454)	(9.023)	(8.961)	(8.959)
EU and others	-0.108***	-0.108***	-0.108***	-0.135***	-0.135***	-0.135***
	(-3.033)	(-3.033)	(-3.036)	(-3.468)	(-3.469)	(-3.472)
EC and others	-0.007	-0.008	-0.008	-0.040	-0.041	-0.041
	(-0.297)	(-0.319)	(-0.321)	(-1.457)	(-1.479)	(-1.480)
EEC and others	0.164***	0.164***	0.166***	0.146***	0.146***	0.148***
	(3.134)	(3.137)	(3.161)	(2.813)	(2.817)	(2.841)
Inactive RTAs	0.034	0.035	0.035	0.065	0.065	0.065
	(0.724)	(0.733)	(0.736)	(1.296)	(1.307)	(1.309)
Split	0.196**	0.191**		0.192**	0.186**	
	(2.215)	(2.179)		(2.046)	(2.013)	
N	804496	804204	804204	580224	579407	579407
R^2	0.97	0.97	0.97	0.97	0.97	0.97

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Optimal Sample: PPML

	(1)	(2)	(3)	(4)
	1975-2015 Excluding		1992-2015 Excluding	
	Dependent	Dependent & Not Yet Independent	Dependent	Dependent & Not Yet Independent
Bilateral (<1993)	0.012	0.033	-0.119	-0.118
	(0.200)	(0.547)	(-1.196)	(-1.123)
Bilateral (≥1993)	0.038	0.018	0.064*	0.044
	(0.993)	(0.434)	(1.835)	(1.215)
CU	1.005***	0.974***	0.666***	0.671***
	(6.846)	(6.609)	(3.547)	(3.508)
FTA	0.142*	0.214**	-0.188***	-0.197***
	(1.785)	(2.144)	(-3.056)	(-2.668)
PSA	0.298**	0.327***	-0.055	-0.001
	(2.441)	(2.722)	(-0.475)	(-0.005)
CU & EIA	0.226***	1.021	-0.309	-0.332
	(2.923)	(1.470)	(-1.579)	(-0.770)
FTA & EIA	0.150	0.411*	0.178	0.507*
	(0.590)	(1.802)	(0.631)	(1.878)
PSA & EIA	0.003	0.010	-0.008	-0.002
	(0.032)	(0.111)	(-0.082)	(-0.016)
ASEAN	0.328***	0.318***	0.324***	0.315***
	(3.849)	(3.616)	(3.800)	(3.567)
NAFTA	0.160**	0.162**	-0.039	-0.048
	(2.079)	(2.095)	(-0.407)	(-0.485)
EFTA	-0.057	-0.104*	-0.030	-0.081
	(-1.048)	(-1.818)	(-0.392)	(-0.965)
GCC	-0.064	-0.087	-0.143	-0.143
	(-0.544)	(-0.727)	(-1.168)	(-1.163)
MERCOSUR	0.503***	0.504***	0.356*	0.361*
	(3.230)	(3.217)	(1.880)	(1.890)
EU	0.366***	0.407***	0.240***	0.273***
	(8.442)	(8.378)	(5.536)	(5.445)
EU and others	-0.090**	-0.112***	-0.041	-0.068*
	(-2.495)	(-2.895)	(-1.153)	(-1.751)
EC and others	-0.002	-0.024	-0.013	-0.033
	(-0.078)	(-0.907)	(-0.544)	(-1.230)
EEC and others	0.167***	0.142***		
	(3.356)	(2.891)		
Inactive RTAs	0.025	0.057	-0.557***	0.185
	(0.506)	(1.150)	(-2.779)	(0.448)
N	653020	468174	489248	323081
R^2	0.97	0.97	0.97	0.97

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A9: The Set of RTA Parameters

Parameters	Values
Bilateral ($<$1993)	0
Bilateral ($\geq$1993)	0
CU	0.97
FTA	-0.2
PSA	0.33
CU and EIA	0
FTA and EIA	0.51
PSA and EIA	0
ASEAN	0.32
NAFTA	0
GCC	0
MERCOSUR	0.36
EFTA	-0.1
EU	0.41
EU and Other countries	-0.11
EEC and Other countries	0
EC and Other countries	-0.56
Inactive RTAs	0

Table A10: Effects of Missing Values Caused by Occurrence of New Countries: LSDV

Method	CU	FTA	PSA	ASEAN	EU	EU_Others
Panel A: (10,10,10) independent in (1990,1995,2000)						
Occurrence of	0.97	-0.199	0.339	0.313	0.409	-0.107
New Countries	(0.034)	(0.034)	(0.096)	(0.170)	(0.081)	(0.050)
	[0.037]	[0.030]	[0.087]	[0.191]	[0.077]	[0.049]
Random	0.969	-0.198	0.335	0.311	0.409	-0.106
Missing	(0.032)	(0.032)	(0.090)	(0.150)	(0.060)	(0.040)
	[0.033]	[0.030]	[0.083]	[0.166]	[0.061]	[0.040]
Missing of Min. Values	0.905	-0.171	0.283	0.361	0.401	-0.109
	(0.031)	(0.031)	(0.085)	(0.141)	(0.057)	(0.037)
	[0.033]	[0.029]	[0.082]	[0.152]	[0.060]	[0.038]
Panel B: (10,10,30) independent in (1990,1995,2000)						
Occurrence of	0.968	-0.201	0.330	0.306	0.414	-0.116
New Countries	(0.039)	(0.038)	(0.109)	(0.190)	(0.086)	(0.053)
	[0.043]	[0.036]	[0.104]	[0.248]	[0.092]	[0.055]
Random	0.969	-0.197	0.323	0.321	0.411	-0.108
Missing	(0.035)	(0.035)	(0.100	(0.165)	(0.065)	(0.043)
	[0.037]	[0.032]	[0.091]	[0.164]	[0.065]	[0.044]
Missing of Min. Values	0.814	-0.142	0.264	0.383	0.423	-0.095
	(0.033)	(0.032)	(0.088)	(0.144)	(0.057)	(0.037)
	[0.033]	[0.030]	[0.090]	[0.145]	[0.057]	[0.040]
Panel C: (30,10,30) independent in (1990,1995,2000)						
Occurrence of	0.970	-0.204	0.336	0.298	0.400	-0.118
New Countries	(0.039)	(0.038)	(0.111)	(0.177)	(0.085)	(0.052)
	[0.037]	[0.038]	[0.111]	[0.187]	[0.082]	[0.050]
Random	0.970	-0.205	0.333	0.304	0.414	-0.115
Missing	(0.036)	(0.037)	(0.101)	(0.170)	(0.068)	(0.045)
	[0.035]	[0.035]	[0.101]	[0.168]	[0.069]	[0.046]
Missing of Min. Values	0.775	-0.134	0.271	0.383	0.430	-0.092
	(0.034)	(0.032)	(0.089)	(0.147)	(0.057)	(0.038)
	[0.036]	[0.035]	[0.090]	[0.143]	[0.058]	[0.040]