Free Trade Areas: Rising Tides that Can Lift All Boats

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This paper employs the gravity model to compare NAFTA-related countries' trade performance. The paper proposes a new method for defining FTA-related variables to consider the time-varying features of FTAs impact and the potential impact of FTAs on non-members. It also proposes an identification strategy for country-specific time-varying variables in the presence of multilateral resistances, which leads to more insightful performance comparisons across countries. The empirical findings reveal heterogeneity in trade performance across countries during NAFTA, highlighting the possibility for some non-members to outperform member countries. Therefore, support of trade agreements should not be confined solely to agreements directly involving or benefiting the countries of interest, as opportunities for non-members to benefit also exist.

JEL Classification: F10, F40
Key words: Free Trade agreements (FTAs), International Trade, NAFTA

1 Introduction

The profound dichotomy between proponents of trade agreements and those who underscore their potential adverse ramifications is an inexhaustible subject of scholarly examination. Hence, Brexit occurred in 2020 while some countries have been dragging their feet in ratifying the African Continental Free Trade Area (AfCTA)[1]. At the same time, numerous other new agreements are being implemented[2]. This paper addresses two shortcomings in estimating the effects of Free Trade agreements (FTAs) to offer valuable insights for policymakers, researchers, and advocates.

Scholars measure Trade agreements by a dummy variable that assumes, by construction, that an FTA impacts its members and has zero impact on non-members. However, the increased trade between FTA members because of decreased inward and outward multilateral resistances Yotov et al. (2016) can constitute an opportunity for non-members in non-member countries where market positions from FTA members have been freed. FTAs can encourage non-member countries to improve their production processes to remain or become competitive in markets created by FTAs. Moreover, non-members of FTAs but suppliers of inputs in production processes in the FTA members can benefit from the enhanced economic activities due to FTAs. Therefore, this paper measures FTA (i.e., NAFTA) by a dummy variable that takes the value of 1 during NAFTA (from 1994) for all countries to account for the inclusive potential effects of FTAs.

The effects of FTAs can be dynamic, starting small from the announcement or beginning of negotiations (Khan and Khederlarian, 2021) until the agreements reach maturity before becoming obsolete and triggering re-negotiations or new agreements [3]. However, in the literature, these potential time-specific time-varying effects of FTAs are captured by time-specific time-invariant FTA variables. This paper addresses this potential measurement error using a time-specific time-varying variable for FTAs (i.e., NAFTA). Estimates of this variable will reflect the growth rate of bilateral trade during the NAFTA period, compared to the growth rate of trade between a benchmark country pair. While it is customary to use intra-national trade to identify the effects of such time-varying variables (Heid et al., 2021; Beverelli et al., 2018), this paper uses, alternatively, single specific country pairs (e.g., USA-USA, USA-CAN, USA-MEX, CHN-USA) as benchmarks which improve the interpretation of estimates and are capable of leading to more insightful policy recommendations.

The North American Free Trade Agreement (NAFTA), in effect since 1994, stood as one of the most comprehensive trade agreements ever conceived, bringing together the United States, Canada, and Mexico to promote economic integration, reduce trade barriers, and foster cooperation. While celebrated for its potential to stimulate growth and job creation, NAFTA faced numerous criticisms from activists and some politicians who suspected that NAFTA might have benefited the members inequitably. These criticisms ultimately led to the end of NAFTA in 2020, paving a path for the United States-Mexico-Canada Agreement (USMCA), which sought to address the decried concerns while retaining key elements of the original agreement.

This paper uses a dataset of more than 200 countries from 1954 to 2014 to reach its goal.

[1] The ratification of trade agreements can be uncertain and be delayed because of conflicting interests (Cole et al., 2021).

[2] Ecuador and China concluded trade agreements negotiations on January 5^{th}, 2023, and other trade agreements are expected in the future.

[3] Khan and Khederlarian (2021) asserted that when trade agreements are expected, firms can anticipate upcoming tariff changes by shifting their purchases to periods with lower costs. Magee (2008) revealed that trade agreements have significant anticipatory effects on trade flows and can continue to impact trade for up to 11 years after the implementation.

The empirical findings reveal heterogeneity in trade performance -trade growth- among countries during NAFTA, highlighting the possibility for non-members to outperform member countries in some markets. More specifically, our related prima facie results reveal that about 90 countries (40 and 118 countries) outperformed the United States (Mexico and Canada) in Canada. About 95 countries (11 and 54 countries) outperformed the United States (Mexico and Canada) in the United States. Moreover, about 71 countries (113 and 55 countries) outperformed the United States (Mexico and Canada) in Mexico. Therefore, Policymakers, including government authorities and international organizations like the WTO, should conduct comprehensive impact assessments of trade agreements to ensure fairness and maximize benefits for all.

Trade agreements are legally binding agreements between multiple countries that aim to liberalize and regulate international trade among them. Most existing studies have predominantly examined the impact of FTAs among their members, often overlooking or not explicitly considering the effects on non-member countries. These agreements can impact participating countries through numerous channels. Antràs and Staiger (2012b) stated that the fundamental problem for a trade agreement to solve is to prevent terms-of-trade manipulation and to reduce tariffs and raise trade volume without introducing distortions into the unilateral choices of domestic tax/subsidy and regulatory policies as a result of the negotiated constraints on tariffs. Some provisions within trade agreements focus on intellectual property rights, such as copyrights and patents, that are apt to drive innovation and economic activities (Drahos, 2017; Osgood and Feng, 2018). Trade agreements can include provisions to protect foreign investors and facilitate Foreign Direct Investments (FDIs)(Büthe and Milner, 2008; Baccini, 2019). Trade agreements can include labor and environmental standards provisions, impacting labor rights and the environment(Bartels, 2013). Breinlich (2008) revealed that trade agreements can trigger mergers and acquisitions in some participating countries, with resources being transferred from less productive to more productive firms. Martin et al. (2012) confirmed that trade agreements, because they create trade, reduce the probability of wars between countries. Baghdadi et al. (2013) found that trade agreements with environmental provisions trigger convergence in CO2 emissions between participating countries. Juhn et al. (2013) revealed possibilities for trade agreements (i.e., NAFTA) to impact gender inequality. More specifically, they found that tariff reductions raise female wage bill shares in blue-collar jobs. Liu and Ornelas (2014) showed that trade agreements can critically reduce the incentive of authoritarian groups to seek power by destroying protectionist rents. The increased competition faced by domestic producers because of trade agreements influenced voters in US elections in favor of the party inclined to trade restriction (Che et al., 2022). Trade agreements can mitigate uncertainty and the probability of policy uncertainty shocks (Carballo et al., 2022). Prusa et al. (2022) revealed that trade agreements could reduce anti-dumping actions when they include anti-dumping rules.

The findings of certain scholars failed to support FTAs or revealed preconditions for FTAs to be more effective. Rose (2004) revealed little evidence that countries joining the GATT/WTO have different trade patterns from outsiders. Although Tomz et al. (2007) attempted to prove that with a different treatment, in the data, of countries (e.g., those colonially linked with participating countries) that could indirectly benefit from trade agreements, Rose (2004)'s findings could uncover positive effects. Trefler (2004) uncovered the conflict in evaluating the effects of FTAs between economists who bore the short-run adjustment costs (e.g., displacement of labor) and those who garnered the long-run efficiency gains (stakeholders of competitive plants and users of final intermediate goods. Karacaovali and Limão (2008) showed that preferential trade agreements could hinder multilateral trade agreements unless they entail accession to a customs union with internal transfers (i.e., the European Union). Antràs and Staiger (2012a) argued that the rise of offshoring (captured by increasing shares of differentiated intermediate inputs and decreasing shares of homogeneous goods in world trade) is likely to be less adapted to traditional GATT/WTO concepts

and rules and would trigger newer types of trade agreements. Lake and Roy (2017) showed that free trade agreements can constitute steps towards global free trade, while global tariff negotiations do not emerge when global negotiations precede trade agreements. Hsieh et al. (2020) showed that Canada experienced net new losses from trade following the Canada-US free trade agreement. Numerous other scholars have focused on whether trade agreements (i.e., PTAs) build or stumble blocks (Krueger, 1999; Winters, 1999; Bagwell et al., 2016; Panagariya, 2000; Menon, 2007).

Other scholars identified factors apt to amplify or attenuate the impacts of FTAs. Burfisher et al. (2001) revealed that the impact of trade agreements (i.e., NAFTA) can depend on macroeconomic factors/issues such as, but not limited to, monetary crises, GDP growth, currency fluctuations, and global trade reforms. Baier and Bergstrand (2004) revealed some economic and political factors influencing the establishment of free trade agreements (i.e., transportation costs, economic sizes, similarity in economic sizes, and political regimes). Baier et al. (2019) and Freeman and Pienknagura (2019) revealed that the effects of trade agreements are weaker for more distant trading partners. In contrast with most existing studies, this paper explicitly accounts for the potential impact of FTAs (i.e., NAFTA) on non-members.

A non-negligible number of scholars focused on accurate predictions of the quantitative impact of trade agreements. In empirical studies, it is typical to represent trade agreements with a dummy variable that takes the value of 1 when two countries are involved in trade agreements and 0 otherwise. The estimated coefficients of this variable indicate the average effect of FTAs. However, the relatively larger coefficients estimated for this variable despite lower existing tariffs have prompted researchers to suggest that the impact of FTAs, as captured by that dummy variable, may go beyond the mere elimination of tariffs (Baier et al., 2019). Moreover, FTAs' effects are dynamic, evolving from initial negotiations (Khan and Khederlarian, 2021) to maturity or obsolescence, leading to re-negotiations or new agreements. Scholars usually capture this dynamic by combining contemporaneous and lagged (or lead) effects to derive cumulative effects that reflect phasing-in effects of trade agreements as economic agents in participating countries gradually adapt to implemented FTAs (Baier and Bergstrand, 2007a; Anderson and Yotov, 2016; Baier et al., 2019). [4] While the phasing-in effects of trade agreements assert that trade flows gradually increase over time following the implementation of trade agreements because of tariff phase-out and delayed pass-through of tariffs into import prices, Besedes et al. (2020) found that the delay in import growth does not correspond to delays in the timing of tariff cuts.

Combining contemporaneous (FTA_t) and lagged (FTA_{t-i}) variables of trade agreements overlook a basic econometric assumption -multicollinearity-, thus casting doubt on the reliability of the related coefficients and the resulting cumulative impact of trade agreements. Notwithstanding that Magee (2008) stated that collinearity is not a major concern when the focus is on the cumulative effect, disparities between the existing estimates (e.g., 89% in 18 years (Magee, 2008) and 100% in 10 years (Baier and Bergstrand, 2007a)) call for more scrutiny in estimating the cumulative effect of trade agreements. It should be noticed that cumulative effects from Baier and Bergstrand (2007a), Magee (2008), and other scholars implicitly assume linear additivity in the relationship between contemporaneous and lagged effects of trade agreements on international trade. Accordingly, contemporaneous and lagged effects of trade agreements are assumed to be additive, meaning that these effects simply sum up to determine the overall impact or the cumulative effect. However, the assumption of linear additivity usually relies on the underlying variables being independent of one another (Smith, 2015), which is not the case in the presence of multicollinearity. Thus, it is

[4] Magee (2008) found that trade agreements raise international trade by 89% after 18 years, and Baier and Bergstrand (2007a) found that, on average, an FTA approximately doubles two members' bilateral trade after 10 years.

crucial to consider the assumption of linear additivity carefully and to be aware of the limitations it may impose on our understanding of the relationship between trade agreements and trade. This paper attempts to estimate the phasing-in effects of trade agreements without any restrictive assumptions regarding the relationship between the highly correlated trade agreement variables in impacting international trade.

Moreover, we suspect that using a time-invariant variable to reflect varying effects could lead to higher estimates that have tentatively been justified as extra impacts of FTAs. The dummy FTA variable compares trade between countries involved in trade agreements and those not involved in any trade agreements. That comparison can also be made over time by interacting the FTA dummy variable with time dummies. While the outcome of such comparison is designated as the effect of trade agreements, it can be due to any other bilateral factors picked by the dummy when those factors are not present in the regression. To address this consequential [5] measurement error, we propose a time-specific time-varying variable to estimate the impact of NAFTA.

The remainder of this paper is organized as follows. Section 2 describes the data and elaborates on the methodology, Section 3 report and discuss the empirical results, and Section 4 concludes.

2 Data and Methodology

2.1 Data and empirical regularities

The paper uses annual bilateral aggregate export data from more than 200 countries from 1954 until 2014, retrieved mainly from the dataset constructed by Fouquin and Hugot (2016).[6] This dataset is complemented with intra-national (domestic) trade data computed as Baier et al. (2016) proposed by taking the difference between total domestic production and total export. Yotov et al. (2021) elaborates more on the benefits of adhering to theory by estimating gravity equations with domestic (in addition to international) trade flows. Head et al. (2010) constructed the original trade agreements data that is updated and available through *Centre d'Études Prospectives et d'Informations Internationales* (CEPII). We graphically describe the data to reveal some regularities. In these figures, we plot the log of trade over time (with a dashed line), mean values of the log of trade before and after NAFTA (the horizontal scatter plots), linear fitted lines for the log of trade before and after NAFTA, and a vertical dashed line at the year 1994 (the implementation year of NAFTA). Figure 1 portrays that after the implementation of NAFTA, the average volume of exports to the United States increased for all members. Although the trade volume had been increasing even before NAFTA, the rate of increase may have slowed down or shifted downward after the agreement.

Figure 2 portrays that after the implementation of NAFTA, the average volume of exports to Mexico increased for all members. Although the trade volume had been increasing even before NAFTA, the increasing rate may have slowed down or shifted downward after the agreement for the United States and Mexico itself.

Figure 3 portrays that after the implementation of NAFTA, the average volume of exports to Canada increased for all members. Although the trade volume had been increasing even before

[5] measurement bias can lead to biased coefficient estimates, inaccurate predictions, loss of efficiency power, reduced efficiency, loss of explanatory power

[6] We retrieved this information from the new dataset constructed by Fouquin and Hugot (2016) and available since November 2016 at the CEPII website. It contains *aggregate* trade data from 1827 until 2014, although the coverage of countries was limited before 1954. (http://www.cepii.fr/CEPII/fr/publications/wp/abstract.asp?NoDoc=9134).

Figure 1: Exports from NAFTA member countries to the United States

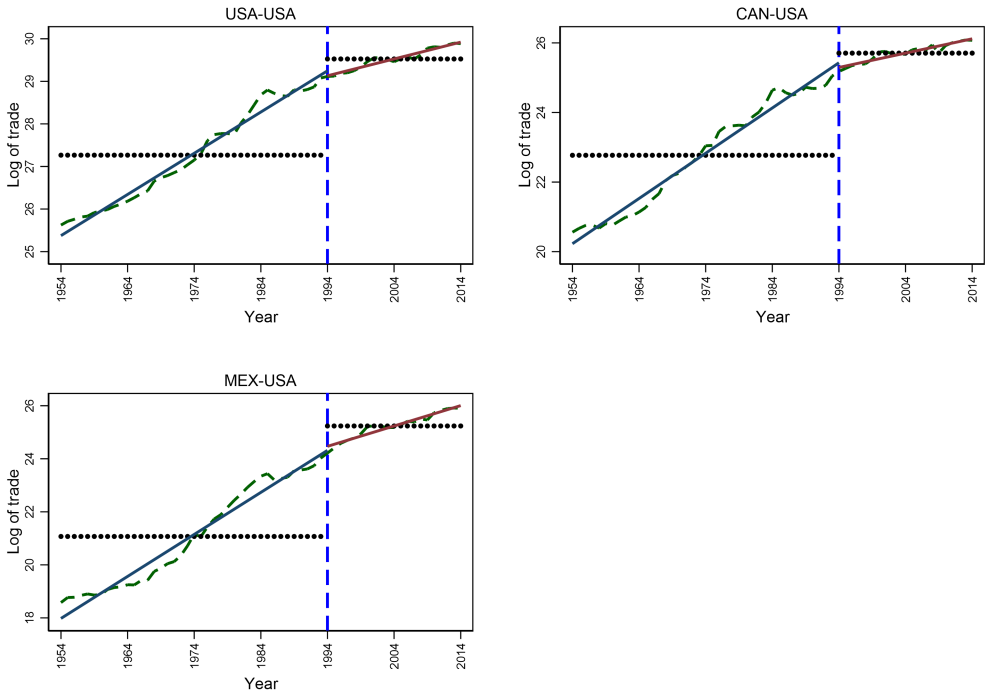
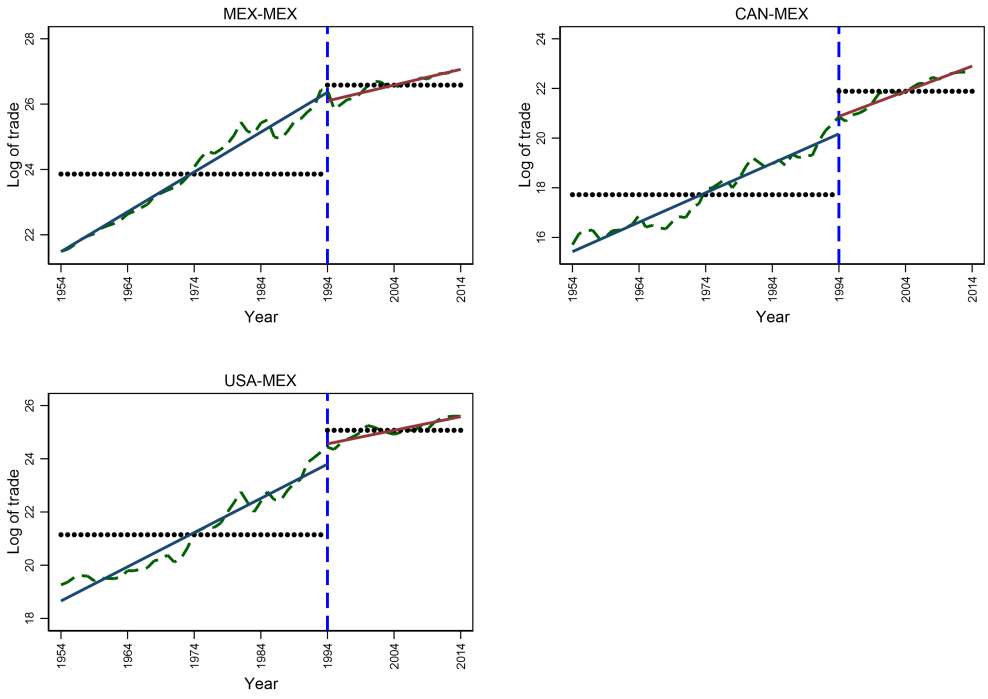


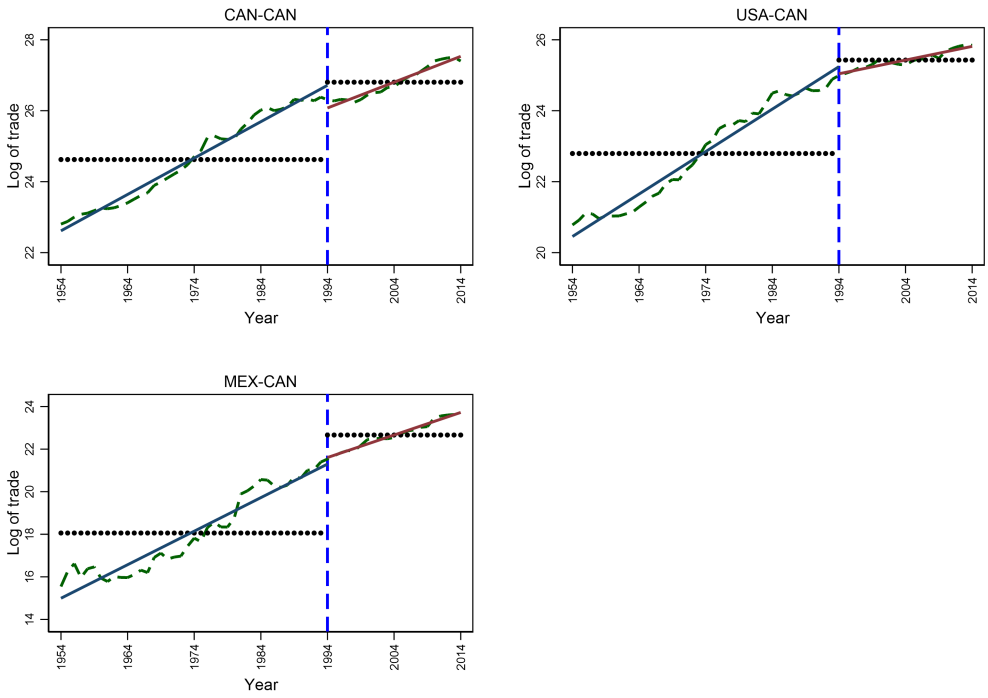
Figure 2: Exports from NAFTA member countries to the Mexico



NAFTA, the increasing rate may have slowed down or shifted downward after the agreement for the United States in the Canadian market.

These figures suggest that while NAFTA positively impacted trade volume, it might have influenced the pace of growth in trade across these countries differently, which is what this paper investigates following the methodology presented in the following sub-section.

Figure 3: Exports from NAFTA member countries to Canada



2.2 Methodology

We use the gravity model to estimate countries' export performance during a trade agreement (i.e., NAFTA). This model was originally used in economics by Tinbergen (1962) and recently improved by deriving its explicit form from economic theories (Anderson and van Wincoop, 2003). The main equation can be written as follows:

$$X_{ijt} = exp\left[\alpha + \beta \text{ NAFTA} + n_{i,t} + \theta_{j,t} + \delta_{ij}\right] + \epsilon_{ijt}. \quad (1)$$

where, X_{ijt} denotes the value of exports from country i to county j in period t. NAFTA_{ijt} is a dummy variable that takes the value of 1 from 1994 and 0 before 1994 (the implementation year of NAFTA). This variable accounts for the potential impact of NAFTA on all country pairs, including those involving non-members. This paper uses fixed effects to account for direct and indirect effects in international trade through multilateral resistances, which capture the general equilibrium effects of trade policy changes (Yotov et al., 2016). Taking advantage of our panel data and following suggestions by Olivero and Yotov (2012), Larch et al. (2017) and Baldwin and Taglioni (2006),

multilateral resistances are given by importer-time ($n_{i,t}$) and exporter-time ($\theta_{j,t}$) fixed effects. δ_{ij} denotes pairwise fixed effects. These pairwise fixed effects will account for all the bilateral trade costs that are sometimes captured through regular time-invariant gravity variables (e.g., geographic distance, language similarities, contiguity, colonial links, and landlockedness). These three sets of fixed effects deal with endogeneity arising from unobservable heterogeneity or omitted variables (Baier and Bergstrand, 2007b; Yotov et al., 2016). ϵ_{ijt} is the error term. However, Equation 1, which aligns with most studies on FTAs, will capture only the average effect of NAFTA, reflecting the gap between the two horizontal lines shown in Figures 1-3. Thus, Equation 1 is modified to also account for the fact that the volume of trade was increasing even before NAFTA and the potential shifting in trade growth after NAFTA. The new equation becomes:

$$X_{ijt} = exp\left[\alpha + \beta_0 \text{ NAFTA} + \beta_1 \text{ TREND} + \beta_2 \text{ NAFTA*TREND} + n_{i,t} + \theta_{j,t} + \delta_{ij}\right] + \epsilon_{ijt} \quad (2)$$

In most existing regressions, β_1 and β_2 are overlooked. To identify β_0, β_1, and β_3, it is customary to use the strategy proposed by Heid et al. (2021) and Beverelli et al. (2018), which consists of multiplying the related variables by a dummy variable that takes the value of 1 for international trade and 0 for intranational trade. While our first results use this strategy, it should also be noted that using intranational trade in all the countries as the benchmark is problematic, especially regarding interpretations of the coefficients. We slightly modify the strategy by Heid et al. (2021) and Beverelli et al. (2018) and use, alternatively, single country pairs as benchmarks (e.g., USA-USA, USA-MEX, and USA-CAN). Doing so allows to compare coefficients between clearly defined country pairs and can lead to insightful comparisons for policymakers, researchers, and advocates. Thus, $(exp^{\beta_0} - 1) * 100$ will represent the average trade gap between all the country-pairs during NAFTA and the benchmark. $(exp^{\beta_1} - 1) * 100$ will represent the average gap in trade growth rate between all country-pairs and the benchmark. $(exp^{\beta_2} - 1) * 100$ will represent the average percentage point gap in trade growth between all the country pairs and the benchmark. This percentage point gap is our measure of trade performance during NAFTA.

However, the variables related to these coefficients are highly correlated and cannot be included in the same regression. Thus, we focus only on β_2, our performance measure. For instance, when analyzing performance in the Mexican market, with USA-MEX as the benchmark pair, we use the following equation:

$$X_{ijt} = exp[\alpha + \beta_2 \text{ Z}_{it} + \beta_3 \text{ Z}_{it} * (\text{MEX-MEX}) + \beta_4 \text{ Z}_{it} * (\text{CAN-MEX}) + n_{i,t} + \theta_{j,t} + \delta_{ij}] + \epsilon_{ijt} \quad (3)$$

With Z_{it} denoting the time-specific time-varying interaction between Trend and NAFTA, MEX-MEX being a dummy variable taking the value of 1 for intranational Mexican trade and 0 otherwise, CAN-MEX is a dummy variable taking the value of 1 for export from Canada to Mexico and 0 otherwise. A positive β_4 will show that Mexico outpaced the trade growth of the United States in the Mexican market by about $(exp^{(\beta_2+\beta_4)} - 1) * 100$. β_2 reflects the average performance of other country pairs in all the markets during NAFTA. The proposed time-varying variable will reflect the duration of the trade agreement. It can be used to measure the length of FTA effects appropriately and allow more detailed analysis, including those related to compounding effects (i.e., phasing-in and phasing-out) of trade agreements. [7]

The paper estimates the gravity model by applying the Poisson Pseudo-Maximum Likelihood (PPML) method, as suggested by Santos Silva and Tenreyro (2006). This method has the merit of

[7] The proposed trade agreement variable is similar to duration variables that have been used in other fields or topics such as firm age (Brown and Medoff, 2003), duration of wars (Cunningham et al., 2009), and length of financial crises (Bernanke, 1983)

incorporating zero export values that would be excluded if we used the OLS method to estimate a log-linearized gravity equation. It also addresses the issue of heteroscedastic error terms created by the log transformation of the gravity model.

3 Empirical results

This section will first display results using consecutive-year data and intranational trade as the benchmark for identifying NAFTA-related variables. Using consecutive-year data to avoid downward-biased effect estimates and improve the efficiency of effect estimates Egger et al. (2022). After that, we use specific country pairs as benchmarks (i.e., from China and the United States). The robustness of the main findings will be checked using different specifications, such as, but not limited to, using interval data (i.e., 2-year and 3-year) and redefining the sample period to account for the entry of China into WTO in 2001.

Table 1: Annual growth rates of exports during NAFTA with intranational trade as benchmark

	Reg 1		Reg 2		Reg 3		Reg 4		Reg 5		Reg 6	
	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.
Non-NAFTA pairs	0.0095***	(0.0014)	0.0091***	(0.0014)	0.0082***	(0.0014)	0.0082***	(0.0008)	0.0069***	(0.0007)	0.0064***	(0.0007)
Mexico - Canada	0.0233***	(0.0028)	0.0231***	(0.0028)	0.0209***	(0.0028)	0.0278***	(0.0042)	0.0288***	(0.0039)	0.0262***	(0.004)
Mexico - United States	0.0267***	(0.0047)	0.0274***	(0.0048)	0.0257***	(0.0048)	0.0221***	(0.0038)	0.0225***	(0.0035)	0.0197***	(0.0036)
Canada - Mexico	0.0049*	(0.0028)	0.0051*	(0.0028)	0.0035	(0.0028)	0.0170***	(0.0044)	0.0183***	(0.0042)	0.0159***	(0.0042)
Canada - United States	0.0066	(0.0045)	0.006	(0.0045)	0.0055	(0.0046)	0.0002	(0.0032)	0.0017	(0.0027)	-0.0001	(0.0026)
United States - Mexico	0.0274***	(0.0047)	0.0285***	(0.0046)	0.0277***	(0.0048)	0.0017	(0.0038)	0.002	(0.0036)	-0.0004	(0.0036)
United States - Canada	0.0099**	(0.0049)	0.0092*	(0.005)	0.0090*	(0.0051)	-0.0078***	(0.003)	-0.0067**	(0.0026)	-0.0083***	(0.0025)
Geographic Distance	-0.5527***	(0.0179)	-0.5445***	(0.0182)	-0.5235***	(0.0184)						
Language similarities	0.2035***	(0.0776)	0.2264***	(0.0777)	0.2190***	(0.0764)						
Contiguity	0.7295***	(0.0862)	0.6878***	(0.0876)	0.6497***	(0.0838)						
Colonial Links	0.1008	(0.0894)	0.0937	(0.0871)	0.1575*	(0.0879)						
Landlockedness	-1.2519***	(0.1763)	-1.2330***	(0.1714)	-1.2495***	(0.1685)						
Linder term			-0.0262***	(0.0095)	-0.0233**	(0.0094)			-0.0491***	(0.0061)	-0.0474***	(0.0059)
FTA_dummy					0.1821***	(0.0631)					0.1877***	(0.0439)
Obs.	1,234,768		1,212,018		1,212,018		1,109,719		1,089,741		1,089,741	
R_2	0.9843		0.9844		0.9845		0.9978		0.9979		0.9979	

Standard errors are reported in the parentheses. The constant term and fixed effects coefficients (exporter-time, importer-time, and exporter-importer are omitted for brevity. A pair country is defined as non-NAFTA if at least one of the countries in the pair is not a NAFTA member.

From the first part of Table 1 (without pairwise fixed effects), Geographic distance, landlockedness, and dissimilarity in demand structures dampen the trade volume. Language similarities, contiguity, and colonial links boost the volume of trade. Moreover, on average, trade is higher when countries are involved in trade agreements.

The time-specific time-varying NAFTA variables are estimated without and with pairwise fixed effects. They are estimated without and with the Linder term and the FTA dummy variable, taking the value 1 when countries are involved in trade agreements and 0 otherwise. Accordingly, in line with the identification strategy elaborated in the previous section, during the NAFTA period, the annual growth rate of non-NAFTA exports (i.e., from non-members and/or to non-members) outpaced that of intranational trade by approximately 0.72%. The annual growth rate of exports from Mexico to Canada outpaced the one of intranational trade by about 2.79%. The annual growth rate of exports from Mexico to the United States outpaced the one of intranational trade by about 2.17%. The annual growth rate of exports from Canada to Mexico outpaced the one of intranational trade by about 1.72%. The annual growth rate of exports from Canada to the United States outpaced the one of intranational trade by about 0.06%. The annual growth rate of exports from the United States to Mexico outpaced the one of intranational trade by about 0.11%. The annual growth rate of exports from the United States to Canada lagged behind that of intranational trade by about 0.76%.

While these results are obtained following the identification strategy proposed by Heid et al. (2021) and Beverelli et al. (2018), which is the current norm in the literature, they present a significant interpretation difficulty given that intranational trade -the benchmark- is difficult to dissect. When the benchmark is unclear, it is like navigating through a maze without a map, making it challenging to draw meaningful comparisons and develop practical policy recommendations. Thus, the results in Table 2 alternatively use specific country pairs from the United States and China as benchmarks, the former being one of the NAFTA members and the latter being one of the main competitors in the global market. Moreover, it is possible to believe that NAFTA negotiations were initiated to counteract the expansion of China in international markets previously dominated by the United States. More precisely, President George H.W. Bush visited Mexico in the second half of 1990 to initiate the negotiations, just after the visit of Chinese president Yang to Mexico in May of 1990 to reinforce its relationships with Mexico as his country was facing retraction of numerous trading partners, including the potential loss of its MFN status with Washington, because of political unrests.

Table 2: Annual growth rates of exports during NAFTA with different benchmark pairs

Benchmark pairs:	USA-USA		CHN-USA		USA-MEX		CHN-MEX		USA-CAN		CHN-CAN	
	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.
Non-NAFTA pairs	-0.0001	(0.0018)	-0.0138***	(0.0034)	0.0139**	(0.0058)	-0.0757***	(0.008)	0.0043**	(0.0022)	-0.0161***	(0.0033)
Mexico - Mexico					-0.0427***	(0.0061)	-0.0376***	(0.004)				
Mexico - Canada									0.0199***	(0.0067)	0.0211***	(0.0066)
Mexico - United States	0.0230***	(0.0036)	0.0240***	(0.0035)								
Canada - Mexico					-0.0003	(0.006)	0.005	(0.0037)				
Canada - Canada									-0.0043*	(0.0022)	-0.0031*	(0.0019)
Canada - United States	0.0034*	(0.002)	0.0043**	(0.0018)								
United States - Mexico							-0.0089**	(0.0036)				
United States - Canada											-0.0032*	(0.0019)
United States - United States			0.001	(0.0015)								
Linder term	-0.0616***	(0.0061)	-0.0574***	(0.0065)	-0.0614***	(0.006)	-0.0613***	(0.006)	-0.0613***	(0.006)	-0.0609***	(0.006)
FTA_dummy	0.3023***	(0.0474)	0.3085***	(0.0462)	0.2853***	(0.0437)	0.2875***	(0.0435)	0.3587***	(0.0569)	0.3593***	(0.0568)
Obs.	1,089,741		1,089,741		1,089,741		1,089,741		1,089,741		1,089,741	
R_2	0.9978		0.9978		0.9978		0.9978		0.9978		0.9978	

Standard errors are reported in the parentheses. The constant term and fixed effects coefficients (exporter-time, importer-time, and exporter-importer are omitted for brevity. A pair country is defined as non-NAFTA if at least one of the countries in the pair is not a NAFTA member.

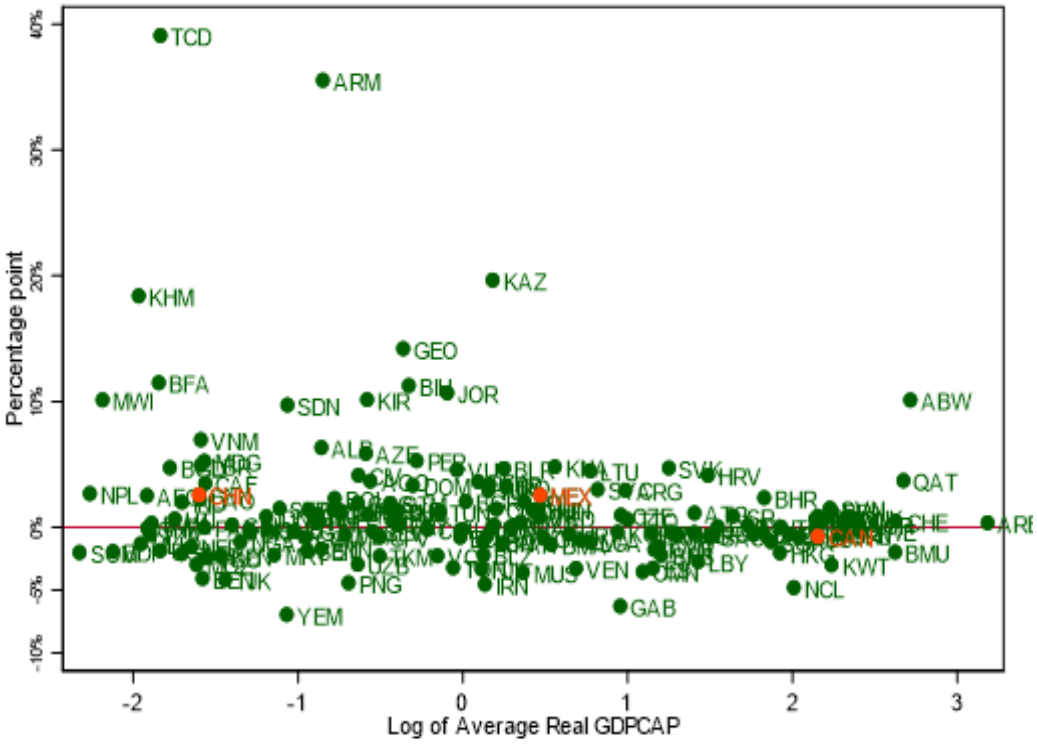
From the results reported in Table 2, the annual growth rate of trade between non-NAFTA country pairs lagged behind the one of intranational US trade by about [(exp(-0.0001)-1)*100] 0.01%. The annual growth rate of exports from Mexico to the United States outpaced the one of intranational US trade by about [(exp(0.0230-0.0001)-1)*100] 2.32%. The annual growth rate of exports from Canada to the United States outpaced the one of intranational US trade by about [(exp(0.0034-0.0001)-1)*100] 0.33%. Annual growth rates of trade between other NAFTA pairs, with CHN-USA as the benchmark, are obtained similarly. Accordingly, the annual trade growth rate between pairs with non-NAFTA members trails behind the one from China to the United States by about 1.37%. The annual growth rate of exports from Mexico to the United States outpaced the one from China to the United States by about 1.02%. The annual growth rate of exports from Canada to the United States trails behind the one from China to the United States by about 0.95%. The annual growth rate of intranational US trade trails behind the one from China to the United States by about 1.27%. With other benchmarks, annual growth rates of trade can be obtained in the same manner.

We can use these results to rank beneficiaries of NAFTA in various markets (i.e., the United States, Canada, and Mexico). Accordingly, Mexico's trade growth rate in the US market outpaced those of the United States, Canada, and China. China's trade growth rate outpaced those of Mexico, Canada, and the United States in the Mexican market. In Canada, the growth rate of Mexico outpaced the ones of China, Canada, and the United States. Our results align with the findings by Dussel Peters and Gallagher (2013), who found that the uninvited guest -China- has gained more market positions in Mexico than the United States. We can use this same methodology

to rank the performance of all the countries in any given market (country) during the NAFTA period. In this paper, we rank the performance of all the countries in the three NAFTA markets (i.e., Canada, Mexico, and the United States). The same exercise can be easily conducted for other markets.

From Figure 4, out of 169 countries, 92 outperformed the United States in the Canadian market during NAFTA, 41 outperformed Mexico, and 119 outperformed Canadian intranational trade[8]. From Figure 5, out of 169 countries, 95 outperformed the United States in the United States market during NAFTA, 11 outperformed Mexico, and 54 outperformed Canada. From Figure 6, out of 131 countries, 71 outperformed the United States in the Mexico market during NAFTA, 113 outperformed Mexico, and 55 outperformed Canada. There is an apparent negative associ-

Figure 4: Trade performance gaps in Canada during NAFTA



ation between trade performance gaps and real gdpcap. This is probably due to many factors, including lower exports to Canada before NAFTA. Potential channels through which non-members can benefit from FTAs more than members include supply chain systems, increased competition, and investment opportunities. More specifically, NAFTA-related reduced trade barriers among its members could have encouraged the development of integrated supply chain systems. These supply chain systems might have used some components from non-members as inputs into production processes in members' production processes. NAFTA could have encouraged non-members to improve their products and reduce prices to remain competitive in members' markets. Released market positions by NAFTA members in non-member countries could constitute opportunities for other non-members. Moreover, increased economic activities could have attracted investors from non-members.

[8]ERI is not displayed in the graph because its performance gap was above 1000%

Figure 5: Trade performance gaps in the United States during NAFTA

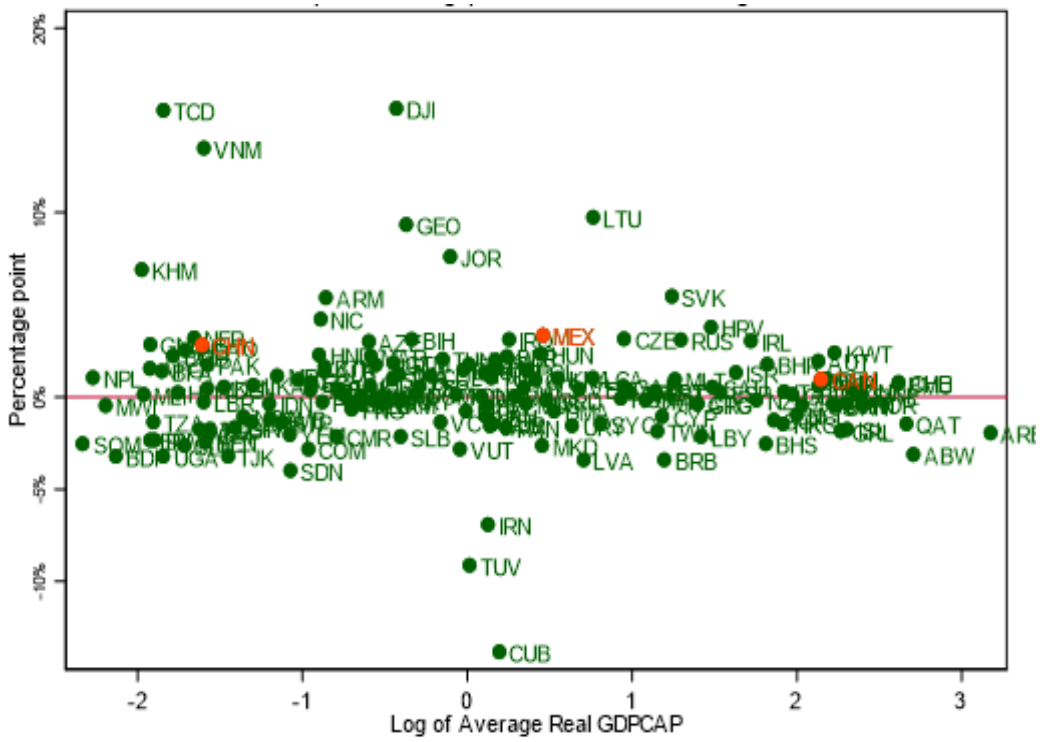
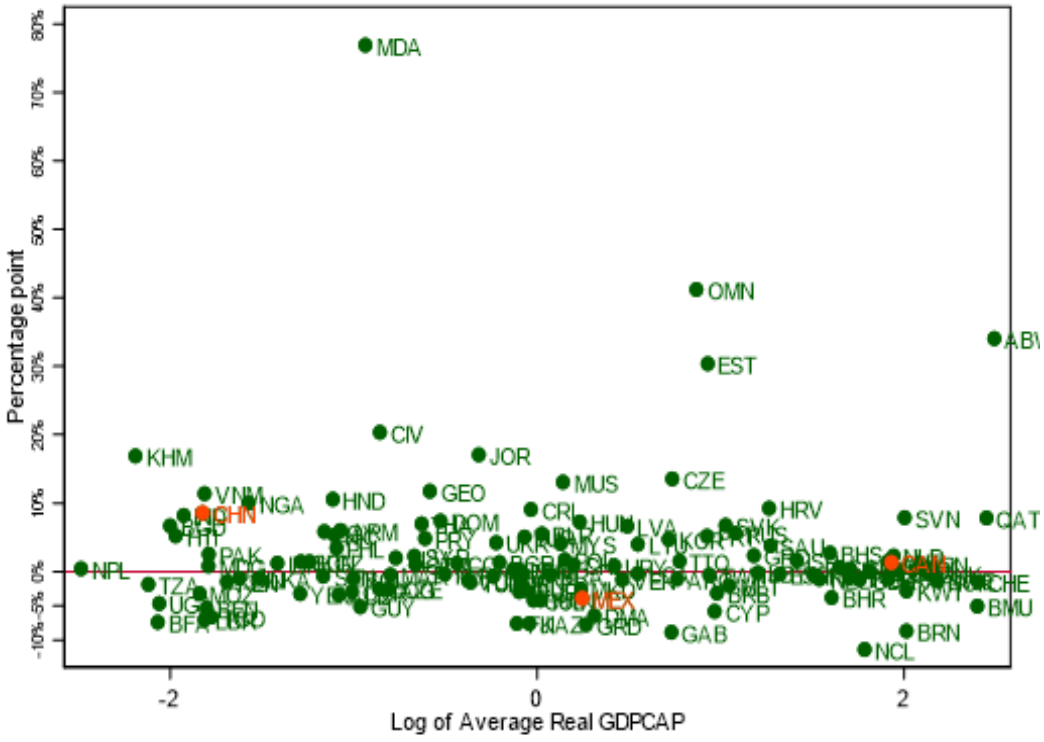


Figure 6: Trade performance gaps in Mexico during NAFTA



3.1 Robustness checks

We use three additional specifications to ensure that the findings from the previous subsection are robust.

Table 3: Annual growth rates of exports during NAFTA with different benchmark pairs (3-year intervals data)

Benchmark pairs:	USA-USA		CHN-USA		USA-MEX		CHN-MEX		USA-CAN		CHN-CAN	
	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.
Non-NAFTA pairs	0.001	(0.0048)	-0.0305***	(0.0096)	0.0362**	(0.0148)	-0.1988***	(0.0225)	0.0122**	(0.0058)	-0.0394***	(0.0088)
Mexico - Mexico					-0.1195***	(0.0156)	-0.1065***	(0.0105)				
Mexico - Canada									0.0540***	(0.0185)	0.0570***	(0.0183)
Mexico - United States	0.0649***	(0.01)	0.0671***	(0.0099)								
Canada - Mexico					-0.0027	(0.0152)	0.0106	(0.0096)				
Canada - Canada									-0.0138**	(0.0059)	-0.0109**	(0.0051)
Canada - United States	0.0095*	(0.0053)	0.0115**	(0.0051)								
United States - Mexico							-0.0234**	(0.0095)				
United States - Canada											-0.0092*	(0.0051)
United States - United States			0.0011	(0.0043)								
Linder term	-0.0601***	(0.0061)	-0.0567***	(0.0066)	-0.0601***	(0.006)	-0.0600***	(0.006)	-0.0597***	(0.006)	-0.0593***	(0.006)
FTA_dummy	0.3179***	(0.0492)	0.3231***	(0.0481)	0.2985***	(0.0456)	0.3007***	(0.0454)	0.3776***	(0.0605)	0.3782***	(0.0604)
Obs.	360,790		360,790		360,790		360,790		360,790		360,790	
R_2	0.9978		0.9978		0.9978		0.9978		0.9977		0.9977	

Standard errors are reported in the parentheses. The constant term and fixed effects coefficients (exporter-time, importer-time, and exporter-importer are omitted for brevity. A pair country is defined as non-NAFTA if at least one of the countries in the pair is not a NAFTA member.

First, instead of continuous panel data, we use 3-year interval data to account for slow trade adjustments in response to trade policies as suggested by Cheng and Wall (2005). Most related results reported in Table 3 align with the main findings. More specifically, Mexico outperformed all the members in the United States and Canada, Canada outperformed the members in Mexico, and the United States outperformed Mexico in Mexico. China -the uninvited guest- outperformed all the NAFTA members in Mexico.

Second, instead of using the whole period, we exclude data after 2000 to show the potential impact of China's WTO entry. The related results, reported in Table 4, confirm that Mexico outperformed The US and Mexico in the United States and Canada, while Canada outperformed the US and Mexico in Mexico. The outperformance of China on the United States in Mexico is more pronounced (about 40% higher) when China WTO era is included. The outperformance of China on the United States in Canada is more pronounced (about 12% higher) when the Chinese WTO era is included. The outperformance of China on the United States in the United States is more pronounced (about 13% higher) when the China WTO era is included. Third, In line

Table 4: Annual growth rates of exports during NAFTA with different benchmark pairs (1954-2000)

Benchmark pairs:	USA-USA		CHN-USA		USA-MEX		CHN-MEX		USA-CAN		CHN-CAN	
	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.
Non-NAFTA pairs	0.0062***	(0.0017)	-0.0226***	(0.0032)	-0.0019	(0.0024)	-0.0226***	(0.0044)	0.0016	(0.0023)	-0.0170***	(0.0046)
Mexico - Mexico					-0.0240***	(0.0026)	-0.0234***	(0.0026)				
Mexico - Canada									0.0134*	(0.0074)	0.0144**	(0.0073)
Mexico - United States	0.0213***	(0.0039)	0.0227***	(0.0037)								
Canada - Mexico					0.0041	(0.0037)	0.0048	(0.0036)				
Canada - Canada									-0.0090***	(0.0023)	-0.0081***	(0.0021)
Canada - United States	0.0065***	(0.0019)	0.0079***	(0.0015)								
United States - Mexico							0.0025	(0.0023)				
United States - Canada											-0.0007	(0.0021)
United States - United States			-0.0049***	(0.0012)								
Linder term	-0.0305***	(0.0057)	-0.0267***	(0.0053)	-0.0311***	(0.0059)	-0.0311***	(0.0059)	-0.0322***	(0.006)	-0.0319***	(0.006)
FTA_dummy	0.2823***	(0.061)	0.2812***	(0.0609)	0.3597***	(0.0283)	0.3599***	(0.0283)	0.4328***	(0.1085)	0.4328***	(0.1085)
Obs.	711,389		711,389		711,389		711,389		711,389		711,389	
R_2	0.9986		0.9986		0.9985		0.9985		0.9985		0.9985	

Standard errors are reported in the parentheses. The constant term and fixed effects coefficients (exporter-time, importer-time, and exporter-importer are omitted for brevity. A pair country is defined as non-NAFTA if at least one of the countries in the pair is not a NAFTA member.

with Bergstrand et al. (2015), in the presence of time-invariant pair fixed effects, variation in the International dummy variable will capture all bilateral factors influencing international relative to intra-national trade over time on average relative to the base period. Controlling for these

time-varying bilateral variables will provide accurate estimates for other bilateral time-varying variables. Thus, we replicate our results from Table 2, but with additional variables: $INTER_{ijt} = INTER_{ij} * D_t$. Where $INTER_{ij}$ is a dummy variable that takes the value of 1 when $i \neq j$ and 0 otherwise and D_t represents time dummies (D_1954, D_1955, ..., D_2014). The results with $INTER_{ijt}$ are reported in Table 5. These results confirm that Mexico outperformed The US and Mexico in the United States and Canada, while Canada outperformed the US and Mexico in Mexico.

Table 5: Annual growth rates of exports during NAFTA with different benchmark pairs (with border effects)

Benchmark pairs:	USA-USA		CHN-USA		USA-MEX		CHN-MEX		USA-CAN		CHN-CAN	
	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.	Coef.	Se.
Non-NAFTA pairs	-0.0129***	(0.0021)	-0.0168***	(0.0031)	0.0138**	(0.0057)	-0.0737***	(0.0073)	0.0047*	(0.0026)	-0.0187***	(0.0034)
Mexico - Mexico					-0.0356***	(0.0059)	-0.0307***	(0.004)				
Mexico - Canada									0.0205***	(0.0053)	0.0220***	(0.0052)
Mexico - United States	0.0245***	(0.0033)	0.0257***	(0.0032)								
Canada - Mexico					-0.0002	(0.0063)	0.0048	(0.0045)				
Canada - Canada									0.0058**	(0.0028)	0.0072***	(0.0025)
Canada - United States	0.0028	(0.0023)	0.0038*	(0.0021)								
United States - Mexico							-0.0090**	(0.0037)				
United States - Canada											-0.0033	(0.0023)
United States - United States			0.0142***	(0.0019)								
Linder term	-0.0444***	(0.0068)	-0.0384***	(0.0066)	-0.0443***	(0.0063)	-0.0442***	(0.0063)	-0.0421***	(0.0063)	-0.0415***	(0.0063)
FTA_dummy	0.1530***	(0.0434)	0.1604***	(0.0416)	0.1341***	(0.0434)	0.1367***	(0.0433)	0.2052***	(0.0488)	0.2058***	(0.0486)
Obs.	1,089,741		1,089,741		1,089,741		1,089,741		1,089,741		1,089,741	
R_2	0.998		0.998		0.998		0.998		0.998		0.998	

Standard errors are reported in the parentheses. The constant term, border effect coefficients, and fixed effects coefficients (exporter-time, importer-time, and exporter-importer are omitted for brevity. A pair country is defined as non-NAFTA if at least one of the countries in the pair is not a NAFTA member.

4 Conclusions

This paper uses the gravity model to analyze the impact of trade agreements on international trade using a dataset of more than 200 countries from 1954 until 2014. The paper examined trade performance during the NAFTA era and introduced innovative methods for characterizing FTA-related variables, accounting for the dynamic nature of FTA impacts, and accounting for potential impacts on non-member countries. Our findings unveiled notable disparities in trade performance among nations during the NAFTA period. Importantly, these findings have underscored the potential for non-member countries to outpace their counterparts within and during NAFTA, signifying trade agreements' complexity and multifaceted nature. For policymakers, these insights emphasize the imperative of crafting comprehensive trade agreements that account for the broader economic ecosystem, including non-member nations. For researchers, this study has illuminated a path for further investigation into the intricate dynamics of trade agreements. Advocates or policymakers from non-member countries can benefit from promoting trade agreements between other nations, excluding their own, mainly when the resulting larger integrated market could provide an outlet for non-member outputs, whether as inputs or final consumer goods. Trade agreements not involving one's country can create market opportunities for non-members in other non-member countries. Future research endeavors should delve deeper into understanding the specific mechanisms through which non-member countries can capitalize on FTAs, including explicitly exploring channels such as, but not limited to, supply chains, competition dynamics, and investment flows. By advancing our comprehension of these mechanisms, researchers can contribute to more informed policy decisions and shape future trade agreements that facilitate positive outcomes for all countries.

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