Nihal Temüge

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Replication of "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" by Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini

Introduction

Free Trade Agreement is an agreement between two or more countries agree on certain obligations that affect trade in goods and services, and protections for investors and intellectual property rights, among other topics. They can contain reduction or elimination of tariffs on qualified, Intellectual Property Protection in the FTA partner country , enforcing the partner country to comply with product standards and other articles related trade activities.[1] The recent surge in globalization has brought about a significant increase in international trade activities, leading to the formation of numerous free trade agreements (FTAs) between countries. The FTAs aim to promote and facilitate free trade by reducing barriers and tariffs, encouraging foreign investments and increasing access to new markets.

However, the implementation of FTAs comes with its own set of challenges, particularly with regards to rules of origin (RoO). Rules of Origin refer to the set of regulations and criteria that are used to determine the economic nationality of a product, based on where it was produced, processed or assembled. The RoO are an essential element of international free trade agreements and are used to determine whether a product qualifies for preferential tariff treatment or other trade benefits under such agreements. RoO are designed to prevent third-party countries from circumventing trade agreements by simply transshipping goods through a member country to receive preferential treatment. The specific RoO applied to a product may vary depending on the country, industry and trade agreement in question. A final good producer has to make a sourcing decision between complying RoO rules meaning that it can benefit from preferential tariffs for exports from FTA partners by sourcing some certain inputs within the FTA or not

[1] https://www.trade.gov/free-trade-agreement-overview

complying RoO rules means that it can export from any other countries with MNF tariffs. If first tariff's referential margin is larger , then it's beneficial to choose complying RoO rules.[2] There are several studies that analyze effects of RoO rules on international trade.

Related Literature

Early studies on the topic of rules of origin (RoOs) focused primarily on their effects on protectionism in exporting to obtain preferential rates by preferring inputs with higher rates from partner countries than inputs with lower rates from non-partner countries.(Krishna and Krueger(1995)). In 1998, Falvey and Reed study on economic effects of rules of origins and focus on its impact on sourcing decision. More recent studies have built on this early literature and have analyzed the effects of RoOs on various aspects of international trade and productivity, as well as the political and institutional factors that influence their design and implementation. Estevadeordal and Suominen (2008) find that RoOs can reduce the volume of trade by increasing transaction costs, especially for small and medium-sized enterprises. Similarly, Kee et al. (2016) argue that RoOs can lead to trade diversion, as firms may choose to source inputs from less efficient domestic suppliers in order to meet the requirements of the rules. In contrast, studies by Cadot et al. (2006) find that RoOs can promote local sourcing and value-added activities, which may lead to higher productivity and quality of exports.

The political economy of RoOs is also an important consideration, as several studies suggest that the design and implementation of RoOs may be influenced by non-economic factors. For instance, Baldwin and Jaimovich (2012) argue that RoOs are often used as a political tool to protect domestic industries from foreign competition. Similarly, Hoekman and Zarrouk (2017) find that the preferences of domestic constituencies and the bargaining power of trade partners can affect the design of RoOs. Duttagupta and Panagariya (2003) also work on the welfare effects of preferential trading under the rules of origin (RoOs) and then shows that the RoOs

[2] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2337

might have positive impact on the political viability of Free Trade Agreements (FTAs). Moreover, the literature on the measurement of RoOs suggests that the effective rate of protection (ERP) is a useful measure of the protectionist effects of RoOs and some of the studies have used alternative measures, such as the number of RoOs or preferential margins, to analyze the effects of RoOs (e.g. Freund and Ornelas, 2010). Addition to this, there are some studies that mainly focus on impacts of a specific agreement called North American Free Trade Agreement (NAFTA) on international trade and consequences for welfare of the partner countries. Cadot,Melo, Estevadeordal, Suwa-Eisenmann and Tumurchudur (2002) investigate effects of NAFTA's Rules of origin by focusing across-sectors analysis in their paper called "Assessing the Effect of NAFTA's Rules of origin". It's one of the baseline papers for "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" paper by Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini(2018) in terms of their man focus and methodologies for the research question. In 2013, Kehoe and Ruhl investigates how trade patterns have been effected by NAFTA and its effects on trade. According to their results , there is a positive impact on trade growth across partner countries. Caliendo and Parro's paper(2015) on NAFTA is also one of the important studies for "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" paper with their methodology i.e. Eaton and Kortum model to analyze effects on intermediate goods and their linkages across sectors and their findings show that NAFTA has different impacts across partner countries.[3]

Overall, it can be argued that there is no reconciliation on effects of rules of origin and FTAs on international trade and welfare. Hence, it's still one of the hot topics in international trade and there are several working papers on it. " Trade Agreements and Enforcement: Evidence from WTO Dispute Settlement" by Bown and Reynolds (2020), published in the American Economic Journal analyzes examines implications of the terms-of-trade theory for the determinants of outcomes arising under the enforcement provisions of international agreements. Felbermayr, Teti and Yalcin(2019) also have publication called "Rules of origin and the profitability of trade deflection" and show deflection is not profitable since there might exist similar external tariffs or non-negligible transportation costs. Additionally, Crivelli and Inama

[3] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2340

(2021) study on the role of the stringency of RoO on URs in their paper "Improving market for LDCs: The impact of the EU Reform of Rules of Origin on Utilization Rates and Trade Flows under the Everything But Arms Initiative (EBA)". Wanyu Chung and Carlo Perroni (2020) investigates rules of origins in Free Trade Areas (FTAs) affect market power and market structure in concentrated intermediate goods markets. They show that producers of intermediate goods charge comparatively higher prices when the associated final goods producers are more constrained by FTA origin requirements and by Most Favoured Nation (MFN) tariffs for both intermediate and final non-FTA goods by using trade patterns in Canadian export data and US producer price data. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" paper by Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini is milestone paper for their analysis since it's the first paper focuses on RoOs impact on trade in intermediate goods and they develop their empirical analysis by benefiting from Conconi et al.'s approach.

Critical Summary of the Paper

Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini investigate the impact of rules of origin on changes in trade in Mexico and they try to understand the implications of these rules for firms' sourcing decisions and for trade and productivity in their paper called "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin". The authors aim to shed light on the extent to which RoO rules can act as trade barriers and to assess the impact of these rules on the trade of inputs (intermediate goods used in production) and final goods by focusing on NAFTA in which rules are disaggregated level and based on changes of tariff classification(HS classification). By using NAFTA data they could build a new dataset consisting by codifying changes of tariff classification requirements for more than 700.000 input-output pairs implanted by RoO in NAFTA.[4] Hence, they can crate linkages between final goods and intermediate inputs that are required to be sourced within NAFTA for the final

[4] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2344

product to be considered as having originated from NAFTA. In addition to this main dataset of their analysis, they also use trade data from 1991 to 2003 provided by the World Integrated Trade Solution (WITS) to construct changes in Mexican imports from non-NAFTA countries relative to imports from NAFTA partners which is formulated by $\Delta Imports_{j,\ non\text{-}NAFTAo} - \Delta Imports_{j,\ NAFTA}$ as dependent variable in their model. They also construct a term that captures changes in tariff rates on imports from US and Canada and also non-NAFTA countries after NAFTA in Mexico and it's formulated by $\Delta Preferential\ Tariff_{j,\ o} = \Delta Tariff_{j,\ o.} - \Delta Tariff_{j,\ NAFTA}$. If this term is bigger, it means that the producers of good j from third country o are facing a larger increase in protection compared to the producers of the same good in the US and Canada.

The main empirical strategy of the paper is difference-in-difference model to analyze NAFTA's effects on Mexican trade and they construct their model based on following regression equation:

$$\Delta Imports_{j,\ non\text{-}NAFTAo} = \alpha + \beta_1 RoO_j^x + \beta_2 \Delta Preferential\ Tariff_{j,\ o} + \delta_{k(j)} + \delta_o + \varepsilon_{j,\ o}$$

In the model, the logarithmic change in imports of a HS6-digit good j from a non-NAFTA country o to Mexico from 1991 to 2003 is defined as a dependent variable while the main independent variable of interest is RoOj, which indicates the impact of introducing NAFTA Rules of Origin on final products i that require intermediate product j with sourcing restrictions. Other independent variable, ΔPreferential Tariffj,o, measures the effect of preferential tariff reductions. It is calculated as the difference in the logarithmic change of tariffs applied by Mexico on imports of good j from non-NAFTA country o versus NAFTA partners in the same period. Lastly, they also include fixed effects at the industry and country-of-origin levels, $\delta k(j)$ and δo, which account for trends in Mexican imports across different sectors and countries. Since this equation cannot capture fixed effect at the same aggregation level that can create omitted variable bias problem in the estimation, they use triple difference models to have cross-product and cross-country effect after treatment and they develop following regression model:[5]

$$\Delta Imports_{j,\ non\text{-}NAFTAo} - \Delta Imports_{j,\ NAFTA} = \alpha_0 + \alpha_1 RoO^x{}_j + \alpha_2 \Delta Preferential\ Tariff_j + \delta_o + \varepsilon_{j,\ NAFTAo,\ NAFTA}$$

[5] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2351

That we can expression by taking difference of these two equations as the same logic in a regular difference-in-difference model:

$$\Delta Imports_{j,\ non\text{-}NAFTAo} = \beta_0 + \beta_1 RoO^x_j + \beta_2 \Delta Preferential\ Tariff_j + X_j + \delta_o + \varepsilon_{j,\ non\text{-}NAFTAo},$$

$$\Delta Imports_{j,\ NAFTA} = \gamma_0 + \gamma_1 RoO^x_j + \gamma_2 \Delta Preferential\ Tariff_j + X_j + \varepsilon_{j,\ NAFTA}$$

As it's mentioned before, the main independent variable RoO^x_j is a dummy variable in which x=1,2 or 3 referring three different treatments. First treatment (x =1) means that all rules on final goods i enforce restriction on sourcing of intermediate good j. Secondly, we have the case of x=2 which captures the rules at the preference margin on the final good and third treatment (x=3) captures only RoO rules at preference margin on the final goods excluding VA rules. [6] In this way, they cannot analyze effects of different treatments separately since first one includes other two and second one also includes third treatment. Hence, they develop three mutually exclusive treatment variables by taking differences of these three treatment variables :

- *"RoO Placebo$_j$*: RoO^1_j - RoO^2_j and thus captures rules $RoO_{i,\ j}$ that are irrelevant (producers have no incentives to comply with them, because the preference margin on good *i* is 0).
- *RoO Flexible$_j$: RoO^2_j - RoO^3_j and thus captures rules $RoO_{i,\ j}$ that are relevant (the preference margin on good i is positive) but flexible (producers can obtain origin by complying with an alternative VA rule).*
- *RoO Strict$_j$: RoO^3_j and thus captures rules $RoO_{i,\ j}$ that are both relevant (the preference margin on good i is positive) and strict(there is no alternative VA rule)."* [7]

According to the regression results of triple difference model, it can be argued that change in Mexican imports from non-NAFTA countries significantly decline by 48.364 log points with restrictions in sourcing by NAFTA which explains 45% of changes in imports of treated goods.

[6] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2352

[7] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2354

They also show that decrease in preferential tariffs reduces Mexican imports of treated input goods from non-NAFTA countries relative to NAFTA partners by 43.935 and 42.899 log points.[8]

Overall, the results of the triple-difference model suggest that changes in rules of origin can have significant effects on firms' sourcing decisions and trade patterns. In particular, the findings suggest that changes in RoOs can lead to a decrease in the probability of sourcing inputs from the country of origin and exporting to the country of destination, and an increase in the probability of sourcing inputs from higher-cost suppliers in the country of sourcing.

The paper "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" by Conconi et al. makes several contributions to the literature on the effects of rules of origin on international trade and productivity. First, the paper provides empirical evidence on the protectionist effect of RoO rules on international trade. Using a triple-difference model to account for the endogeneity of RoO rules, the authors find that RoOs significantly reduce imports of intermediate inputs, leading to higher production costs and lower productivity for firms. Second, the paper highlights the importance of distinguishing between final goods and intermediate inputs when analyzing the effects of RoOs on trade patterns. The authors argue that previous studies that have focused on final goods trade may have underestimated the protectionist effects of RoOs, as firms may be able to source final goods from non-preferential sources while facing greater restrictions in their sourcing of intermediate inputs. Third, the paper sheds light on the channels through which RoOs affect firms' sourcing decisions and productivity. The authors find that ROOs lead to higher production costs and lower productivity for firms, as they are forced to source inputs from less efficient and more expensive suppliers in order to meet the RoOs requirements. Overall, the paper provides new empirical evidence and insights into the effects of RoOs on international trade and productivity, highlighting the need for policymakers to carefully consider the potential costs and benefits of these policies for different stakeholders.

[8] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2357

As it’s mention above, the paper "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" by Conconi et al. uses a triple-difference methodology to estimate the causal effects of RoOs on trade patterns and productivity. While this approach has several advantages, there are also some limitations with the methodology used in the paper. Firstly, assumptions of the triple-difference model might be one of them. The triple-difference model used in the paper relies on several assumptions, such as the absence of time-varying unobserved heterogeneity and the validity of the parallel trends assumption. These assumptions may not hold in practice, and therefore the results may be subject to some degree of bias or uncertainty. The paper acknowledges that the assignment of RoOs may be endogenous, meaning that it may be affected by unobservable factors that also affect trade patterns and productivity. While the authors attempt to address this concern through various robustness checks, the validity of the results may still be subject to some degree of uncertainty. In addition to that, the paper controls for several observable factors that may affect trade patterns and productivity, such as distance ,change in skill levels and language, but it may not fully account for other unobservable factors that may affect the results. Therefore, the results should be interpreted as suggestive rather than definitive, and further research with more comprehensive data and control for other relevant factors may be needed to confirm the robustness of the findings. For example, change in skill levels might create comparative advantage in some of inputs and importing decisions might change accordingly not because of the treatment (NAFTA).

Replication of Main Empirical Results

In this section, models in the original paper are replicated by using datasets from replication package in Open ICPSR website[9]. Firstly, raw datasets have been processed and appropriate datasets were built. After this step, datasets are modified and merged according to the models. To construct models below, trade flows and tariffs within NAFTA data and all rules data are combined.

Table 4
NAFTA RoO and Change in Mexican Imports, Triple-Difference Results (excluding rules for dr>0)

	Dependent variable:		
	delta_imports_triple_alt		
	(1)	(2)	(3)
RoO1	-0.083***		
	(0.012)		
RoO2		-0.095***	
		(0.011)	
RoO3			-0.169***
			(0.011)
Delta preferential Tariff	-0.594***	-0.546***	-0.343***
	(0.068)	(0.069)	(0.070)
Observations	29,027	29,027	29,027
R^2	0.006	0.007	0.014
Adjusted R^2	-0.116	-0.115	-0.107
F Statistic (df = 2; 25862)	76.063***	88.871***	178.567***
Note:		*p<0.1; **p<0.05; ***p<0.01	

Table 4 shows estimation results for effects of each type of RoO on Mexican imports of inputs from non-NAFTA countries. According to the results, all types of rules of origin have negative and statistically significant effect on Mexican imports from non-NAFTA. Their

[9] https://www.openicpsr.org/openicpsr/project/113151/version/V1/view

coefficients are -0.083 , -0.095 and -0.169 respectively (-0.114,-0.117 and -0.161 in the paper). However, these three RoOs are nested ,the exact effect of them cannot be interpreted with this analysis directly. Hence, other three treatment variables are defined i.e. RoO Placebo(RoO1-RoO2), RoO Flexible(RoO2-RoO3) ,RoO3 Strict(RoO3) by subtracting from one to other as in the table 5 below. Trade flows and tariffs within NAFTA data, all rules placebo data and all rules dummy placebo data are combined for the analysis.

Table 5
NAFTA RoO and Change in Mexican Imports, Triple-Difference Results

	Dependent variable:	
	delta_imports_triple_alt	
	(1)	(2)
RoO Placebo(RoO1-RoO2)	-0.027**	-0.004
	(0.012)	(0.013)
RoO Flexible(RoO2-RoO3)	0.009	-0.0002
	(0.013)	(0.015)
RoO Strict(RoO3)	-0.181***	-0.182***
	(0.011)	(0.010)
delta preferential Tariff	-0.296***	-0.298***
	(0.066)	(0.066)
Observations	29,027	29,027
R^2	0.014	0.016
Adjusted R^2	0.010	0.012
F Statistic (df = 4; 28907)	105.247***	114.368***
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 5 shows the results of triple-difference regression models that three treatment variables i.e. RoO Placebo(RoO1-RoO2) , RoO Flexible(RoO2-RoO3) and RoO Strict(RoO3) are included. Model 1 (column 1) contains all rules regardless of vertical linkages between goods. However, Model 2 only includes rules that are relevant to vertically related goods. RoO

Flexiblej and RoO Strictj are used to represent RoOi,j rules that have to satisfy fistly complying with these rules would be beneficial for producers, as indicated by a positive NAFTA Preference Margin for RoOi. Secondly, the restricted good j is used as an input in the production of good I , as indicated by a positive dri,j.[10]

According to the results of Table 5, RoO Placebo(RoO1- RoO2) (-0.027 and -0.004) and RoO Placebo (RoO2- RoO3) (0.009 and -0.0002) don't have highly statistically significant coefficients for both models at 1 percent level. It can be interpreted as Mexican imports are not affected by irrelevant rules and rules that are relevant but flexible ones since if producers of good I are able to meet an alternative VA rule to qualify for origin, then a RoOi,j rule is unlikely to impact their decisions on sourcing intermediate j as Conconi et al. remark in their paper. However, coefficients of RoO Restrict (-0.181, -0.182) are negative and statistically significant at 1 percent level which means that these rules have impact on decisions on sourcing and resulting in trade diversions since the dependent variable is difference between change in Mexican imports of good j from non-NAFTA and change in Mexican imports of good j from NAFTA. If RoO Restrict increases one unit , this difference decreases by -0.181 and -0.182 percent according to my replication models. These results show that growth rate of Mexican imports of intermediate good j from non-NAFTA countries is declined with NAFTA when compared to imports from NAFTA countries because of relevant and strict rules of origin. Coefficients of RoO Restrict are -0.181 and -0.182 and they are statistically significant. It can be argued that all coefficients of replication models in this table are consistent with authors' findings.

[10] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2354-5

Table 6
Quantification of the Effect of RoO

	(1)	(2)
beta hat	-0.168847235169719	-0.172450755280667
mean RoO3	3.01543637619651	2.84973458121656
delta imports	1.082364896917	1.05607820384524
effect of Roo3(in log points)	-47.0403369881298	-46.5343266332809
effect of Roo3(as percent of deltaimports)	42.5223094817397	44.5077753426789

In models in the table above, trade flows and tariffs within NAFTA data, all rules placebo data and all rules dummy placebo data are combined for the analysis and regression coefficients, means are used to construct it . Table 6 displays the extent of the impacts of the rules by providing the estimated coefficients of RoO3j. According to the results in column 1, effect of RoO3 in log points has -47.04 which means the growth of Mexican imports of intermediate goods from non-NAFTA countries when compared to imports from NAFTA countries declines by -47.04 log points because of NAFTA sourcing restrictions which is supportive for findings in the paper i.e. it decreases by 48.36 log points. Coefficient for effect of RoO3 as percent of delta imports can be interpreted as if there is no RoO3 then Mexican imports of intermediate goods from non-NAFTA countries than from NAFTA partners would be 42.52% higher (it's 44.209 %in the paper).

According to the results in column 2 , effect of RoO3 in log points has -46.53 which means the growth of Mexican imports of intermediate goods from non-NAFTA countries when compared to imports from NAFTA countries declines by 46.53 log points because of NAFTA sourcing restrictions which is supportive for findings in the paper i.e. it decreases by 48.31 log points. Coefficient for effect of RoO3 as percent of delta imports can be interpreted as if there is no RoO3 then Mexican imports of intermediate goods from non-NAFTA countries than from NAFTA partners would be 44.50% higher (it's 45.280 % in the paper).

After these analysis, next step is studying on relevant and strict sourcing restrictions on intermediate goods, as indicated by a positive RoO3 and their impacts on trade. It's important to analyze Mexican final good producers' incentives to comply for examining how rules of origin in NAFTA affected Mexican imports and sourcing decision process. As we know, the difference between MNF tariffs and preferential tariffs with NAFTA is one of the crucial parameters that might affect Mexican final good producers' decision on intermediates sourcing. If there is a significant difference between MNF tariffs and preferential tariffs , Mexican final good producers are tend to have sourcing decision for input goods for their final goods from NAFTA partners which are Canada and the United States rather than sourcing their inputs from non-NAFTA countries to get benefit from low tariff levels. Hence, the authors define Average Margin NAFTAj representing average of Preference Margin NAFTAi for all goods i that impose restrictions on j, based on the MNF and preferential tariffs imposed by Canada and United States with NAFTA.[11]

The impact of NAFTA RoO on sourcing decisions is expected to be greater for final goods that are more important export markets for the United States and Canada. For instance, the impact of RoO on Mexican imports of intermediate goods j should be influenced by the significance of NAFTA export markets for Mexican producers of final goods i. It can be argued that Mexican producers exporting to the North American market should be more affected by RoO as compared to those exporting more to the rest of the world. Hence, the variable Exports NAFTAj is used as a proxy to determine the significance of NAFTA export markets for Mexican producers of final goods i. This variable measures the total volume of Mexican exports to the United States and Canada before NAFTA (1991) and it's summed across all goods i that impose sourcing restrictions on j.[12] Therefore, the authors include this variable to their models for a more accurate analysis by considering the impact of final good producers' incentive to comply with them on effects of NAFTA sourcing restrictions.

[11] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2357

[12] [12] Conconi, Paola, Manuel García-Santana, Laura Puccio, and Roberto Venturini. 2018. "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin." American Economic Review, 108 (8): 2358

In the column 1 of Table 7 , we also have interaction term between RoO3 and Average Margin NAFTA while interaction term between RoO3 and Exports NAFTA is included in model 2. In model 3, we have both interaction terms in the regression. According to the results in column 1, coefficient for Average Margin NAFTA is 0.254 (0.276 in the paper) and it's statistically significant at 1 percent level. This means that for every one unit increase in Average Margin NAFTA, the dependent variable is expected to increase by 0.254 units, on average. Additionally, interaction term (RoO3 * Average Margin NAFTA) has negative and statistically significant coefficient -0.098(-0.103 in the paper). This means that the effect of RoO3 on the dependent variable depends on the level of Average Margin NAFTA. Specifically, for every one unit increase in RoO3, the effect on the dependent variable is expected to decrease by an additional 0.098 units for each unit increase in Average Margin NAFTA.

Results in column 2 show that interaction term between RoO3 and Exports NAFTA has a regression coefficient of 0.002 .This means that the effect of RoO3 on the growth rate of imports from third countries to relative to NAFTA partners depends on the level of Exports NAFTA. Specifically, for every one unit increase in RoO3, the effect on the growth rate of imports from third countries to relative to NAFTA partners is expected to increase by an additional 0.002 units for each unit increase in Exports NAFTA. However, this coefficient is not statistically significant at conventional levels (i.e., $p > 0.05$). Coefficient of Exports NAFTA is 0.075 and it's highly statistically significant at 1 percent level. This means that for every one unit increase in Exports NAFTA, the growth rate of imports from third countries to relative to NAFTA partners is expected to increase by 0.075 units, on average.

In column 3, both interaction terms are added. The results show that all explanatory variables have statistically significant at 1 percent level and their signs are consistent with results in column1 and column 2. Overall, these results can be interpreted as the effect of NAFTA rules of origin on Mexican imports of intermediate goods is greater when Mexican final good producers have stronger incentives to comply with them. This is evidenced by larger preference margins and a greater importance of NAFTA partners as export markets. Additionally, replication results in Table 7 are totally consistent with Conconi et al.'s results in the original paper.

Table 7

NAFTA RoO and Change in Mexican Imports, Triple-Difference Result

	Dependent variable:		
	delta_imports_triple_alt		
	(1)	(2)	(3)
RoO3	-0.028	-0.293***	-0.362***
	(0.020)	(0.053)	(0.065)
Average Margin NAFTA	0.254***		0.309***
	(0.043)		(0.058)
Exports NAFTA		0.075***	0.034***
		(0.008)	(0.010)
Delta preferential Tariff	-0.355***	-0.288***	-0.320***
	(0.071)	(0.070)	(0.071)
RoO3xAverage Margin NAFTA	-0.098***		-0.091***
	(0.011)		(0.014)
RoO3xExports NAFTA		0.002	0.021***
		(0.005)	(0.006)
Observations	29,027	29,027	29,027
R^2	0.017	0.017	0.019
Adjusted R^2	-0.103	-0.103	-0.101
F Statistic	111.024*** (df = 4; 25860)	113.099*** (df = 4; 25860)	82.457*** (df = 6; 25858)
Note:			*p<0.1; **p<0.05; ***p<0.01

Overall, it can be argued that replicated tables above provide compatible analysis with analysis by Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini in their paper.

Additional Robustness Checks

In this section, additional robustness check is executed. Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini 's analysis might not be robust because of omitted variable bias. Not including distance in the analysis may result in an endogeneity problem because distance is likely to be correlated with both the outcome variable (trade flows) and the explanatory variables of interest (tariffs and rules of origin). This creates a situation where the estimated effect of rules of origin on trade flows may be biased due to the omitted variable bias. For example, if two countries that have a free trade agreement (FTA) also happen to be geographically close to each other, then their bilateral trade flows may be influenced not only by the preferential tariffs under the FTA but also by the lower transportation costs associated with proximity. If the analysis does not control for distance, then the estimated effect of the FTA on trade flows may be overstated, as some of the increase in trade may be due to the reduction in transportation costs. Additionally, distance may have a direct effect on trade flows that is not captured by the other variables, so including it in the model can improve the overall fit and predictive power of the model.

First step of the additional robustness check is adding "distance" variable to the models. To do so, new dataset is downloaded from CEPII database which provides bilateral data consisting of the difference measures (direct km, distance between capital cities, weighted distance etc.) and other irrelevant variables for this analysis. In this dataset , country ISO 3 codes are available , not country codes in numbers as in the original datasets that are used for the main analysis. To merge distance data and the original datasets, a dataset from Open Data Soft webpage containing both variables is used.[13] After this step, models are built and results are obtained as below.

[13] https://public.opendatasoft.com/explore/dataset/countries-codes/export/

Table 4
NAFTA RoO and Change in Mexican Imports, Triple-Difference Results (excluding rules for dr>0) (Adding "Distance")

	Dependent variable:		
	delta_imports_triple_alt		
	(1)	(2)	(3)
RoO1	-0.118***		
	(0.011)		
RoO2		-0.120***	
		(0.010)	
RoO1			-0.167***
			(0.011)
Delta preferential Tariff	-0.541***	-0.496***	-0.315***
	(0.066)	(0.067)	(0.069)
distwces	0.240***	0.231***	0.211***
	(0.010)	(0.009)	(0.009)
Observations	28,702	28,702	28,702
R^2	0.137	0.138	0.141
Adjusted R^2	0.137	0.138	0.141
Residual Std. Error (df = 28699)	2.868	2.867	2.862
F Statistic (df = 3; 28699)	1,518.561***	1,526.852***	1,566.808***
Note:			*p<0.1; **p<0.05; ***p<0.01

According to the results of extended models, all types of rules of origin still have negative and statistically significant effect on Mexican imports from non-NAFTA. Their coefficients are -0.118 , -0.120 and -0.167 respectively and these results are consistent with previous results.

In the following Table 5, new treatment variables are used again and "distance" variable is also added to the model.

Table 5 (Adding "Distance")
NAFTA RoO and Change in Mexican Imports, Triple-Difference Results

	Dependent variable:	
	delta_imports_triple_alt	
	(1)	(2)
RoO Placebo(RoO1-RoO2)	-0.014	0.010
	(0.012)	(0.014)
RoO Flexible(RoO2-RoO3)	0.009	-0.001
	(0.014)	(0.016)
RoO Strict(RoO3)	-0.167***	-0.168***
	(0.011)	(0.010)
delta preferential Tariff	-0.319***	-0.320***
	(0.069)	(0.068)
distance	0.214***	0.206***
	(0.010)	(0.010)
Observations	28,702	28,702
R^2	0.141	0.142
Adjusted R^2	0.141	0.141
Residual Std. Error (df = 28697)	2.862	2.860
F Statistic (df = 5; 28697)	940.341***	947.111***
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 5 above shows the results of triple-difference regression models that three treatment variables i.e. RoO Placebo(RoO1-RoO2) , RoO Flexible(RoO2-RoO3) and RoO Strict(RoO3) are included and also distance. Only difference between these models above and original models in Table 5 in the paper is that here there is additional explanatory variable called "distance". Model 1 (column 1) contains all rules regardless of vertical linkages between goods again. However, Model 2 only includes rules that are relevant to vertically related goods.

According to the results of Table 5, coefficient of distance explanatory variable is 0.214 and it's statistically significant. RoO Placebo(RoO1- RoO2) (-0.014 and -0.010) and RoO Placebo (RoO2- RoO3) (0.009 and -0.001) don't have highly statistically significant coefficients for both models at 1 percent level as results in the replication models and the results in the original paper. It can be interpreted as Mexican imports are not affected by irrelevant rules and rules that are relevant but flexible ones since if producers of good i are able to meet an alternative VA rule to qualify for origin,then a RoOi,j rule is unlikely to impact their decisions on sourcing intermediate j again although "distance" explanatory variable is added to the model. However, coefficients of RoO Restrict (-0.167, -0.168) are still negative and statistically significant at 1 percent level which again means that these rules have impact on decisions on sourcing and resulting in trade diversions since the dependent variable is difference between change in Mexican imports of good j from non-NAFTA and change in Mexican imports of good j from NAFTA. If RoO Restrict increases one unit , this difference decreases by -0.167 and -0.168 percent according to my replication models. These results corroborate the argument that growth rate of Mexican imports of intermediate good j from non-NAFTA countries is declined with NAFTA when compared to imports from NAFTA countries because of relevant and strict rules of origin. Coefficients of RoO Restrict are -0.167 and -0.168 and they are statistically significant. Coefficients of RoO Restrict are -0.181 and -0.182 and they are statistically significant. It can be argued that all coefficients of new models in this table are consistent with authors' findings and also previous replication models and they robust.

Table 7 (Adding Distance)

NAFTA RoO and Change in Mexican Imports, Triple-Difference Result

	Dependent variable:		
	delta_imports_triple_alt		
	(1)	(2)	(3)
RoO3	0.830***	0.770***	0.740***
	(0.198)	(0.202)	(0.206)
Average Margin NAFTA	0.250***		0.148***
	(0.043)		(0.056)
Exports NAFTA		0.090***	0.070***
		(0.008)	(0.010)
Delta preferential Tariff	-0.310***	-0.254***	-0.266***
	(0.071)	(0.070)	(0.071)
RoO3xAverage Margin NAFTA	-0.093***		-0.049***
	(0.011)		(0.014)
RoO3xExports NAFTA		-0.010**	-0.001
		(0.004)	(0.006)
RoO3xDistance	-0.094***	-0.101***	-0.099***
	(0.021)	(0.021)	(0.021)
Observations	28,702	28,702	28,702
R^2	0.018	0.019	0.020
Adjusted R^2	-0.104	-0.102	-0.102
F Statistic	91.011*** (df = 5; 25535)	101.045*** (df = 5; 25535)	73.976*** (df = 7; 25533)
Note:			*p<0.1; **p<0.05; ***p<0.01

In the column 1 in Table 7, we also have interaction term between RoO3 and distance in addition to interaction term between RoO3 and Average Margin NAFTA. Similarly, we again add interaction term between RoO3 and distance to original model 2 in the paper. In model 3, we have all interaction terms in the regression. According to the results in column 1, coefficient for Average Margin NAFTA is 0.250 (0.254 in the replication and 0.276 in the paper) and it's

statistically significant at 1 percent level. This means that for every one unit increase in Average Margin NAFTA, the dependent variable is expected to increase by 0.250 units, on average. Additionally, interaction term (RoO3 * Average Margin NAFTA) has negative and statistically significant coefficient -0.093 (-0.098 in the replication and -0.103 in the paper). Moreover, interaction term (RoO3 * distance) has negative and statistically significant coefficient -0.094. Hence, it still holds the argument that that the effect of RoO3 on the dependent variable depends on the level of Average Margin NAFTA. Specifically, for every one unit increase in RoO3, the effect on the dependent variable is expected to decrease by an additional 0.093 units for each unit increase in Average Margin NAFTA.

Results in column 2 show that interaction term (RoO3 * distance) has negative and statistically significant coefficient. Additionally, interaction term between RoO3 and Exports NAFTA has a regression coefficient of 0.010 (0.002 in the replication and 0.017 in the paper) .This coefficient still suggests that the effect of RoO3 on the growth rate of imports from third countries to relative to NAFTA partners depends on the level of Exports NAFTA and it means that for every one unit increase in RoO3, the effect on the growth rate of imports from third countries to relative to NAFTA partners is expected to increase by an additional 0.010 units for each unit increase in Exports NAFTA. However, this coefficient is not statistically significant at 1 percent level. Coefficient of Exports NAFTA is 0.90 (0.075 in the replication and 0.123 in the paper) and it's highly statistically significant at 1 percent level. This means that for every one unit increase in Exports NAFTA, the growth rate of imports from third countries to relative to NAFTA partners is expected to increase by 0.90 units, on average which supports findings in the paper.

In column 3, all interaction terms are added. The results show that all explanatory variables have statistically significant at 1 percent level and their signs are consistent with results in column1 and column 2. Overall, these results can be interpreted as the effect of NAFTA rules of origin on Mexican imports of intermediate goods is greater when Mexican final good producers have stronger incentives to comply with them. This is evidenced by larger preference margins , a greater importance of NAFTA partners as export markets and distance. To sum up, these results of NAFTA RoO on Mexican imports and trade-diverting show that authors' results and replication results are robust to including distance variable.

Conclusions

In recent times, the phenomenon of globalization has given rise to a notable escalation in international trade engagements, which has consequently spurred the establishment of multiple free trade agreements (FTAs) between nations. These agreements are intended to foster and ease the practice of free trade by means of curtailing barriers and tariffs, incentivizing foreign investments, and augmenting the accessibility of new markets.

In conjunction with the objective of promoting and facilitating free trade, FTAs often incorporate rules of origin (RoO) provisions. These provisions outline the criteria for determining the origin of goods and products, which is essential for enforcing preferential trade agreements and ensuring that the benefits of the agreement are only conferred to the goods originating from participating countries. According to the early theoretical studies that predict effects of RoOs on trade , RoOs might enhance trade flows and have positive impact on trade diversions. However, further studies show that there are potential drawbacks of incorporating rules of origin (RoOs) provisions in free trade agreements (FTAs). For example, Estevadeordal and Suominen (2008) assert that ROOs can result in increased transaction costs, particularly for small and medium-sized enterprises, leading to a reduction in the volume of trade. Similarly, Kee et al. (2016) contend that RoOs may result in trade diversion, as firms may opt to source inputs from less efficient domestic suppliers to comply with the requirements of the rules. Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini also study on it in their "From Final Goods to Inputs: The Protectionist Effect of Rules of Origin" paper which is the first paper focuses on RoOs impact on trade in intermediate goods. Their empirical strategy is triple-difference approach by assessing three different treatment effects as different types for rules of origin restrictions in NAFTA across products and across countries.

Their findings show that there is a negative effect of NAFTA RoOs on imports of treated goods from non-NAFTA countries and it decreased the growth rate of import from non-NAFTA countries compared to NAFTA-countries by 48 log points on average.

One of the concerns with their analysis is heterogeneity problem. In their analysis, distance between partners is not taken into account and it might create omitted variable bias. Distance is one of the important variable for trade analysis since it tends to be correlated with both the trade flows and the explanatory variables tariffs and rules of origin. Hence, the estimation for effect of rules of origin on trade flows may be biased. If the analysis does not control for distance, then the estimated effect of the FTA on trade flows may be overstated, as some of the increase in trade may be due to the reduction in transportation costs. Additionally, distance may have a direct effect on trade flows that is not captured by the other variables. So distance variable is added to the analysis to check robustness and improve the analysis. Results of extended models with distance variable show that Paola Conconi, Manuel García-Santana, Laura Puccio and Roberto Venturini's analysis provide robust results with their triple-difference model.

To sum up, their paper makes several important contributions to the literature by using sophisticated empirical approach(triple-difference model) to provide empirical evidence of the protectionist effect of RoOs on imports of intermediate inputs and by emphasizing the importance of distinguishing between final goods and intermediate inputs when analyzing the impact of RoOs on trade patterns. Finally, the paper sheds light on the channels through which RoOs affect firms' sourcing decisions and productivity and its findings highlight the need for policymakers to carefully balance the costs and benefits of RoOs.

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