Rules of Origin and the Use of NAFTA

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Abstract

In countries with a Free Trade Agreement, firms can export using the FTA or WTO membership, the former requiring firms to comply with Rules of Origin to avoid paying higher tariffs when exporting. How do RoO affect the use of an FTA? What are the effects of protectionist trade policies? Using Mexican customs data in which we observe if an export used NAFTA, we document (i) How firm size affects its use, where the underlying mechanism is fixed costs of using NAFTA and sourcing from foreign countries, and (ii) The distortion RoO have on firms' input sourcing decisions, where the opportunity cost of complying with RoO depends on firm size. We incorporate these findings into a model of global sourcing in which firms choose to export using NAFTA and from which countries to source their inputs. We structurally estimate these fixed costs and perform counterfactuals that quantify how increases in RoO or Tariffs imply, across all sectors, higher import prices for US consumers, lower profits for Mexican firms, and lower bilateral trade between the USA and Mexico.†

JEL Codes: F12, F13, F15, F23, O19

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†The data used in this paper are confidential and were made available through the Econlab at Banco de México. Inquiries regarding the terms and conditions for accessing this data should be directed to econlab@banxico.org.mx. The views and conclusions in this paper are solely those of the authors and do not necessarily reflect the opinions of Banco de México or its Board of Governors. All errors are our own.

1 Introduction

Ever since the creation of the WTO in 1995, there has been a proliferation of Free Trade Agreements (FTA) around the World; a term coined as the *Spaghetti Bowl Effect* by Bhagwati (1995) to describe how international trade is nowadays dominated by regional agreements instead of relying on multilateral organizations such as the WTO. Figure 1 shows the cumulative number of FTAs around the World for the last 50 years. Because FTAs are established between a small set of countries, members have disproportional negotiating power, which could result in FTAs adopting discriminatory trade policies.

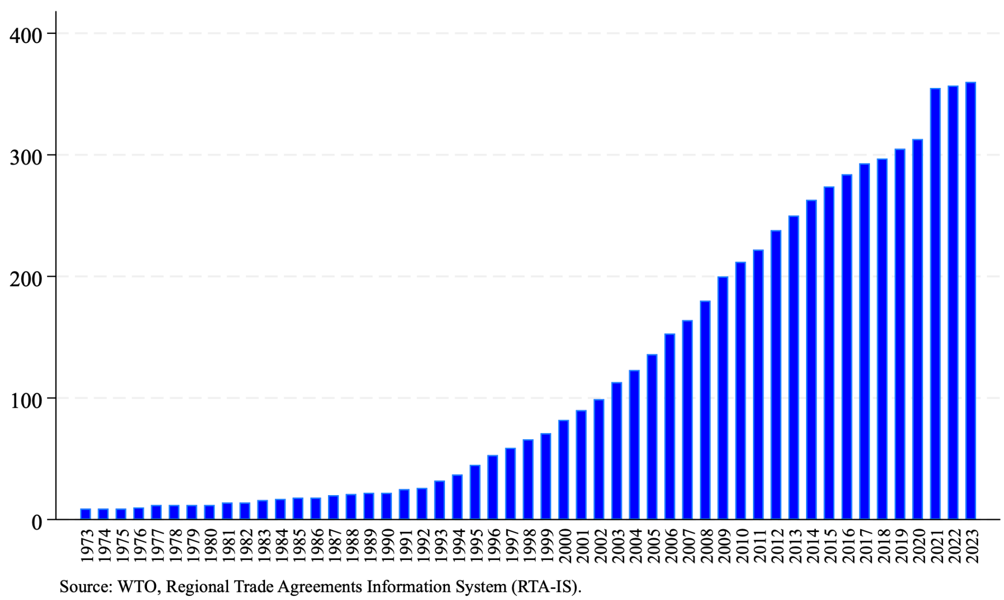


Figure 1: Cumulative number of active FTAs.

One of these policies are Rules of Origin (RoO), defined by the WTO as *"the criteria needed to determine the national source of a product"*. These are implemented to avoid third countries taking advantage of an FTA, and to protect local industries by forcing domestic firms to source their intermediate inputs from member countries. RoO are highly pervasive, Kniahin and De Melo (2022) find that at least 62% of FTAs contain them. Although how RoO are implemented varies across FTAs, most of the ones in NAFTA were expressed as *HS Classification Changes* as documented by Conconi et al. (2018). This type of RoO specifies for each product which inputs must be sourced from suppliers within NAFTA countries, based on the HS codes of both the final product and its intermediate inputs[1].

[1]For example, under this type of RoO, a firm exporting a product with HS code 85 has to source all inputs belonging to the same HS code 85 from NAFTA countries, while any other input can be freely sourced from around the World.

This paper studies how RoO affect firms' use of NAFTA to export. We assemble a unique dataset for the universe of Mexican exporters in which we observe whether they used NAFTA or WTO membership for their exports to the USA. We also observe their sourcing choices, i.e., which inputs Mexican firms import from which foreign countries. We combine data for the RoO[2] firms had to comply with if using NAFTA with data for the exact input composition of final products, which results in a product-level measure of RoO Strictness, interpreted as the share of a product's inputs restricted to be sourced from within NAFTA countries. Lastly, we use data on the MFN Tariffs the USA applies to importers, i.e., the tariffs a Mexican firm would have to pay if it uses WTO membership to export, representing the benefit of using NAFTA. Our dataset thus captures firm behavior regarding the use of NAFTA and input sourcing, and the costs and benefits of using NAFTA to export.

We begin by documenting empirical facts present in the data. First, we show a positive correlation between RoO Strictness and MFN Tariffs. This implies that firms face a tradeoff when choosing NAFTA or WTO for their exports, i.e., whenever the benefit of using NAFTA is high because firms can avoid paying high tariffs, the cost of using NAFTA is also high as they have to source a larger share of their inputs from NAFTA countries, which might not be the best suppliers of these inputs. Second, we uncover an inverse U-relationship between firm size and the use of NAFTA, i.e., small and large firms use NAFTA less intensively than medium-sized firms. We theorize that smaller firms use NAFTA less often as they should be constrained by the fixed costs of using the FTA, while large firms can source their inputs from suppliers around the World, making RoO costly to comply with. This reasoning introduces the key mechanism in our paper: the opportunity cost of complying with RoO is increasing in firm size. By exploiting cross-sectional differences in RoOs and MFN Tariffs across the firm size distribution, we provide evidence of the existence of fixed costs of using NAFTA and sourcing inputs from foreign countries.

Third, we quantify the extent to which RoO distort firms' sourcing choices. We regress the probability that a firm sources inputs from non-NAFTA countries against deciles of firm size, controlling for industry and time fixed effects to account for any industry-specific factors that might affect these choices, e.g., for some industries, it is more attractive to source their inputs from China. We estimate this relationship separately for firms exporting using either NAFTA or WTO. Results show that across all firm sizes, using NAFTA to export decreases the probability of sourcing from non-NAFTA countries, consistent with compliance with RoO. This decrease also follows an inverse U-shape relationship with firm size, again suggesting that fixed costs are relevant for the effect of RoO on firm behavior.

[2]We only consider RoO defined in terms of *HS Classification Changes* and restrict our sample to products for which firms have to comply if they choose to use NAFTA to export.

Using NAFTA has little impact on small firms; however, the effect increases with size as RoO become binding. Interestingly, the distortion decreases for the largest firms, as their import volume is large enough for them to still find it profitable to import from non-NAFTA countries even if restricted by RoO.

We incorporate these findings into a workhorse model of global input sourcing, extending it to include the use of NAFTA and featuring RoO and MFN Tariffs. For the demand side, we assume US consumers value imported Mexican varieties across different industries. For the supply side, firms in Mexico can choose whether to export to the USA using NAFTA or WTO membership, the former forcing them to comply with RoO while the latter requires them to pay MFN Tariffs. Final good firms in Mexico are monopolistically competitive and require a continuum of intermediate inputs that they can source from suppliers around the World. These suppliers sell at marginal cost, which depends on unit-labor costs assumed to follow a Fréchet distribution. We introduce RoO by assuming that a share of a firm's inputs can only be sourced from NAFTA countries. Furthermore, we assume there are fixed costs of using NAFTA and sourcing from foreign countries. In our model, the larger a firm is, the greater the set of foreign countries from which it could be sourcing inputs, thus facing larger increases in the price of inputs resulting from compliance with RoO whenever they choose to use NAFTA. Final good firms are heterogeneous in terms of the RoO and MFN tariffs they face, their fixed costs of using NAFTA and sourcing from foreign countries, and their productivity, which is randomly drawn from a Pareto distribution.

We present comparative statistics for the probability a firm uses NAFTA to export. Higher RoO decrease this probability, while higher MFN Tariffs increase it. Likewise, a firm is more likely to use NAFTA to export if its fixed cost is lower, while less likely to do so whenever the costs of sourcing from foreign countries are higher. One might think that if NAFTA countries are good suppliers of a firm's inputs, it is more likely a firm chooses to use NAFTA as the opportunity cost of RoO is lower. We argue this is not necessarily the case, as cheap inputs from NAFTA countries could provide a firm with enough revenue to source inputs from non-NAFTA countries, thereby decreasing the probability it chooses NAFTA to export. This example shows the complex mechanisms captured in our model and motivates its estimation to quantitively evaluate the effect RoO have on firm behavior.

We estimate our model in three distinct stages. First, we take some parameters from the literature while calibrating others. Second, we estimate at the industry level how attractive it is for a firm to source its inputs from a set of foreign countries. Third, we use *Simulated Method of Moments* to estimate US market demand and the fixed costs of using NAFTA and sourcing from foreign countries, leveraging on observed sectoral variation in the use of NAFTA and import behavior, among other moments. For this last step of the estimation, we feed into our model the RoO and MFN Tariffs that, according to the data, each simulated firm within an industry-sector would either have to comply with or pay.

We conduct policy-relevant counterfactual scenarios where we quantify whether the USA and Mexico would benefit from a set of policy changes. We focus our attention on three key variables policymakers are likely to care about: For those in the USA, we study US exports of intermediate goods to Mexico and US consumer prices for Mexican imports. For Mexican policymakers, we study the change in firm profits. We explore the sectoral heterogeneity in these effects and argue it depends on the firm size composition of each sector, consistent with our discussion of how firm size impacts the opportunity cost of RoO.

The first counterfactual we explore is the transition from NAFTA to USMCA[3] by assuming the new agreement implied an overall increase of 25%[4] in the RoO faced by Mexican firms. Results suggest that because of this policy change, US exports decreased on average by 1.24%, US prices increased 0.25%, and Mexican firm profits decreased by 1.08%. The second counterfactual we simulate is a situation in which all Mexican imports pay at least a 5% tariff, following a proposal by the US government in 2019. If this policy had been implemented, our model predicts US exports would have decreased by 12.7%, US prices would have increased by 5.28%, and Mexican firm profits would have decreased by 12.45%. These counterfactuals suggest these protectionist trade policies are detrimental to the USA and Mexico. The last counterfactual we explore is what would have happened if NAFTA had instead removed RoO on all products, while still having fixed costs of using NAFTA and MFN Tariffs. Results suggest that US exports would have increased by 6.36%, US prices would have decreased by 1.43%, and Mexican firm profits would have been 7.15% higher.

This paper is related to several branches of the literature. First, on the impact of trade liberalization and Free Trade Agreements. Seminal papers on this topic are those by Trefler (2004), Romalis (2007), Arkolakis et al. (2008), Bustos (2011), Ossa (2011), Antràs and Staiger (2012), Kehoe and Ruhl (2013), Caliendo and Parro (2015), De Loecker et al. (2016), among others. Our contribution to this literature is that, to the best of our knowledge, this is the first paper to provide evidence on which firms are using NAFTA to export, and how this depends on firm characteristics such as their size and industry.

Second, our paper builds on the literature on global sourcing decisions, where notable papers are those by Antras and Helpman (2004), Goldberg et al. (2010), Rodríguez-Clare (2010), Garetto (2013), Kee and Tang (2016), Tintelnot (2017), Bernard et al. (2018), and Head and Mayer (2019). Our model extends the one built by Antras et al. (2017) in which

[3]On July 1st, 2020, the United States-Mexico-Canada Agreement (USMCA) replaced the NAFTA agreement, which had been in place since January 1st, 1994.

[4]This is a simplifying assumption as in reality the increase in RoO was heterogeneous across industries. This increase is close to that experienced by the automobile sector which has been well documented by the media.

the authors develop a model of global sourcing in which firms choose the set of countries from which they can import their inputs. Final-good producers compete monopolistically, and suppliers around the World sell intermediate goods at marginal cost. The authors use their estimated model to show how sourcing decisions change as a response to China's entry into the WTO. We adopt this framework but assume domestic firms are exporting to the USA, either using NAFTA or WTO membership. RoO are introduced by assuming that a share of a firm's inputs can only be sourced from the cheapest supplier within NAFTA countries, while MFN Tariffs impact marginal cost directly if a firm uses WTO to export.

Third, our paper speaks directly to the literature on content protection and the effects RoO have on firm behavior, starting with the work by Dixit and Grossman (1982), Grossman and Helpman (1992), and Krishna and Krueger (1995). More recent papers on this topic are those by Ju and Krishna (2005), Anson et al. (2005), Deardorff (2018), Krishna et al. (2021), Acosta and Leal (2022), and Ornelas and Turner (2023). Our work is closely related to that by Conconi et al. (2018) where using country-level data, the authors find that the more restricted an input became under RoO, the larger the extent to which Mexico substituted sourcing it from non-NAFTA countries towards NAFTA countries. Our firm-level analysis confirms these effects; across the firm size distribution and controlling for industry fixed effects, the probability that a firm sources inputs from non-NAFTA countries is lower whenever a firm uses NAFTA to export. Head et al. (2022) also build a model of input sourcing and compliance with RoO, which the authors calibrate to the automobile industry in North America; allowing them to characterize a Laffer Curve relationship between RoO and the amount of regional content in exports. While our paper is similar to theirs in spirit, as stricter RoO increase the opportunity cost of using NAFTA to export and potentially decrease its use, our work contributes by accounting for fixed costs of using NAFTA and sourcing from foreign countries. These fixed costs imply that the opportunity cost of complying with RoO depends on firm size; therefore differences in firm size across sectors result in different responses to changes in RoO and trade policy.

The rest of the paper is organized as follows. Section 2 describes the data sources we use and how we combine them to construct a dataset capturing firm behavior and the costs and benefits of using NAFTA to export. In Section 3, we show empirical facts we observe in the data, as well as conduct reduced-form estimations to uncover the main mechanisms we describe through the paper. Section 4 develops our structural model for the use of NAFTA and firms' choice of complying with RoO. Section 5 details the estimation of our model, while Section 6 presents the counterfactual scenarios we explore with our estimated model. Section 7 acts as a conclusion to the paper and discusses our main findings.

2 Data

This section describes the data we use in this paper, with which we create a unique dataset containing firms' choices regarding their use of NAFTA and their sourcing decisions, as well as the product-level costs and benefits of using NAFTA to export.

First, we use highly detailed customs data for Mexico from the country's Central Bank, Banco de México, containing the universe of exports and imports at the transaction level. For every transaction, we observe its product at the HS 6-digit level, trade value, the origin/destination of the transaction, and whether the transaction was classified as an intermediate or final good. The crucial aspect of this data is that we also observe whether the transaction used NAFTA or WTO membership if it was an export to the USA; that is, we observe if RoO restricted a firm in terms of its input sourcing. Our sample period is between September 2014 and June 2020, as the former is the first month for which the NAFTA usage information is available, and the latter is the last month before the transition to USMCA.

An observation in our sample is a firm-product-year-month combination. This paper studies firms that import their intermediate inputs from around the World, assemble a final product in Mexico, and export it to the USA. For this reason, we only include in our sample transactions for either exports of final goods to the USA or imports of intermediate goods from any country around the World. Since we are treating the use of NAFTA as a binary choice, we discard firms that export the same product using both NAFTA and WTO in the same time period. This is justified as whenever a firm uses both NAFTA and WTO to export the same product, the WTO transaction is of very small value i.e. *de minimis value*. Lastly in terms of our customs data, we exclude from our sample firms for which the total value of their exports to all destinations is lower than the total value of their imports to all destinations. The reason for this is that we can not identify firms that are either trade intermediaries or mostly sell their products in the domestic market. Since our paper is about how RoO restrict final-good producers when exporting to the USA, this assumption while admittedly strong, should in fact help us identify the type of firms we are interested in.

Second, we use NAFTA's RoO contained in NAFTA's Annex 401 documentation, which details the exact RoO applied to each product at the HS 6-digit level. The data we use comes from Conconi et al. (2018), which the authors have generously publicly provided. As these authors point out, most of NAFTA's RoO are defined in terms of *HS Classification Changes*; however, there are some products for which exporters can choose whether to comply with these RoO or with an alternative Value-Added rule. Their database contains information on exactly for which HS 6-digit codes this is the case, and thus, we restrict our sample to products without an alternative Value-Added rule. Firms in our sample have to comply with

RoO if they want to use NAFTA to export their products.

Third, we again follow the work by Conconi et al. (2018) and use BEA's 1997 IO Tables, in particular, the Direct Requirements Table[5]. While the authors compute the number of final goods for which RoO restrict the sourcing of a particular input, we use this data to study the number of restricted inputs for each output as these tables provide products' input composition. Matching the RoO data with the IO Tables is not straightforward, as the former uses the *Harmonized System* (HS) classification system, while the latter uses the 1997 version of the *North American Industry Classification System* (NAICS). Correspondence tables between these two classification systems are readily available, however the match is of the many-to-many type i.e. a NAICS code can match to multiple HS 6-digit codes, and an HS 6-digit code can match to multiple NAICS codes. Whenever a NAICS code for an input corresponds to more than one HS code, we uniformly distribute the direct requirement coefficient, i.e. how much does a particular output use of a given input, across all of its corresponding HS codes. This procedure yields a correspondence table where outputs are defined in NAICS, inputs are defined in HS, and the shares across inputs each output uses add up to one. Lastly, whenever an HS code for an output corresponds to more than one NAICS code, we take the average of the direct requirement coefficients across all the NAICS codes corresponding to this particular HS 6-digit code. The end-product of this computation is the exact input composition of every product at the HS 6-digit level.

We combine these last two data sources, RoO and IO Tables data, to compute a product-level measure of RoO Strictness. Since we know the input intensity of every product, and we know exactly which of their inputs are restricted to be sourced exclusively from within NAFTA countries, our measure of RoO Strictness is defined as the share of a product's inputs that have to be sourced from NAFTA countries if a firm chooses to use NAFTA. An hypothetical example is the following: According to IO Tables, *Product 1* uses 60% of *Input 1*, and 40% of *Input 2*. According to NAFTA's RoO, whenever a firm wants to export *Product 1* to the USA using NAFTA, *Input 2* has to be sourced exclusively from NAFTA countries, while *Input 3* can be freely sourced from around the World. These numbers imply that the RoO Strictness of *Product 1* is 60%. We compute this measure for every product Mexican firms exported to the USA during our sample periods.

The last data source we use in this paper are the MFN Tariffs contained in the USA's Harmonized Tariff Schedule for 2022. Since the preferential rate for exports using NAFTA is 0%, MFN Tariffs represent the preferential margin a firm gets whenever it chooses to comply with RoO. As such, we interpret MFN Tariffs as the benefit of using NAFTA to export, where

[5]We assume that the 1997 IO Tables are still applicable for the years in our sample, and that these tables are applicable for Mexican firms i.e. production technology is comparable between the USA and Mexico.

the higher the tariff a firm would pay if it uses WTO membership to export, the greater the incentive of using NAFTA. We assume that the tariffs contained in the 2022 HTS apply to all periods in our sample, as anecdotal evidence suggests there was little variability in these tariffs across time. We use this data to restrict our sample in two significant ways: (i) Only keep products for which tariffs are defined in ad-valorem terms, as we want them to be comparable across product types.[6] (ii) Only keep products with strictly positive tariffs. Firms whose exported products did not have a positive tariff should have no incentives to use NAFTA, as they would have no benefit of doing so.

Our final sample includes 410 HS 6-digit products within 48 different HS 2-digit industries, and 9,918 unique firms exporting final goods to the USA. An illustrative example of our data is the following: In our customs data we observe that *Firm A* exported *Product 1* to the USA, imported *Input 1* from the USA, and imported *Input 2* from China, we also know that *Firm A* used NAFTA to export. From the IO Tables we know *Product 1* is made 40 % of *Input 1*, 40 % of *Input 2*, and 20 % of *Input 3*.[7] From RoO data, we know that if a firm uses NAFTA to export *Product 1*, then it has to source *Input 1* and *Input 3* from NAFTA countries, which implies that the RoO Strictness of *Product A* is 60%. Lastly, HTS data tells us that whenever a firm exports *Product A* to the USA using WTO, it has to pay a 10% ad-valorem tariff. Combining these data sources, we have complete information on firms' choices regarding their use of NAFTA and input sourcing, and on the benefit and some of the costs of using NAFTA to export; the latter as the treaty imposed other costs on firms, which will be discussed in the next section.

3 Empirical Facts

This section aims to show and test empirical facts observed in the data, emphasizing how they are reflected in our structural model. Our first empirical fact is shown in Figure 2, where we show the correlation between RoO Strictness and MFN Tariffs. We compute the average at the HS 2-digit level, which through this paper, will represent an industry. The correlation is equal to 0.54 and reflects the fact that across all industries, firms are facing a tradeoff when using NAFTA vs. using WTO to export, e.g. if a firm has high incentives of using NAFTA as it can avoid paying a high tariff, it also faces a high cost of using it as the RoO on its product will be high as well. This implies firms are deliberately evaluating

[6]An example of a non-ad-valorem tariff is US dollars per pound. Then, a pound of cabbages should not have the same value as a pound of steel, which implies that if we did not exclude non ad-valorem tariffs we would not be capturing the extent to which these tariffs represent a significant cost to exporters.

[7]As this example suggests, the input composition of final-goods from the IO Tables combined with import data implicitly provides information on which inputs Mexican firms should be sourcing domestically.

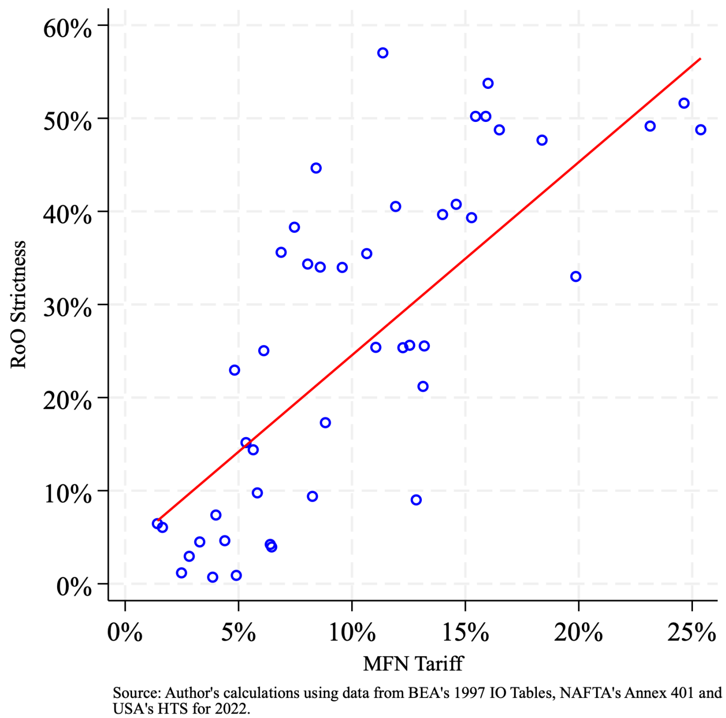


Figure 2: Correlation between RoO Strictness and MFN Tariffs.

whether it is worth it to be restricted in terms of the sourcing of their inputs to avoid paying a MFN Tariffs.

Empirical Fact 1 *There is a positive correlation between RoO Strictness and MFN Tariffs.*

Second, in Figure 3 we show how the use of NAFTA depends on firm size. We proxy firm size by computing average monthly total exports to all destinations. We divide firms into percentiles of size and for each one of these, compute the share of firms that export using NAFTA. One might think that larger, thus more productive, firms should be the ones using NAFTA more intensively, however, this relationship follows an inverse u-shape i.e. small and large firms use NAFTA less intensively than medium-sized firms. While it is intuitive that small firms are using NAFTA less intensively, as they should be less able to pay its fixed cost, it seems counterintuitive that the largest firms are also not intensively using NAFTA. Large firms are the ones that have access to international input markets, and thus it is costlier for them to export under NAFTA because of RoO. For them, paying MFN Tariffs could be cheaper than switching to input suppliers from NAFTA countries. In summary, the inverse U-shape relationship should be explained by fixed costs of using NAFTA to export and sourcing from foreign countries; the latter documented in Antras et al. (2017).

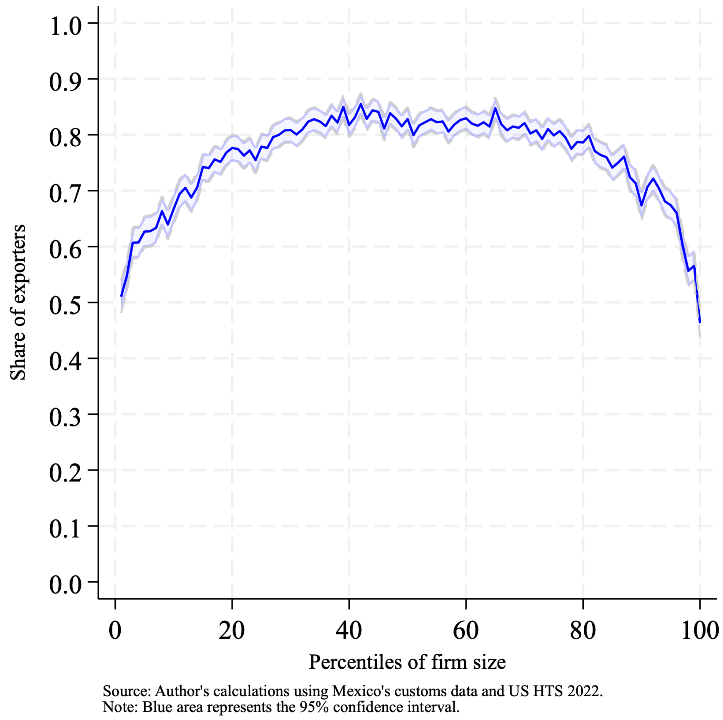


Figure 3: Share of exporters using NAFTA by size percentile.

Using NAFTA to export not only required complying with RoO but also with labor, environmental, and health regulations. Exporters also need to learn how to use the FTA and keep track of the sourcing of their inputs by presenting a *Certificate of Origin*.[8] We consider all of these part of a fixed cost of using NAFTA to export, as documented in Demidova et al. (2012), Cherkashin et al. (2015), and Krishna et al. (2021). Fixed costs of sourcing from foreign countries should capture the costly process of a Mexican firm finding a foreign supplier, them agreeing on product characteristics, etc.

Small firms should be less able to pay the fixed cost of NAFTA, and therefore use it less intensively. Then, as firms get larger they can pay this fixed cost, so NAFTA usage increases. The intuition for why when firms are large enough, they use NAFTA less intensively lies at the core of this paper. If there are fixed costs of sourcing, then a firm's ability to pay them because of its size will directly impact the opportunity cost of complying with RoO. Medium-sized firms should not be able to source from many foreign countries, therefore their cost of being restricted by RoO is not very high. In comparison, a large firm can source inputs from many different countries across the World, so being restricted by RoO is very costly for it.

[8]A document required under NAFTA to certify that a good being exported qualifies as an originating good, and thus qualifies for preferential tariff treatment.

Empirical Fact 2 *The relationship between the use of NAFTA and firm size follows an inverse U-shape.*

This intuition is challenged by the possibility that the inverse u-shape relationship is not actually driven by firm size, but rather by selection into sectors i.e. small and large firms do not use NAFTA less intensively because of their size, but rather because these firms are in industries in which the incentives of using NAFTA are lower. Using LPM, we regress an indicator variable equal to one when a firm uses NAFTA against deciles of firm size:

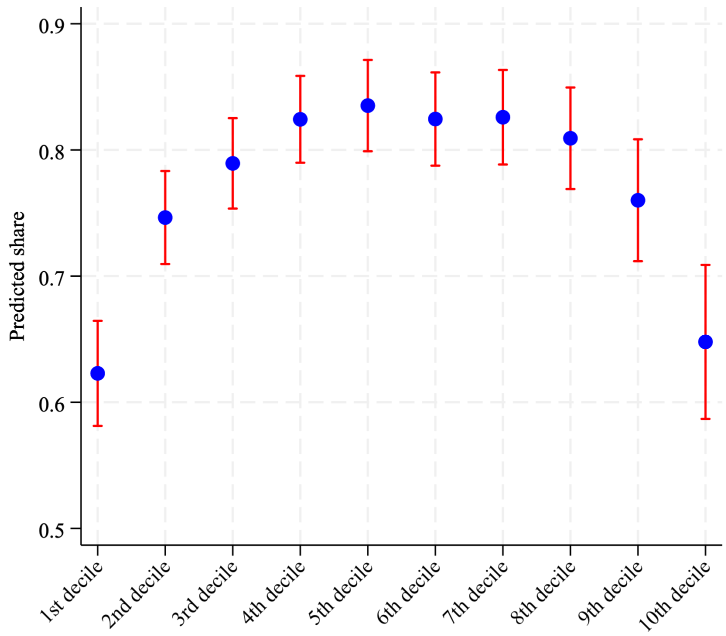
$$\mathbb{N}_{ikjt} = \beta_0 + \sum_{k=2}^{10} \beta_k \mathbb{I}_{ikt} + \alpha_1 \mathrm{RoO}_j + \alpha_2 \mathrm{MFN}_j + \iota_t + \epsilon_{ikjt} \tag{1}$$

where $\mathbb{N}_{ikjt} = 1$ if firm i of size k exporting product j at time t is using NAFTA to export, $\mathbb{I}_{ikt} = 1$ if the firm belongs to size decile k where deciles are computed as described for Figure 3. To account for the product-level incentives of using NAFTA, we control for RoO_j, which is the share of restricted inputs for product j if using NAFTA, and MFN_j which stands for product j's ad-valorem tariff if using WTO. Finally, we include time fixed effects ι_t to control for any variation at the time level e.g. over time fixed costs of sourcing from foreign countries have decreased, changing the costs of complying with RoO.

Figure 4 shows how the estimated coefficients for intercepts $\hat{\beta}_0 + \hat{\beta}_k$ change across size deciles k, while the estimation tables are shown in Appendix B. In the figure, the x-axis shows the deciles of firm size and the y-axis shows the predicted share of firms using NAFTA, assuming $\mathrm{RoO}_j = 0$ and $\mathrm{MFN}_j = 0$ for simplicity as we are interested in the direct effect that firm size has over the use of NAFTA. These results suggest firm size does in fact explain the use of NAFTA, even after controlling for the product-level costs and benefits of it.

Robustness checks are described in Appendix B. In particular, we show that the inverse U-shape relationship between the use of NAFTA and firm size is robust to: (i) Including industry fixed effects, which account for any industry-level heterogeneity including RoO and MFN Tariffs, (ii) Different specifications and proxies for firm size, (iii) Excluding certain industries from our sample, which could be those in which firms that are either part of GVCs or Maquilas concentrate, and (iv) Removing one industry at a time, showing results are not driven by a particular industry.

We argue this relationship is driven by fixed costs of using NAFTA and sourcing from foreign countries. If there were no fixed costs, the likelihood of two firms in the same industry, one small and one large, of using NAFTA should be the same, as both the benefit and cost of using NAFTA scale up with size; the benefit being an ad-valorem tariff and the cost that of complying with RoO which affect marginal cost. If fixed costs are present then these two firms of different sizes should not respond to RoO and MFN Tariffs in the same way. For



Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Red intervals indicate the 95% confidence interval. Standard errors are clustered at the firm-level.

Figure 4: Predicted share of exporters using NAFTA by size decile.

example, even if the small firm faces a higher MFN Tariff which intuitively would make it more likely to use NAFTA, the fixed costs could constraint it from doing so, resulting in MFN Tariffs not having a significant effect on the use of NAFTA for small firms. On the other hand, for two large firms with different MFN Tariffs, the firm with a higher tariff should be more likely to use NAFTA to export as the benefit for this firm is higher and it is not constrained by the fixed cost.

The same story goes for the effect of RoO. Fixed costs of sourcing should constrain small firms, therefore, a small firm facing high RoO should be equally as likely to use NAFTA as a small firm facing low RoO; small firms' inability to source from foreign countries implies a low opportunity cost of RoO and thus differences in RoO do not translate into differences in the use of NAFTA for small firms. On the other hand, for two large firms not constrained by these fixed costs of sourcing, the firm facing higher RoO should have a lower probability of using NAFTA to export as RoO effectively restrict its input sourcing strategy.

To test this, we again estimate how the probability of a firm using NAFTA to export depends on deciles of firm size, as in Equation 1, but allowing the slope with respect to RoO and MFN Tariffs to vary across firm sizes:

$$\mathbb{N}_{ikjt} = \beta_1 + \sum_{k=2}^{10} \beta_k \mathbb{I}_{ikt} + \alpha_1 \text{RoO}_j + \sum_{k=2}^{10} \alpha_k \mathbb{I}_{ikt} \times \text{RoO}_j + \gamma_1 \text{MFN}_j + \sum_{k=2}^{10} \gamma_k \mathbb{I}_{ikt} \times \text{MFN}_j + \iota_t + \epsilon_{ikjt} \tag{2}$$

where again $\mathbb{N}_{ikjt} = 1$ if firm i of size k exporting product j at time t is using NAFTA to export, and $\mathbb{I}_{ikt} = 1$ if the firm belongs to size decile k. In this regression, we are interested in the absolute value of slope coefficients $\hat{\alpha}_0 + \hat{\alpha}_k$ and $\hat{\gamma}_0 + \hat{\gamma}_k$ across firm deciles k. If the absolute value of these slope coefficients weakly increases with size, it is evidence of fixed costs of using NAFTA and sourcing from foreign countries being the driving mechanism behind the relationship of the use of NAFTA and firm size.

Figures 5 and 6 show the estimated slopes by firm size. We can observe in Figure 5 that RoO do not have a significant effect on the use of NAFTA for small firms, while the larger the firms, the greater the effect of RoO on their use of NAFTA. The same story is true for the effect of MFN Tariffs as shown in Figure 6. MFN Tariffs do not significantly affect the probability that small firms use NAFTA to export, but the larger the firm is the larger the positive effect that a higher MFN Tariff would have over its probability of using NAFTA. We interpret these results as evidence of fixed costs of using NAFTA and sourcing from foreign countries being present. The full details of this estimation are contained in Appendix B.

Empirical Fact 3 *The effects of RoO and MFN Tariffs are increasing with firm size.*

Our fourth empirical fact is that of Figure 7 which shows the share of exporters sourcing inputs outside of NAFTA countries by firm size. An exporter sources outside of NAFTA countries if we observe imports of intermediates coming from countries other than the USA or Canada. The relationship is increasing with firm size, consistent with the literature, and again suggests the presence of fixed costs of sourcing.

One might ask how is the use of NAFTA reflected in this figure, as firms using it have to comply with RoO which should generate a distortion in their sourcing decisions i.e. if a firm chooses to export using NAFTA, it is less likely that the firm will pay the fixed cost of sourcing from non-NAFTA countries as it would only be able to source a share of their inputs from these. For this purpose, we estimate how firm size affects the probability that a firm sources inputs outside of NAFTA countries:

$$\mathbb{S}_{ikst} = \beta_0 + \sum_{k=2}^{10} \beta_k \mathbb{I}_{ikt} + \iota_{st} + \epsilon_{ijt} \tag{3}$$

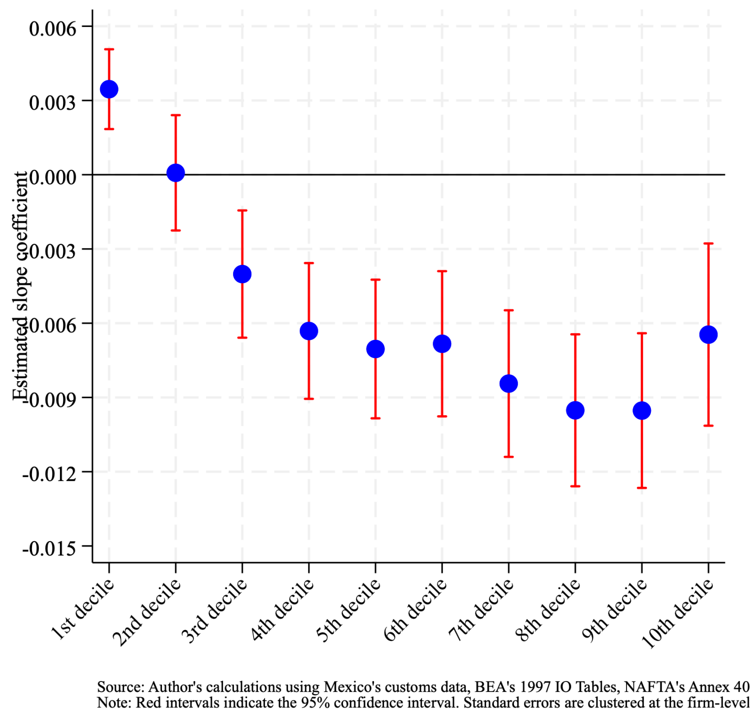


Figure 5: Marginal effect of RoO Strictness on NAFTA usage.

where $\mathbb{S}_{ikst} = 1$ if firm i of size k from industry s at time t sources inputs outside of NAFTA countries. We control for any unobservables by including industry and year fixed-effects ι_{st}, e.g. for a particular industry it might be more attractive to source from China as this country is a good supplier of its inputs. As we are interested in studying the effect of RoO on these sourcing decisions, we estimate this relationship separately for firms using either NAFTA or WTO membership to export.

Figure 8 shows for each size decile the estimated coefficients $\hat{\beta}_0 + \hat{\beta}_k$ for exporters either using NAFTA and WTO. We are interested in the gap between NAFTA and WTO coefficients, which we interpret as the distortion in sourcing choices induced by RoO. The gap is increasing with size, building to the narrative of the opportunity cost of RoO being increasing with size. The figure shows RoO do not create much of a distortion for smaller firms as these are less able to pay the fixed costs of sourcing from foreign countries; thus a small firm is not likely to source outside of NAFTA countries regardless of whether it is using NAFTA or not. As firm size increases, the ability of firms to pay these fixed costs increases, leading to RoO creating a larger distortion in terms of input sourcing. Interestingly, the gap in the estimated coefficients decreases for the 10th decile. We interpret this as a result of the import volume the largest firms have, i.e. the largest firms purchase such a large quantity of inputs that even if restricted by RoO, they still find it profitable to source

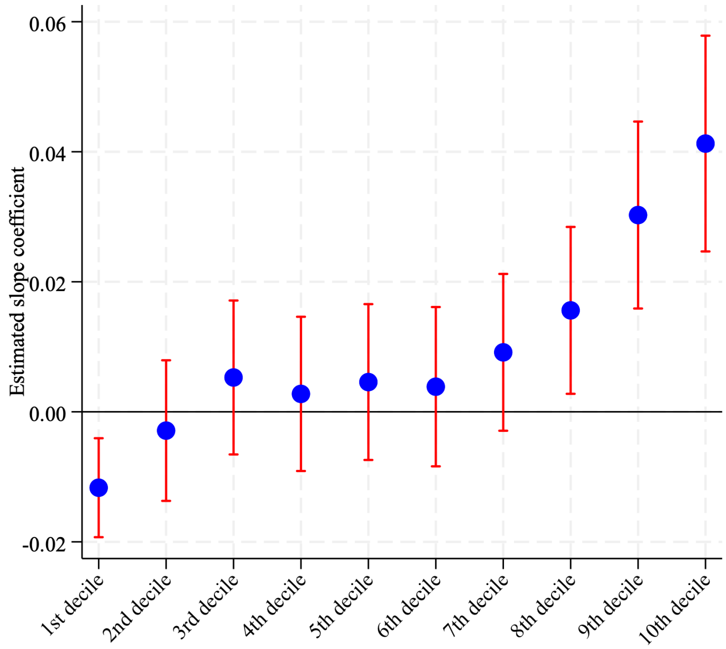


Figure 6: Marginal effect of MFN Tariffs on NAFTA usage.

from a non-NAFTA country. For example, even if a car manufacturer can only buy from non-NAFTA countries its screws, it plans to buy millions of them so it is still profitable to pay the fixed cost and source them from the best supplier in the World.

Empirical Fact 4 *The distortion in input sourcing decisions created by RoO follows an inverse U-shape.*

Full results for the estimation of Equation 3 are included in Appendix B. We also conduct the same robustness checks as that for Equation 1, namely trying different specifications and proxies for firm size, and showing our results are not driven by a specific industry; addressing concerns on the potential biases introduced in our estimates coming from firms being part of either GVCs or Maquilas.

4 A Model of Rules of Origin and NAFTA Usage

Our model extends the one built in Antras et al. (2017) to include RoO and the choice of using NAFTA to export. The key elements of their model are CES preferences over varieties and monopolistic competition final good producers, as developed in Melitz (2003). Each

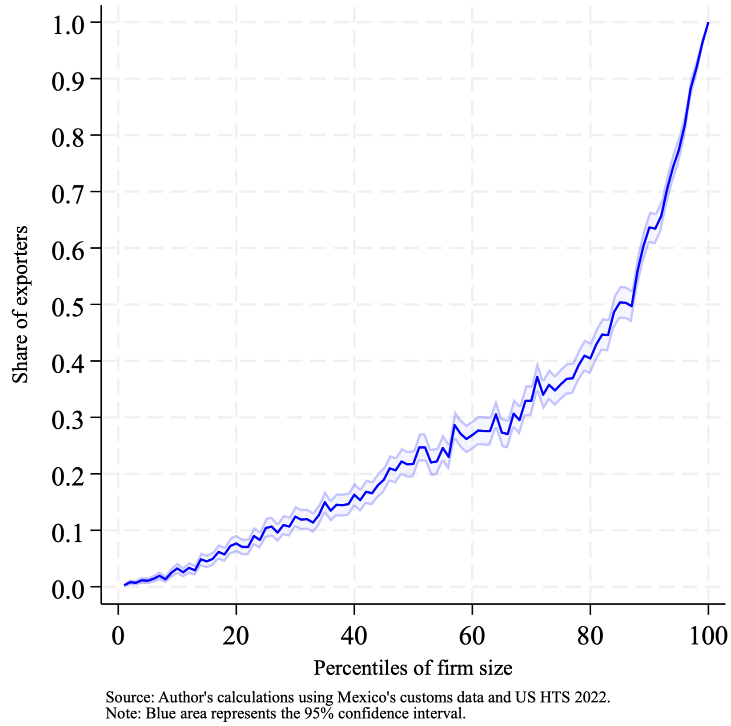


Figure 7: Share of exporters sourcing outside of NAFTA by size percentile.

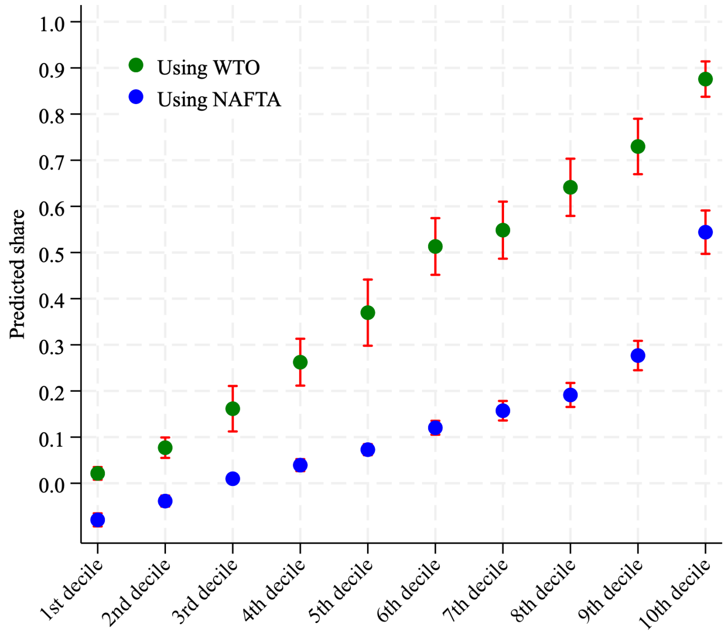
variety uses a continuum of intermediate inputs $\nu \in [0, 1]$, with competitive global suppliers, as in Eaton and Kortum (2002). Final good producers choose from which countries they can source their inputs, their *sourcing strategy*, by paying a fixed cost of sourcing. While their work assumes no trade in final goods, we assume Mexican firms are exporting their final goods to the USA.

Firms also choose whether they export using NAFTA or WTO membership, the former requiring them to comply with RoO which restrict firms to source a share of their inputs exclusively from the NAFTA countries in their sourcing strategy. To make use of the richness of our product-level data on RoO Strictness and MFN Tariffs, we add sectors and industries in our model, following the work by Chor (2010).

4.1 US Consumers

Let N be the set of NAFTA countries. We assume consumers in the USA value consumption of domestic good D and Mexican varieties ω across distinct industries and sectors.

$$U = D^{1-\eta} \prod_{s=1}^{S} \Big[\sum_{i=1}^{I_s} \Big(\int_{\omega \in \Omega_{si}} q_{si}(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \Big)^{\frac{\sigma(\epsilon-1)}{\epsilon(\sigma-1)}} \Big]^{\frac{\alpha_S \eta \epsilon}{(\epsilon-1)}} \tag{4}$$



Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Red intervals indicate the 95% confidence interval. Standard errors are clustered at the firm-level.

Figure 8: Predicted share of exporters sourcing outside of NAFTA by size decile.

Domestic good D is meant to capture all non-Mexican products. There is an S number of sectors, and an I_s number of industries within these. Ω_{si} represents the set of varieties of sector s and industry i being exported to the USA. σ is the elasticity of substitution across varieties of a given industry, while ϵ is across industries within a given sector. For simplicity, we assume these elasticities are the same across all industries and sectors. Consumers at the USA spend a $\eta \in [0, 1]$ share of their income in Mexican imports, and a $1 - \eta$ share in domestic good D. Finally, we assume consumers spend an α_s share of their total expenditure in Mexican imports of sector s, where:

$$\sum_s \alpha_s = 1$$

Consumers maximize their utility in Equation 4 subject to their budget constraint:

$$D + \sum_{s=1}^{S} \sum_{i=1}^{I_s} \Big(\int_{\omega \in \Omega_{si}} q_{si}(\omega) p_{si}(\omega) d\omega \Big) = E \tag{5}$$

where E represents the total income/expenditure of the USA, and $p_{si}(\omega)$ stands for the price of variety ω of industry i from sector s. We assume domestic good D acts as a numeraire, and thus the price of a Mexican variety $p_{si}(\omega)$ is expressed relative to it.

Solving the consumer's optimization problem, demand faced at the USA by firm of variety ω is given by:

$$q_{si}(\omega) = \frac{\alpha_s \eta E P_{si}^{\sigma-\epsilon}}{\sum\limits_{k} P_{sk}^{1-\epsilon}} p_{si}(\omega)^{-\sigma} \tag{6}$$

where $P_{si}^{1-\sigma} \equiv \int_0^1 p_{si}(\omega)^{1-\sigma} d\omega$ is the Dixit-Stiglitz ideal price index for industry i of sector s. Demand for variety ω is increasing in the expenditure level at the US, and increasing in either the share of expenditure spent in Mexican imports η or the share α_i of total expenditure in Mexican imports spent on industry i. Imposing the restriction $\sigma > \epsilon$, as demand should be more elastic within an industry than across them, yields that demand is increasing in the ideal price index, and decreasing in price as $\sigma > 0$.

4.2 Mexican Firms

To introduce RoO and the use of NAFTA into the model we first need to define a set of objects. First, $\kappa \in \{0, 1\}$ is a choice variable equal to 1 when a firm chooses to export using NAFTA, and 0 if it chooses WTO membership. $\lambda(\omega) \in [0, 1]$ represents the share of inputs firm ω has to source from NAFTA countries if it chooses to use NAFTA, and $\tau(\omega) \in [0, \infty)$ is the ad-valorem tariff it would have to pay if it chooses to export using WTO. These two objects are exogenous to firms and specific to each variety. In what follows, we drop the ω index to ease up notation. Motivated by our discussion in Section 3, we assume that if firms use NAFTA to export, they have to pay a fixed cost represented by $\zeta_{si}(\omega) \in \mathbb{R}^{++}$. Firms also have to pay fixed cost $f_{si}^{j}(\omega) \in \mathbb{R}^{++}$ to be able to source inputs from foreign country j.

For computational convenience, we assume that firm behavior consists of four distinct stages. First, a firm in industry i of sector s observes its λ and τ, and fixed costs ζ and f^j $\forall j$. Second, the firm chooses whether to enter the US export market. We assume that a firm's export-specific productivity ϕ is unknown to it unless it pays a fixed cost of entry υ. Third, the firm chooses whether to export using NAFTA or WTO membership. Lastly, given the firm's previous choice, it chooses the set of countries from which it can source inputs from, that is, its sourcing strategy.

Final good producers use a continuum of inputs of measure equal to one. These inputs are specific to each industry i and sector s. Marginal costs of producing an input are not only heterogeneous across countries but also across industries and sectors, e.g. China might be better at supplying inputs used by industry i than inputs used by industry i'. We assume unit labor costs a_{si}^{j} are Fréchet distributed according to:

$$F_{si}^j(a) = \exp(-T_{si}^j a^{-\theta})$$

where T_{si}^j captures the aggregate productivity level of country j at supplying inputs for industry i of sector s. Let $d^j > 1$ represent an iceberg-type trade cost between Mexico and country j, and w_{si}^j the wage paid at country j per unit of labor when producing inputs for industry i of sector s. We are assuming that suppliers of intermediate inputs, both domestic and at foreign countries, are competitive and thus price at marginal cost. The price paid by a Mexican firm for input $\nu \in [0,1]$ is given by:

$$z_{si}(\nu,\kappa,\lambda,J) = \begin{cases} \min\limits_{j\in N\cap J}\{d^j a_{si}^j(\nu) w_{si}^j\} & \text{if } \nu \in [0,\kappa\lambda) \\ \\ \min\limits_{j\in J}\{d^j a_{si}^j(\nu) w_{si}^j\} & \text{if } \nu \in [\kappa\lambda, 1] \end{cases} \tag{7}$$

where $J(\phi,\kappa,\lambda,\tau)$ represents the sourcing strategy of firm ϕ, i.e. the countries from which it can source inputs having paid their fixed costs of sourcing. Equation 7 states that the price a firm will pay for input ν is the lowest marginal cost among the countries from which it can source input ν. This is where we introduce RoO into the model: if a firm chooses to export using NAFTA, it has to source inputs $\nu \in [0,\lambda)$ exclusively from the NAFTA countries in its sourcing strategy $N \cap J$; whereas the rest of the inputs $\nu \in [\lambda, 1]$ can be freely sourced from any country in J. In our model, RoO lead to an increase in marginal cost as firms have to source some of their inputs from the subset of NAFTA countries:

$$\min_{n\in N\cap J}\{d^n a_{si}^n(\nu) w_{si}^n\} \geq \min_{j\in J}\{d^j a_{si}^j(\nu) w_{si}^j\}$$

The increase in firms' marginal cost when using NAFTA is proportional to the increase in expenditure in intermediate inputs induced by having to comply with RoO:

$$\int_0^{\kappa\lambda} \Big[\min_{j\in N\cap J}\{d^j a_{si}^j(\nu) w_{si}^j\} - \min_{j\in J}\{d^j a_{si}^j(\nu) w_{si}^j\}\Big] d\nu$$

A firm's marginal cost would not increase if it chooses WTO to export, i.e. $\kappa = 0$, or it does not face any RoO, i.e. $\lambda = 0$. Alternatively, if $N = J$ then RoO no longer have an effect over a marginal cost, even if a firm exports using NAFTA and faces positive RoO. This is where fixed costs of sourcing come into play: if a firm is unable to source from non-NAFTA countries, the opportunity cost of being restricted by RoO, an increase in marginal cost, is lower. It could also be the case that for a given industry, NAFTA countries are in fact the cheapest suppliers of its inputs and there is no opportunity cost of being restricted by RoO.

Within an industry, firms are heterogeneous in terms of their export-specific productivity ϕ, which we assume is drawn from a Pareto distribution with shape parameter χ. Given input prices described in Equation 7, a firm of productivity ϕ faces marginal costs given by:

$$c_{si}(\phi,\kappa,\lambda,\tau,J) = \frac{1+(1-\kappa)\tau}{\phi}\left(\int_0^{\kappa\lambda} z_{si}(\nu)^{1-\rho}d^*\nu + \int_{\kappa\lambda}^1 z_{si}(\nu)^{1-\rho}d\nu\right)^{1/(1-\rho)} \tag{8}$$

Equation 8 represents the marginal cost of producing and exporting. This is where we introduce the benefit of using NAFTA to export: if a firm chooses to export using WTO, $\kappa = 0$, then it has to pay MFN Tariff $\tau \geq 0$. Marginal cost is decreasing in ϕ, and the rest of the expression is a CES aggregation over the price of intermediate inputs, where ρ represents firms' elasticity of substitution across these. The measure of inputs is split in two integrals because the distribution of input prices is different depending on whether an input is restricted by RoO, $\nu \in [0,\lambda)$, or it can be freely sourced, $\nu \in [\lambda, 1]$.

Using the properties of the Fréchet distribution for unit labor costs, we can express the marginal cost of a firm with productivity ϕ in industry i of sector s as:

$$c_{si}(\phi,\kappa,\lambda,\tau,J) = \frac{1}{\phi}\gamma^{-1/\theta}[1+(1-\kappa)\tau][\kappa\lambda\Psi_{si}(\phi)^{(\rho-1)/\theta} + (1-\kappa\lambda)\Phi_{si}(\phi)^{(\rho-1)/\theta}]^{\frac{1}{1-\rho}} \tag{9}$$

with:

$$\Psi_{si}(\phi) = \sum_{h\in N\cap J} T^h_{si}(d^h w^h_{si})^{-\theta} \qquad \text{and} \qquad \Phi_{si}(\phi) = \sum_{h\in J} T^h_{si}(d^h w^h_{si})^{-\theta}$$

We refer to $\Psi_{si}(\phi)$ as a firm's *NAFTA sourcing capability*, and $\Phi_{si}(\phi)$ as its *total sourcing capability*. Intuitively, $T^h_{si}(d^h w^h_{si})^{-\theta}$ captures how attractive is to a firm of industry i of sector s to include country h in its sourcing strategy. We refer to this term as a country's *sourcing potential*, and is the incentive a firm has for paying the fixed cost of being able to source inputs from country h. Lastly, term $\gamma^{-1/\theta}$ is a constant Gamma function of parameters.

The model yields predictions for the share of inputs a firm is going to source from each of the countries in its sourcing strategy J. These shares are subject to a distortion caused by RoO. Using again the properties of the Fréchet distribution, the share of inputs coming from non-NAFTA country $j \in J \setminus N$ is:

$$x^j_{si}(\phi,\kappa,\lambda,J) = (1-\kappa\lambda)\frac{T^j_{si}(d^j w^j_{si})^{-\theta}}{\sum\limits_{h\in J} T^h_{si}(d^h w^h_{si})^{-\theta}} \tag{10}$$

While the share of inputs sourced from NAFTA country $n \in J \cap N$ is given by:

$$x_{si}^{n}(\phi, \kappa, \lambda, J) = \kappa\lambda \frac{T_{si}^{n}(d^{n} w_{si}^{n})^{-\theta}}{\sum\limits_{h \in N \cap J} T_{si}^{h}(d^{h} w_{si}^{h})^{-\theta}} + (1 - \kappa\lambda) \frac{T_{si}^{n}(d^{n} w_{si}^{n})^{-\theta}}{\sum\limits_{h \in J} T_{si}^{h}(d^{h} w_{si}^{h})^{-\theta}} \tag{11}$$

In our model, RoO increase the share of inputs sourced from NAFTA countries, regardless of their sourcing potential. Note that if a firm is choosing to export using WTO, $\kappa = 0$, or faces no RoO, $\lambda = 0$, then the expression for the share of inputs sourced from any country collapses to the standard input shares derived in Eaton and Kortum (2002).

Since firms compete monopolistically, the optimal price a firm sets, taking US demand as given, is a constant markup over the marginal cost of producing and exporting:

$$p_{si}(\phi, \kappa, \lambda, \tau, J) = \frac{\sigma}{\sigma - 1} c_{si}(\phi, \kappa, \lambda, \tau, J) \tag{12}$$

Combining Equations 6, 9, and 12, a firm's operating profits for a choice of κ and J are given by:

$$\pi_{si}(\phi, \kappa, \lambda, \tau) = \phi^{\sigma-1} \gamma^{(\sigma-1)/\theta} B_{si} [1 + (1 - \kappa)\tau]^{1-\sigma} [\kappa\lambda \Psi_{si}(\phi)^{(\rho-1)/\theta} + (1 - \kappa\lambda) \Phi_{si}(\phi)^{(\rho-1)/\theta}]^{\frac{1-\sigma}{1-\rho}} \tag{13}$$

where B_{si} represents its market demand at the USA:

$$B_{si} = \frac{1}{\sigma} \left(\frac{\sigma}{\sigma - 1} \right)^{1-\sigma} \left[\frac{\alpha_s \eta E P_{si}^{\sigma-\epsilon}}{\sum_k P_{sk}^{1-\epsilon}} \right] \tag{14}$$

which the firm takes as given. Equation 13 shows the benefits and costs of using NAFTA. On one hand, using NAFTA implies a firm will not have to pay tariff τ, which decreases marginal cost, decreasing its price and increasing its profits. On the other, using NAFTA implies a firm will have to source share λ of its inputs from NAFTA countries, giving more weight to the NAFTA sourcing capability at the expense of total sourcing capability, decreasing profits as $\Psi_{si}(\phi) \leq \Phi_{si}(\phi)$. Equation 13 collapses to that for operating profits in Antras et al. (2017) if there were no use of NAFTA nor RoO in place.

As described before, we assume that firm choice occurs in distinct stages i.e. a firm first chooses whether it will use NAFTA or WTO membership to export, then it chooses the set of countries in its sourcing strategy. Assume that a firm has already chosen either NAFTA or WTO. Firms will choose the sourcing strategy that maximizes their operating profits subject to paying a fixed cost of sourcing from each country:

$$\Pi_{si}(\phi,\kappa,\lambda,\tau) = \max_{I^j_{si}\in\{0,1\}^J_{j=1}} \pi_{si}(\phi,\kappa,\lambda,\tau,I^1,....,I^J) - w\sum_{j=1}^{J} I^j_{si} f^j_{si}(\phi) \tag{15}$$

where $I^j_{si} = 1$ if the firm chooses country j to be in its sourcing strategy. We assume that fixed costs of sourcing are firm-specific in order to capture any firm-level heterogeneity in these fixed costs e.g. firms located at the border with the USA should have a lower fixed cost of sourcing from this country. In particular, fixed costs of sourcing are random draws from a log-normal distribution:

$$f^j_{si}(\phi) \sim \text{Log-normal}(\mu^j_{si}, \delta^j_{si})$$

Location parameter $\mu^j_{si} \in (-\infty, +\infty)$ and shape parameter $\delta^j_{is} > 0$ are sector-industry-country specific to capture any differences across countries because of proximity, common language, sectors' easiness in finding suppliers abroad, etc.

The optimization in Equation 15 is a combinatorial discrete choice problem for firms as they choose the combination of countries that maximizes their profits given their previous choice of using either NAFTA or WTO membership. Implicitly, a firm's chosen sourcing strategy will be a function of whether it chose NAFTA or WTO to export, e.g. a firm has fewer incentives to source inputs from Non-NAFTA countries when using NAFTA to export as RoO restrict a share of its inputs to be sourced exclusively from NAFTA countries.

By backwards induction, a firm will choose the κ, either NAFTA where $\kappa = 1$ or WTO where $\kappa = 0$, that maximizes its profits subject to paying a fixed cost if using NAFTA:

$$\kappa^* = \arg\max_{\kappa\in\{0,1\}} \{\Pi_{si}(\phi,\kappa,\lambda,\tau) - \kappa w \zeta_{si}\} \tag{16}$$

where ζ_{si} is the fixed cost of using NAFTA to export. Note we are assuming that both fixed costs of sourcing and using NAFTA are expressed in labor units, thus being multiplied by w which are wages in Mexico.

To summarize firm behavior: firms observe realizations for their productivity and fixed costs. They also observe the RoO they would have to comply with if using NAFTA and the MFN Tariffs they would have to pay if using WTO. Then they choose whether they will export using NAFTA or WTO, followed by their choice of sourcing strategy. Lastly, firms meet demand, pricing at a constant markup over their marginal cost.

4.3 Equilibrium

In order to close our model, we assume that the measure of non-exporting firms is large enough such that firms exporting to the USA treat wages as exogenous; which implies our model is one of partial equilibrium. Additionally, we assume firms observe their export-specific productivity ϕ after paying the fixed cost of entry into export markets υ. This results in a free-entry condition where expected profits of exporting have to be equal to the cost of entry into the export market:

$$\int_{\tilde{\phi}_{is}}^{\infty} \phi^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{is}[1+(1-\kappa(\phi)\tau]^{1-\sigma}[\kappa(\phi)\lambda\Psi_{is}(\phi)^{(\rho-1)/\theta}+(1-\kappa(\phi)\lambda)\Phi_{is}(\phi)^{(\rho-1)/\theta}]^{\frac{1-\sigma}{1-\rho}}dG(\phi) = w\upsilon$$

where $G(\cdot)$ is the cdf of the Pareto distribution and $\tilde{\phi}_{si}$ denotes the productivity of the least productive firm from industry i of sector s that chooses to enter. In our model, an equilibrium is a set of prices of varieties $p_{si}(\omega)$ and Mexican wages w such that:

1. Consumers maximize utility by choosing $q_{si}(\omega)$
2. Firms maximize profits by choosing κ^* and J^* given $\{\lambda, \tau, f, \zeta\}$
3. Firms meet demand for their variety
4. Expected profits of exporting to the USA are zero

This last condition results in the equilibrium number of firms of industry i from sector s actively exporting to the USA being given by:

$$N_{si} = \frac{\alpha_s \eta E[1-G(\tilde{\phi}_{si})]}{\sigma w\Big[\upsilon + \int_{\tilde{\phi}_{si}}^{\infty}\Big(\kappa(\phi)\zeta_{si} + \sum_{j\in J(\phi)} f_{si}^{j}(\phi)\Big)dG(\phi)\Big]} \times \frac{P_{si}^{1-\epsilon}}{\sum_k P_{sk}^{1-\epsilon}} \tag{17}$$

Equation 17 shows that the number of Mexican firms exporting to the US in a given industry is increasing in the share of US expenditure in Mexican imports η, the share of expenditure in its particular sector α_s and total US expenditure/income E. On the other hand, the number of firms is decreasing in the elasticity of substitution σ, as firm profits are decreasing on it, in wage w, as fixed costs are expressed in labor units, in fixed costs of using NAFTA and sourcing ζ and f, and in the industry-level ideal price index $P_{si}^{1-\epsilon}$ as $\epsilon > 1$.

4.4 Gravity

Our model generates predictions for Mexico's purchases of intermediate inputs from foreign countries. It can be shown that firm ϕ's purchases of inputs from country j can be expressed as a share of its operating profits:

$$M_{si}^{j}(\phi) = (\sigma - 1)x_{si}^{j}(\phi, \kappa^*, \lambda, J^*)\pi_{si}^{o}(\phi, \kappa^*, \lambda, \tau) \tag{18}$$

where $x_{si}^{j}(\phi, \kappa^*, \lambda, J^*)$ is the share of inputs purchased from country $j \in J^*$, under optimal choices for κ^* and J^*. As Section 4.2 details, the expression for these shares is different between NAFTA and non-NAFTA countries because of the distortionary effects of RoO. Input purchases from non-NAFTA country $j \in J^* \setminus N$ are given by:

$$\begin{aligned} M_{si}^{j}(\phi) &= (\sigma - 1)\phi^{\sigma-1}\gamma^{(\sigma-1)/\theta}(1 + (1 - \kappa^*)\tau)^{-\sigma}B_{si}(1 - \kappa^*\lambda)\Phi_{si}(\kappa^*)^{-1}T_{si}^{j}(d^j w_{si}^{j})^{-\theta} \\ &\times \left(\kappa^*\lambda\Psi_{si}(\kappa^*)^{(\rho-1)/\theta} + (1 - \kappa^*\lambda)\Phi_{si}(\kappa^*)^{(\rho-1)/\theta}\right)^{\frac{1-\sigma}{1-\rho}} \end{aligned} \tag{19}$$

While input purchases from NAFTA country $j \in J^* \cap N$ follow:

$$\begin{aligned} M_{si}^{j}(\phi) = (\sigma - 1)\phi^{\sigma-1}\gamma^{(\sigma-1)/\theta}(1 + (1 - \kappa)\tau)^{-\sigma}B_{si}\left[\kappa^*\lambda\Psi_{si}(\kappa^*)^{-1} + (1 - \kappa^*\lambda)\Phi_{si}(\kappa^*)^{-1}\right]T_{si}^{j}(d^j w_{si}^{j})^{-\theta} \\ \times \left(\kappa^*\lambda\Psi_{i}^{*}(\kappa)^{(\rho-1)/\theta} + (1 - \kappa^*\lambda)\Phi_{i}^{*}(\kappa)^{(\rho-1)/\theta}\right)^{\frac{1-\sigma}{1-\rho}} \end{aligned} \tag{20}$$

And $M_{si}^{j}(\phi) = 0 \ \forall j \notin J^*$. The model's predictions for a sector's input purchases from country j are then:

$$M_{s}^{j} = \sum_{i=1}^{I_s}\left[N_{si}\int_{\tilde{\phi}_{si}}^{\infty} M_{si}^{j}(\phi)dG(\phi)\right] \tag{21}$$

We are not able to analytically characterize Equation 21 as it is a highly non-linear object. A firm's input purchases from a country depend not only on its sourcing potential, but also on the sourcing potential of the other countries in the firm's sourcing strategy, which in turn is endogenous to the firm's productivity and the RoO and MFN Tariff it faces, affecting whether the firm uses NAFTA or WTO membership to export. In practice, we simulate sectors' input purchases by first computing these at the firm-level following, Equation 18, and then adding across our simulated firms within a sector.

Equations 20 and 21 hint to the potentially detrimental effects of a higher λ. An increase in RoO will not necessarily result in higher input purchases from a NAFTA country, as firms could optimally choose to use WTO instead. Moreover, even if a firm chooses to comply with these higher RoO and thus the share of inputs it sources from NAFTA countries increases, the induced increase in marginal costs could offset the increase in input shares and lead to an overall decrease in its imports of intermediates from a given NAFTA country.

4.5 Comparative Statics

This section aims to further build intuition on the transmission mechanisms operating in our model. For simplicity, if there was no fixed cost of using NAFTA or fixed costs of sourcing, a firm would choose to export using NAFTA if:

$$(1+\tau)\Phi^{-\frac{1}{\theta}} > \left[\lambda\Psi^{\frac{\rho-1}{\theta}} + (1-\lambda)\Phi^{\frac{\rho-1}{\theta}}\right]^{\frac{1}{1-\rho}}$$

Intuitively, a firm will export using NAFTA if the benefit of it, avoid paying the MFN tariff, is larger than its cost, the increase in marginal cost because of RoO. Note that if there are no fixed costs, then Ψ and Φ are constant, as firms will always include all countries in their sourcing strategy. For convenience, we can rewrite the above as:

$$LHS \equiv \frac{1-(1+\tau)^{1-\rho}}{\lambda} > 1 - \left(\frac{\Psi}{\Phi}\right)^{\frac{\rho-1}{\theta}} \equiv RHS$$

First, NAFTA usage is decreasing in λ: the derivative of the RHS is 0 while that of the LHS is negative given that $\rho > 1$, making the inequality less likely to hold:

$$-\frac{[1-(1+\tau)^{1-\rho}]}{\lambda^2} < 0$$

An increase in RoO increases the price a firm has to pay for inputs restricted to be sourced within NAFTA countries. This would not be true in the unlikely case that non-NAFTA countries have zero sourcing potential for a given industry. Second, NAFTA usage is increasing in MFN Tariffs, the derivative of the RHS is 0, while that of the LHS is positive:

$$\frac{\rho-1}{\lambda}(1+\tau)^{-\rho} > 0$$

Not paying MFN Tariffs is the benefit of using NAFTA, therefore, an increase in these increases the incentives of using it. Third, NAFTA usage is increasing in the sourcing potential of NAFTA countries: the derivative of the LHS is 0 while that of the RHS is negative given $\Phi > \Psi$:

$$\frac{1-\rho}{\theta}\Big(\frac{\Psi}{\Phi}\Big)^{\frac{\rho-1}{\theta}-1}\Big[\frac{\Phi-\Psi}{\Phi^2}\Big] < 0$$

The higher the sourcing potential of NAFTA countries relative to that of non-NAFTA countries, the lower the opportunity cost of complying with RoO, e.g. if Mexico is the best place to source my inputs from, RoO do not increase my marginal cost as I would have sourced from Mexico either way. Fourth, NAFTA usage is decreasing in the sourcing potential of non-NAFTA countries: the derivative of the LHS is 0, while that of the RHS is positive:

$$\frac{1-\rho}{\theta}\Big(\frac{\Psi}{\Phi}\Big)^{\frac{\rho-1}{\theta}-1}\Big[-\frac{\Psi}{\Phi^2}\Big] > 0$$

An increase in the sourcing potential of non-NAFTA countries increases the opportunity cost of RoO, e.g. if China is the best place to source my inputs from, it is very costly for me to be forced to source a share of my inputs exclusively from NAFTA countries. Fifth, NAFTA usage is decreasing in the fixed cost of using NAFTA to export, and increasing in the fixed cost of sourcing from a foreign country. The latter follows as if a firm is unable to source its inputs from a foreign country, RoO will not affect its sourcing strategy, i.e. if I can not source my inputs from China, it does not matter if RoO tell me I can not source my inputs from there.

The above discussion relied on not having any fixed costs, as these introduce interesting non-linearities into the model. For example, if Mexico's sourcing potential increases, the opportunity cost of RoO should decrease and lead to higher NAFTA usage. However, the increase in sourcing potential will decrease marginal cost and increase exports. This increase could give a firm enough revenue so it can now pay the fixed cost of sourcing from a non-NAFTA country, thereby decreasing the incentives of using NAFTA to export. This one particular example illustrates the richness of our model, as the use of NAFTA is both a result of its product-level incentives, RoO and MFN Tariffs, how good foreign countries are at supplying an industry's inputs, and fixed costs representing diverse aspects such as bureaucracy, learning how to use the FTA, finding the right supplier, etc.

Lastly, parameter θ plays a key role in determining the responsiveness of NAFTA usage with respect to changes in RoO. θ is the shape parameter of the Fréchet distribution for a country's unit labor costs of producing an input, where higher values of θ imply less variability in unit labor costs across inputs and thus less comparative advantage across countries. This can be seen in Equation 13 where low values for θ will magnify any difference between

(a) $\theta = 1.8$ (b) $\theta = 0.2$

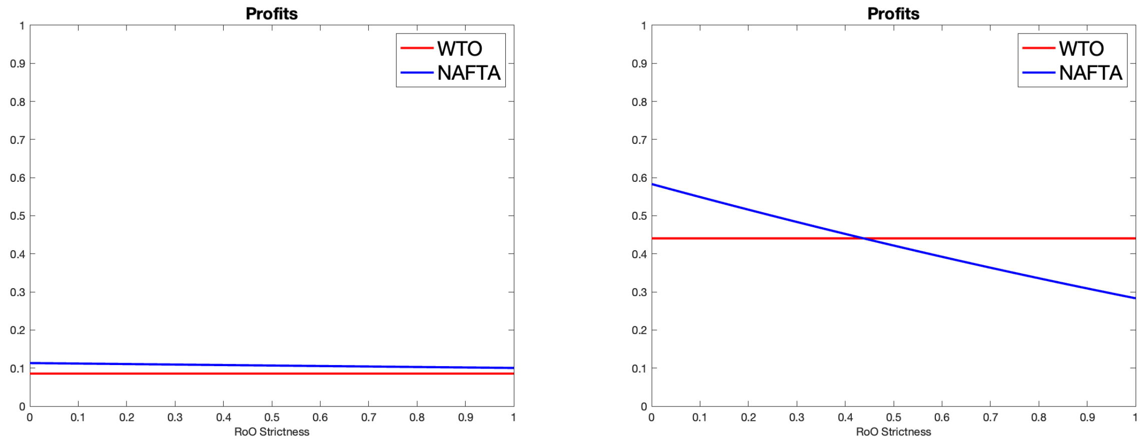


Figure 9: NAFTA profits as a function of θ

firms' NAFTA and total sourcing capabilities, therefore increasing the opportunity cost of complying with RoO. Intuitively, parameter θ acts as an elasticity of substitution across sourcing countries, with lower values of it making countries more complementary to each other and thus increasing the cost of being restricted in terms of input sourcing.

To show how this works, Figure 9 shows a simulation of our model for how firm profits change for different values of RoO, under both a higher value of θ, estimated by Antras et al. (2017), and an arbitrary lower value for it.

5 Estimation of the Model

The estimation of our model is split into three different methodologies. First, we take several parameters from seminal papers in the literature, decreasing the computational burden of the estimation. Second, we estimate countries' sourcing potentials at the industry level, i.e. how attractive it is for an industry to source its inputs from a given country. For this, we use data on inferred input shares and regress these against industry-country fixed effects. Third, we use *Simulated Method of Moments* with a *Simulated Annealing* algorithm to find the fixed costs and US market demand that best match a set of simulated moments with their data counterparts, following the methodology described in Eaton et al. (2011).

We use our detailed data on product-level RoO and MFN Tariffs by including a set of industries and sectors. Industries stand for HS 2-digit categories, which we aggregate into 6 broadly defined sectors: Agriculture and Foods, Minerals and Chemicals, Skins and Textiles, Mining, Manufacturing, and Others.[9] Within a sector, industries are heterogeneous in terms

[9] Agriculture and Foods: HS Sections I-IV; Minerals and Chemicals: HS Sections V-VII; Skins and Textiles:

of their RoO and MFN Tariffs[10], the number of firms, which we take from the data, and countries' sourcing potentials, i.e. the attractiveness of sourcing inputs from China should not be the same for the textile industry versus the electrical machinery industry.

For simplicity, firms can only source from four countries/regions: Mexico, NAFTA -the USA and Canada-, China, and Europe, the latter including the ten largest exporters of intermediate inputs to Mexico from this continent. There are two reasons for this. First, these countries represent on average 72% of Mexico's imports of intermediates in terms of trade value, thus we should be capturing most of the incentives firms have for sourcing from foreign countries. Second, to make our SMM estimation computationally feasible, as the set of different sourcing strategies increases exponentially with the number of countries a firm can source from. Unlike Antras et al. (2017), profits in our model are not necessarily supermodular in productivity, and thus, do not satisfy having increasing differences in a firm's sourcing strategy. This as a result of the non-linearities introduced by the choice of using NAFTA and RoO. As such, we are unable to reduce the dimensionality of the firm's problem as in Jia (2008) and have to compute firm profits for each possible sourcing strategy.

5.1 Parametrization

We take several parameters from the literature, detailed in Table 1. These are the elasticities of substitution across final goods σ, intermediate inputs ρ, and industries within a sector ϵ, as well as the shape parameter χ of the Pareto distribution for firm productivity.

Parameter	Value	Source
σ	3.85	Antras et al. (2017)
ρ	2.63	Fujiy et al. (2022)
χ	4.25	Melitz and Redding (2015)
ϵ	3.00	Assumed so $\sigma > \epsilon$

Table 1: Parameters from the literature.

As detailed in Section 4.5, the shape parameter of the Fréchet distribution for unit labor costs determines the responsiveness of NAFTA usage with respect to a change in RoO. We

HS Sections VIII-XII; Mining: HS Sections XIII-XV; Manufacturing: HS Sections XVI-XVIII; Others: HS Sections XIX-XXII.

[10]For every HS 2-digit code in our sample, we average RoO and MFN Tariffs across its 6-digit products.

calibrate this parameter so our model generates a change in NAFTA usage given an increase in RoO consistent with our reduced-form estimations detailed in Section 3; this results in a value of $\theta = 0.3$ which we use throughout the rest of the paper.

5.2 Estimation of Sourcing Potentials

Estimation of how attractive countries are to source inputs from will follow the methodology employed by Antras et al. (2017). In Section 4.2 we show that the share of inputs a firm sources from country j when it either uses WTO or faces no RoO is given by:

$$x_{si}^{j}(\phi) = \frac{T_{si}^{j}(d^{j} w_{si}^{j})^{-\theta}}{\sum\limits_{h \in J} T_{si}^{h}(d^{h} w_{si}^{h})^{-\theta}}$$

Normalizing Mexico's sourcing potential to one, i.e. $T_{si}^{MEX}(d^{MEX} w_{si}^{MEX})^{-\theta} = 1$, and taking the ratio between the sourcing potential of country j and that of Mexico:

$$\frac{x_{si}^{j}(\phi)}{x_{si}^{MEX}(\phi)} = T_{si}^{j}(d^{j} w_{si}^{j})^{-\theta}$$

Taking logs from both sides and assuming an idiosyncratic measurement error ϵ_{si}^{j} yields:

$$lnx_{si}^{j}(\phi) - lnx_{si}^{MEX}(\phi) = lnT_{si}^{j}(d_{j} w_{si}^{j})^{-\theta} + \epsilon_{si}^{j}(\phi)$$

We regress using OLS the left-hand side, which is data on inferred firm-level input shares, against the right-hand side using industry-country fixed effects. In this estimation, we restrict our sample to firms either using WTO or facing no RoO. For firms using NAFTA, the expression for input shares is different for NAFTA and non-NAFTA countries because of the distortion induced by RoO, i.e. the ratio of input shares of a non-NAFTA country to those of Mexico does not result in a clean industry-country fixed effect.

Input shares are inferred since we do not observe the share of inputs Mexican firms source from Mexico itself, only those purchased from abroad; therefore the need to infer them from our customs data. We do this in the following way. First, we use IO Tables for the input composition of every final product in our sample. Second, we place the key assumption that any input that was not imported was sourced from Mexico, and any input we observe was purchased from a foreign country, was not sourced from Mexico at all. For example, if a product is made of 60% of input A and 40% of input B, and we observe that a firm exporting this product is importing input B from China, then the share of inputs coming from China is 40% while that of Mexico is 60%. The rest of the countries have an input share of 0%

as we do not observe any imports coming from them. As long as the measurement error in this calculation is idiosyncratic across firms and industries, this procedure should give us an approximation for how attractive it is to source inputs from each foreign country.

The estimation above captures how good a country is at supplying inputs of a given exporting industry i.e. how good is China at supplying electrical components. To better capture the overall benefit of sourcing from a foreign country, we need sourcing potentials to be defined at the importing industry level i.e. how attractive it is to the automotive industry in Mexico to source inputs from China. To compute this, we again use the input composition of each final product. For example, if we have already estimated that China has a sourcing potential of 0.4 in supplying input A and 0.6 in supplying input B, and we know that an industry in Mexico uses 50% of input A and 50% of input B, the sourcing potential of China specific to this industry in Mexico will be a weighted average equal to 0.5.

Figure 10 shows the estimates for the industry-specific sourcing potentials by country. On average, the sourcing potentials of NAFTA, China and Europe are 0.30, 0.10, and 0.04, respectively. This implies that, on average, the total sourcing capability of a firm importing inputs from all countries is 44% higher than that of a firm only sourcing inputs from Mexico.[11] In comparison, Antras et al. (2017) estimate the total sourcing capability of a firm sourcing from all countries to only be 19% higher. The difference in our estimates can be attributed to two factors. First, their estimates are for US firms, and it is likely that the USA is better than Mexico at supplying inputs to its domestic firms, i.e. estimates are relative to the sourcing potential of the home country. Second, in their paper, higher sourcing capability directly results in lower marginal cost. In our work, RoO restrict the share of inputs sourced from non-NAFTA countries, and thus our higher estimates do not imply higher marginal cost savings, i.e. China being a great supplier of your inputs does not lower marginal cost by much when a firm can only source a share of its inputs from it.

To illustrate these results, the Mexican industry with the lowest potential sourcing capability is *Meat and Edible Meats* (HS Chapter 2), with an 11% higher total sourcing capability compared to a firm only sourcing from Mexico. The industry with the highest one is *Electrical Machinery* (HS Chapter 85) with an 83% higher total sourcing capability. The full results for every industry-country pair are presented in Appendix G.

Sourcing potentials represent the incentive firms have on paying the fixed cost of sourcing from a given country. Industries in which the attractiveness of sourcing from non-NAFTA countries is higher: (i) The use of NAFTA should be lower, because of a higher opportunity cost of complying with RoO, (ii) The share of firms sourcing from these countries should be higher, as firms find it profitable to pay their fixed costs. Results support this intuition, as

[11] By construction, a firm only sourcing inputs from Mexico has a total sourcing capability equal to 1.

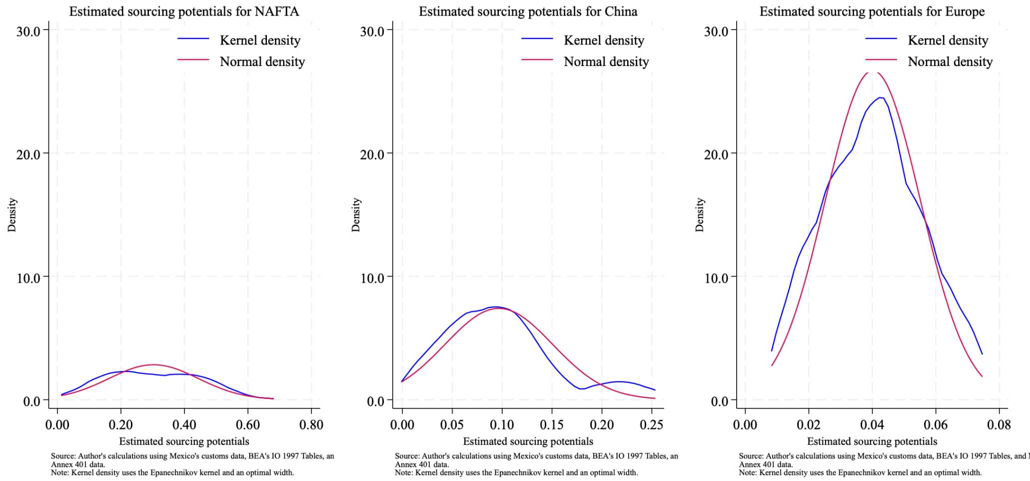


Figure 10: Estimated sourcing potentials at the industry level

Figure 11 shows there is a negative industry-level correlation between our estimated sourcing potentials and the share of firms using NAFTA to export, and a negative one between these sourcing potentials and the share of firms sourcing from non-NAFTA countries.

5.3 Estimation of Fixed Costs and US Market Demand

We structurally estimate the fixed cost of using NAFTA, the distribution of fixed costs of sourcing, and US market demand. For computational simplicity, we assume these parameters are sector-specific instead of being defined at the industry-sector level. As in Section 4.2, the fixed cost of using NAFTA is constant across firms within a sector, and fixed costs of sourcing from foreign countries follow:

$$f_s^j(\phi) \sim \text{Log-normal}(\mu_s^j, \delta_s^j)$$

We assume $\delta_s^j = \sqrt{log2}$ across all sectors and countries since we cannot separately identify μ and δ as both of them influence the mean and the variance of the log-normal distribution. Since firms in Section 5.2 always source inputs from Mexico, we set its fixed cost of sourcing to zero. For every sector s, we independently estimate the following set of parameters:

$$\xi_s = [\zeta_s, \mu_s^{NAFTA}, \mu_s^{CHN}, \mu_s^{EUR}, B_s]$$

Estimation follows Eaton et al. (2011) in using Simulated Method of Moments together with a Simulated Annealing solution algorithm, which optimally combines random exploration of the parameter space with searching for parameters that decrease our objective

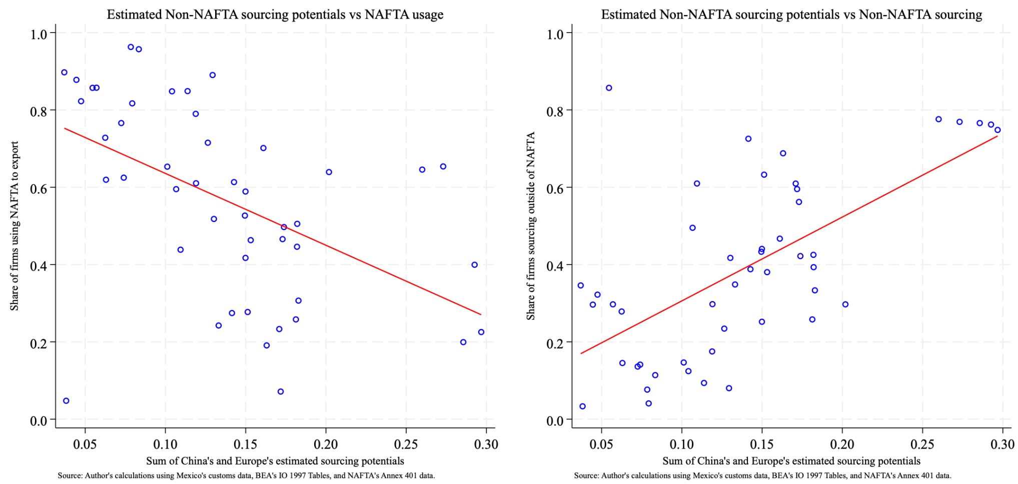


Figure 11: Correlations with estimated non-NAFTA sourcing potentials

function. It accomplishes this by using a *temperature*, which influences the acceptance rate of points that do not reduce the objective function. For every new point that the algorithm considers moving to, if the new point decreases the objective function, it moves to that point. If the point does not reduce the objective function, then it still moves to it if:

$$\exp\left(\frac{f'-f}{t}\right) > p$$

Where f is the lowest value for the objective function up to that point, f' is the objective function evaluated at the point in consideration, t is the current temperature, and p is a random draw of a standard uniform distribution. Temperature is initialized at an arbitrary value and gradually decreases at a chosen rate as the algorithm searches the parameter space. When the temperature is high, the algorithm accepts many new points even if they do not decrease our objective function, thus favoring exploration at the early stages. As iterations continue and the temperature decreases, the probability of acceptance decreases, and thus, the algorithm focuses on finding the point that results in the lowest possible value for the objective function. This method adapts the Metropolis-Hastings algorithm described in Metropolis et al. (1953) and has the advantage of dealing with the discontinuities present in our model due to estimating fixed costs in a discrete choice setting.

Let x_s represent data for a sector and ξ_s a set of sector-specific parameters. Our estimation consists in finding the parameters that minimize the following objective function:

$$\min_{\xi_s} ||\hat{m}(\tilde{x}_s|\xi_s) - m(x_s)||$$

where $m(\cdot)$ represents a set of R different moments, and $\tilde{x}_s$ is simulated data from our model under parametrization ξ_s. We use the L^2 distance norm, and define the moment error function as the percent difference between the vectors of simulated and data moments:

$$e(\tilde{x_s}, x_s|\xi_s) = \frac{\hat{m}(\tilde{x_s}|\xi_s) - m(x_s)}{m(x_s)}$$

Therefore, our implementation of SMM consists in finding the set of parameters that minimizes the sum of squared errors:

$$\hat{\xi}_s = \arg\max_{\xi_s} e(\tilde{x_s}, x_s|\xi_s)^T I_R e(\tilde{x_s}, x_s|\xi_s)$$

with I_R being an $R \times R$ identity matrix. We define our objective function in percentage deviations so that all moments in $m(\cdot)$ are expressed in the same units and no moment receives an unintended larger weight. The set of sector-specific moments we include in our estimation to identify the true parameter vector ξ_s are:

1. Share of firms using NAFTA to export: This moment helps us pin down the fixed cost of using NAFTA to export ζ_s, as variation in this parameter will directly affect how many firms can pay the fixed cost of using NAFTA to export.

2. Share of firms sourcing from each country: Conditional on a country's sourcing potential, the costlier it is to source from a foreign country, the lower the share of firms sourcing their inputs from it. We use the extensive margin of sourcing to pin down the location parameter of the distribution of fixed costs of sourcing from every country.

3. Average firm exports: To identify market demand in the USA, we use the average exports across all firms of a given sector.[12] In our model, productivity and market demand are isomorphic for revenue, and since we assume the same distribution of productivity across all sectors, there is a one-to-one relationship between US market demand and firm-level exports.

Our previous discussion on the relationship between the use of NAFTA and firm size being driven by fixed costs motivates us to include additional moments in our estimation, as they should help us identify how large fixed costs need to be to generate this relationship, as well as that for firms' non-NAFTA sourcing. These additional moments are:

4. Share of firms using NAFTA to export, by quintile of firm size

[12] We use a weighted average, with weights based on industries' contribution to the total trade value of a given sector.

	ζ_s	f_s^{CHN}	f_s^{EUR}	f_s^{NAF}	B_s
Agriculture and Foods	0.29	45.45	23.31	35.68	7.46
Minerals and Chemicals	0.01	3.36	1.67	6.75	1.56
Skins and Textiles	0.39	3.39	9.66	10.29	6.42
Mining	0.02	15.19	8.76	16.79	0.14
Manufacturing	1.85	7.62	3.19	7.04	100.00
Others	0.70	6.50	7.18	13.17	0.67
Average	0.54	13.58	8.96	14.95	19.38

Table 2: Estimates for Fixed Costs and US Market Demand.

5. Share of firms sourcing inputs outside of NAFTA, by quintile of firm size

Our simulation of the model for a particular guess of ξ_s is as follows: First, for each industry within sector s, we take N_{si} random draws for productivity from a Pareto distribution with shape parameter χ. Second, we take $N_s = \sum_{i=1}^{I_s} N_{si}$ random draws for the fixed costs of sourcing from each country. All firms within an industry face the same RoO, MFN Tariffs, and sourcing potentials. Third, by backwards induction and fixing either the use of NAFTA or WTO, for every firm we find the set of sourcing countries that maximizes their profits subject to paying fixed costs of sourcing, following Equation 15. Fourth, having found each firm's optimal sourcing strategy, we compare profits under NAFTA and WTO and assign firms to the option that yields the largest profits, as described in Equation 16. Having fully simulated firms' choices for the use of NAFTA and global sourcing strategies, we use Equations 10, 11, 12, 13, and 18, to compute predictions for input shares, imports of intermediates, firm exports and profits, and price indexes.

We present the results of this estimation in Table 2. These are not the point estimates resulting from our application of SMM, but rather normalizations so results are easier to interpret. For the fixed cost of using NAFTA ζ and fixed costs of sourcing f, we show the average of estimated fixed costs as a share of total exports, e.g. for a firm in the *Agriculture and Foods* sector, being able to source inputs from China represents 45.45% of its revenue in the USA. For the estimates for US market demand B we normalize market demand for *Manufactures* to be equal to 100, and thus, market demand for the rest of the sectors is relative to it. The estimated parameters are shown in Appendix H.

Results suggest: (i) Heterogeneity across sectors in the fixed cost of using NAFTA. (ii) Heterogeneity in fixed costs of sourcing, both across countries and sectors. This heterogeneity should directly affect firms' opportunity cost of complying with RoO, which together with (i) should partly explain the use of NAFTA at the sectoral level. (iii) US market demand

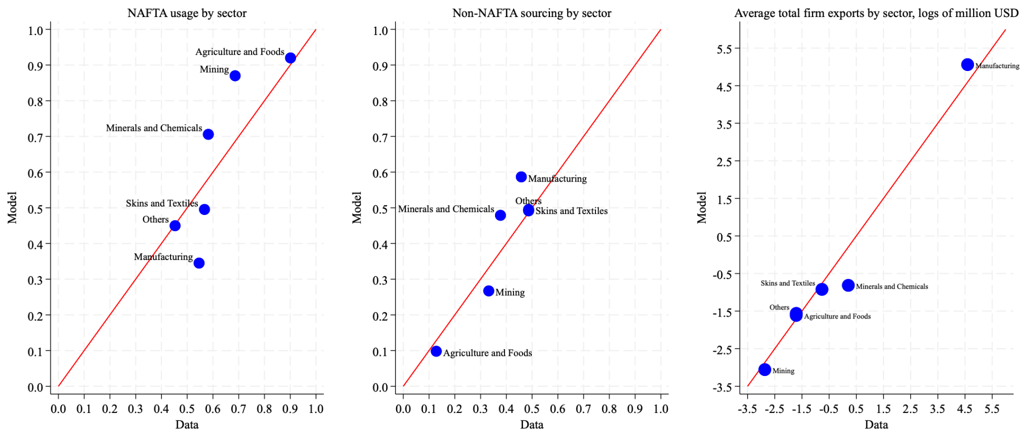


Figure 12: Sectoral fit of the model in terms of firms' choices.

for *Manufactures* is much larger compared to other sectors, consistent with the fact that in our sample, averaging across time periods, 77% of export value from Mexico to the USA corresponds to this sector.

5.4 Fit of the Model

We evaluate the model's fit at the sectoral and aggregate levels. At the sectoral level, Figure 12 shows the model's predictions for the share of firms using NAFTA to export and the share of firms sourcing inputs outside of NAFTA. The figure also shows the fit of the model in terms of average firm exports. In these figures, the x-axis shows the data moment, and the y-axis the simulated one. The closer to the 45-degree line, the better the fit for that sector.

Across all sectors, the model captures firm behavior regarding the use of NAFTA and how firms choose their sourcing strategies in response to RoO. Related to the latter, Figure 13 shows the model's predictions in terms of the extensive margin of sourcing: the share of firms, for each sector, that source inputs from either China, Europe, or NAFTA countries. Once again, the model achieves a good fit, although it over-predicts entry rates to all countries for the *Manufacturing* sector. One plausible explanation is we might be overestimating how attractive it is for this sector to source from foreign countries.

To this end, we present Figure 14, which shows the model's fit regarding the share of inputs sourced from each foreign country. These moments relate to the extensive margins, as a firm choosing not to source from a given country implies that its input share is equal to zero. On the other hand, if a firm decides to source inputs from a country, then input shares are determined by the estimated sourcing potentials discussed in Section 5.2. In this figure, we observe that the prediction for firms' input shares from foreign countries are mostly in

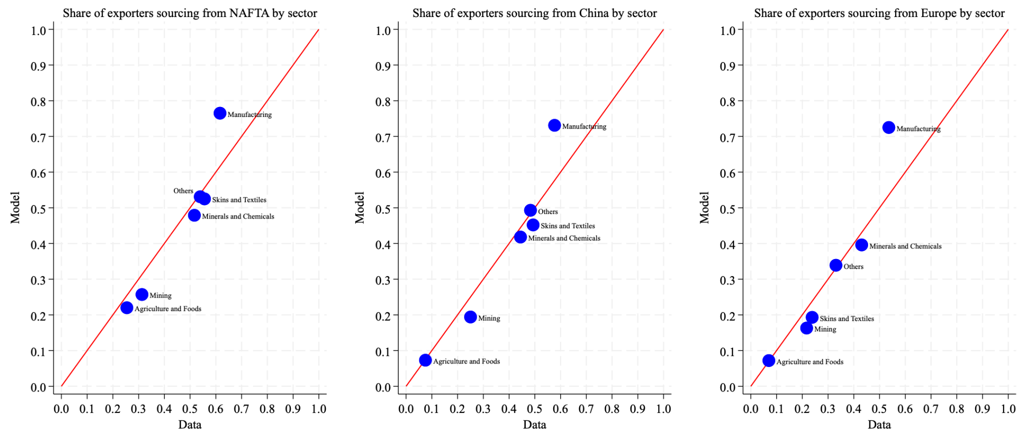


Figure 13: Sectoral fit of the model in terms of the extensive margin.

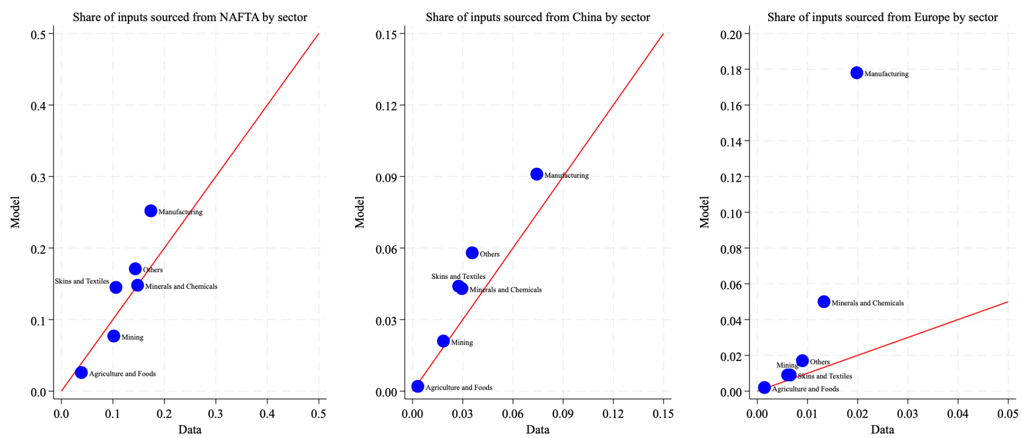


Figure 14: Sectoral fit of the model in terms of input shares.

line with the data except for the *Minerals and Chemicals* and *Manufacturing* sectors, where the model predicts a larger average input share for Europe. We interpret this as the result of overestimating Europe's sourcing potential for these sectors, potentially because of an upward bias induced by only including firms using WTO to export in the estimation.

So far, we have discussed the fit of the model at the sectoral level. For the fit at the aggregate level, we present Figures 15 and 16, in which we ignore industries and instead compute size quintiles according to export revenue, consistent with our empirical facts presented in Section 3. Figure 15 shows the model's replication of the inverse U-shape relationship between the use of NAFTA and firm size. While we do not generate the exact same shape, it does predict that small and large firms will use NAFTA to export less intensively compared to medium-sized firms. This is the result of the fixed cost of using NAFTA being too

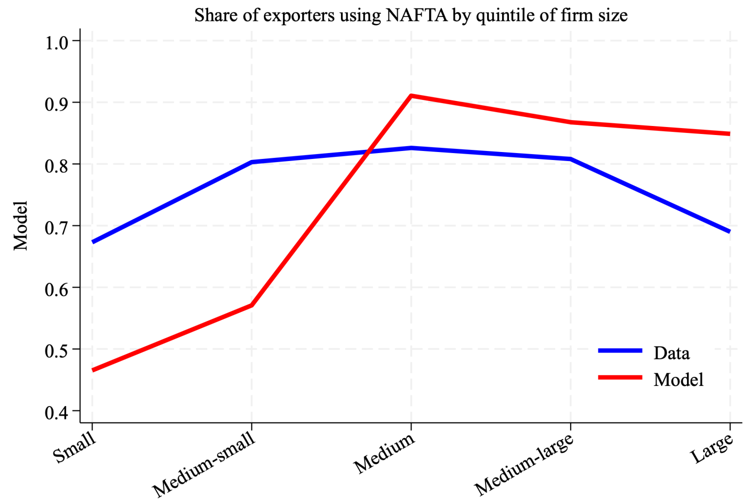


Figure 15: Aggregate fit in terms of the use of NAFTA.

expensive for small firms, and the fixed costs of sourcing resulting in the opportunity cost of complying with RoO being increasing with firm size.

Regarding the share of firms sourcing inputs outside of NAFTA, Figure 16 shows we do replicate its increasing relationship with firm size at the aggregate level. This relationship should be driven by firm size, as the larger the firm the greater the likelihood it can pay the fixed cost of sourcing from foreign countries, and by the use of NAFTA, as it decreases the incentives firms have for sourcing from non-NAFTA countries. As in the data, the model predicts that even though the largest firms use NAFTA less intensively than medium-sized firms, almost all of the largest firms source inputs from non-NAFTA countries. This should be the result of large firms finding it profitable to pay these costs, even if restricted by RoO, because of their large export and import volume. Other predictions for the aggregate fit of the model are presented in Appendix I. Overall, the model captures the choices and incentives firms have regarding the use of NAFTA and compliance with RoO.

6 Effects of Protectionist Trade Policies

This section describes the counterfactuals we explore in our paper. Given the richness of our product-level data and our model capturing diverse aspects of trade policy, such as RoO and Tariffs, we can conduct a wide range of policy-relevant counterfactual simulations. The counterfactuals we study are: (i) The transition from NAFTA to USMCA, (ii) An increase in tariffs on Mexican imports, and (iii) NAFTA without RoO. Our counterfactuals study how the USA and Mexico are affected from the policy change, focusing our attention to the

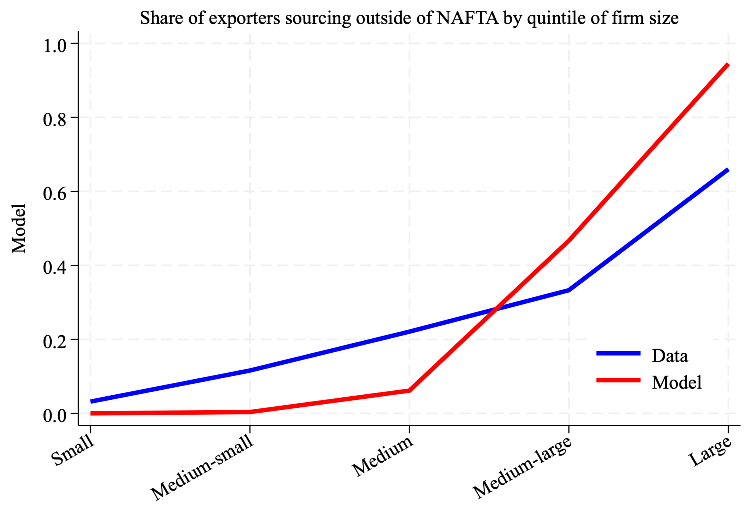


Figure 16: Aggregate fit in terms of non-NAFTA sourcing.

variables policymakers in these countries are likely to care for. In the case of the USA, we will study the change in US exports of inputs to Mexico and the price US consumers pay for Mexican imports. For policymakers in Mexico, we will study the change in Mexican firm profits. We emphasize the heterogeneity in responses to these policy changes across different firm sizes, highlighting the primary mechanism discussed in our paper: firm size determines the opportunity cost of complying with RoO, thus affecting firms' use of NAFTA.

In these counterfactuals we are silent on other margins of adjustment not captured by our model. For example, we implicitly assume countries' sourcing potentials are not endogenous to policy changes. This idea is presented in Ornelas and Turner (2023) in which the authors study how RoO can result in higher investment whenever an industry has high productivity, which could indeed be what policymakers have in mind when they implement RoO to protect domestic industries from foreign competition.

6.1 Transition to USMCA

In July 2020, NAFTA, which had been in place since 1994, was replaced by USMCA. This revised FTA brought a wide array of changes, both in terms of regulations and in an increase in RoO. We consider the latter in this counterfactual in which we ask if the USA and Mexico benefit from a generalized increase in RoO. The proper way of implementing this counterfactual would be to compute the change in the RoO Strictness at the 6-digit product level, which is feasible as USMCA's RoO are detailed in the documentation for the treaty. Still, it is out of the scope of this paper to code the full details of these new RoO.

For this reason, in this counterfactual we assume a general increase of 25% in the strictness

	US Exports of inputs to Mexico	US Price index for Mexican imports	Mexican firm profits
Agriculture and Foods	-1.75	0.30	-1.28
Minerals and Chemicals	-0.41	0.12	-0.47
Skins and Textiles	-1.85	0.24	-1.70
Mining	-0.18	0.15	-0.24
Manufactures	-0.21	0.08	-0.22
Others	-3.05	0.59	-2.59
Average	-1.24	0.25	-1.08

Table 3: Changes in key variables due to an increase in RoO.

of RoO on all products, e.g., if a particular product had a RoO Strictness of 10% under NAFTA, under USMCA we will assume it has a 12.5% RoO Strictness. This increase of 25% is in line with the increase in RoO for the automotive sector, which was studied by Head et al. (2022). They find that the increase in RoO decreased the share of regional content in the automotive sector as the new rule fell to the right side of the Laffer Curve.

Table 3 shows the results for our variables of interest in terms of their percentage change. Averaging across sectors, US exports of intermediates would decrease on average by 1.24%, while US prices for Mexican imports would increase on average by 0.25%. For Mexico, firm profits would be 1.08% lower. These results suggest that neither the USA nor Mexico benefited from the increase in RoO that the transition to USMCA implied.

To study the mechanisms behind these effects, we focus on discussing the change in US exports of intermediates. We identify three distinct effects: (i) A substitution effect, (ii) An income effect, and (iii) A switching effect, which can either increase or dampen the first two effects. First, when higher RoO are implemented across all sectors, firms are forced to substitute some of the inputs they were sourcing from non-NAFTA countries towards NAFTA countries. This could have been the main mechanism policymakers had in mind when implementing higher RoO in the USMCA agreement. This substitution does not necessarily imply higher US exports of intermediates, as Mexican firms could choose to start sourcing these inputs either from Mexico or Canada, still complying with RoO. The extent to which this substitution effect does imply an increase in US exports depends on whether firms can source their inputs from the USA, and on the relative sourcing potential of the USA to that of Mexico, e.g. Mexican sectors with the largest increases in their import from the USA are those for which the USA is better than Mexico at sourcing their inputs.

Second, as our model suggests, an increase in RoO should lead to an increase in firms' marginal cost, unless firms are either unable to source from non-NAFTA countries or are

	SP of NAFTA to non-NAFTA	RoO Strictness	MFN Tariff
Agriculture and Foods	2.20	0.09	0.08
Minerals and Chemicals	2.81	0.02	0.04
Skins and Textiles	2.03	0.34	0.11
Mining	2.62	0.07	0.07
Manufactures	1.67	0.01	0.03
Others	2.33	0.12	0.06

Table 4: Relative sourcing potential, RoO Strictness, and MFN Tariffs by sector.

already sourcing all their inputs from NAFTA countries. Increases in marginal cost directly imply higher US import prices, leading to lower demand for Mexican imports, and thus, lower input purchases from all countries, including the USA. This is our income effect because of the increase in RoO. This detrimental income effect will be larger in sectors with either larger firms, or sectors for which NAFTA countries have a relatively lower sourcing potential compared to non-NAFTA countries.

The third mechanism proposed in these counterfactuals is a switching effect. When RoO increase, some firms might no longer find it optimal to export using NAFTA and switch to export using WTO. It is unclear whether these firms will increase or decrease their purchases of inputs from the USA. On the one hand, these purchases might increase as firms can now source from the cheapest suppliers around the World, leading to lower marginal costs and higher demand. On the other, switching to WTO implies firms will source a smaller share of their inputs from the USA as they do not comply with RoO, and will now have to pay MFN tariffs which increase the price of US imports.

These three transmission mechanisms highlight the importance of studying the effects of an increase in RoO both at the firm level and across different sectors, as these effects depend on the relative sourcing potential of the USA, MFN Tariffs, and on the size composition of a given sector. For this purpose, we present Tables 4 and 5. The former shows the relative sourcing potential of NAFTA to that of non-NAFTA countries, while the latter shows the distribution of firm size across sectors.

For sectors with a higher NAFTA sourcing potential, such as *Minerals and Chemicals* or *Mining*, the positive substitution effect on US exports of inputs should be higher as it is more likely that firms will source from the USA when required to source from NAFTA countries. In terms of the negative income effect, sectors in which NAFTA has a relatively higher sourcing potential should experience less of a decrease in demand as for these sectors, the increase in marginal cost because of higher RoO should be lower compared to sectors for

	Small	Medium-small	Medium	Medium-large	Large
Agriculture and Foods	0.10	0.45	0.27	0.10	0.08
Minerals and Chemicals	0.28	0.00	0.03	0.28	0.41
Skins and Textiles	0.11	0.03	0.15	0.33	0.39
Mining	0.69	0.01	0.16	0.11	0.03
Manufacturing	0.00	0.00	0.00	0.39	0.61
Others	0.23	0.00	0.28	0.37	0.12

Table 5: Distribution of firm sizes across sectors.

	Change						
	Small	Medium-small	Medium	Medium-large	Large	Aggregate	Units
Share of firms using NAFTA	-0.18	-0.12	-0.52	-10.93	-8.74	-4.10	p.p. Δ
Share of firms sourcing from China	0.00	0.01	-0.61	-3.21	-0.45	-0.85	p.p. Δ
Share of firms sourcing from Europe	0.00	0.00	-0.54	0.17	-0.09	-0.09	p.p. Δ
Share of firms sourcing from NAFTA	0.00	-0.03	-0.39	-0.09	-0.05	-0.11	p.p. Δ
Share of inputs coming from NAFTA	0.00	-0.01	-0.09	-0.03	-0.03	0.02	p.p. Δ
Average Marginal Cost	0.00	0.09	0.57	2.57	2.99	0.69	% Δ
Average Exports	-0.30	-0.20	-1.35	-2.18	-0.33	-0.36	% Δ

Table 6: Responses to the increase in RoO by firm size.

which NAFTA countries are poor suppliers of their inputs.

For sectors with larger firms, such as *Manufacturing* or *Skins and Textiles*, the positive substitution effect on US exports should be higher, as these firms can source from the USA when required to comply with stricter RoO. However, the negative income effect should also be higher, as these sectors were importing more intensively from non-NAFTA countries and thus face larger increases in marginal cost when having higher RoO. Additionally, sectors with a higher share of larger firms should benefit from firms switching from NAFTA to WTO as these firms can now access non-NAFTA sourcing, leading to lower marginal cost and increased exports. Table 6 shows the responses to the increase in RoO by quintiles of firm size. Consistent with Figure 5, medium to large firms are the ones for which the use of NAFTA decreases the most, while smaller firms experienced lessened effects. This ties back to Table 5 as sectors with larger firms should be the ones for which both the substitution and income effects are the strongest.

For the switching effect, we present Table 7. It shows the share of firms that either keep using NAFTA or switch to WTO to export their products. On average, firms that keep using

	NAFTA to WTO	WTO to NAFTA	Stayed WTO	Stayed NAFTA	Units
Share of firms	0.04	0.00	0.21	0.75	-
	Change				
Share of firms sourcing from China	-1.02	-	0.00	-1.08	p.p. Δ
Share of firms sourcing from Europe	6.74	-	0.00	-0.49	p.p. Δ
Share of firms sourcing from NAFTA	-1.62	-	0.00	-0.06	p.p. Δ
Share of inputs coming from NAFTA	-0.87	-	0.00	0.01	p.p. Δ
Average Marginal Cost	18.92	-	0.75	0.20	% Δ
Average Exports	-8.27	-	0.00	-0.28	% Δ

Table 7: Responses to the increase in RoO by transitions between NAFTA and WTO.

NAFTA do increase the share of their inputs coming from NAFTA countries, implying the substitution effect is positive. However, these same firms experience an increase in marginal cost because of lower non-NAFTA sourcing, indicating a negative and detrimental income effect. Firms that switch to WTO experience a significant increase in their marginal cost because they now have to pay MFN Tariffs. This decreases their revenue, so even if RoO no longer restrict them, their non-NAFTA sourcing doesn't necessarily increase as they might no longer be able to pay fixed costs of sourcing, e.g. those for China.

To conclude our discussion on the effects of the increase in RoO as a result of the transition from NAFTA to USMCA, across all sectors, purchases of inputs from the USA would decrease, even if for some sectors the share of inputs coming from the USA would indeed increase. The detrimental effects of higher prices for Mexican imports, coupled with the fact that 4.1% of firms would stop using NAFTA, dominate any potential gains from stricter RoO and thus, result in lower bilateral trade and higher prices for US consumers.

6.2 Increase in tariffs on Mexican imports

On May 30$^{\text{th}}$ 2019, Donald Trump published a *tweet*[13] announcing that the USA would impose a 5% tariff on all goods coming into the country from Mexico. The objective of this measure was to exert political pressure on Mexico to address the issue of illegal immigration. On June 7$^{\text{th}}$ of that same year, it was announced that an agreement had been reached, with Mexico accepting to adopt stricter measures at the Border. In this counterfactual, we quantify the effects this policy change would have had on the USA and Mexico.

It is hard to interpret precisely what Donald Trump meant in those *tweets*, as "all Mexican

[13]Source: https://twitter.com/realDonaldTrump/status/1134240653926232064

	US Exports of inputs to Mexico	US Price index for Mexican imports	Mexican firm profits
Agriculture and Foods	-15.34	5.59	-14.09
Minerals and Chemicals	-13.26	5.90	-13.19
Skins and Textiles	-10.61	4.15	-10.91
Mining	-16.02	6.58	-17.08
Manufactures	-13.48	5.22	-13.32
Others	-7.47	4.22	-6.13
Average	-12.7	5.28	-12.45

Table 8: Changes in key variables due to an increase in Tariffs.

imports will pay a 5% tariff"' does not provide much detail on the exact implementation of the policy. For the purposes of this counterfactual, we interpret it as if all Mexican firms had to pay at least a 5% tariff. If a firm uses NAFTA to export, it will have to pay a 5% tariff. If a firm uses WTO to export, then it would have had to pay at least a 5% tariff, i.e. if in the baseline a firm had to pay a tariff lower than 5%, then we increase the tariff to 5%; whereas if a firm had to pay a higher tariff, then the counterfactual implies no change.

Table 8 details the results for the key variables policymakers should care for in terms of their percentage change given the increase in tariffs.[14] Averaging across sectors, US exports of intermediates would have decreased by 12.7%, while the US price index for Mexican imports would have increased by 5.28%. For Mexico, firm profits would have been 12.45% lower. These results suggest it would have been very costly for the USA to implement this measure as Mexico is one of its main trading partners, even if it gains political leverage. From Mexico's point of view, the policy would have also been highly detrimental as exports to the USA represent, on average, 80.1% of Mexico's total export value.

For discussing the mechanisms behind these results, Table 9 presents the change in key moments by quintiles of size. Consistent with the results described in Table 6, medium to large firms would have responded the most to the policy change. When exporters have to pay a tariff even if using NAFTA, the incentive for it decreases, which lowers the share of firms using NAFTA across all firm sizes. Lower NAFTA usage does not necessarily imply higher non-NAFTA sourcing, as it depends on firm size. For smaller firms, non-NAFTA sourcing would not have increased; it actually would have decreased even if they would be using NAFTA less intensively. The reason for this is that higher tariffs decrease revenue, which lowers the ability to source from foreign countries. Larger firms would have sourced

[14]We do not include results for the change in US tariff revenue as we do not consider this was the motivation behind the intended policy change.

	Change						
	Small	Medium-small	Medium	Medium-large	Large	Aggregate	Units
Share of firms using NAFTA	-31.12	-58.43	-47.12	-50.91	-36.03	-44.72	p.p. Δ
Share of firms sourcing from China	0.00	-0.22	-4.68	1.28	-0.07	-0.74	p.p. Δ
Share of firms sourcing from Europe	-0.01	-0.01	-2.15	0.39	0.38	-0.28	p.p. Δ
Share of firms sourcing from NAFTA	-0.34	-0.20	-11.73	-0.77	-0.30	-2.67	p.p. Δ
Share of inputs coming from NAFTA	-0.08	-0.05	-2.27	-0.14	-0.23	1.03	p.p. Δ
Average Marginal Cost	4.25	6.27	12.90	6.47	7.02	6.98	% Δ
Average Exports	-17.96	-16.42	-23.98	-12.48	-13.20	-13.24	% Δ

Table 9: Responses to the increase in Tariffs by firm size.

more intensively from non-NAFTA countries, given their decrease in NAFTA usage, but this positive effect on marginal cost would have been dominated by the increase in tariffs, and thus, marginal cost would also have increased for these firms. This explains why the decrease in exports would have been larger for smaller firms, and thus sectors with a higher share of these firms, as detailed in Table 5, are those for which bilateral trade decreases the most, namely the *Agriculture and Foods*, *Minerals and Chemicals*, and *Mining* sectors.

Table 10 shows the same moments but according to whether firms would keep using the same trade regime or switch to a different one as a result of the increase in tariffs. Around 45% percent of the firms would switch from NAFTA to WTO. For these firms, no longer being constrained by RoO would not translate into larger sourcing from China, but sourcing from Europe would increase. According to our estimates in Section 5.2, Europe's sourcing potential for Mexican firms is much lower than that of China, so this would not lead to marginal cost reductions even these firms would no longer comply with RoO. Moreover, as these firms would no longer use NAFTA, the share of firms sourcing from the USA and Canada would have decreased by 4.21 percentage points which, together with the increase in marginal cost, would have decreased purchases of inputs from these countries.

Firms that would keep using NAFTA to export, 34% of firms, would decrease their sourcing from all foreign countries even if not restricted by higher RoO. The fact that now they would have to pay tariffs even if using NAFTA, would decrease their revenue and therefore their ability to pay fixed costs of sourcing. Lastly, firms that would keep using WTO would exhibit the smallest changes, as a share of these firms would not experience any change because of the counterfactual, i.e. firms that were already paying tariffs higher than 5%. Firms that had MFN Tariffs lower than 5% also would experience an increase in marginal cost because of the higher tariffs, which would decrease their revenue, decreasing their foreign

	NAFTA to WTO	WTO to NAFTA	Stayed WTO	Stayed NAFTA	Units
Share of firms	0.45	0.00	0.21	0.34	-
	Change				
Share of firms sourcing from China	-0.58	-	-0.29	-1.21	p.p. Δ
Share of firms sourcing from Europe	0.42	-	-0.16	-1.27	p.p. Δ
Share of firms sourcing from NAFTA	-4.21	-	-0.40	-2.03	p.p. Δ
Share of inputs coming from NAFTA	-0.97	-	-0.09	-0.30	p.p. Δ
Average Marginal Cost	11.20	-	0.92	6.29	% Δ
Average Exports	-13.60	-	-10.51	-14.36	% Δ

Table 10: Responses to the increase in Tariffs by transitions between NAFTA and WTO.

sourcing and further increasing their marginal cost. As a summary, sectors with the largest share of firms using NAFTA to export, namely *Agriculture and Foods* and *Mining* according to Figure 12, are those for which purchases of inputs from the USA would have decreased the most, and the ones that would have experienced the largest price increases. These results highlight the significant costs policies aimed at gaining political power would have, to the detriment of a country's own manufacturers of intermediate goods and consumers.

6.3 NAFTA without Rules of Origin

The purpose of RoO is to protect local industries and to encourage bilateral trade among FTA member countries. While these effects can be achieved, as discussed in Ornelas and Turner (2023), sourcing potentials are likely fixed in the short run. Therefore, RoO have a detrimental effect on trade as they restrict exporters from being able to take advantage of comparative advantage across the World. This section provides evidence on what would have happened if instead of increasing NAFTA's RoO, as in USMCA, these were removed. Importantly, we do not ask what would happen today if NAFTA had not had RoO to begin with, as sourcing potentials today might be different. If RoO had never been implemented, the sourcing potential of NAFTA countries could be lower today, implying our results can be interpreted as a lower bound for the effects of NAFTA never having RoO.

For this counterfactual, we set RoO Strictness to be equal to zero across all industries. However, we still assume fixed costs of using NAFTA and MFN Tariffs whenever firms choose to export using WTO membership. If RoO are removed, the cost of using NAFTA to export decreases while the benefit of it, not paying MFN Tariffs, remains the same. Table 11 shows the changes in the key variables policymakers in the USA and Mexico likely care for.

	US Exports of inputs to Mexico	US Price index for Mexican imports	Mexican firm profits
Agriculture and Foods	7.63	-1.70	6.46
Minerals and Chemicals	1.64	-0.42	1.88
Skins and Textiles	15.31	-3.01	18.64
Mining	0.75	-0.60	0.97
Manufactures	0.81	-0.33	0.92
Others	12.01	-2.52	14.03
Average	6.36	-1.43	7.15

Table 11: Changes in key variables due to the removal of RoO.

Across all sectors, the removal of RoO would be beneficial for both countries. The USA would increase its exports of intermediates, and its consumers would face lower prices for their Mexican imports. Mexican firms would see their profits increase. The US firms that would benefit the most are those supplying inputs to the *Skins and Textiles* and *Others* sectors in Mexico. US consumers of goods from these sectors would experience the largest decrease in the price of their imports, as well as the ones for which Mexican firms would experience the largest increase in profits. The sectors that would benefit the least are *Mining* and *Manufacturing*, which could be the result of: (i) Already having lower RoO, as shown in Table 4. (ii) NAFTA countries are good suppliers of inputs for the *Mining* sector, so the removal of RoO does not matter as much because they were already sourcing from NAFTA. (iii) Firms in the *Mining* sector are smaller in size, according to Table 5, therefore they were less likely to source from non-NAFTA countries, and thus the removal of RoO would have a small effect. As in Section 6.1, we discuss the effects on US exports of intermediates in terms of three mechanisms: a substitution, an income, and a switching effect.

For the substitution effect, intuitively the removal of RoO should decrease the share of inputs being sourced from NAFTA countries. Inspection of Table 12 reveals this is not necessarily the case, as smaller firms would actually increase the share of their inputs coming from NAFTA. The removal of RoO would induce smaller firms to use NAFTA, decreasing marginal costs as they would no longer pay MFN Tariffs, and in turn, increasing revenue so these firms can now pay the fixed cost of sourcing from NAFTA. For larger firms, the substitution effect is indeed negative, as they would decrease the share of inputs they source from NAFTA countries. Since larger firms are able to source from either China or Europe, once RoO no longer restrict them, they increase the share of their inputs coming from these countries, as shown in Table 12. US suppliers selling to Mexican sectors in which there is a higher share of smaller firms actually experience a beneficial substitution effect, while firms

	Change						
	Small	Medium-small	Medium	Medium-large	Large	Aggregate	Units
Share of firms using NAFTA	3.43	1.53	3.61	15.76	14.68	7.80	p.p. Δ
Share of firms sourcing from China	0.00	-0.15	7.06	15.89	2.68	5.10	p.p. Δ
Share of firms sourcing from Europe	0.00	0.00	4.23	15.57	5.60	5.08	p.p. Δ
Share of firms sourcing from NAFTA	0.01	0.38	5.01	0.50	0.36	1.25	p.p. Δ
Share of inputs coming from NAFTA	0.00	0.13	1.24	-0.52	-0.36	-0.07	p.p. Δ
Average Marginal Cost	-0.24	-1.25	-6.85	-7.95	-6.95	-3.28	% Δ
Average Exports	4.47	3.12	18.17	26.28	1.77	2.13	% Δ

Table 12: Responses to the removal of RoO by firm size.

selling to sectors with larger firms will see their exports of intermediates decrease.

In this counterfactual, a stronger income effect benefits the USA and Mexico. The removal of RoO implies firms can now source their inputs from the cheapest suppliers across the World, which should decrease marginal cost, increasing demand and input purchases from the USA. The extent to which this is the case depends on firms' ability to source from non-NAFTA countries. Table 12 shows that larger firms are the ones that would increase their sourcing from these countries the most, thus experiencing the largest decreases in marginal cost. US firms selling to Mexican sectors with larger firms should experience the strongest income effect, as even if the share of inputs sourced from them decreases, these sectors experience an increase in their exports and thus, increase their purchases of intermediates from the USA. In summary, the beneficial income effect should be negligible for sectors with smaller firms, but beneficial for those with larger firms.

Lastly, for discussing the switching effect we present Table 13. Firms that would benefit the most from the removal of RoO are those that switch from WTO to NAFTA, experiencing on average a 24.23% increase in their exports. Their marginal cost would decrease significantly as they would no longer pay MFN Tariffs, and their increased revenue would now allow them to source from foreign countries. Firms that would keep using NAFTA do increase their exports but to a lower extent, as the removal of RoO would allow them to source a larger share of inputs from non-NAFTA countries, decreasing their marginal cost by 1.71%. US firms selling to Mexican sectors in which firms use NAFTA less intensively, and US consumers purchasing goods from them, would be the ones that benefit the most. Likewise, sectors benefiting the most would be those for which non-NAFTA countries are relatively better suppliers of their inputs, as it is the case of the *Skins and Texiles* sector according to Table 4.

	NAFTA to WTO	WTO to NAFTA	Stayed WTO	Stayed NAFTA	Units
Share of firms	0.00	0.08	0.13	0.79	-
	Change				
Share of firms sourcing from China	-	12.81	0.00	5.17	p.p. Δ
Share of firms sourcing from Europe	-	11.36	0.00	5.29	p.p. Δ
Share of firms sourcing from NAFTA	-	12.85	0.00	0.31	p.p. Δ
Share of inputs coming from NAFTA	-	2.18	0.00	-0.09	p.p. Δ
Average Marginal Cost	-	-34.75	-0.01	-1.71	% Δ
Average Exports	-	24.23	0.00	1.65	% Δ

Table 13: Responses to the removal of RoO by transitions between NAFTA and WTO.

This counterfactual suggests that removing RoO would benefit the USA and Mexico across all sectors. The degree to which a sector benefits depends on the size of its firms, the relative sourcing potential of NAFTA countries, and how strict were RoO. For sectors with larger firms, the removal does imply a lower share of intermediates being sourced from the USA. However, the effect of lower marginal costs achieved by firms being able to source from cheaper suppliers would be larger, and thus, US exports of intermediates would increase. Sectors in which firms are smaller would also benefit, as removing RoO would still lead to an increase in the share of firms using NAFTA, decreasing their marginal cost as these firms would no longer pay MFN Tariffs.

7 Discussion

This paper attempts to answer two questions: (i) How do RoO affect the use of NAFTA?, and (ii) What are the effects of protectionist policies, such as increases in RoO or Tariffs? To answer the first question, we present evidence that shows the impact of RoO on the use of NAFTA depends on firm size. Small firms should be less able to pay the fixed cost of using NAFTA to export, e.g. complying with labor and environmental regulations. Large firms should be more likely to be able to source from foreign countries, which increases their opportunity cost of complying with RoO.

Our empirical facts support this story, as we uncover an inverse U-shape relationship between the share of firms using NAFTA to export and firm size. This relationship is robust to controlling for the product-level incentives of using NAFTA, and other factors, such as how attractive it is for firms to source their inputs from non-NAFTA countries. By exploiting product-level variation in RoO and MFN Tariffs, we provide evidence on the existence of fixed costs of using NAFTA and sourcing from foreign countries. This by showing that larger firms are more responsive, in terms of their probability of using NAFTA, to stricter RoO and higher MFN Tariffs. We also find that the distortion in sourcing choices follows an inverse U-shape relationship with firm size: small firms can not source from non-NAFTA countries as intensively, and thus, having to comply with RoO does not significantly affect their behavior. The largest firms, on the other hand, will still source inputs from non-NAFTA countries. Even if restricted by RoO, their import volume is large enough to still find it profitable to pay countries' fixed costs of sourcing.

We include these findings in a structural model of global sourcing in which firms choose from which countries they can source their inputs, are whether they export using NAFTA or WTO membership. The former requires them to comply with RoO, while the latter implies they have to pay MFN Tariffs when exporting. Differences in firm size arise due to differences in US market demand and firm productivity, which is assumed to decrease marginal cost. Using our data on RoO and MFN Tariffs, we estimate the model by taking certain parameters from the literature, backing out country-industry specific sourcing potentials from inferred input shares, and using SMM to estimate US market demand, fixed costs of using NAFTA, and fixed costs of sourcing from foreign countries, independently for each sector.

We conduct three counterfactuals to evaluate the effects of protectionist trade policies: (i) The transition from NAFTA to USMCA, (ii) An increase in US Tariffs on Mexican imports, and (iii) NAFTA without RoO. Results suggest that protectionist policies are detrimental to the USA and Mexico. We focus our attention on three key variables policymakers in these countries are likely to care for: US exports of intermediates, US prices for Mexican imports, and Mexican firm profits. Our model predicts that the effects of these changes in trade policy are heterogeneous across sectors. Sectors with larger firms should be the ones most affected by these policies, as these firms have the highest opportunity cost of complying with RoO. Not only firm size matters when determining these effects, but also how attractive it is for sectors to source from NAFTA countries vs. non-NAFTA countries. An increase in RoO will disproportionally affect firms in sectors where NAFTA countries have a comparative disadvantage in supplying their inputs.

When including RoO in FTAs, policymakers seek to protect local industries and increase the regional content of exports within member countries. However, a detrimental effect arises: by forcing firms to source their inputs from possibly more expensive suppliers, the price of exports increases, leading to lower bilateral trade within the region, affecting firms and consumers. Additionally, changes in trade policy could lead to changes in how firms export their products, which could have the unintended consequence of them reducing the share of inputs they source from the region instead of increasing it, as these firms would no longer comply with RoO. Even if a policy successfully increases the share of regional content in exports, bilateral trade could decrease. The objective of trade policies should not be to maximize the share of the pie countries within an FTA get, but rather maximize the amount of pie these countries are getting in the end.

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Appendix

A Direct Requirement Coefficients in HS

According to the BEA, Direct Requirement Coefficients "show the amount of inputs purchased directly to produce one dollar of output." That is, the exact input composition of every final product, where the sum of these coefficients across a product's inputs adds up to one. As described in Section 2, Direct Requirement Coefficient (DRC) Tables are in NAICS, while the rest the data used in this paper is in HS. To illustrate how we construct HS input composition tables, we use the following example. Suppose the DRC Tables, which are in NAICS, look like Table 14.

NAICS Output	NAICS Inputs	DR Coefficient
A	C	0.6
A	D	0.4
B	C	0.8
B	D	0.2

Table 14: Example of Direct Requirement Coefficients Tables.

While the NAICS-HS correspondence looks like that of Table 15. Notice that the match NAICS-HS is of the many-to-many type, e.g. NAICS code A corresponds to more than one HS code, it corresponds to HS codes 1 and 2; while HS code 1 corresponds to more than one NAICS code, it corresponds to NAICS codes A and B.

NAICS Code	HS Code
A	1
A	2
B	1
B	3
C	3
C	4
D	4
D	5

Table 15: Example of the NAICS-HS Correspondence.

The first step is to create a match where outputs are defined in NAICS and inputs are in HS. We expand Table 14 by uniformly distributing the direct requirement coefficients of each NAICS input code across its corresponding HS codes, according to Table 15. This is shown in Table 16. By construction, note that for each NAICS output, the sum of the DR coefficients across its HS inputs adds up to one. We include NAICS-HS input combinations for which DR coefficients are implicitly equal to 0, e.g. HS code 5 does not correspond to NAICS code C.

NAICS Output	NAICS Inputs	HS Inputs	Adjusted NAICS DR Coefficient
A	C	3	0.3
A	C	4	0.3
A	C	5	0.0
A	D	3	0.0
A	D	4	0.2
A	D	5	0.2
B	C	3	0.4
B	C	4	0.4
B	C	5	0.0
B	D	3	0.0
B	D	4	0.1
B	D	5	0.1

Table 16: NAICS Outputs - HS Inputs correspondence.

We add the DR coefficients across every NAICS output - HS input combination, and then match NAICS outputs to HS outputs according to Table 15. Note that HS code 1 corresponds to both NAICS codes A and B. Table 17 shows how the DR coefficients table would look for HS output code 1.

HS Output	HS Inputs	Adjusted HS DR Coefficient
1	3	0.3
1	4	0.5
1	5	0.2
1	3	0.4
1	4	0.5
1	5	0.1

Table 17: HS Outputs - HS Inputs correspondence.

Lastly, we average the DR coefficients across every HS output-input combination; this is not necessary whenever an HS code corresponds to a unique NAICS code. Table 18 shows the final product of this computation, the exact input composition of HS output code 1 in terms of its HS input codes. It is important that the HS direct requirement coefficients add up to one because our computation of RoO Strictness is a weighted average of the inputs restricted under RoO for each final product.

HS Output	HS Inputs	Adjusted HS DR Coefficient
1	3	0.35
1	4	0.50
1	5	0.15

Table 18: Input Composition of HS Code 1.

B Regression Tables and Robustness Checks

In this appendix we include the estimation tables and robustness checks we conduct for the empirical facts in our paper. Table 19 shows the estimation results for the probability of using NAFTA to export, both for Equation 1 and for a regression where instead of controlling for the product-level RoO Strictness and MFN Tariffs, we control for industry fixed-effects to account for any unobserved heterogeneity at the industry-level. These fixed effects should already capture variation across industries in their RoO and MFN Tariffs.

Figure 17 shows the predicted share of firms using NAFTA by deciles of firm size, assuming for simplicity that RoO Strictness and MFN Tariffs are equal to zero. In blue are the same results as in Figure 4, in red we show the estimated coefficients when controlling for industry fixed effects, and in green when we control for both RoO Strictness, MFN Tariffs, and industry fixed effects. Results show that our result of an inverse U-shape relationship between the use of NAFTA and firm size is result to controlling for industry fixed effects, thus to any source of heterogeneity at the industry-level. To further check the robustness of these findings, we estimate the following relationship:

$$\mathbb{N}_{ikjt} = \beta_0 + \beta_1 \text{Size}_{it} + \beta_2 \text{Size}^2_{it} + \alpha_1 \text{RoO}_j + \alpha_2 \text{MFN}_j + \iota_t + \epsilon_{ikjt} \tag{22}$$

where $\mathbb{N}_{ikjt} = 1$ if firm i of size k exporting product j at time t is using NAFTA to export, and Size_{it} represents a proxy for firm i's size at time t. We consider two different proxies: (i) Percentiles of firm size, as described in Section 3. (ii) The log of a firm's total exports. We also either control for RoO Strictness and MFN Tariffs, or include industry fixed effects. Results of these estimations are shown in Table 20.

	(1) Pr(NAFTA)	(2) Pr(NAFTA)
2nd decile	0.123***	0.0358
	(7.09)	(1.94)
3rd decile	0.166***	0.0946***
	(8.12)	(4.39)
4th decile	0.201***	0.124***
	(9.72)	(5.60)
5th decile	0.212***	0.138***
	(9.94)	(6.04)
6th decile	0.201***	0.137***
	(9.25)	(5.79)
7th decile	0.203***	0.133***
	(9.34)	(5.40)
8th decile	0.186***	0.128***
	(8.24)	(4.97)
9th decile	0.137***	0.106***
	(5.35)	(3.95)
10th decile	0.0242	0.0625*
	(0.76)	(2.15)
RoO Strictness	-0.00510***	
	(-10.68)	
MFN Tariff	0.00817***	
	(4.81)	
Constant	0.624***	0.717***
	(29.37)	(35.77)
HS Chapter F.E.	✗	✓
Observations	105,959	70,936

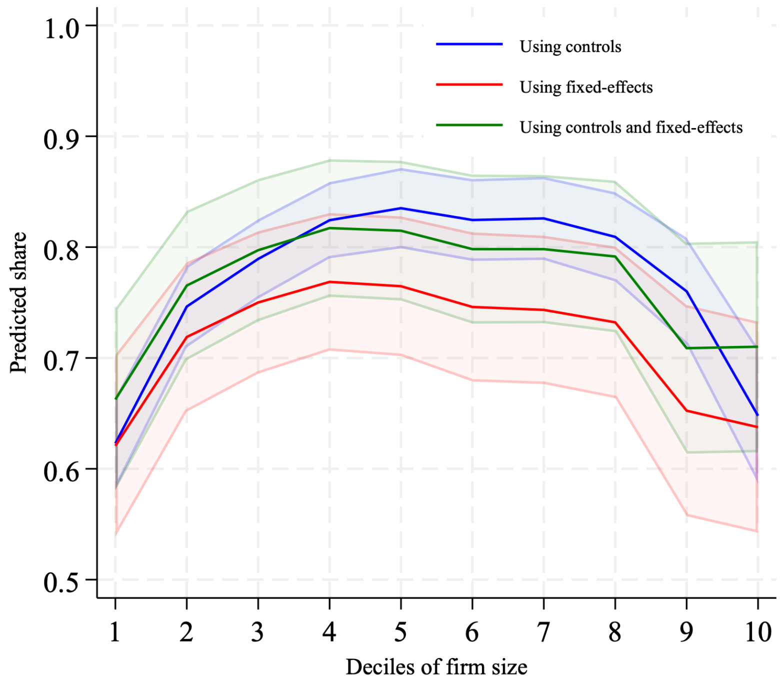
t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 19: Regression Output for the Probability of using NAFTA

	(1) Pr(NAFTA)	(2) Pr(NAFTA)	(3) Pr(NAFTA)	(4) Pr(NAFTA)
Size percentile	0.0104***	0.00607***		
	(11.51)	(6.79)		
Percentile sq	-0.000100***	-0.0000529***		
	(-11.01)	(-6.77)		
RoO Strictness	-0.00508***		-0.00520***	
	(-10.64)		(-10.94)	
MFN Tariff	0.00793***		0.00769***	
	(4.67)		(4.54)	
Log of exports			0.161***	0.0701***
			(10.63)	(4.96)
Log of exports sq			-0.00697***	-0.00287***
			(-9.96)	(-4.33)
Constant	0.586***	0.685***	-0.105	0.405***
	(25.95)	(30.06)	(-1.30)	(5.29)
HS Chapter F.E.	✗	✓	✗	✓
Observations	105,959	70,935	105,959	70,935

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 20: Robustness Checks for the Probability of using NAFTA

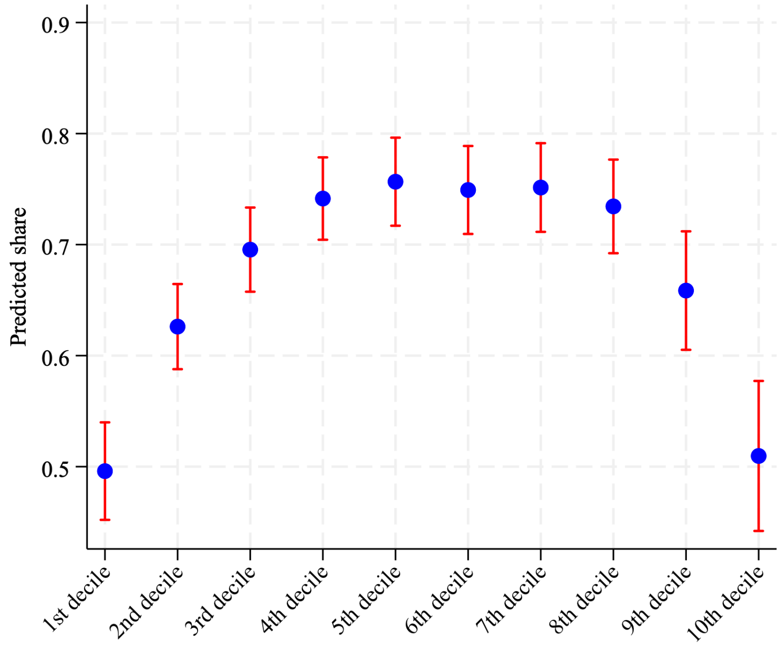


Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Prediction shows the estimated coefficients controlling either for the effect of RoO and MFN Tariffs, or including HS Chapter fixed-effects. Colored areas show the 95% confidence interval. Standard errors are clustered at the firm-level.

Figure 17: Predicted share of exporters using NAFTA by size decile.

In our data, we can not identify firms that are part of either Global Value Chains or Maquilas. It is a possibility that these types of firms are unable to choose whether to use NAFTA or WTO, or choose their sourcing strategy and compliance with RoO. Therefore, including them in our data sample could introduce a bias in our estimates, e.g. if a Maquila firm has to export using NAFTA, then the probability of using NAFTA to export is not affected by RoO Strictness, and thus, this will introduce a downward bias in our estimates for the marginal effect of RoO Strictness over the probability of using NAFTA to export. This same intuition applies to firms that are part of a GVC, where Mexican firms might not have enough market power for them to choose their use of NAFTA and their sourcing strategy. To address these concerns, we perform the following additional robustness checks: (i) Estimate Equation 1 but excluding the automotive and textiles industries,[15] as anecdotal evidence suggests these are the industries in which most of the Mexican firms that are part of either GVCs or Maquilas concentrate. (ii) Estimate the same equation but now remove one industry at a time, thus providing evidence that a particular industry does not drive our

[15]For textiles, we drop all observations corresponding to HS Chapters 61, 62, and 63. For automobiles, we drop HS Chapter 87.



Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Red intervals indicate the 95% confidence interval. Standard errors are clustered at the firm-level. Data sample used for the estimation excludes firms in the Textiles or Automotive industries; those from HS Chapters 61, 62, 63, and 87.

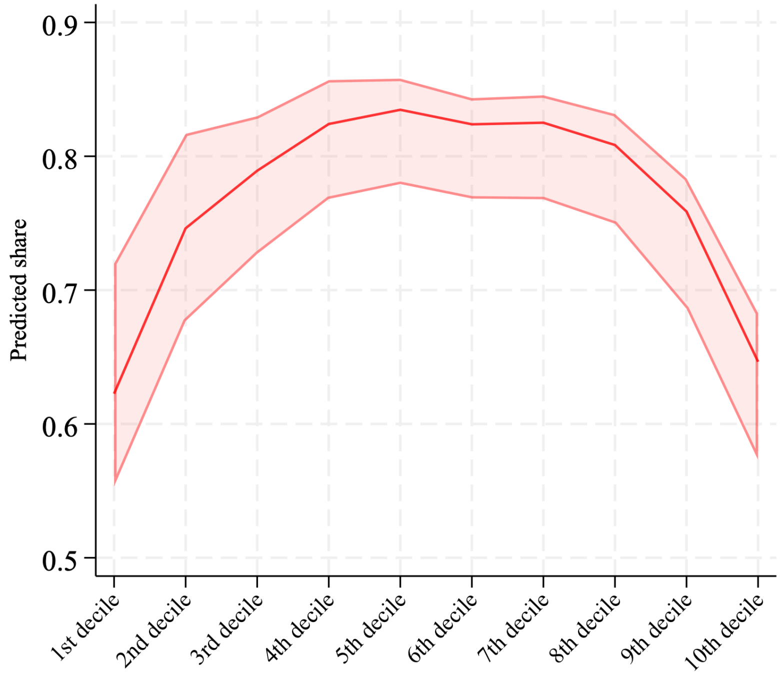
Figure 18: Predicted share of exporters using NAFTA removing Textiles and Automotive.

results for the inverse U-shape relationship.

Figure 18 shows our results for the inverse U-shape relationship between the use of NAFTA and firm size, excluding observations for either the Textiles or Automotive industries. Results for removing one industry at a time and studying how the inverse U-shape relationship changes are shown in Figure 19, which plots the *convex hull* of the predicted share of firms using NAFTA by size decile, i.e. we estimate Equation 1 removing one industry at a time. Then for each estimation we predict the share of firms using NAFTA to export by size decile. Then for each decile, we find the lowest and the highest prediction. Figure 19 plots the area between these two predictions.

These results support our empirical findings for the inverse U-shape relationship between the use of NAFTA and firm size. This relationship is robust to controlling for product-level incentives of using NAFTA, including industry fixed effects to account for any industry-level heterogeneity, using alternative proxies for firm size, and showing that the results does not depend on particular industries, which might be affected by the presence of GVCs or Maquilas.

Table 21 shows the full results of estimating Equation 2, where we omit including a



Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Figure shows the convex hull of the predictions resulting from removing one industry at a time
Standard errors are clustered at the firm-level.

Figure 19: Predicted share of exporters using NAFTA removing one industry at a time.

dummy for the first decile for the intercept and for the interactions with RoO Strictness and MFN Tariffs, thus the results should be interpreted relative to the first decile.

In terms of the effect of firm size on the probability of sourcing inputs outside of NAFTA, estimation results for Equation 3 are shown in Table 22. We conduct the same robustness checks as those for the probability of using NAFTA to export. First, Table 23 shows estimates for the following equation:

$$\mathbb{S}_{ist} = \beta_0 + \beta_1 \text{Size}_{it} + \beta_2 \text{Size}_{it}^2 + \iota_{st} + \epsilon_{ikjt} \tag{23}$$

where $\mathbb{S}_{ist} = 1$ if firm i of industry s is sourcing inputs outside of NAFTA at time t, and Size_{it} represents again different proxies for firm size. Results are robust to using these alternative measures. Next, we estimate the same relationship but again: (i) Removing observations for Textiles or Automotive industries from our sample. (ii) Estimating the relationship by removing one industry at a time.

Results for (i) are shown in Figure 20, which provides evidence on our empirical finding for the distortion caused by RoO not driven by the Textiles or Automotive industries. For (ii), we estimate Equation 24 but instead of separately estimating the relationship for firms

	(1)
	Pr(NAFTA)
2nd decile	0.0966** (3.15)
3rd decile	0.137*** (3.55)
4th decile	0.235*** (6.04)
5th decile	0.242*** (5.91)
6th decile	0.236*** (5.69)
7th decile	0.216*** (5.24)
8th decile	0.157*** (3.49)
9th decile	-0.0340 (-0.54)
10th decile	-0.266*** (-3.95)
RoO Strictness	0.00346*** (4.20)
2nd decile × RoO Strictness	-0.00338*** (-3.94)
3rd decile × RoO Strictness	-0.00747*** (-7.31)
4th decile × RoO Strictness	-0.00977*** (-8.63)
5th decile × RoO Strictness	-0.0105*** (-8.98)
6th decile × RoO Strictness	-0.0103*** (-8.23)
7th decile × RoO Strictness	-0.0119*** (-9.38)
8th decile × RoO Strictness	-0.0130*** (-9.74)
9th decile × RoO Strictness	-0.0130*** (-9.51)
10th decile × RoO Strictness	-0.00992*** (-5.87)
MFN Tariff	-0.0117** (-3.01)
2nd decile × MFN Tariff	0.00879* (2.24)
3rd decile × MFN Tariff	0.0170*** (3.66)
4th decile × MFN Tariff	0.0144** (3.11)
5th decile × MFN Tariff	0.0162*** (3.44)
6th decile × MFN Tariff	0.0155** (3.17)
7th decile × MFN Tariff	0.0208*** (4.36)
8th decile × MFN Tariff	0.0273*** (5.17)
9th decile × MFN Tariff	0.0419*** (6.74)
10th decile × MFN Tariff	0.0529*** (7.04)
Constant	0.661*** (22.60)
Observations	105,959

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 21: Estimated Marginal Effects of RoO and MFN Tariffs.

	(1) Firms using WTO	(2) Firms using NAFTA
2nd decile	0.0549***	0.0399***
	(5.00)	(7.41)
3rd decile	0.137***	0.0879***
	(5.41)	(11.46)
4th decile	0.237***	0.117***
	(8.98)	(11.69)
5th decile	0.342***	0.151***
	(9.19)	(14.35)
6th decile	0.486***	0.197***
	(15.01)	(16.11)
7th decile	0.524***	0.235***
	(15.86)	(15.28)
8th decile	0.616***	0.268***
	(18.49)	(15.29)
9th decile	0.704***	0.353***
	(22.07)	(17.54)
10th decile	0.850***	0.619***
	(40.80)	(23.95)
Constant	0.0244***	-0.0774***
	(3.48)	(-10.78)
HS Chapter F.E.	✓	✓
Observations	13,293	57,642

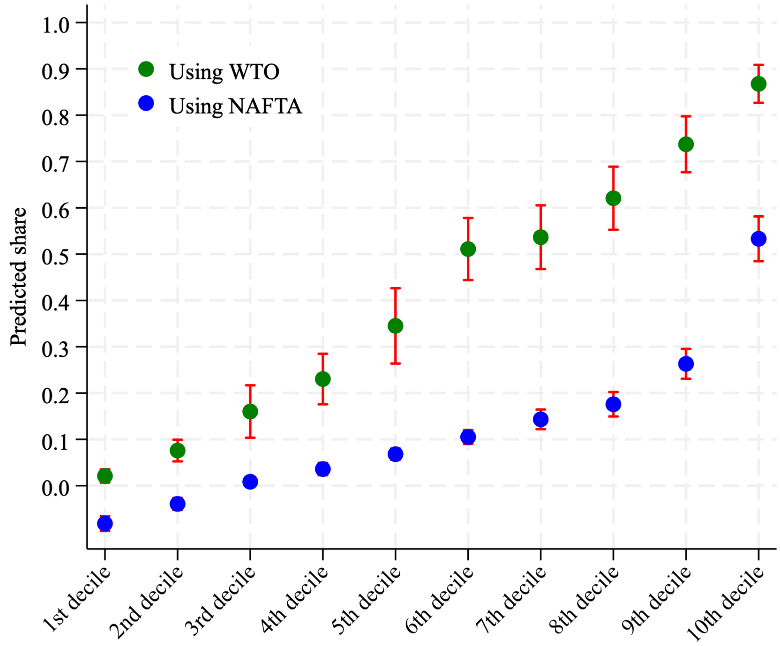
t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 22: Regression Output for the Probability of Non-NAFTA sourcing.

	(1) Firms using WTO	(2) Firms using NAFTA	(3) Firms using WTO	(4) Firms using NAFTA
Size percentile	0.00747***	-0.00151*		
	(6.55)	(-2.25)		
Percentile sq	0.0000187	0.0000689***		
	(1.63)	(9.55)		
Log of exports			0.0283*	-0.0977***
			(1.97)	(-9.24)
Log of exports sq			0.00314***	0.00782***
			(4.18)	(14.85)
Constant	-0.0236	-0.0273*	-0.304***	0.216***
	(-1.87)	(-2.24)	(-5.02)	(4.12)
HS Chapter F.E.	✓	✓	✓	✓
Observations	13,293	57,642	13,293	57,642

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 23: Robustness Checks for the Probability of Non-NAFTA sourcing.



Source: Author's calculations using Mexico's customs data, BEA's 1997 IO Tables, NAFTA's Annex 401, and US HTS 2022.
Note: Red intervals indicate the 95% confidence interval. Standard errors are clustered at the firm-level. Data sample used for the estimation excludes firms in the Textiles or Automotive industries; those from HS Chapters 61, 62, 63, and 87.

Figure 20: Predicted non-NAFTA sourcing removing Textiles and Automotive.

using NAFTA and those using WTO, we explicitly control for the effect of using NAFTA to export and allow it to change by firm size:

$$\mathbb{S}_{ikst} = \beta_0^n + \sum_{k=2}^{10} \beta_k^n \mathbb{I}_{ikt} + \sum_{k=1}^{10} \alpha_k^n \mathbb{I}_{ikt} \mathbb{N}_{ikt} + \iota_{st}^n + \epsilon_{ijt} \tag{24}$$

Figure 21 shows the mean and convex hull for α_k across size deciles. There are 53 industries in our sample, therefore we have 53 sets of $\{\alpha_k^n\}_{k=1}^{10}$. For a given decile k, the line in the middle is the average across estimations:

$$\bar{\alpha}_k = \frac{1}{53} \sum_{n=1}^{53} \alpha_k^n$$

The colored area shows both the lowest estimated effect $\alpha_k^{min} = \min_n \alpha_k^n$ and the largest one $\alpha_k^{max} = \max_n \alpha_k^n$, i.e. the colored area does not represent the size of the distortion, but rather the set of predicted distortions obtained by removing one industry at a time. The distortion induced by RoO is the distance between the zero line and any point inside the convex hull of the predictions.

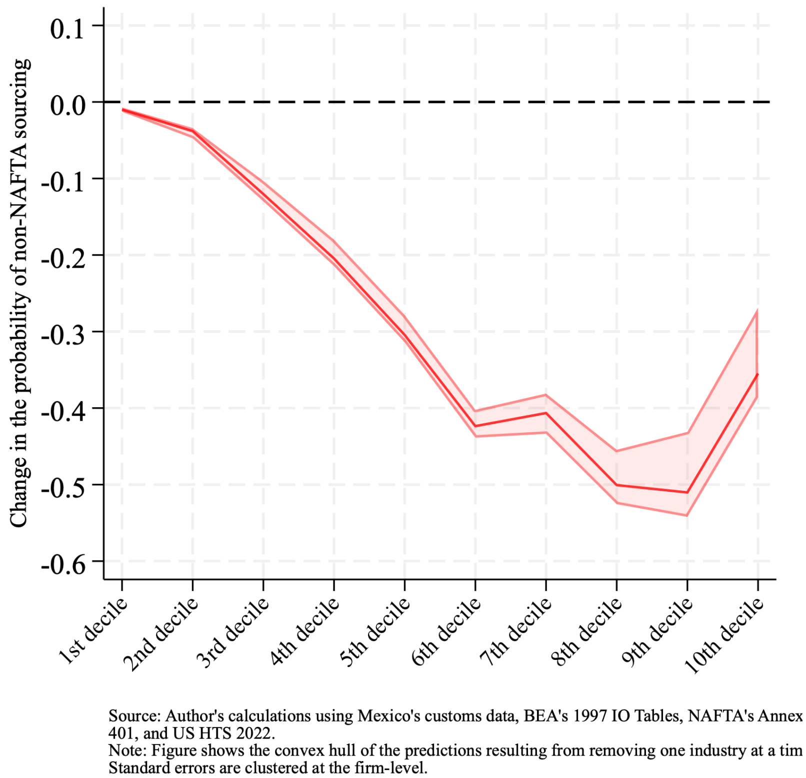


Figure 21: Distortion in non-NAFTA sourcing removing one industry at a time.

These results provide evidence on the robustness of our empirical fact for the U-shape relationship between firm size and the distortion in non-NAFTA sourcing induced by RoO.

C Additional Empirical Facts

This section provides additional empirical facts we observe in the data. Figure 22 shows the time series for the share of firms using NAFTA to export by export destination. The share of using NAFTA remained constant over our sample periods, although a degree of seasonality can be observed in the Figure. This seasonality is likely driven by changes in the composition of Mexican exports throughout the year, e.g. if vegetables are mostly exported during Winter months, and vegetable producers use NAFTA more intensively. The Figure also shows that the intensity of the use of NAFTA is mostly the same whether exporting to the USA or to Canada, although volatility is higher for the latter.

Consistent with our structural model, there is industry-level heterogeneity in both the use of NAFTA and sourcing from non-NAFTA countries, which is presented in Figures 23 and 24, respectively. Industries correspond to an HS 1-digit level of disaggregation. In the

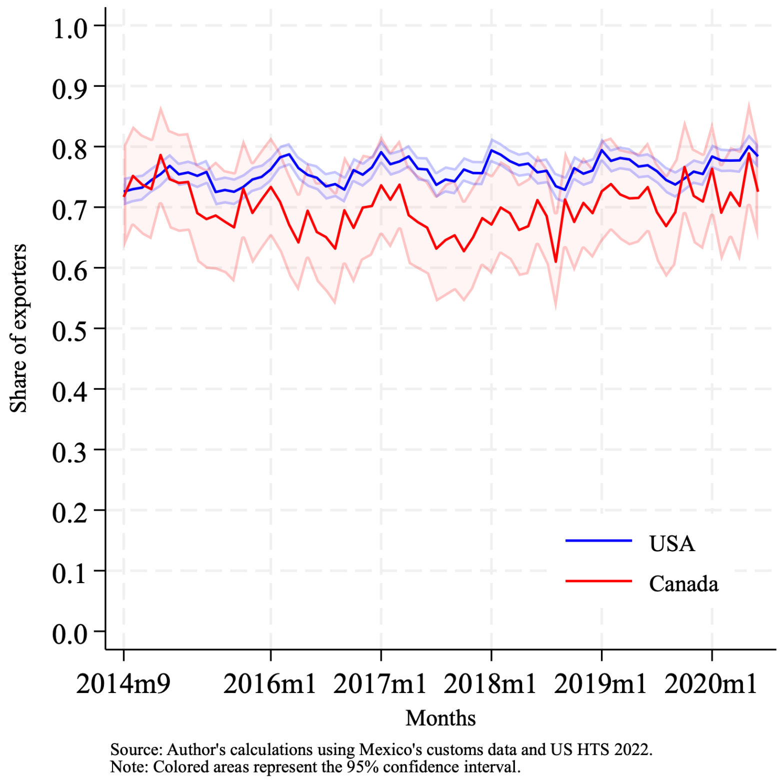


Figure 22: Share of exporters using NAFTA by Export Destination.

case of the use of NAFTA, this observed heterogeneity intuitively should be driven either by heterogeneity in the benefits of using NAFTA or in its costs. In terms of benefits, industries are heterogeneous in terms of the MFN Tariffs they would have to pay if exporting using WTO membership, and in terms of the costs either in terms of their RoO or the fixed cost of using NAFTA. In our model, we incorporate these features by directly feeding in RoO and MFN Tariffs at the industry level and allowing the fixed cost of using NAFTA to be industry-specific.

Turning our attention to sourcing outside of NAFTA countries, once again, the heterogeneity should be driven by different benefits and costs of sourcing from Non-NAFTA countries. Industries should be heterogeneous in terms of how attractive it is to source from Non-NAFTA countries, depending on the patterns of comparative advantage across the World e.g. if for Mexican firms in a particular industry the USA is a great supplier of their inputs, then there is not much of an incentive to source from Non-NAFTA country. Costs of sourcing outside of NAFTA should also be heterogeneous across industries, as some of them should find it easier to source inputs from foreign countries due to the nature of their inputs, how connected worldwide is their industry, etc. In our model, we allow for the attrac-

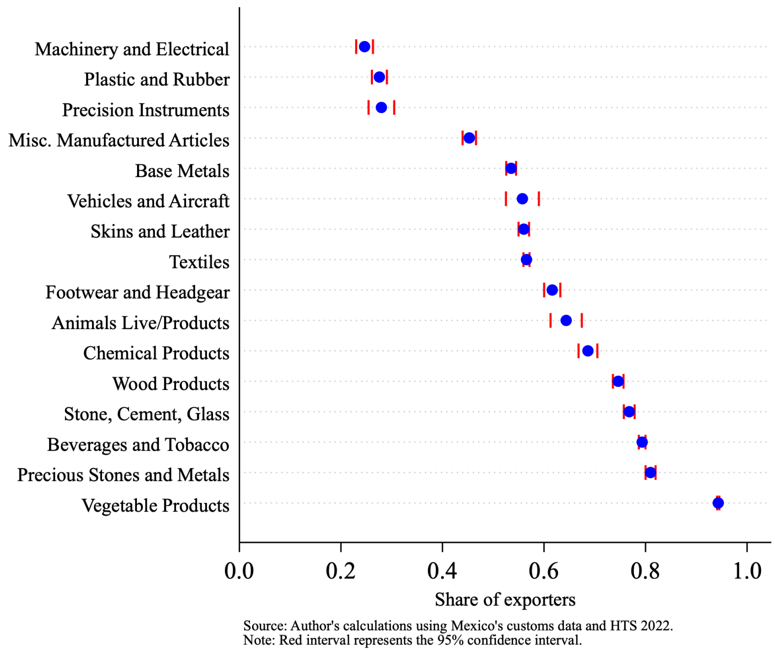


Figure 23: Share of exporters using NAFTA by HS Section.

tiveness of sourcing from foreign countries and fixed costs of sourcing to be heterogeneous at the industry level.

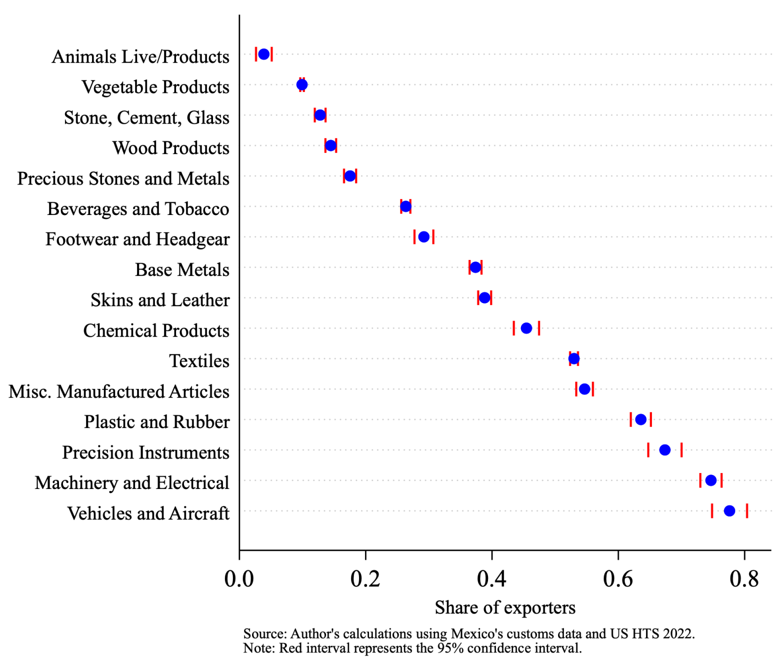


Figure 24: Share of exporters sourcing outside of NAFTA by HS Section.

D Marginal Cost of Producing and Exporting

According to Equation 8, the marginal cost of producing and exporting is given by:

$$c_{si}(\phi,\kappa,\lambda,\tau,J) = \frac{1+(1-\kappa)\tau}{\phi}\left(\int_{0}^{\kappa\lambda} z_{si}(\nu)^{1-\rho}d^{*}\nu + \int_{\kappa\lambda}^{1} z_{si}(\nu)^{1-\rho}d\nu\right)^{1/(1-\rho)}$$

Which we can rewrite as:

$$c_{si}(\phi,\kappa,\lambda,\tau,J) = \frac{1+(1-\kappa)\tau}{\phi}\left(\kappa\lambda\int_{0}^{\infty} z^{1-\rho}dG^{*}_{si}(z) + (1-\kappa\lambda)\int_{0}^{\infty} z^{1-\rho}dG_{si}(z)\right)^{1/(1-\rho)}$$

Taking into account the distribution for prices depends on whether it is an input restricted under RoO, $G^{*}_{si}(z)$, or an unrestricted one, $G_{si}(z)$. Following Eaton and Kortum (2002):

$$\int_{0}^{\infty} z^{1-\rho}dG^{*}_{si}(z) = \Gamma\Big(\frac{\theta-1-\rho}{\theta}\Big)\left[\sum_{h\in N\cap J} T^{h}_{si}(d^{h}w^{h}_{si})^{-\theta}\right]^{\frac{-(1-\rho)}{\theta}}$$

And:

$$\int_{0}^{\infty} z^{1-\rho}dG_{si}(z) = \Gamma\Big(\frac{\theta-1-\rho}{\theta}\Big)\left[\sum_{h\in J} T^{h}_{si}(d^{h}w^{h}_{si})^{-\theta}\right]^{\frac{-(1-\rho)}{\theta}}$$

Which allows us to rewrite marginal cost as:

$$c_{si}(\phi,\kappa,\lambda,\tau,J) = \frac{1}{\phi}\gamma^{-\frac{1}{\theta}}\Big[1+(1-\kappa)\tau\Big]\Big[\kappa\lambda\Psi^{\frac{\rho-1}{\theta}} + (1-\kappa\lambda)\Phi^{\frac{\rho-1}{\theta}}\Big]^{1/(1-\rho)}$$

With:

$$\gamma = \Gamma\Big(\frac{\theta-1-\rho}{\theta}\Big)^{-\frac{\theta}{1-\rho}}$$

$$\Psi = \left[\sum_{h\in N\cap J} T^{h}_{si}(d^{h}w^{h}_{si})^{-\theta}\right]^{\frac{-(1-\rho)}{\theta}}$$

$$\Phi = \left[\sum_{h\in J} T^{h}_{si}(d^{h}w^{h}_{si})^{-\theta}\right]^{\frac{-(1-\rho)}{\theta}}$$

E Purchases of Intermediate Inputs

This section shows how firm ϕ's purchases of inputs from country j can be expressed as a share of its operating profits, as stated in Equation 18. Using 12 we can write operating profits as:

$$\begin{aligned} \pi^o_{si}(\phi,\kappa^*,\lambda,\tau) &= [p_{si}(\phi,\kappa,\lambda,\tau,J) - c_{si}(\phi,\kappa,\lambda,\tau,J)]q_{si}(\phi) \\ \Rightarrow c_{si}(\phi,\kappa,\lambda,\tau,J)q_{si}(\phi) &= (\sigma-1)\pi^o_{si}(\phi,\kappa^*,\lambda,\tau) \end{aligned} \tag{25}$$

As firm ϕ is sourcing share x^j_{si} of its inputs from country j, the share of its marginal cost coming exclusively from its purchases from j will be then given by:

$$\begin{aligned} c^j_{si}(\phi,\kappa,\lambda,\tau,J) &= x^j_{si}(\phi,\kappa,\lambda,J)c_{si}(\phi,\kappa,\lambda,\tau,J) \\ \Rightarrow c_{si}(\phi,\kappa,\lambda,\tau,J) &= \frac{c^j_{si}(\phi,\kappa,\lambda,\tau,J)}{x^j_{si}(\phi,\kappa,\lambda,J)} \end{aligned}$$

And then rewrite Equation 25 as:

$$\begin{aligned} q_{si}(\phi)\frac{c^j_{si}(\phi,\kappa,\lambda,\tau,J)}{x^j_{si}(\phi,\kappa,\lambda,J)} &= (\sigma-1)\pi^o_{si}(\phi,\kappa^*,\lambda,\tau) \\ \Rightarrow q_{si}(\phi)c^j_{si}(\phi,\kappa,\lambda,\tau,J) &= (\sigma-1)x^j_{si}(\phi,\kappa,\lambda,J)\pi^o_{si}(\phi,\kappa^*,\lambda,\tau) \end{aligned}$$

Since c^j_{si} is the marginal cost exclusively coming from j, i.e. the value of inputs purchased from j for the production of one unit of the final good, and $q_{si}(\phi)$ represents the number of units sold, it follows that:

$$M^j_{si}(\phi) = (\sigma-1)x^j_{si}(\phi,\kappa,\lambda)\pi^o_{si}(\phi,\kappa,\lambda,\tau)$$

F Supermodularity of Firm Profits

This section shows how in our model, firm profits are not necessarily supermodular in productivity and thus could not feature increasing differences in a firm's sourcing strategy. For this reason, we cannot reduce the dimensionality of the firm's problem as in Antras et al. (2017), following Jia (2008), and have to compute firm profits under each possible sourcing strategy.

According to Topkis's Modularity Theorem, if the expression for profits in Equation 15 satisfies being supermodular in $(I_{si}^j(\phi), \phi)$ where $I_{si}^j(\phi) = 1$ if firm ϕ sources inputs from j, then $I_{si}^*(\phi) = (I_{si}^1(\phi), ..., I_{si}^J(\phi))$ is non-decreasing in ϕ, i.e. the cardinality of a firm's sourcing strategy is increasing in its productivity. For profits to be supermodular, two conditions have to be satisfied:

1. Let $X = [0,1]^J$ and $Y = \mathbb{R}^+$, where X and Y are lattices and thus $X \times Y$ is a lattice as well. $\pi_{si}(\phi)$ has to have increasing differences in $(I_{si}(\phi), \phi) \iff \pi_{si}(\phi)$ features increasing differences in $(I_{si}^j(\phi), \phi)$ $\forall j \in J$, given $I_{si}^k(\phi)$ for $k \neq j$.

2. $\pi_{si}(\phi)$ features increasing differences in $(I_{si}^j(\phi), I_{si}^k(\phi))$, given $I_{si}^h(\phi)$ for $h \neq j, k$.

Our proof relies on showing that our profit function does not necessarily satisfy increasing differences in $(I_{si}^j(\phi), \phi)$, therefore it does not have to be supermodular, implying that the cardinality of a firm's sourcing strategy might not increase with firm productivity. Let $\phi_H > \phi_L$, for profits to feature increasing differences in $(I_{si}^j(\phi), \phi)$ the following has to hold true:

$$\begin{aligned}\mathbb{E}\Big[\pi_{si}(1,\phi_H) - \kappa(\phi_H)w\zeta_{si} - \pi_{si}(0,\phi_H) + \kappa(\phi_H)w\zeta_{si}\Big] &\geq \mathbb{E}\Big[\pi_{si}(1,\phi_L) - \kappa(\phi_L)w\zeta_{si} - \pi_{si}(0,\phi_L) + \kappa(\phi_L)w\zeta_{si}\Big] \\ \Rightarrow \mathbb{E}\Big[\pi_{si}(1,\phi_H) - \pi_{si}(0,\phi_H)\Big] &\geq \mathbb{E}\Big[\pi_{si}(1,\phi_L) - \pi_{si}(0,\phi_L)\Big]\end{aligned} \tag{26}$$

since $I_{si}^{j'} \geq I_{si}^j \Rightarrow I_{si}^{j'} = 1 \wedge I_{si}^j = 0$. We do not consider the case for which $I_{si}^{j'} = I_{si}^j = 0$ as it is trivially satisfied. Note that we are fixing other countries in the firm's sourcing strategy, i.e. $I_{si}^{k'} = I_{si}^k$ $\forall k \neq j$. Using the objective function in Equation 15, each side of the inequality can be expressed as:

$$\phi^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{si}[1+(1-\kappa)\tau]^{1-\sigma}[\Lambda(1,\phi)-\Lambda(0,\phi)]-w\mathbb{E}\Big[f_{si}^j(\phi)\Big]-w\sum_{k\neq j}I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi)\Big]+w\sum_{k\neq j}I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi)\Big]$$

Where:

$$\Lambda(I_{si}^j, \phi) \equiv [\kappa\lambda\Psi_{si}(I_{si}^j, \phi)^{(\rho-1)/\theta} + (1-\kappa\lambda)\Phi_{si}(I_{si}^j, \phi)^{(\rho-1)/\theta}]^{\frac{1-\sigma}{1-\rho}}$$

Which allows us to rewrite Inequality 26 as:

$$\phi_H^{\sigma-1}[\Lambda(1,\phi_H) - \Lambda(0,\phi_H)] - w\mathbb{E}\Big[f_{si}^j(\phi_H)\Big] \geq \phi_L^{\sigma-1}[\Lambda(1,\phi_L) - \Lambda(0,\phi_L)] - w\mathbb{E}\Big[f_{si}^j(\phi_L)\Big]$$

Since we assume that fixed costs of sourcing do not depend on firm size, expectations cancel and we get:

$$\phi_H^{\sigma-1}[\Lambda(1,\phi_H)-\Lambda(0,\phi_H)] \geq \phi_L^{\sigma-1}[\Lambda(1,\phi_L)-\Lambda(0,\phi_L)]$$

By assumption $\phi_H > \phi_L$ and $\sigma > 1$, so for the above to necessarily hold true it needs to be the case that:

$$\Lambda(1,\phi_H)-\Lambda(0,\phi_H) \geq \Lambda(1,\phi_L)-\Lambda(0,\phi_L) \tag{27}$$

Following the definition for $\Lambda(I_{si}^j,\phi)$ and since $\sigma > \rho$, Inequality 27 is true if $\phi_L \leq \phi_H \Rightarrow \Lambda(\phi_L) \leq \Lambda(\phi_H)$. Assume $\phi_L \leq \phi_H$, firms' chosen sourcing strategies $J^*(\phi_H)$ and $J^*(\phi_L)$ have to satisfy that for the high productivity firm:

$$\begin{aligned}
&\phi_H^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{si}[1+(1-\kappa(\phi_H))\tau]^{1-\sigma}\Lambda(J^*(\phi_H)) - w\sum_{j\in J^*(\phi_H)} I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi_H)\Big] - \kappa(\phi_H)w\zeta_{si}\\
\geq\ &\phi_H^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{si}[1+(1-\kappa(\phi_L))\tau]^{1-\sigma}\Lambda(J^*(\phi_L)) - w\sum_{j\in J^*(\phi_L)} I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi_L)\Big] - \kappa(\phi_L)w\zeta_{si}
\end{aligned}$$

And for the low productivity firm:

$$\begin{aligned}
&\phi_L^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{si}[1+(1-\kappa(\phi_L))\tau]^{1-\sigma}\Lambda(J^*(\phi_L)) - w\sum_{j\in J^*(\phi_L)} I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi_L)\Big] - \kappa(\phi_L)w\zeta_{si}\\
\geq\ &\phi_L^{\sigma-1}\gamma^{(\sigma-1)/\theta}B_{si}[1+(1-\kappa(\phi_H))\tau]^{1-\sigma}\Lambda(J^*(\phi_H)) - w\sum_{j\in J^*(\phi_H)} I_{si}^j\mathbb{E}\Big[f_{si}^j(\phi_L)\Big] - \kappa(\phi_H)w\zeta_{si}
\end{aligned}$$

The above follows from the fact that for the high productivity firm ϕ_H sourcing strategy $J^*(\phi_H)$ yields larger profits, and correspondingly for the low productivity firm ϕ_L. Adding these two inequalities and using the fact that fixed costs of sourcing do not depend on firm productivity, gives us:

$$[\phi_H^{\sigma-1}-\phi_L^{\sigma-1}]\Big([1+(1-\kappa(\phi_H))\tau]^{1-\sigma}\Lambda(J^*(\phi_H)) - [1+(1-\kappa(\phi_L))\tau]^{1-\sigma}\Lambda(J^*(\phi_L))\Big) \geq 0$$

Since $\phi_L \leq \phi_H$ and $\sigma > 1$, this implies that:

$$[1+(1-\kappa(\phi_H))\tau]^{1-\sigma}\Lambda(J^*(\phi_H)) \geq [1+(1-\kappa(\phi_L))\tau]^{1-\sigma}\Lambda(J^*(\phi_L))$$

For $\Lambda(\phi_H) \geq \Lambda(\phi_L)$ to necessarily be the case, it has to be true that:

$$[1 + (1 - \kappa(\phi_H))\tau]^{1-\sigma} \leq [1 + (1 - \kappa(\phi_L))\tau]^{1-\sigma}$$
$$\Rightarrow (1 - \kappa(\phi_H))\tau \geq (1 - \kappa(\phi_L))\tau$$
$$\Rightarrow \kappa(\phi_H) \leq \kappa(\phi_L)$$

That is, that whenever a firm uses NAFTA to export, $\kappa(\phi_H) = 1$, any other firm with lower productivity has to use it as well, $\kappa(\phi_L) = 1$. In our model, this is not necessarily true. Because of fixed costs of using NAFTA, it could be the case that a medium-sized is using NAFTA to export, while a smaller less-productive firm is not. Since $\phi_L \leq \phi_H \not\Rightarrow \Lambda(\phi_L) \leq \Lambda(\phi_H)$, profits in our model do not necessarily feature increasing differences in $(I^j_{si}(\phi), \phi)$, and thus are not necessarily supermodular in productivity. This implies we can not invoke Topkis's Modularity Theorem to argue that the cardinality of a firm's sourcing strategy is increasing in its productivity, and have to brute-force the firm's optimization problem by computing profits for each possible sourcing strategy.

Intuitively, this is the case because the use of NAFTA and RoO introduce additional non-linearities into our model. For example, a low productivity firm might not be able to pay the fixed cost of using NAFTA, and therefore it chooses to source from non-NAFTA countries. A more productive firm might be able to pay this fixed cost and choose to use NAFTA, which then could lead to the firm choosing to source its inputs exclusively from member countries. In this example, the set of countries from which the lower productivity firm can source inputs from is larger than that of the higher productivity firm.

G Full Results for Sourcing Potentials

For some industries in foreign countries, Mexican firms never imports some of their inputs from them, which implies that the input shares for these product-country combinations are equal to 0. When regressing the log-difference with respect to the corresponding input share for Mexico against industry-country fixed effects, if we ignored these observations for which input shares are equal to 0, we would introduce an upward bias in our estimates for sourcing potentials. For example, suppose in China *Industry A* is made of *Inputs* 1-100. Mexico does not import from China any product from *Industry A* except for *Input* 100, and it coincides with Mexico barely sourcing this product domestically. This implies the relative input share of China to that of Mexico for *Input* 100 is large, and since *Inputs* 1-99 are not imported at all, the observation for *Inputs* 100 is the only one used in the estimation. A bias is introduced as *Input* 100 is just a small part of *Industry A*, but we would estimate a large sourcing potential of China for this industry. To avoid dropping observations and introducing these biases, whenever an input is not sourced from a foreign country, we assign an input share equal to 0.1 to this input-country combination.

Table 24 shows the full results of our estimation for foreign countries' sourcing potentials. As a reminder, these estimates are interpreted as relative to the sourcing potential of Mexico, which is normalized to be equal to 1. For the NAFTA region, the industry (HS Chapter) with the lowest sourcing potential is *Meats and Edible Meats* with 0.07, while the one with the highest one is *Aluminum and articles thereof* with 0.62. For China, the industry (HS Chapter) with the lowest sourcing potential is *Preparations of meat, or fish, or crustaceans* with 0.02, while the one with the highest one is *Nuclear reactors, boilers, machinery and mechanical appliances* with 0.23. For Europe, the industry (HS Chapter) with the lowest sourcing potential is *Meats and Edible Meats* with 0.01, while the one with the highest one is *Electrical machinery and equipment and parts thereof* with 0.06. Lastly, for the total sum of estimated sourcing potentials, the industry (HS Chapter) with the lowest sourcing potential is *Meats and Edible Meats* with 0.10, while the one with the highest one is *Electrical machinery and equipment and parts thereof* with 0.82.

H Point-Estimates using SMM

Table 25 shows the point estimates resulting from our estimation using SMM. In particular, our estimate for US market demand for the *Manufacturing* is 0.045. To put this number into perspective, Antras et al. (2017) estimate the US market demand faced by US firms to be equal to 0.12. Our estimate is a third of that, which is reasonable as ours represents the US market demand faced by Mexican firms.

The estimates for the location parameter of the log-normal distribution for fixed costs of sourcing depend on our simplifying assumption for the shape parameter, i.e. $\delta_s^j = \sqrt{log2}$, which results in the variance of fixed costs of sourcing being given by $\mathbb{V}(f_{si}^j) = exp(2\mu_{si}^j + log2)$

I Aggregate Fit of the Model

Table 26 shows the aggregate fit in terms of the share of firms using NAFTA and sourcing from non-NAFTA countries, both by quintiles of firm size. These moments are the ones shown in Figures 15 and 16. The table also shows the share of firms sourcing inputs from each foreign country and input shares for these countries.

HS Chapter	Description	Sector	HS Section	SP NAFTA	SP China	SP Europe	Total SP
02	Meats and Edible Meats	1	1	0.07	0.02	0.02	0.10
03	Fish and crustaceans	1	1	0.27	0.04	0.04	0.35
04	Dairy Produce, Eggs, Natural Honey	1	1	0.18	0.06	0.03	0.26
06	Live trees and other plants	1	2	0.23	0.09	0.04	0.36
07	Edible vegetables	1	2	0.17	0.06	0.03	0.25
08	Edible fruits and nuts	1	2	0.18	0.05	0.03	0.26
09	Coffee, tea, mate and spices	1	2	0.12	0.03	0.02	0.17
16	Preparations of meat, or fish, or crustaceans	1	4	0.07	0.02	0.02	0.11
17	Sugars and sugar confectionery	1	4	0.10	0.03	0.02	0.14
18	Cocoa and cocoa preparations	1	4	0.08	0.03	0.02	0.13
19	Preparations of cereals, flour, starch or milk	1	4	0.13	0.04	0.02	0.20
20	Preparations of vegetables, fruit, or nuts	1	4	0.12	0.04	0.02	0.19
21	Mischellaneous edible preparations	1	4	0.12	0.04	0.02	0.17
32	Tanning or dyeing extracts	2	6	0.48	0.12	0.06	0.66
33	Essential oils and resionoids, perfumery, cosmetics	2	6	0.37	0.11	0.05	0.53
36	Explosibes, pyrothehnic products	2	6	0.28	0.09	0.04	0.42
38	Mischellaneuous chemical products	2	6	0.40	0.13	0.05	0.58
39	Plastics and articles thereof	2	7	0.45	0.11	0.05	0.61
40	Rubber and articles thereof	2	7	0.45	0.10	0.05	0.60
42	Articles of leather	3	8	0.30	0.10	0.04	0.45
43	Furskins and artificial fur	3	8	0.20	0.09	0.04	0.33
44	Wood and articles of wood	3	9	0.17	0.05	0.02	0.24
46	Manufactures of straw, esparto or other plaiting materials	3	9	0.16	0.05	0.02	0.23
54	Man-made filaments	3	11	0.30	0.11	0.07	0.47
56	Wadding, felt and nonwovens, special yarns, ropes	3	11	0.26	0.09	0.05	0.40
61	Articles of appareal and clothing accessories, knitted	3	11	0.20	0.08	0.03	0.31
62	Articles of appareal and clothing accessories, not knitted	3	11	0.20	0.07	0.03	0.31
63	Other made up textile articles	3	11	0.24	0.10	0.05	0.39
64	Footwear, gaiters and the like	3	12	0.32	0.08	0.04	0.44
65	Headgear and parts thereof	3	12	0.30	0.09	0.04	0.42
66	Umbrellas, walking sticks, whips	3	12	0.36	0.11	0.04	0.51
67	Prepared feathers and down articles	3	12	0.36	0.11	0.04	0.51
69	Ceramic products	4	13	0.26	0.06	0.04	0.36
70	Glass and glassware	4	13	0.20	0.07	0.03	0.30
71	Precious stones, precious metals	4	14	0.26	0.08	0.04	0.38
73	Articles of iron or steel	4	15	0.42	0.13	0.05	0.60
74	Copper and articles thereof	4	15	0.20	0.08	0.04	0.32
76	Aluminum and articles thereof	4	15	0.62	0.13	0.05	0.79
83	Mischellaneous articles of base metal	4	15	0.44	0.15	0.05	0.64
84	Nuclear reactors, boilers, machinery and mechanical appliances	5	16	0.45	0.23	0.06	0.74
85	Electrical machinery and equipment and parts thereof	5	16	0.53	0.23	0.07	0.82
87	Vehicles other than railway or tramway	5	17	0.39	0.20	0.06	0.65
90	Optical, photographic, precision, medical apparatus	5	18	0.49	0.22	0.06	0.77
91	Clocks and watches and parts thereof	5	18	0.44	0.21	0.06	0.71
92	Musical instruments	5	18	0.34	0.13	0.05	0.53
94	Furniture, bedding, mattresses, cushions, lamps	6	20	0.39	0.13	0.05	0.56
95	Toys, games and sports requisites	6	20	0.44	0.12	0.05	0.61
96	Miscellaneous manufactured articles	6	20	0.39	0.11	0.05	0.54
Average		-	-	0.29	0.10	0.04	0.43
Minimum		-	-	0.07	0.02	0.02	0.10
Maximum		-	-	0.62	0.23	0.07	0.82

Table 24: Industry-level Sourcing Potentials by Foreign Country.

Extensive margins are overestimated, while input shares from foreign countries are underestimated. This is puzzling as input shares depend on countries' sourcing potentials, which in turn are the incentives firms have for paying fixed cost of sourcing and including these countries in their sourcing strategy, i.e. overestimating the extensive margin should be the result of overestimating sourcing potentials, but this is in direct contradiction with the underestimation of input shares from foreign countries. This leads us to believe we should be underestimating both fixed costs of sourcing and sourcing potentials.

Lower fixed costs of sourcing would explain the higher share of firms sourcing from foreign countries, and lower sourcing potentials would explain the lower input shares. The latter could be explained as we might have a bias in the estimation of sourcing potentials by restricting the data sample to firms either using WTO to export or those with no RoO.

	ζ_s	μ_s^{CHN}	μ_s^{EUR}	μ_s^{NAF}	B_s
Agriculture and Foods	0.001	-2.845	-3.513	-3.087	0.003
Minerals and Chemicals	1.11e-04	-3.533	-4.233	-2.836	0.001
Skins and Textiles	0.002	-4.496	-3.447	-3.385	0.003
Mining	1.00e-05	-5.099	-5.649	-4.999	6.43e-05
Manufacturing	1.833	1.675	0.805	1.596	0.045
Others	0.001	-4.79	-4.69	-4.084	3.03e-04

Table 25: Point Estimates for Fixed Costs and US Market Demand.

	Data	Model
Share of firms using NAFTA	0.76	0.73
... small	0.67	0.47
... medium-small	0.80	0.57
... medium	0.83	0.91
... medium-large	0.81	0.87
... large	0.69	0.85
Share of firms sourcing outside of NAFTA		
... small	0.03	0.00
... medium-small	0.12	0.00
... medium	0.22	0.06
... medium-large	0.33	0.47
... large	0.66	0.95
Share of firms sourcing from...		
... Mexico	1.00	1.00
... China	0.10	0.28
... Europe	0.06	0.18
... NAFTA	0.33	0.39
Share of inputs coming from...		
... Mexico	0.78	0.90
... China	0.04	0.02
... Europe	0.04	0.01
... NAFTA	0.14	0.08

Table 26: Fit of the Model at the Aggregate Level.

J Sectoral Results of the Counterfactual Analyses

This section shows further details on the counterfactuals studied in Section 6. In particular, we emulate Table 26 but for each individual sector, for each one of the counterfactuals we explore.

J.1 Transition to USMCA

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.92	0.91	-0.58
Share of firms sourcing outside of NAFTA	0.07	0.07	-0.24
Share of firms sourcing from China	0.07	0.06	-0.23
Share of firms sourcing from Europe	0.03	0.03	-0.11
Share of firms sourcing from NAFTA	0.19	0.19	-0.06
Share of inputs coming from Mexico	0.97	0.97	0.02
Share of inputs coming from China	0.00	0.00	-0.01
Share of inputs coming from Europe	0.00	0.00	0.00
Share of inputs coming from NAFTA	0.03	0.03	-0.01
Imports from Mexico	0.10	0.10	-1.38
Imports from China	0.00	0.00	-0.87
Imports from Europe	0.00	0.00	-0.63
Imports from NAFTA	0.02	0.02	-1.75
Average firm exports	0.17	0.16	-1.41
Average firm profits	0.03	0.03	-1.28
Price Index	0.57	0.57	0.30

Table 27: Agriculture and Foods: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.83	0.83	-0.04
Share of firms sourcing outside of NAFTA	0.58	0.58	-0.16
Share of firms sourcing from China	0.55	0.55	-0.18
Share of firms sourcing from Europe	0.38	0.38	-0.24
Share of firms sourcing from NAFTA	0.72	0.72	-0.05
Share of inputs coming from Mexico	0.74	0.74	0.04
Share of inputs coming from China	0.04	0.04	-0.03
Share of inputs coming from Europe	0.01	0.01	-0.01
Share of inputs coming from NAFTA	0.21	0.21	0.00
Imports from Mexico	0.58	0.58	-0.4
Imports from China	0.06	0.06	-1.03
Imports from Europe	0.03	0.03	-1.11
Imports from NAFTA	0.27	0.27	-0.41
Average firm exports	1.27	1.26	-0.46
Average firm profits	0.29	0.28	-0.47
Price Index	0.19	0.19	0.12

Table 28: Minerals and Chemicals: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.66	0.57	-8.74
Share of firms sourcing outside of NAFTA	0.67	0.64	-2.86
Share of firms sourcing from China	0.64	0.62	-2.24
Share of firms sourcing from Europe	0.49	0.49	-0.08
Share of firms sourcing from NAFTA	0.86	0.86	-0.23
Share of inputs coming from Mexico	0.80	0.80	-0.11
Share of inputs coming from China	0.03	0.04	0.11
Share of inputs coming from Europe	0.01	0.01	0.07
Share of inputs coming from NAFTA	0.16	0.16	-0.07
Imports from Mexico	0.28	0.28	-2.14
Imports from China	0.02	0.02	2.25
Imports from Europe	0.01	0.01	2.70
Imports from NAFTA	0.08	0.08	-1.85
Average firm exports	0.53	0.52	-1.72
Average firm profits	0.11	0.11	-1.70
Price Index	0.30	0.30	0.24

Table 29: Skins and Textiles: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.87	0.87	-0.01
Share of firms sourcing outside of NAFTA	0.26	0.26	-0.07
Share of firms sourcing from China	0.25	0.25	-0.07
Share of firms sourcing from Europe	0.16	0.16	-0.05
Share of firms sourcing from NAFTA	0.32	0.32	-0.02
Share of inputs coming from Mexico	0.87	0.87	0.02
Share of inputs coming from China	0.02	0.02	-0.01
Share of inputs coming from Europe	0.00	0.00	0.00
Share of inputs coming from NAFTA	0.11	0.11	0.00
Imports from Mexico	0.02	0.02	-0.23
Imports from China	0.00	0 .00	-0.49
Imports from Europe	0.00	0.00	-0.52
Imports from NAFTA	0.01	0.01	-0.18
Average firm exports	0.06	0.06	-0.24
Average firm profits	0.01	0.01	-0.24
Price Index	0.26	0.26	0.15

Table 30: Mining: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.30	0.29	-0.53
Share of firms sourcing outside of NAFTA	0.52	0.52	-0.03
Share of firms sourcing from China	0.52	0.52	-0.03
Share of firms sourcing from Europe	0.36	0.36	-0.06
Share of firms sourcing from NAFTA	0.56	0.56	-0.03
Share of inputs coming from Mexico	0.76	0.76	0.02
Share of inputs coming from China	0.07	0.07	-0.01
Share of inputs coming from Europe	0.01	0.01	0.00
Share of inputs coming from NAFTA	0.16	0.16	0.00
Imports from Mexico	37.87	37.79	-0.21
Imports from China	8.71	8.68	-0.37
Imports from Europe	2.23	2.22	-0.42
Imports from NAFTA	19.17	19.13	-0.21
Average firm exports	91.84	91.62	-0.24
Average firm profits	16.13	16.09	-0.22
Price Index	0.17	0.17	0.08

Table 31: Manufacturing: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.58	0.3	-28.33
Share of firms sourcing outside of NAFTA	0.66	0.66	-0.39
Share of firms sourcing from China	0.64	0.64	-0.33
Share of firms sourcing from Europe	0.43	0.43	-0.11
Share of firms sourcing from NAFTA	0.77	0.77	-0.14
Share of inputs coming from Mexico	0.74	0.73	-0.21
Share of inputs coming from China	0.05	0.05	0.27
Share of inputs coming from Europe	0.01	0.01	0.08
Share of inputs coming from NAFTA	0.20	0.2	-0.14
Imports from Mexico	0.10	0.09	-3.09
Imports from China	0.01	0.01	0.68
Imports from Europe	0.00	0.00	0.78
Imports from NAFTA	0.04	0.04	-3.05
Average firm exports	0.20	0.20	-2.72
Average firm profits	0.04	0.04	-2.59
Price Index	0.21	0.21	0.59

Table 32: Others: Changes in moments due to the removal of RoO.

J.2 Increase in tariffs on Mexican imports

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.92	0.43	-48.73
Share of firms sourcing outside of NAFTA	0.07	0.06	-0.93
Share of firms sourcing from China	0.07	0.06	-0.83
Share of firms sourcing from Europe	0.03	0.03	-0.38
Share of firms sourcing from NAFTA	0.19	0.16	-2.93
Share of inputs coming from Mexico	0.97	0.97	0.46
Share of inputs coming from China	0.00	0.00	-0.01
Share of inputs coming from Europe	0.00	0.00	0.00
Share of inputs coming from NAFTA	0.03	0.03	-0.45
Imports from Mexico	0.10	0.09	-14.88
Imports from China	0.00	0.00	-6.43
Imports from Europe	0.00	0.00	-7.55
Imports from NAFTA	0.02	0.01	-15.34
Average firm exports	0.17	0.14	-14.62
Average firm profits	0.03	0.03	-14.09
Price Index	0.57	0.60	5.59

Table 33: Agriculture and Foods: Changes in moments due to the increase in Tariffs.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.83	0.16	-66.44
Share of firms sourcing outside of NAFTA	0.58	0.52	-5.80
Share of firms sourcing from China	0.55	0.50	-5.64
Share of firms sourcing from Europe	0.38	0.33	-4.95
Share of firms sourcing from NAFTA	0.72	0.67	-5.49
Share of inputs coming from Mexico	0.74	0.76	2.00
Share of inputs coming from China	0.04	0.03	-0.33
Share of inputs coming from Europe	0.01	0.01	-0.13
Share of inputs coming from NAFTA	0.21	0.19	-1.54
Imports from Mexico	0.58	0.51	-13.31
Imports from China	0.06	0.05	-11.39
Imports from Europe	0.03	0.02	-11.40
Imports from NAFTA	0.27	0.24	-13.26
Average firm exports	1.27	1.10	-13.12
Average firm profits	0.29	0.25	-13.19
Price Index	0.19	0.20	5.90

Table 34: Minerals and Chemicals: Changes in moments due to the increase in Tariffs.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.66	0.36	-29.77
Share of firms sourcing outside of NAFTA	0.67	0.67	0.55
Share of firms sourcing from China	0.64	0.65	1.03
Share of firms sourcing from Europe	0.49	0.51	1.53
Share of firms sourcing from NAFTA	0.86	0.84	-2.21
Share of inputs coming from Mexico	0.80	0.80	-0.16
Share of inputs coming from China	0.03	0.04	0.51
Share of inputs coming from Europe	0.01	0.01	0.13
Share of inputs coming from NAFTA	0.16	0.15	-0.48
Imports from Mexico	0.28	0.26	-9.96
Imports from China	0.02	0.02	-2.49
Imports from Europe	0.01	0.01	-3.12
Imports from NAFTA	0.08	0.07	-10.61
Average firm exports	0.53	0.48	-9.51
Average firm profits	0.11	0.10	-10.91
Price Index	0.30	0.32	4.15

Table 35: Skins and Textiles: Changes in moments due to the increase in Tariffs.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.87	0.27	-60.73
Share of firms sourcing outside of NAFTA	0.26	0.23	-2.71
Share of firms sourcing from China	0.25	0.22	-2.68
Share of firms sourcing from Europe	0.16	0.14	-2.18
Share of firms sourcing from NAFTA	0.32	0.30	-2.69
Share of inputs coming from Mexico	0.87	0.88	1.03
Share of inputs coming from China	0.02	0.02	-0.19
Share of inputs coming from Europe	0.00	0.00	-0.06
Share of inputs coming from NAFTA	0.11	0.10	-0.79
Imports from Mexico	0.02	0.02	-16.07
Imports from China	0.00	0.00	-15.83
Imports from Europe	0.00	0.00	-16.58
Imports from NAFTA	0.01	0.01	-16.02
Average firm exports	0.06	0.05	-16.05
Average firm profits	0.01	0.01	-17.08
Price Index	0.26	0.27	6.58

Table 36: Mining: Changes in moments due to the increase in Tariffs.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.30	0.00	-29.79
Share of firms sourcing outside of NAFTA	0.52	0.50	-2.45
Share of firms sourcing from China	0.52	0.49	-2.43
Share of firms sourcing from Europe	0.36	0.33	-2.60
Share of firms sourcing from NAFTA	0.56	0.53	-2.40
Share of inputs coming from Mexico	0.76	0.77	1.03
Share of inputs coming from China	0.07	0.06	-0.29
Share of inputs coming from Europe	0.01	0.01	-0.09
Share of inputs coming from NAFTA	0.16	0.15	-0.66
Imports from Mexico	37.87	32.76	-13.48
Imports from China	8.71	7.58	-12.99
Imports from Europe	2.23	1.91	-14.42
Imports from NAFTA	19.17	16.59	-13.48
Average firm exports	91.84	79.49	-13.44
Average firm profits	16.13	13.98	-13.32
Price Index	0.17	0.17	5.22

Table 37: Manufacturing: Changes in moments due to the increase in Tariffs.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.58	0.03	-54.83
Share of firms sourcing outside of NAFTA	0.66	0.65	-0.95
Share of firms sourcing from China	0.64	0.63	-0.85
Share of firms sourcing from Europe	0.43	0.43	-0.61
Share of firms sourcing from NAFTA	0.77	0.76	-0.87
Share of inputs coming from Mexico	0.74	0.73	-0.08
Share of inputs coming from China	0.05	0.05	0.37
Share of inputs coming from Europe	0.01	0.01	0.09
Share of inputs coming from NAFTA	0.20	0.20	-0.39
Imports from Mexico	0.10	0.09	-7.30
Imports from China	0.01	0.01	5.40
Imports from Europe	0.00	0.00	5.45
Imports from NAFTA	0.04	0.04	-7.47
Average firm exports	0.20	0.19	-6.17
Average firm profits	0.04	0.04	-6.13
Price Index	0.21	0.22	4.22

Table 38: Others: Changes in moments due to the increase in Tariffs.

J.3 NAFTA without Rules of Origin

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.92	0.92	0.01
Share of firms sourcing outside of NAFTA	0.07	0.08	1.07
Share of firms sourcing from China	0.07	0.08	1.01
Share of firms sourcing from Europe	0.03	0.04	0.65
Share of firms sourcing from NAFTA	0.19	0.20	0.30
Share of inputs coming from Mexico	0.97	0.97	-0.15
Share of inputs coming from China	0.00	0.00	0.09
Share of inputs coming from Europe	0.00	0.00	0.02
Share of inputs coming from NAFTA	0.03	0.03	0.03
Imports from Mexico	0.10	0.11	5.96
Imports from China	0.00	0.00	29.16
Imports from Europe	0.00	0.00	28.5
Imports from NAFTA	0.02	0.02	7.63
Average firm exports	0.17	0.18	7.12
Average firm profits	0.03	0.03	6.46
Price Index	0.57	0.56	-1.70

Table 39: Agriculture and Foods: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.83	0.83	0.24
Share of firms sourcing outside of NAFTA	0.58	0.59	0.72
Share of firms sourcing from China	0.55	0.56	0.80
Share of firms sourcing from Europe	0.38	0.39	0.76
Share of firms sourcing from NAFTA	0.72	0.72	0.28
Share of inputs coming from Mexico	0.74	0.74	-0.20
Share of inputs coming from China	0.04	0.04	0.11
Share of inputs coming from Europe	0.01	0.01	0.04
Share of inputs coming from NAFTA	0.21	0.21	0.04
Imports from Mexico	0.58	0.59	1.60
Imports from China	0.06	0.06	4.23
Imports from Europe	0.03	0.03	4.45
Imports from NAFTA	0.27	0.28	1.64
Average firm exports	1.27	1.29	1.86
Average firm profits	0.29	0.29	1.88
Price Index	0.19	0.19	-0.42

Table 40: Minerals and Chemicals: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.66	0.87	21.76
Share of firms sourcing outside of NAFTA	0.67	0.80	13.68
Share of firms sourcing from China	0.64	0.78	13.58
Share of firms sourcing from Europe	0.49	0.63	13.94
Share of firms sourcing from NAFTA	0.86	0.89	3.08
Share of inputs coming from Mexico	0.80	0.78	-2.04
Share of inputs coming from China	0.03	0.05	1.34
Share of inputs coming from Europe	0.01	0.02	0.50
Share of inputs coming from NAFTA	0.16	0.16	0.20
Imports from Mexico	0.28	0.34	18.36
Imports from China	0.02	0.03	34.39
Imports from Europe	0.01	0.01	34.47
Imports from NAFTA	0.08	0.09	15.31
Average firm exports	0.53	0.63	19.03
Average firm profits	0.11	0.13	18.64
Price Index	0.30	0.29	-3.01

Table 41: Skins and Textiles: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.87	0.87	0.04
Share of firms sourcing outside of NAFTA	0.26	0.26	0.28
Share of firms sourcing from China	0.25	0.25	0.28
Share of firms sourcing from Europe	0.16	0.16	0.23
Share of firms sourcing from NAFTA	0.32	0.32	0.13
Share of inputs coming from Mexico	0.87	0.87	-0.07
Share of inputs coming from China	0.02	0.02	0.04
Share of inputs coming from Europe	0.00	0.00	0.01
Share of inputs coming from NAFTA	0.11	0.11	0.02
Imports from Mexico	0.02	0.02	0.97
Imports from China	0.00	0.00	2.06
Imports from Europe	0.00	0.00	2.26
Imports from NAFTA	0.01	0.01	0.75
Average firm exports	0.06	0.06	1.00
Average firm profits	0.01	0.01	0.97
Price Index	0.26	0.26	-0.60

Table 42: Mining: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.30	0.32	2.30
Share of firms sourcing outside of NAFTA	0.52	0.52	0.06
Share of firms sourcing from China	0.52	0.52	0.07
Share of firms sourcing from Europe	0.36	0.36	0.23
Share of firms sourcing from NAFTA	0.56	0.56	0.05
Share of inputs coming from Mexico	0.76	0.76	-0.05
Share of inputs coming from China	0.07	0.07	0.03
Share of inputs coming from Europe	0.01	0.01	0.01
Share of inputs coming from NAFTA	0.16	0.16	0.00
Imports from Mexico	37.87	38.17	0.81
Imports from China	8.71	8.84	1.49
Imports from Europe	2.23	2.27	1.71
Imports from NAFTA	19.17	19.33	0.81
Average firm exports	91.84	92.68	0.92
Average firm profits	16.13	16.28	0.92
Price Index	0.17	0.16	-0.33

Table 43: Manufacturing: Changes in moments due to the removal of RoO.

	Baseline	Counterfactual	Change (p.p., %)
Share of firms using NAFTA	0.58	0.77	18.67
Share of firms sourcing outside of NAFTA	0.66	0.71	5.34
Share of firms sourcing from China	0.64	0.70	5.46
Share of firms sourcing from Europe	0.43	0.49	6.13
Share of firms sourcing from NAFTA	0.77	0.79	2.69
Share of inputs coming from Mexico	0.74	0.72	-1.61
Share of inputs coming from China	0.05	0.06	0.88
Share of inputs coming from Europe	0.01	0.01	0.30
Share of inputs coming from NAFTA	0.2	0.21	0.43
Imports from Mexico	0.10	0.11	12.14
Imports from China	0.01	0.01	28.80
Imports from Europe	0.00	0.00	30.86
Imports from NAFTA	0.04	0.04	12.01
Average firm exports	0.20	0.23	13.70
Average firm profits	0.04	0.04	14.03
Price Index	0.21	0.21	-2.52

Table 44: Others: Changes in moments due to the removal of RoO.