Firms' Strategic Responses to Rules of Origin: Evidence from the USMCA*

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Abstract

Free Trade Agreements (FTAs) are prevalent and increasingly complex. This paper analyzes firms' strategic responses to the stricter Rules of Origin (RoO) for the automotive industry introduced during the renegotiation of the US-Mexico-Canada Trade Agreement (USMCA). Using Mexican customs administrative data, we demonstrate that tighter RoO increased the share of Mexican exports to the U.S. subject to tariffs and prompted car manufacturers in Mexico to source more inputs from North America. Consistent with existing theoretical predictions, we find that firms respond strategically based on how close they were ex-ante to comply with new RoO: firms that already complied or were far from complying respond the least, and therefore, the effect on inputs sourced from the region exhibits an inverse U-shape. Finally, we show that these higher costs are passed on to consumers: among cars sold in the United States, those that were not ex-ante compliant with USMCA saw prices rise by an additional 2% compared to vehicles that were.

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Free trade agreements have dramatically increased in number, growing from 22 in 1990 to over 370 by 2025. As value chains become more complex, these FTAs have also evolved in how they determine tariff exemptions for goods. The mere location of manufacturing is no longer enough to qualify for these exemptions. Modern FTAs increasingly include detailed Rules of Origin (RoO) that set regional content requirements alongside labor and environmental standards. Although RoOs are designed to enhance production within the trading bloc, they may unintentionally have the opposite effect if the standards are too strict, prompting firms to relocate production outside the bloc and incur the applicable tariffs to import the goods.

How do firms strategically respond to new rules of origin or to the tightening of existing ones? Theoretically, the effects are ambiguous (Head, Mayer, and Melitz (2024) Grossman (1981) Ju and Krishna (2002)). If the cost the firm has to incur to fulfill the RoO is lower than the tariff, the firm will fulfill the rule; otherwise, it will pay the tariff instead. In particular, firms with a very high cost to comply and those with zero cost to comply (already in compliance) should respond the least. In contrast, those with a reasonable cost to comply should respond the most, leading to an inverse U-shaped relationship between the firm's response and the cost of complying. Identifying this relationship empirically constitutes a significant challenge because it requires an unexpected shock to RoO as well as granular data on firms' inputs, outputs, and tariff payment records.

This paper overcomes these challenges by leveraging administrative transaction-level data from Mexican customs and the shock stemming from the renegotiation of the US-Mexico-Canada Trade Agreement (USMCA). The USMCA governs one of the largest trading blocs in the world, encompassing nearly 30% of the global economy, with trade flows exceeding US$3 million per minute. For the automotive industry, which represents 10%, 18%, and 11% of the manufacturing GDP of the U.S., Mexico, and Canada, respectively,[1] the USMCA tightened the criteria for tariff-free eligibility by raising the regional content requirement rule of 60% to 75% and introduced additional requirements regarding the sourcing of steel, aluminum, and core parts, as well as a high-wage labor content rule.

We use a difference-in-difference framework, exploiting the timing of the agreement's implementation and the differential change in RoO across industries. In particular, we compare automakers, subject to new and significantly stricter rules of origin, with exporters of other high-tech

[1] See (AMIA, 2021; Center for Automotive Research, 2010; Trade Commissioner, 2018)

manufactured goods, whose rules of origin remained unchanged. Then, we test for the theoretically predicted inverse-U-shaped relationship between the firm's response and the cost of complying. We approximate compliance costs using the degree of integration of the firm to the trade block (share of imports from the US and Canada) prior to the renegotiation.[2]

During our study period from 2018 to 2024, we find that, on average, the stricter RoOs introduced by USMCA increased the share of exports subject to tariffs for automotive firms based in Mexico by nearly 12 percentage points (pp). Automakers in Mexico also increased the share of their inputs, steel, and aluminum imports from North America by 4 pp in the same period. These net effects mask differentiated strategic responses across firms. Some firms chose to pay the tariff, and others adjusted to comply.

Theoretically, the firms' responses to the USMCA should be a function of the cost of complying with the RoO. While we cannot observe the product content of North America directly, we proxy it for each firm using its share of imports from Canada and the United States. As the ex-ante North American share of the firms' product content increases, the cost of complying with the treaty weakly decreases. When the ex-ante share of North American inputs is low, the cost of complying is high. As we move along the distribution of ex-ante share of North American inputs, the firm becomes closer to the RoO threshold; therefore, it is easier (and less expensive) for the firm to adjust its production process to comply. Once the firm exceeds the RoO threshold, it does not need to change its production process because it is already complying.[3]

Therefore, we expect the probability of paying tariffs to be weakly decreasing in the ex-ante share of the firms' product contents from USMC countries because firms with the highest costs of complying will be the most likely to pay the tariff instead.[4] Similarly, we expect an inverse-U shape in the firms' response regarding their USMC input demand ex-ante: firms with a very high or a null cost to comply should not respond, while only those with a reasonable cost (one that is below the size of the tariff) to comply should adjust.

We find that the effect on dutiable exports is inversely related to the ex-ante share of inputs

[2]Ideally, we would also use the share of the product that can be attributed to Mexico; however, that information is not available in the customs data.

[3]Firms could incur administrative costs if they need to certify the new content rules, but if they were using the treaty to export before the implementation of the USMCA, these are plausibly relatively low.

[4]Before the renegotiation of the USMCA, automotive firms where paying virtually no tariffs to import to the United States.

from North America: the less pre-USMC content, the more tariffs a firm pays. Consistently, the response in the inputs coming from North America follows an inverse-U pattern. Firms around the median of ex-ante share of inputs from North America increased their share of regional imports the most. In contrast, those with the lowest and highest ex-ante regional content responded the least.

Stricter rules of origin increase the costs for automakers that were not complying ex-ante, as they now must either pay a tariff or adjust their production processes to comply. How much of this cost increase is passed on to the consumers? We find that, relative to the prices in May 2022, cars sold in the United States that were not ex-ante compliant with USMCA experienced a price increase 2% larger than those that were. The estimates suggest a pass-through to consumers of at least 80%, since the maximum possible cost increase is 2.5% (the tariff's value).

The paper contributes to the literature on rules of origin in Free Trade Agreements. While the paper does not have theoretical contributions, it leverages the critical theoretical advances in this literature that showcase the mechanisms through which rules of origin affect firms' incentives. Krishna and Krueger (1995) and Falvey and Reed (2000) show that RoO distort resource allocation by forcing producers to shift from more efficient global suppliers to higher-cost regional ones in order to meet content requirements. Ornelas and Turner (2024) show that RoO can boost investment and welfare when applied to high-productivity suppliers. Head et al. (2024) uses a model of heterogenous firms to introduce the concept of a Laffer curve for RoO, where stricter content requirements initially increase regional sourcing but ultimately lead to a reduction when the costs of compliance outweigh the benefits. We derive our main theoretical predictions from this literature, but instead of calibrating a model to fit part cost shares for autos sold in North America like Head et al. (2024), we use transaction-level microdata to test whether the heterogenous strategic responses across firms exist and have the expected inverse-u shaped pattern.

This paper is more closely related to the empirical literature on Rules of Origin, which remains scarce due to the complexity of these rules and the difficulty of quantifying their effects. By exploiting cross-product and cross-country variation over time, Conconi, García-Santana, Puccio, and Venturini (2018) examine changes in tariff classification, showing that NAFTA's RoO led to significant reductions in imports of intermediate goods from third countries relative to NAFTA partners. Similarly, Anson et al. (2005) assess the effects of RoO restrictiveness on bilateral trade

volumes and document that compliance with NAFTA's RoO imposed substantial costs on Mexican firms, effectively negating the tariff advantages for many exporters. Additionally, López Espino (2024) explores the potential effects on the Mexican automotive sector resulting from the changes in RoO stemming from the transition from NAFTA to USMCA. She used the network of suppliers and the flow of goods from value-added tax records from 2017 to estimate whether firms complied with the RoO requirements under NAFTA and USMCA. She finds that, compared to NAFTA, applying USMCA's RoO in 2017 would have led to a 9.7% decrease in the compliance rate.

To our knowledge, this research is the first to empirically test the inverse U-shape of firms' strategic responses to changes in rules of origin. The theoretical literature has highlighted the potential heterogeneous effects of rules of origin, and this paper provides empirical evidence supporting that notion. On one hand, firms with low or no gains from higher regional value content and those with the highest compliance costs (lowest regional value content) will respond the least. On the other hand, firms with the lowest adjustment costs, whose regional value content is close to the cutoff, are the ones that respond the most.

The remainder of the paper is organized in the following sections: Background, Data, Empirical strategy, Results, and Conclusion.

1 Background

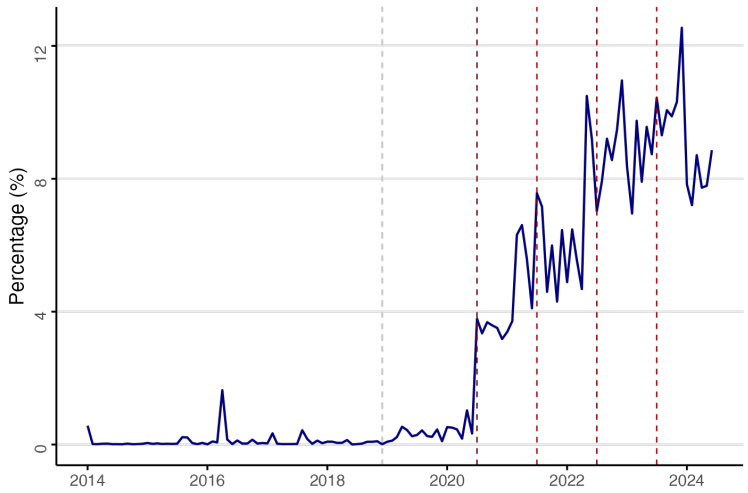
The United States-Mexico-Canada Agreement (USMCA), which replaced the North American Free Trade Agreement (NAFTA), took effect in July 2020. The automotive sector, which entails 10%, 18%, and 11% of the U.S., Mexico, and Canada manufacturing GDP respectively, had a central role in the renegotiation. Compared to NAFTA, which had a single regional content requirement of 62.5% for light vehicles and 60% for heavy vehicles, the USMCA introduced stricter and more complex rules for tariff exemptions.

The key USMCA content requirements affecting the automotive industry were modifications to the regional value content (RVC), and the requirements of steel and aluminum sourcing, and core parts' origin rules in order for vehicles to gain tariff-free status. From July 2020 to July 2024, the agreement required a phased increase in RVC thresholds, raising the requirement from 62.5% to 75% for light vehicles and from 60% to 70% for heavy vehicles. Furthermore, at least 70% of

the steel and aluminum used in vehicle production must originate from within the USMCA region, and specific core automotive components, including engines, transmissions, and suspensions, must be manufactured in North America. In addition to these stricter content requirements, the USMCA introduced a first-of-its-kind Labor Value Content (LVC), mandating that 40-45% of a vehicle's value must be produced in facilities where the average wage for direct production workers was at least US$16 per hour.

These new requirements significantly altered trade incentives. When automakers fail to meet the content or wage requirements, they face Most Favored Nation (MFN) tariffs, which are 2.5% for passenger vehicles and 25% for trucks—a substantial cost relative to industry gross profit margins that are usually below 20%. Following the implementation of the USMCA, the share of U.S. car imports from Mexico subject to tariffs rose from less than 2% to nearly 12% (Figure 1), suggesting a significant shift in compliance behavior and potential disruptions for Mexican exporters.

Figure 1: Share of U.S. Car Imports from Mexico Subject to Tariffs



Author calculations based on data from the U.S. Census Bureau. The vertical dashed line represents the date of the signing of the USMCA (gray), and the dates of the stages it entered into force (red).

Access to tariff exemptions is particularly crucial for Mexico's automotive industry due to its export-driven nature. Over 85% of vehicles produced in Mexico are destined for international markets, with the United States and Canada as primary buyers (AMIA, 2021). In fact, one in every five automobiles driven in the U.S. originates from Mexico. Firms may need to prioritize North American suppliers and inputs over non-regional alternatives to comply with regional content

rules. However, this likely raises costs for manufacturers and might ultimately lead them to pay tariffs instead, or even consider offshoring production altogether.

Beyond the automotive sector, other high-tech industries, including machinery, electrical equipment, and aerospace manufacturing, experienced only minimal updates to their rules of origin under the USMCA. Changes in these sectors primarily aimed to modernize outdated provisions and align compliance criteria with technological advancements. Most high-tech goods retained regional content requirements between 50% and 60%, similar to NAFTA-era thresholds.

2 Data

The primary data source for this project is the universe of transaction-level customs data for Mexico, accessed through Econlab at *Banco de México*. This includes all import and export operations. For each transaction, we observe the Firm ID, the product at the HS 6-digit level, the type of operation (export/import), the trade value in USD and Mexican Pesos, the origin/destination of the transaction, whether the transaction is classified as an intermediate or final good, and a self-reported variable indicating if the transaction benefited from preferential tariffs through a Free Trade Agreement.

To examine changes in the Rules of Origin for each product from NAFTA to the USMCA, we utilized Annex 401 of NAFTA, along with Chapter 4 and the Uniform Regulations document of that chapter under the USMCA. These documents are publicly accessible online.

Analysis Sample We use data between January 2018 and July 2024, and we aggregate it at the firm-product-quarter level. We classify the economic activity of each firm based on their exports. We construct two groups of exporters: Motor Vehicle exporters and exporters of other high-tech manufacturing goods, such as machinery, electronics, railways, and aerospace. For a firm to be included in our group of auto exporters, at least 60% of its exports prior to the USMCA must consist of light and heavy vehicles. Our auto exporters group includes the universe of car manufacturing firms operating in Mexico. We exclude auto-part exporters from our sample to avoid biases in our results stemming from spillovers because they could also supply motor vehicle exporters. Furthermore, to ensure that our sample includes manufacturing firms rather than merely importer or exporter agencies, we restrict our sample to firms with at least 30 manufacturing workers.

2.a Price data

Our price data come from VinAudit's database of U.S. online vehicle listings (over 15 million listings per year). We purchased these data for academic research purposes. The raw data are at the VIN level and include the advertised, transaction-relevant price shown in the listing, detailed vehicle characteristics (make, model, model year, trim, body type), seller information (dealer identifier and location when available), and listing metadata (posting date and other listing attributes). We focus on listings for new vehicles observed from 2021 to 2024.

We enrich the VinAudit listings using VIN decoding information from the National Highway Traffic Safety Administration (NHTSA). The VIN decoder provides standardized vehicle descriptors that we use to construct consistent make-model-trim identifiers across listings. These standardized identifiers are the key link that allows us to map information across our data sources.

To determine whether specific models and trims were produced in compliance with the USMCA, we also use the American Automobile Labeling Act (AALA) Reports. The AALA Reports provide detailed content and origin information, including: (i) the percentage U.S./Canadian parts content; (ii) the names of up to two non-U.S./Canadian countries that each contribute at least 15 percent of parts content, along with their shares; (iii) the final assembly location; (iv) the country of origin of the engine; and (v) the country of origin of the transmission. We map AALA records to VinAudit listings by matching on the standardized make-model-trim identifiers constructed from the decoded VIN.

For our main outcome, we use the listing price reported by VinAudit. This measure is closer to the price faced by consumers in the marketplace than MSRP because it reflects the price displayed by the seller and can incorporate dealer-level pricing decisions.

Finally, because the data are collected from online listings, the timing at which a given dealership begins to appear in the scraped data may be endogenous. To minimize concerns that changes in coverage drive our results, our baseline specification is estimated on a balanced panel of dealerships that are observed continuously over the sample period. In robustness checks, we show that the results are similar when using the full unbalanced panel while controlling for dealership entry into the data and common time effects.

Descriptive Statistics Table 1 presents summary statistics for motor vehicle exporters and ex-

porters of other high-tech manufacturers before the USMCA. Motor vehicle exporters employ more workers and pay higher wages than other high-tech exporters. Both groups have a similar share of US-Canada inputs, but motor vehicle exporters source a greater share of US-Canada steel.

These differences may hinder causal identification if the other high-tech exporters are not a representative counterfactual of motor vehicle exporters. Yet, the parallel trends observed between these two groups prior to the USMCA (reflected as no different effect between the treatment and control groups prior to the implementation of the USMCA) indicate that the other high-tech group might be a reasonable proxy for observing what would have happened to motor vehicle exporters absent the tightening rules of the USMCA. Additionally, in the Robustness section, we discuss specifications that further refine the other high-tech groups to match motor vehicle exporters' wage levels and output more closely, yielding similar estimates.

Table 1: Summary Statistics for Motor Vehicles and Other High-Tech Manufacturers

Motor Vehicles					
Number of firms:					17
Total employment:					114,920
Variable	Mean	Std Dev	p25	p50	p75
Share of Exports to North America	79.7	23.5	73.9	86.6	96.0
Share of Exports to North America with Tariff	23.8	38.4	0.2	2.3	31.1
Share of US-Can Inputs	51.4	36.7	13.3	57.2	84.6
Share of US-Can Steel	49.9	39.2	10.8	69.6	82.9
Share of US-Can Core Parts	53.3	40.9	8.1	68.9	88.3
Number of Workers	6760.5	6117.6	2482.3	4032.6	9664.8
Daily Wage for Manuf Workers (MXN)	663.2	233.8	512.0	634.8	807.0
Corrected Daily Wage for Manuf Workers (MXN)	699.1	270.6	524.2	662.8	865.8
Other High-Tech Manufacturers					
Number of firms:					1,220
Total employment:					406,260
Variable	Mean	Std Dev	p25	p50	p75
Share of Exports to North America	73.2	39.3	48.0	100.0	100.0
Share of Exports to North America with Tariff	36.6	45.2	0.0	1.8	100.0
Share of US-Can Inputs	51.6	40.4	6.5	53.6	95.9
Share of US-Can Steel	43.2	44.8	0.0	22.2	99.9
Number of Workers	332.4	1977.8	53.2	104.2	247.5
Daily Wage for Manuf Workers (MXN)	355.6	204.0	228.8	315.3	426.3
Corrected Daily Wage for Manuf Workers (MXN)	368.8	242.1	229.5	317.7	436.1

3 Empirical Strategy

We estimate a Difference-in-Difference specification at the firm level to assess the effect of the USMCA's more stringent regulations. We compare motor vehicle exporting firms, whose RoO became stricter, to exporters of other high-tech manufacturing goods, whose RoOs remained unchanged. We estimate the following equation:

$$y_{i,t} = \alpha_i + \gamma_t + \sum_{j \neq t_0} \tau_j \mathbb{1}(j = t) \times AutoExp_i + \epsilon_{i,t} \tag{1}$$

Where $y_{i,t}$ represents the outcome of interest for firm i at time t (share of exports subject to tariffs, the share of inputs from U.S. and Canada, among other outcomes). The firm fixed effects are α_i and the year $\times$ month fixed effects are α_t. $AutoExp_i$ is a dichotomous variable that takes the value of 1 if the firm is a motor vehicle exporter and 0 if it is a high-tech exporter, and $\mathbb{1}(t = j)$ is a time indicator for each period of our window of study. Our coefficients of interest are τ_j – the estimates of the effect of USMCA. Since the agreement came into force in July 2020, we use November 2019 or the 4th quarter of 2019 as our omitted period to avoid having as a reference a period with potentially major trade disruptions caused by the COVID-19 pandemic.[5]

Heterogeneous Effects of USMCA by Input Composition

We then test the predicted inverse U-shape in the response in terms of the intensity of use of inputs from US or Canada of motor vehicle manufacturers based on their degree of integration with the block by estimating their responses in groups according to quartiles of integration. We measure the level of integration using the share of US and Canada in their inputs prior to USMCA, which assumes that firms that imported more from the U.S. and Canada relied more on producing within the bloc.[6] Specifically, we estimate the following difference-in-differences equation:

$$y_{i,t} = \alpha_i + \gamma_t + \sum_{q=1}^{q=4} \gamma_q Post_t \times AutoExp_i \times Q^{Pre}_{I,q(i)} + \epsilon_{i,t} \qquad \text{where} \tag{2}$$

[5] In May 2020, the automotive industry was declared an essential industry in Mexico, allowing it to resume operations and maintain the continuity of North American supply chains under strict health protocols.

[6] We do not observe the Mexican input content, so we use the share of US and Canada as a proxy for the share of inputs from within the bloc.

$$Q^{Pre}_{I,q(i)} = \mathbf{1}\{USCanShare^{Pre}_{I,i} \in \text{Quartile } q\} \qquad \text{and} \qquad USCanShare_{I,i} = \frac{M^{\text{U.S. and Canada}}_{I,i}}{M^{\text{World}}_{I,i}} \text{ ;}$$

$Q^{Pre}_{I,q(i)}$ is a dummy indicating the quartile of the automotive industry q of firm i's share of imports (M) of input I from U.S. and Canada ($USCanShare^{Pre}_{I}$), where I corresponds to (1) all inputs, (2) steel and aluminum, or (3) core parts. The $USCanShare^{Pre}_{I}$ is measured prior USMCA (2016 and 2017). $y_{i,t}$ is our outcome that varies across specifications, including the share of firm i's exports subject to tariffs and its share of inputs from U.S. and Canada at time t. α_i are the firm fixed effects, and $Post_t$ is a dummy variable that takes the value of 1 after the USMCA came into effect (July 2020). Equation 2 does not include the uninteracted $Post_t$ dummy. Therefore, there is no reference quartile and the coefficients of interest γ_q are absolute (not relative) effects.

Threats to Identification A challenge to identification is that the implementation of USMCA coincided with the severe disruptions to economic activity caused by the COVID-19 pandemic. This would affect our identification strategy if the pandemic differentially affected the automotive industry compared to the control group. The impact on demand was plausibly different across industries: demand for cars decreased substantially during the shutdown period, while demand for electronics increased. However, this is not a threat to our identification, since shocks to demand need not affect businesses' decisions about whether to use the free trade agreement to export or the composition of their inputs by origin.

However, the pandemic also led to severe disruptions in global production, affecting input supply (particularly the microchip global shortage in 2021, which had significant impacts on the automotive and electronics industries). If businesses had to change their suppliers of inputs due to unavailability, our 2021 results could be contaminated. However, this threat is mitigated for the other years as supply disruptions are gradually resolved. To ensure the validity of our findings, we employ several robustness checks. First, we exclude 2020 from our analysis to mitigate pandemic-related distortions.

An additional concern could be how the control group is constructed. We assess the robustness of our results by using alternative control groups, such as focusing on large firms, matching firms with similar wage levels to those in the automotive industry, and selecting control industries that are most similar to automakers via k-means clustering.

4 Results

With the introduction of USMCA, the share of exports to the United States and Canada subject to tariffs increased by nearly 12 percentage points (pp) more for automakers than for other high-tech exporting firms unaffected by USMCA on average over the period of study. Figure 2 presents the estimates of Eq. 1, in which we observe a gradual increase in the share of exports paying tariffs until reaching an increase of 20 pp in mid-2022 and remaining relatively stable thereafter. Column 1 of Table 2 presents the average effect across periods.

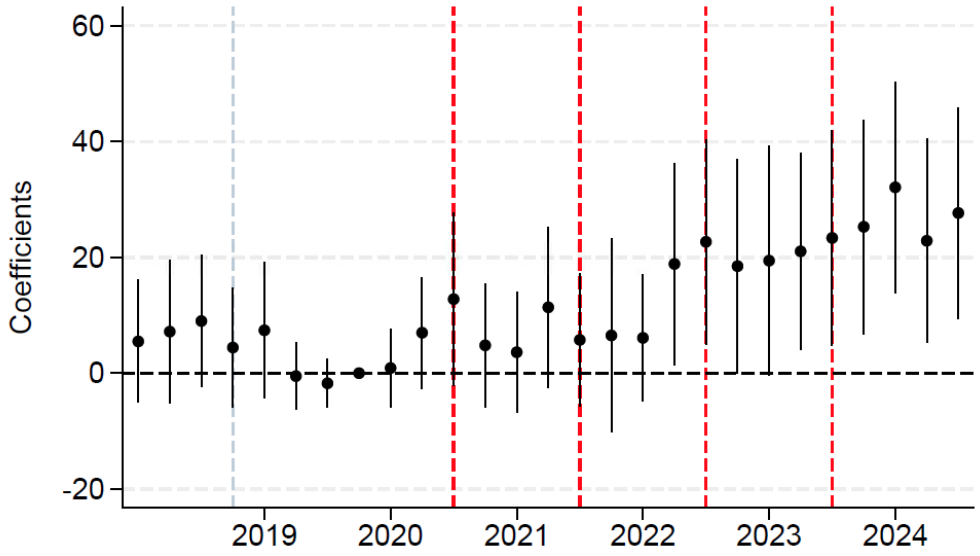


Figure 2: Share of Exports to the U.S. and Canada Subject to Tariffs

Notes: Each circle corresponds to the point estimate of the treatment indicator for different months relative to the reference period (2019q4). Error bars represent 95% confidence intervals. The vertical dashed line represents the signing of the USMCA (gray), and the dates of its implementation stages (red).

The increase in the share of exports to the U.S. and Canada that are subject to tariffs was greater for light vehicles (cars) than for heavy vehicles (trucks). Columns 2 and 3 of Table 2 document this finding, which was theoretically expected. Firms need to weigh the cost of compliance against the tariff cost, and if the compliance cost is similar, a larger tariff would make it more likely for the firm to opt for compliance. Although we lack data on compliance costs, the response aligns with higher tariffs leading to increased compliance. A non-complying car's tariff is 2.5% , while the one for a non-complying truck is 25%. Therefore, as expected, firms tried to avoid the larger tariff more

than the smaller one.

Columns 2 and 3 of Table 2 document that the increase in the share of exports to the U.S. and Canada that are subject to tariffs was greater for light vehicles (cars) than for heavy vehicles (trucks). This result was theoretically expected because the tariff for non-complying cars is smaller than that of non-complying trucks (2.5% vs 25%). Although we lack data on compliance costs, higher tariffs are expected to increase compliance, as firms weigh the cost of compliance against the tariff. Thus, it is reasonable that a larger fraction of trucks comply and avoid tariffs.

Table 2: Impact of the USMCA on Trade Dynamics and Wages

	Share Exports with Tariff (All)	Share Exports with Tariff (Cars)	Share Exports with Tariff (Trucks)	Share of US-Can Inputs	Share of US-Can Steel
Automaker × *post*	11.82*	16.65*	7.121	3.886***	3.447
	(4.909)	(6.755)	(6.973)	(1.006)	(2.119)
N	21,513	21,363	21,256	32,676	18,263
Clustered standard errors at the firm level in parentheses					
* p<0.05, ** p<0.01, *** p<0.001					

Note: The table presents the effect of the USMCA. The variable $treat$ is a dummy that takes the value of 1 if the firm is a Motor Vehicle Exporter and 0 if it is an exporter of other high-tech manufactured goods. The variable $post$ is a dummy that takes the value of 1 if the period studied is after the implementation of the USMCA (July 2020) and 0 otherwise. The interaction $treat \times post$ captures the differential effect of the USMCA on Motor Vehicle Exporters compared to other high-tech manufacturers. All models include firm and time fixed effects.

The average share of inputs from the U.S. and Canada is estimated to have increased by 4 pp due to the change in RoO (Column 4 of Table 2). Similarly, the average share of American and Canadian steel import increased by 3.4pp, but it is not statistically significant (Column 5 of Table 2). Figure 3 displays the dynamic pattern of the effect on the share of inputs from the United States and Canada. Similar to the effect on the share of export paying tariffs, there is a gradual increase after the introduction of USMCA that becomes statistically significant in 2022 and remains relatively stable afterwards.

The effect on the share of exports subject to tariffs is likely heterogeneous between firms. Firms that were not complying before USMCA and opted to pay the tariff instead of adjusting their production process to the new RoO should be driving the effect on tariffs. On the other hand, some firms may not have been in compliance with the new rules of USMCA but adjusted their production process to source more inputs from the bloc and comply with the new rules. These firms drive the effect on the share of inputs from U.S. and Canada.

The effects observed thus far likely represent an average of highly varied responses from au-

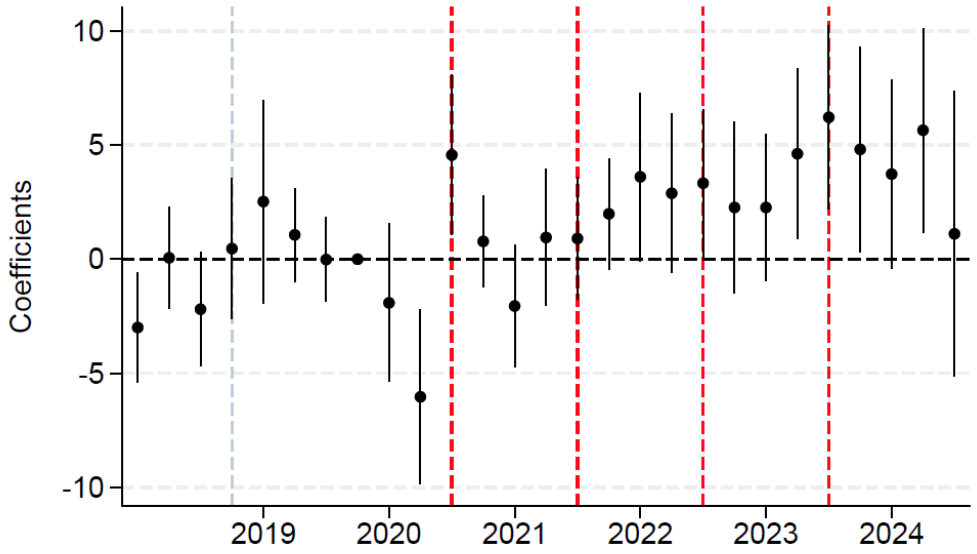


Figure 3: Effect on Share of Inputs from U.S and Canada

Notes: Each circle corresponds to the point estimate of the treatment indicator for different months relative to the reference period. Error bars represent 95% confidence intervals. The vertical dashed line represents the signing of the USMCA (gray), and the dates of its implementation stages (red).

tomakers. Some chose to pay the tariff, and some (plausibly those whose cost of compliance was lower than the tariff) opted to adjust their production process. Based on the producer configuration prior to the USMCA, the firm would be more likely to opt for one of the alternatives. The following section investigates these strategic responses.

Heterogeneous Effects of USMCA by Input Composition

There are three potential groups of automakers based on how the change in incentives of the USMCA affected their behavior based on their individual relative cost of the tariff and the adjustment of the production process. The first group, *ex-ante compliers*, includes those already in compliance with the RoO of the USMCA before its implementation, for whom the new regulations did not affect incentives. The second group, *compliers* consists of those who adjusted their production process to comply with the new rules and avoid paying the tariff. Finally, the third group, *non-compliers*, are those that opted to pay the tariff.

Overall, the less integrated an automaker is into the bloc, the higher the costs of complying with the new rules. As a result, it is more likely to be a *non-complier* that pays the tariff. Conversely, the

more integrated a firm is into the bloc, the more likely it is to have been an *ex-ante complier*. We evaluate how integrated an automaker is into the bloc—and thus their likelihood of being in these different groups—by examining the share of imported inputs from the U.S. and Canada prior to the USMCA.

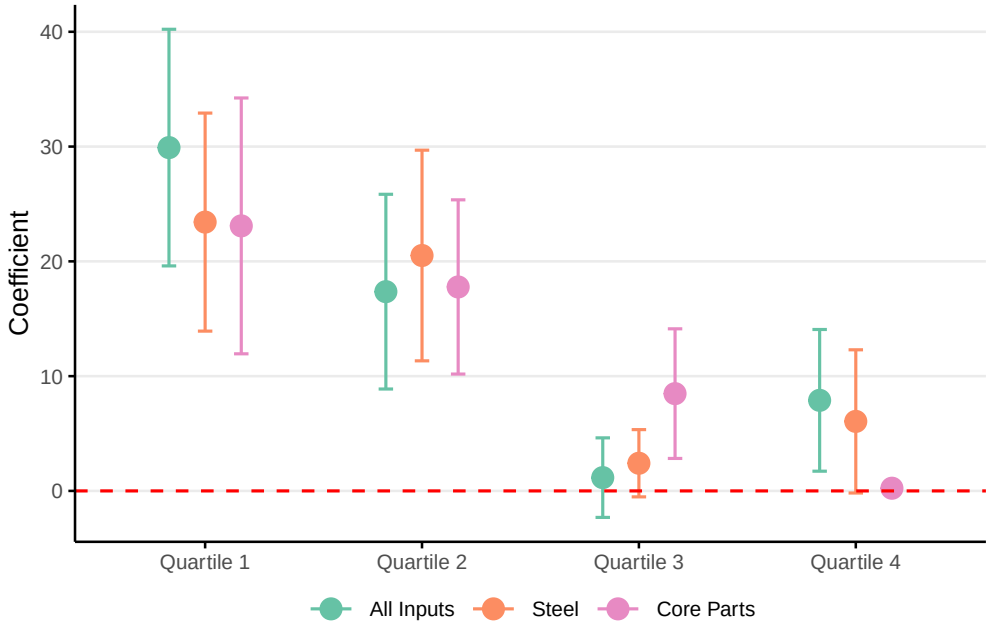
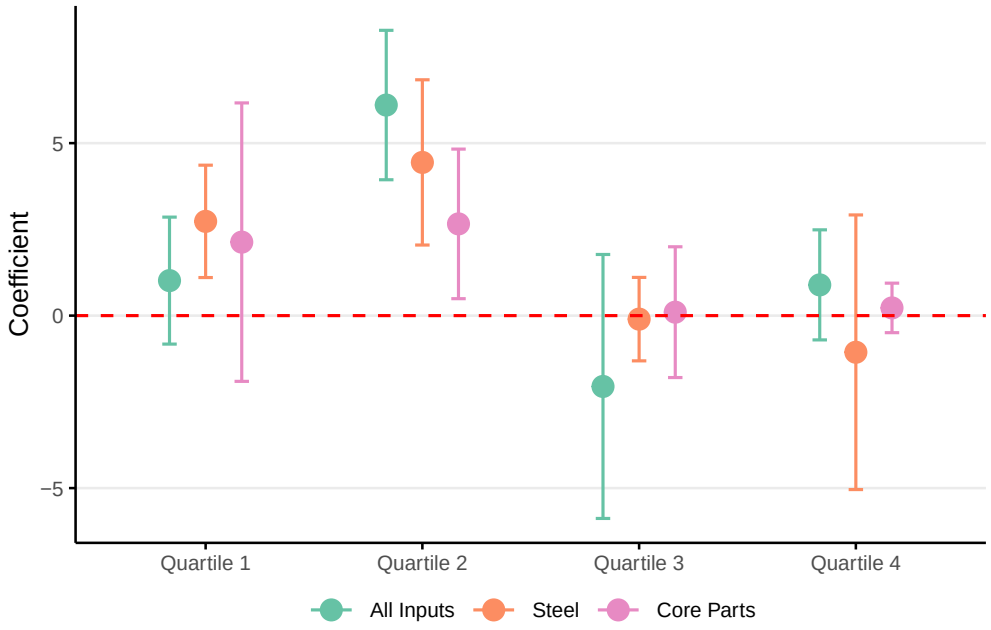


Figure 4: Share of Mexican Exports Subject to Tariffs

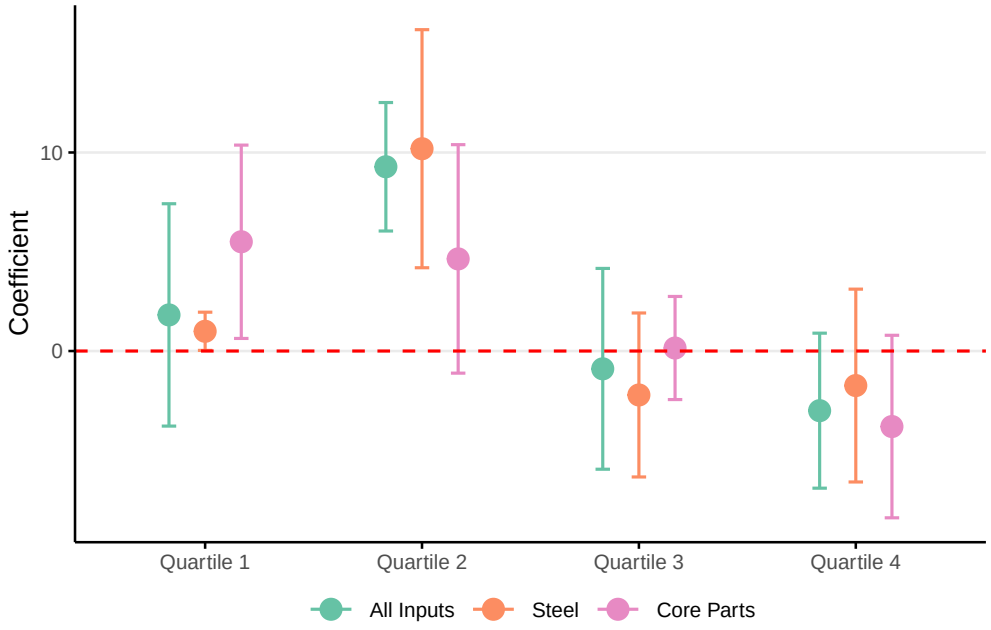
Notes: Circles show point estimates for the total effect on each quartile with 95% confidence intervals based on the share of imports of input K from the U.S. or Canada in the pre-USMCA period.

Prior to the USMCA, the automotive industry was paying virtually zero tariffs to export to the U.S. and Canada. Therefore, we would expect the automakers least integrated into the bloc to be those who experience the largest increase in their share of exports subject to tariffs. This is indeed what we observe in Figure 4. For the least integrated group, the first quartile, the share of exports subject to tariffs increased dramatically, between 20 and 30 pp. This result is robust to calculating the ex-ante integration to the bloc using imports of all inputs, steel, or core parts.

We now proceed to test the inverse U-shape pattern in automakers' responses in terms of the change in the share of inputs from the bloc based on their degree of ex-ante integration into the bloc. The inverse U-shape is expected to arise because the *non-compliers* and the *ex-ante compliers* do not adjust their production process to source more inputs from the bloc, and only those in between, the *compliers*, are increasing their sourcing of inputs from the bloc to avoid paying tariffs.



Panel A: Effect on Share of Inputs from U.S and Canada



Panel B: Effect on Share of Steel from U.S and Canada

Figure 5: Inverse U-Shape Response

Notes: Circles show point estimates for the total effect on each quartile with 95% confidence intervals based on the share of imports of input K from the U.S. or Canada in the pre-USMCA period.

As the theory predicts, firms' responses exhibit an inverse U-shape pattern. Firms in the second quartile show the most significant increase in their share of inputs sourced from North America (5 pp). This holds true when examining the response based on ex-ante integration concerning imports of all inputs (top of Figure 5) and steel (bottom of Figure 5). This indicates that firms with intermediate share of North American inputs were the most responsive to the new requirements, as they were likely the ones closest to, but below, the compliance threshold. For firms in this group, increasing their input share, despite incurring in higher costs, proved to be more profitable than incurring in paying tariffs. Conversely, firms with either very low or very high pre-USMCA North American input shares (quartiles 1, 3, and 4) did not make substantial adjustments. The first quartile likely includes the *non-compliers* who opted to pay the tariff instead, a pattern consistent with the effect on paying tariffs (Figure 4). In contrast, the third and fourth quartiles are likely *ex-ante compliers* because they did not have to increase their input sourcing from the bloc in order to avoid paying additional tariffs.

Robustness

Other potential confounding events occurred during our analysis period, including the COVID-19 pandemic and global microchip shortages. To ensure the validity of our results, we employ several robustness checks presented in the Appendix. First, we exclude 2020 from our analysis to mitigate pandemic-related distortions. Additionally, we assess the robustness of our results by using alternative control groups, such as focusing on large firms, matching firms with similar wage levels to those in the automotive industry, and selecting control industries most similar to automakers via k-means clustering.

5 Discussion: Effect on Prices

Stricter rules of origin increase the costs for automakers that were not complying ex-ante, as they now must either pay a tariff or adjust their production processes to comply. In this section, we estimate the effect of the USMCA's new rules on the prices in the United States of cars produced in Canada and Mexico that were not already made in compliance with the USMCA using the following estimating equation,

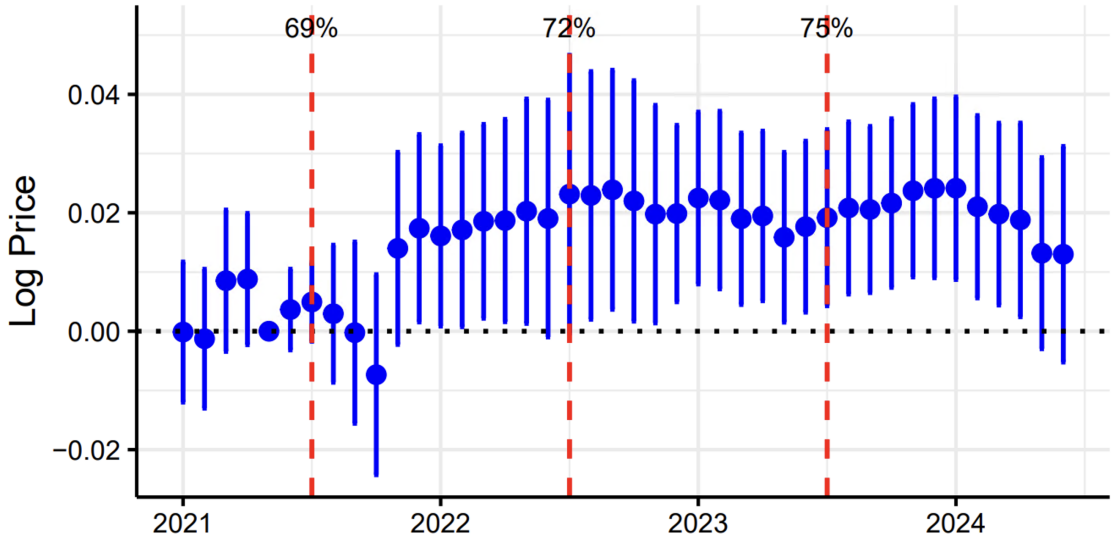


Figure 6: Price Effects on Affected Models and Trims

Notes: The figure displays the effect of USMCA rules on prices of vehicles that were not ex-ante complying with the additional requirements, estimated using equation 3. Standard errors are clustered at the automaker level, and all coefficients are displayed with 95% confidence intervals. The dotted red lines indicate the point in time at which the RoO for cars increased.

$$p_{i,c,t} = \alpha_i + \gamma_{c,t} + \sum_{j \neq t_0} \tau_j \mathbb{1}(j = t) \times NonComp_i^{Pre} + \epsilon_{i,t} \tag{3}$$

where $p_{i,c,t}$: is the log price of a car model and trim i at time t produced by company c, α_i and and $\gamma_{c,t}$ are the model $\times$ trim and time $\times$ company fixed effects. Finally, $NonComp_i^{Pre}$ is a dummy variable that equals one if that model-trim was not produced in compliance with USMCA from 2017 to 2019, before the agreement came into force. Based on NAFTA (Annex 401) and USMCA (Chapter 4), we consider a model and trim not in compliance if its regional content value is less than 80% or if any of its core parts (engine or transmission) does not comply with the regional value content requirements. For our main specification, we consider cars sold in the United States and manufactured within the USMCA, and we maintain a balanced panel of retailers across 2021 and 2024.

We find that, relative to the prices in May 2022, cars that were not ex-ante compliant with USMCA experienced a price increase 2% larger than those that were. This effect becomes evident in the data towards the end of 2021 and persists until the end of our data span in mid 2024. Yet, we do not find that the coming into effect of the 72% and the 75% rules of origin had an additional

effect. The estimates suggest a pass-through to consumers of at least 80%, since the maximum possible cost increase is 2.5% (the tariff's value).

We interpret our results as suggestive because we have limited data prior to 2021. Therefore, our estimated effects are relative to early 2021, after the treaty was ratified but before its implementation. Prices could have increased before, since companies would have already known about their expected cost increases, making our estimates a lower bound. The estimates may also be a lower bound due to the inclusion of time $\times$ company fixed effects, which allows us to remove all the company-specific shocks, such as scandals or shortages of inputs. However, price effects are observed only if car markers where passing through the additional model-specific cost increases to the models with the cost increase. For example, if, as a response to the cost increase in vehicle A due to USMCA's new rules, the manufacturer increased the price of model A and model B (which was not affected by USMCA), then the estimated effect on A's price would be biased downward since the *control* group also experienced a price increase.

6 Conclusions

This paper provides novel empirical evidence on how firms strategically respond to stricter RoO by leveraging transaction-level customs data from Mexico and the exogenous policy shock introduced by the renegotiation of the USMCA. Aligning with theoretical predictions, our findings reveal an inverse U-shaped relationship between firms' pre-existing regional integration and their responses to the new RoO. Firms with low and high levels of ex-ante North American integration adjust the least, while those with intermediate levels respond the most. Consequently, firms with lowest ex-ante integration end up paying tariffs rather than sourcing more inputs from the region. This finding underscores that when RoO are too strict, they may fail to promote stronger regional integration.

The more stringent USMCA rules can significantly impact welfare. First, they have increased U.S. government revenue from tariff collection, and the use of that revenue should enhance welfare. However, these stricter rules come with various costs. Initially, there is the cost of inefficiency inherent in any definition of RoO, no matter how stringent: since firms now need to solve a constrained profit optimization problem, profits may be lower, and costs are likely to be higher. These

increased costs, whether from paying tariffs or adjusting production processes, will be passed on to consumers to some extent, affecting the welfare of consumers who buy cars or use services impacted by car costs (e.g., ride-hailing). Moreover, there could be spillover effects in automakers' pricing strategies. Firms that did not encounter increased costs because they were already complying with the new rules may see an opportunity: as their competitors raise prices, they can improve their markups by doing the same. Additionally, any inefficiency will have a cost in terms of the region's competitiveness, and may put it in a disadvantageous position to compete with the rest of the world in car production.

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ONLINE APPENDIX

Firms' Strategic Responses to Rules of Origin: Evidence from the USMCA

by Angel Espinoza E, María José Orraca, and Miguel Ángel Talamas Marcos

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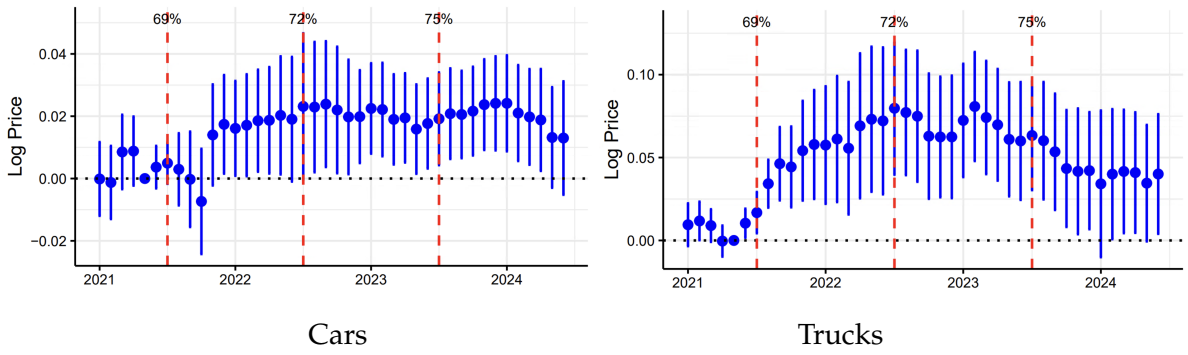

Cars Trucks

Figure A.1: Price Effects on Affected Models and Trims (Cars vs Trucks)

Notes: The figure displays the effect of USMCA rules on prices of vehicles that were not ex-ante complying with the additional requirements, estimated using equation 3. Standard errors are clustered at the automaker level, and all coefficients are displayed with 95% confidence intervals. The dotted red lines indicate the point in time at which the RoO for cars or trucks increased.