Markups and Cost Pass-through Along the Supply Chain*

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Abstract

We study markups and pricing strategies along the supply chain. Our unique dataset combines detailed price and cost information from a large global manufacturer with matched retail prices collected online for the period July 2018 through June 2023. We show that total markups—reflecting the difference between retail prices and production costs—are stable over time, despite the inflationary period at the end of the sample. Along the supply chain, manufacturer and retail markups are negatively correlated. For the most part, we find similar patterns across countries, though there is substantial heterogeneity in the split of markups between the manufacturer and retailers. Our analysis also reveals divergent pricing behaviors in response to cost shocks. The manufacturer adjusts prices more quickly than retailers and appears to more fully incorporate idiosyncratic cost shocks to specific products. Both types of firms respond more quickly to expected costs than to unexpected costs.

Keywords: Markups, Supply Chain, Vertical Relationships, Pass-through, Inflation
JEL Codes: D22, D40, E3, L11, L81

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1 Introduction

Firm pricing decisions along the supply chain affect product markups and play a key role in the transmission of cost shocks to final consumer prices. Markups charged by upstream and downstream firms—i.e., double marginalization—can exacerbate the effects of market power, leading to higher prices and lower quantities for consumers (Spengler, 1950). Dynamically, the interactions between manufacturers and retailers can affect the rate at which shocks to production costs are transmitted to consumer prices. Using a combination of model-based estimates and some direct evidence, a large prior literature has focused on markups and cost pass-through for retailers and manufacturers separately. However, understanding these phenomena as a product moves along the supply chain can better inform economic questions related to equilibrium prices, firm profits, and inflation.

We use product-level data to provide direct evidence on markups and pricing behaviors along the supply chain. Unlike most of the existing literature, we observe production costs and prices at the manufacturer level and directly link these to the final prices of the same products at the retail level. This allows us to measure markups at the manufacturer and retailer level, study how firms react to cost changes, and measure the differential degrees of pass-through between upstream and downstream sectors.

The dataset originates from a collaboration between a large global manufacturer (hereinafter "the manufacturer"), active in the sector of nondurable household products, and the Pricing Lab at Harvard Business School. The manufacturer data contains product prices and costs, with a detailed breakdown into expected and unexpected costs, along with consumer survey-based quality indicators. Retail prices were sourced from PriceStats, a private company related to the Billion Prices Project (Cavallo and Rigobon, 2016), which has shown that online retail prices are similar, both in levels and behaviors, to offline prices in the same stores (Cavallo, 2017). The dataset spans five years, from July 2018 through June 2023, and encompasses data from the United States, the United Kingdom, Canada, and Mexico. The combined dataset includes monthly production and retail information for approximately 2,000 products.

We start by examining *total markups*, which we define as the Lerner index in terms of retail prices and production costs. Across countries, the average is approximately 0.65. In magnitudes, these markups are roughly in line with recent evidence using the demand approach (Döpper et al., 2022) and the production approach (De Loecker et al., 2020, De Loecker and Eeckhout, 2018) to estimate markups.[1]

In the US, total markups were stable from June 2018 through June 2023, covering the pandemic and the recent inflationary period. Retail prices increased in 2022, but total markups did not. Thus, for the products in our sample, the primary driver of increased

[1]The demand and production approaches are empirical methods developed to recover markups either by estimating consumer demand on transaction data or firm production function on production data. See De Loecker and Scott (2022) for an overview and a comparison of the two methods.

consumer prices was an increase in production costs, rather than a net increase in markups.

However, when we examine each stage of the supply chain separately, we do find time-series variation in markups at the firm level. In the second half of 2020, manufacturer markups increased while retail markups fell. In 2022, retail markups increased while manufacturer markups fell. In our data, markup shocks at one stage of the supply chain are partially offset by symmetric adjustments at another, contributing to the stability of total markups. As a result, although manufacturer and retail markups vary over time, they lead to limited fluctuations in total markups.

We next examine cross-sectional patterns. In the US, there is substantial heterogeneity in markups at each stage of the supply chain, and manufacturer markups are consistently higher than retail markups. Notably, markups are negatively correlated along the supply chain, such that a higher manufacturer markup corresponds to a lower retail markup. One driver of these differences is product quality. Within a product category, the manufacturer sets higher dollar margins and markups for higher-quality products. Retailers, on the other hand, apply a uniform dollar margin across all products within a category. Because higher quality products are more costly to produce, retail markups are decreasing with product quality. This suggests that the manufacturer and retailers have distinct pricing behaviors. Put together, total product margins increase with customers' perceived quality, while total product markups do not show such a systematic relation.

We then turn to analyze how production cost shocks translate into retail prices, highlighting the differential dynamics between the manufacturing and retail sectors. We report our main results in levels, rather than in logs, consistent with the industrial organization literature (e.g., Weyl and Fabinger, 2013). Our findings reveal that the manufacturer adjusts prices rapidly, typically achieving complete pass-through within two months for aggregate shocks and instantaneously for product-specific shocks. Retailers, on the other hand, adjust prices more gradually, achieving complete cost pass-through within five months for aggregate shocks and passing through only partially idiosyncratic shocks.

Overall, our evidence suggests that the manufacturer strategically considers both aggregate and product-specific characteristics to influence its prices and markup levels directly. In contrast, the retailer price-setting process may prioritize broader market conditions, such as aggregate demand and supply dynamics within product categories, over individual product characteristics (Nakamura, 2008).

We further analyze heterogeneity in cost pass-through along two dimensions: whether or not the cost shock was expected, and whether the product is of higher or lower quality. Our findings indicate that the cost pass-through of production costs to retail prices is greater for expected costs relative to unexpected costs, as a result of the differential behavior of the manufacturer. Higher quality and lower quality products demonstrate similar pass-through patterns, though lower quality products have slightly higher pass-through for idiosyncratic cost shocks. Thus, though quality is correlated with markup levels, it appears to have a limited impact on the speed of cost adjustment.

Finally, we extend our analysis to Canada, Mexico, and the United Kingdom, finding heterogeneity across countries in the markup split along the supply chain. In Canada, similarly to the US, the manufacturer has higher markups, whereas in Mexico and the United Kingdom retailers have larger markups. Our pass-through findings in these countries confirm what we find in the United States. The manufacturer shows an immediate reaction for idiosyncratic shocks, while pursuing a more gradual approach for aggregate ones. For retailers, the pass-through of idiosyncratic shocks is more limited than for aggregate shocks. These distinct approaches underscore a fundamental divergence in pricing strategies between the two sectors.

Our paper contributes to the empirical literature on markups and cost pass-through. In relation to the first, our total markup values are consistent with estimates in the United States from De Loecker et al. (2020) and Döpper et al. (2022), and in Canada, Mexico, and the United Kingdom from De Loecker and Eeckhout (2018). In magnitudes, our markups are also consistent with those from publicly listed firms found by Díez et al. (2021). We complement this literature by showing a relatively stable evolution in recent years and during the pandemic, therefore a changing trend with respect to the previous decades, and by presenting unique evidence of the breakdown along the supply chain. Moreover, our results are also important for the methodology used to estimate markups. Existing structural approaches tend to rely on strong assumptions about pricing behaviors in either the upstream or downstream sectors, as discussed in De Loecker and Scott (2022). Our evidence can help inform appropriate assumptions in future work. Finally, given the high-frequency nature of our data, we also relate to the literature on the short-run markup fluctuations. Anderson et al. (2018) finds a mildly procyclical behavior in the retail sector, Vaona (2016) a countercyclical one in the manufacturing sector, and Bils et al. (2018) a countercyclical behavior for the entire economy. Nekarda and Ramey (2020) highlights that different markup measures lead to different results. We reconcile this evidence showing an asymmetric behavior along the supply chain, with manufacturer and retailer markup adjusting differently to similar shocks. This is also related to the different aggregation results shown in Burstein et al. (2020) and the network delay of commodity shocks in Minton and Wheaton (2023).

The second main strand of the literature we contribute to is the one empirically studying cost pass-through. A large literature has analyzed the degree of cost pass-through, often finding incomplete transmission of costs to prices (recent examples include Amiti et al., 2019, Auer et al., 2018, 2021, Bonadio et al., 2020). While these studies typically focus on pass-through elasticities, we estimate pass-through in levels in order to be able to compare and compound the effect of a shock along the supply chain. Contemporary work by Sangani (2022) reconciles levels and logs pass-through estimates for commodity shocks while analyzing the role of risk-adverse managers and overhead costs. Analyses along the supply chain are somehow more limited as data requirements, i.e., prices and costs for downstream and upstream sectors, are often prohibitive. Exceptions include Nakamura (2008), which finds a limited role of manufacturing shocks for retailers' observed behavior, and Nakamura and Zerom (2010), which shows that retailers pass on completely commodity shocks, thus playing a limited role in the incomplete transmission along the supply chain.[2] Our data allows us to not rely only on aggregate shocks, such as exchange rate fluctuations or monetary policy shocks, and to study differential responses along the supply chain to product-specific and more aggregate shocks. In contemporaneous work, Alexander et al. (2024) analyze the heterogeneous pass-through of aggregate and idiosyncratic shocks across different wholesale sectors and its relevance for cost transmission. Their research complements our approach, which focuses on transmission along the vertical relationship. Finally, our results complement the findings in MacKay and Remer (2024) showing the differential response to expected and unexpected production cost shocks.

The paper proceeds as follows: Section 2 presents the data and evidence on total markups across countries. Section 3 focuses on the US, documenting the negative correlation along the supply chain and investigating pricing behaviors along the quality distribution. Section 4 examines cost pass-through at different stages of the supply chain and Section 5 presents the results from the international comparison. Finally, Section 6 concludes.

2 Data

2.1 Prices, Costs, and Quantities

Our analysis relies on two distinct data sources that together allow us to measure markups and examine pricing behavior along the value chain. The first source comprises detailed product-level information from a global manufacturer. The second consists of a vast collection of retail prices provided by PriceStats, a private company related to the The Billion Prices Project (Cavallo and Rigobon, 2016). Developed in the Pricing Lab at Harvard Business University, this combined dataset offers a unique opportunity to study price formation and pass-through mechanisms along the entire supply chain, from production to retail.

The first dataset, originating from a large global manufacturer active in the sector of nondurable household products, includes monthly SKU-level records of revenues, quantities, and costs from Canada, Mexico, the United Kingdom, and the United States. Our definition of a product is a combination of a brand, a product form, a package size, and a variant (for example, fragrance). Our raw data has multiple SKUs that correspond to identical products according to our definition. To prepare the data for the analysis, we aggregate across these SKUs, and we then link these products to the retail online prices in the second dataset. We calculate unit prices and unit costs by dividing revenues and costs by the quantity sold. The

[2] Koujianou Goldberg and Hellerstein (2013) finds similar results in the beer market in the United States.

measure of costs we were provided reflects variable costs, including raw materials, packaging, manufacturing operating expenses, transportation, and warehousing.

The manufacturer dataset features two distinctive features that are useful for our purposes: indicators of product quality and a detailed breakdown of costs into expected and unexpected categories. Quality measures, ranging from 0 to 5, are derived from consumer surveys in which respondents rank the uniqueness of the product relative to competitors and rate perceived quality. The resulting indicators, Differentiation and Perceived Quality, available only for products sold in the United States, provide insight into pricing strategies relative to product quality. As for the cost breakdown, the manufacturer relies on an in-house team of experts to forecast costs for each product, which are recorded as *expected* costs. Any discrepancies between these forecasts and the actual realized costs are recorded as *unexpected* costs. This data, available from 2019, allows us to examine how pricing strategies vary in response to different types of cost shocks.

The second dataset includes retail prices and is provided by PriceStats, a private firm that collects prices from online retailers using web-scraping techniques and uses them to provide insights into daily price changes and product details, including category and sale status. Although the products in our data are also sold through brick-and-mortar channels, we view online prices as a reasonable measure for our purposes.[3] We aggregate daily observations to monthly average prices for each product-retailer, and manually match them with the manufacturer's production data. We drop observations with negative values for revenues or costs and instances in which costs exceed revenues (implying negative markups), and we winsorize all variables at the 1% level.[4]

The resulting sample of analysis includes more than 1,900 matched products, divided into seven product categories and 13 brands, over the period from June 2018 to June 2023. Table A.1 shows the number of observations, products, brands, and retailers available for each country. We were able to match more than 93% of the manufacturer's sales to the retail data in the United States, and around 86% considering all countries. Table A.2 reports summary statistics for the matched sample.

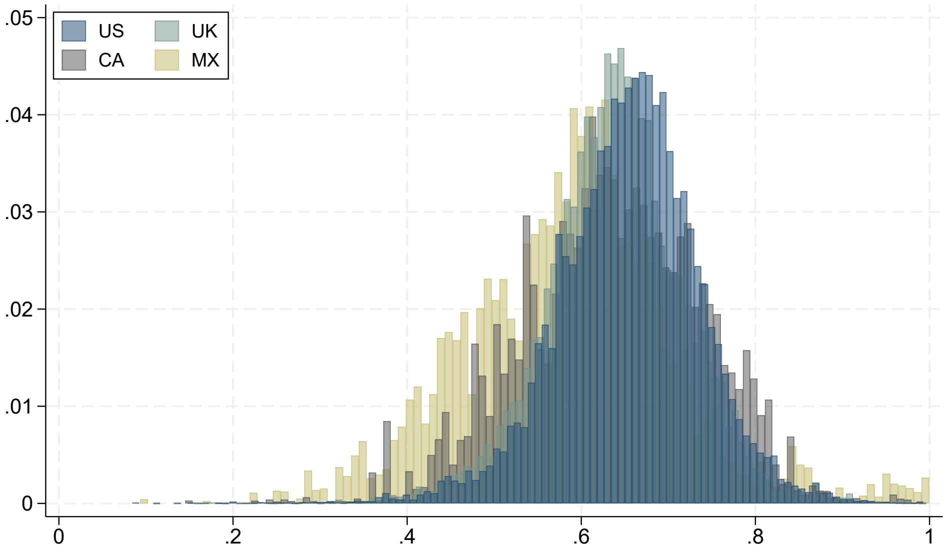
2.2 Product Markups

A key object of interest for our study is the supply chain *total markup*. For product i at time t, we compute this value as the Lerner index in terms of retail price and production cost, $\mu_{it}^{TOT} = \frac{p_{it}^{R} - c_{it}}{p_{it}^{R}}$. This markup reflects the wedge between the price that consumers pay and the production costs, and it usually takes on values between 0 (price equals cost) and 1 (prices

[3]Cavallo (2017) shows that online prices are very similar to offline ones, even identical in 72% of the cases. Other papers using this data include Cavallo (2013), Cavallo et al. (2024), Cavallo and Kryvtsov (2023), Cavallo (2018), and Alvarez et al. (2022).

[4]We further classify as outliers observations that double in size and prices over one month. This includes around 200 observations in the US.

Figure 1: *Total Markups*



Notes: This figure shows the sales-weighted frequency distribution of total markups ($\frac{p^R_{it}-c_{it}}{p^R_{it}}$) along the supply chain for each country.

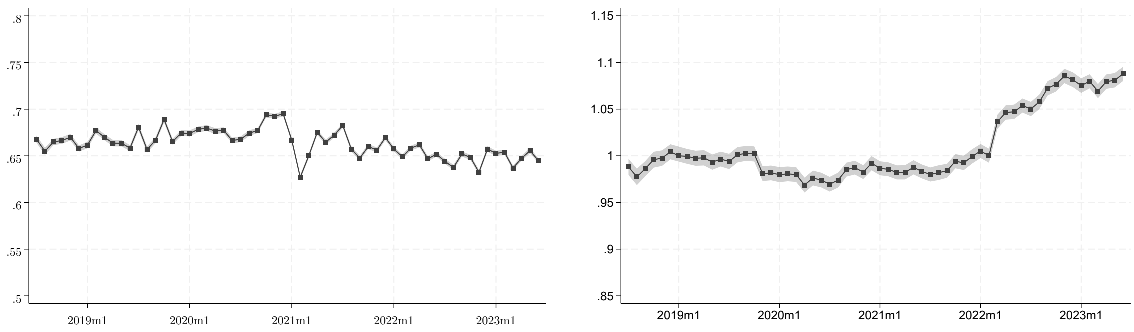
substantially greater than costs).

Figure 1 shows total markups in Canada, Mexico, the United Kingdom, and the United States. The distribution of total markups is remarkably similar across countries, with average values around 0.65. In magnitudes, the total markups are broadly consistent with recent estimates in the retail sector (Döpper et al., 2022) and the broader economy (De Loecker et al., 2020, De Loecker and Eeckhout, 2018). See Table A.3 for additional summary statistics.

Our data also allow us to construct markups at the manufacturer and retailer level separately for individual products. We compute manufacturer markups as the Lerner index in terms of wholesale prices and production costs, $\mu^M_{it} = \frac{p^M_{it}-c_{it}}{p^M_{it}}$. We note that our price and cost measures are constructed as the average of revenues and variable costs, which may not always correspond to revenues and costs for the marginal unit. However, due to the nature of the products in our sample and the fact that these data are used by the manufacturer to assess margins, we think they provide reasonably good measures.

Finally, we compute retail markups as the Lerner index with retail and wholesale prices, $\mu^R_{it} = \frac{p^R_{it}-p^M_{it}}{p^R_{it}}$, following other papers that study retail markups (Aguirregabiria, 1999, Eichenbaum et al., 2011, Anderson et al., 2018, among others). The rationale for this approach is that the marginal cost of a product for a retailer is its replacement cost, with other retailing costs fixed over short horizons (Gopinath et al., 2011). To the extent that additional variable retailing costs (such as shipping costs) exists, our measure of retail markups will be biased upward. In

Figure 2: *Time Series of Prices and Total Markups*



(a) *Total Markups* **(b)** *Retail Prices*

Notes: This figure shows the time series trends in total markups (a) and retail prices (b) in the United States. Total markups are defined as the Lerner Index using retail prices and manufacturing costs. Point estimates and 95% (robust) confidence intervals are obtained from a regression on period and product fixed effects using sales weights.

that case, our retail markups may be interpreted as upper bounds.[5] Similarly, our measure of total markups omits these additional retailer marginal costs and may be biased upward. In our regressions, we employ fixed effects to control for certain types of unobserved costs.

3 Markups and Pricing Behavior in the United States

In this section, we analyze markups and pricing behavior in the US market. We begin by documenting the level and stability of markups, and then focus on the heterogeneity along the supply chain.

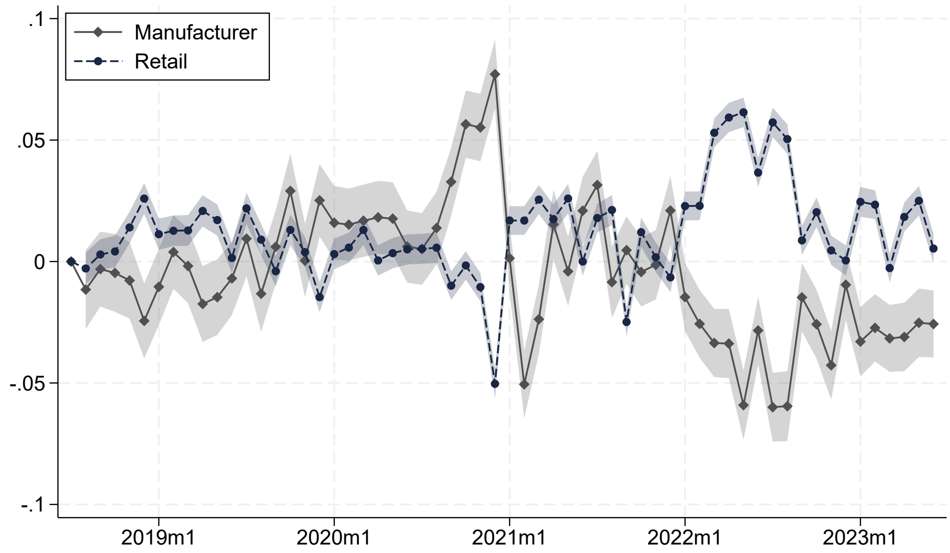
3.1 Markups Over Time

Figure 2a shows that the average total markup in the US is fairly stable over time.[6] The average value is 0.66, with slightly higher values in 2020 a slight decline starting in 2021. By contrast, retail prices (Figure 2b) rise sharply in 2022, coinciding with the inflationary period in the United States. The fact that markups are stable while prices are increasing indicates that, for the products sold by the manufacturer, inflation was not driven by markup changes, but rather by changing costs. This finding indicates that, during this period, there was no discrete change in pricing practices across the supply chain, as would be implied narratives

[5]Sangani (2022) compares retail markups measured using replacement costs with estimates resulting from structural methods based on demand and production models, therefore incorporating a richer notion of marginal costs, and finds similar markup levels.

[6]Throughout, we construct time series trends by regressing measures of markups (or prices) on period-specific indicators while including product fixed effects, which controls for changes in the composition of products over time.

Figure 3: *Markup Dynamics*



Notes: This figures shows the negative dynamic correlation of markups along the supply chain in the United States. Changes in average markups and 95% (robust) confidence intervals resulting from a regression on period and product fixed effects using sales weights.

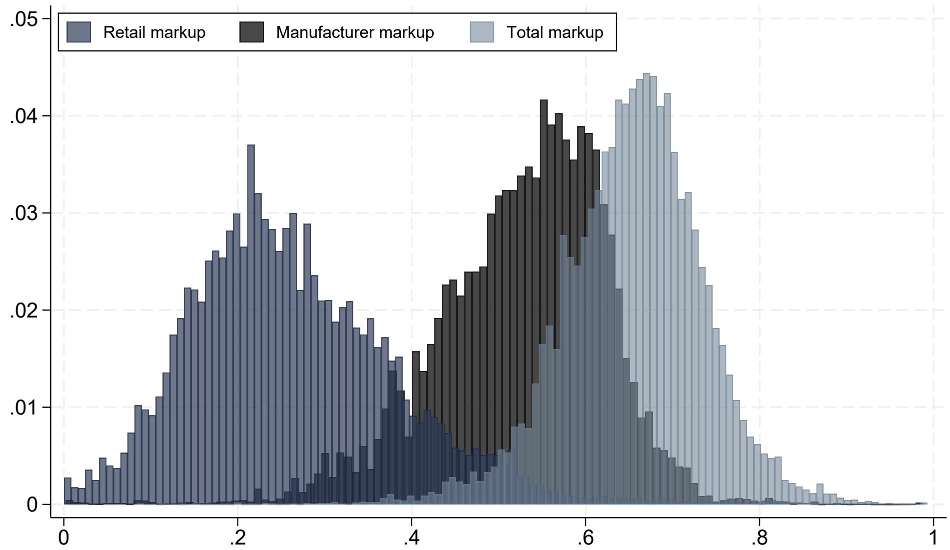
for which inflation was driven by primarily by higher markups, such as the "greedflation" hypothesis.

In Figure 3, we plot the time series of manufacturer and retailer markups separately. In contrast to total markups, there are meaningful fluctuations in markups at individual stages in the supply chain. Manufacturer markups increased sharply at the end of 2020, returned to previous levels in 2021, then declined in 2022. Retailer markups followed an inverse pattern, declining at at the end of 2020 and increasing in 2022. Even at a monthly frequency, we observe that changes in one sector's markups are often offset by inverse changes in the other, contributing to stable total markups. The negative correlation between manufacturer and retailer markups implies that the empirical relationship between firm profitability and consumer prices can depend on where the firm is in the supply chain. During the period of increased consumer prices starting in 2022, variable profits, as captured by the markup, were relatively higher for retailers and relatively lower for the manufacturer.

3.2 Cross-Sectional Patterns

In Figure 4, we plot the distribution of markups for each stage of the supply chain in the US. The figure indicates substantial heterogeneity in both sectors. This is particularly striking because the products in our study come from a single manufacturer in a limited set of product categories. Thus, we document meaningful within-firm markup heterogeneity, which may be an important fact to accommodate when assessing equilibrium outcomes. Figure A.1 shows

Figure 4: *Markups Along the Supply Chain*



Notes: This figure shows the sales-weighted frequency distribution of markups along the supply chain in the United States. Retail markups ($\frac{p^R - p^M}{p^R}$) are shown in dark blue, manufacturer markups ($\frac{p^M - c}{p^M}$) in dark grey, and total markups ($\frac{p^R - c}{p^R}$) in light blue.

the same figure separately for each year and indicates that this heterogeneity is also present within short periods of time.

Another notable pattern is that markups are consistently higher for the manufacturer than for the retailers. The average manufacturer markup is 0.54, compared to a retailer markup of 0.26.[7] This indicates that manufacturers and retailers are not symmetric in terms of competitive pressures, bargaining positions, or both.

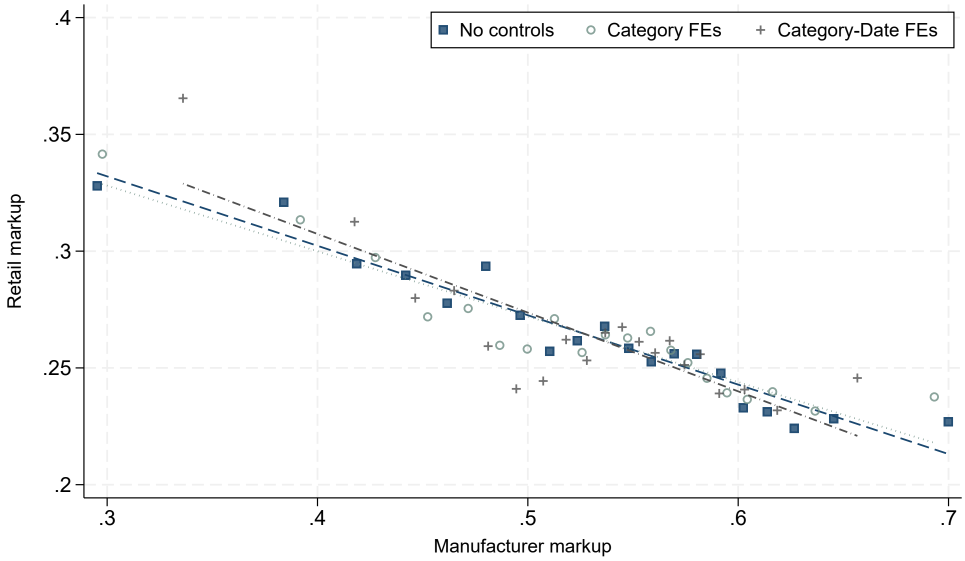
There is greater variation in retailer markups and manufacturer markups than there is for total markups. This is driven by negative correlation between manufacturer and retailer markups, as shown in Figure 5. This negative correlation persists even after controlling for period fixed effects, indicating that the negative correlation is a feature of the cross section.

To inform the determinants of these patterns, we focus on one mechanism that can drive heterogeneity in markups: product quality. In our data, product quality and total margins, defined as retail prices minus production costs, are positively correlated, as documented in Figure 6a.[8] Intuitively, this implies that prices increase relatively more than costs along with quality. However, the right panel, Figure 6b, shows that this does not translate into a positive

[7]The difference is not simply due to the fact that retailer markup is calculated with a larger denominator. Figure A.3 shows that the margin share—i.e., the share of the variable profits in dollar terms—is much higher for manufacturers.

[8]In this section we focus on product quality defined as product differentiation. In Figure A.4, we plot margins and markups against the alternative quality indicator–perceived quality–finding consistent results. In conversations with the manufacturer, they confirmed to us the importance of our primary measure.

Figure 5: *Markups Correlation Along the Supply Chain*



Notes: This figure shows the negative correlation of markups along the supply chain in the United States. Bins include sales-weighted values residualized on product and category times period fixed effects.

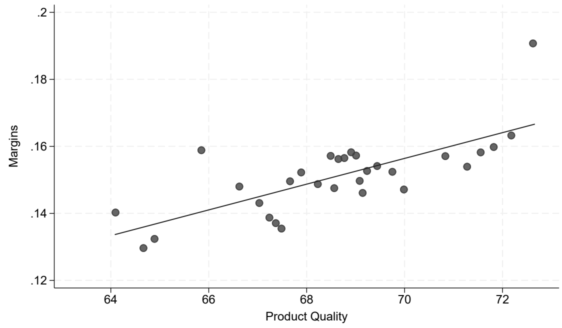
correlation between markups and quality, as costs also increase with quality.

Examining the patterns separately for the manufacturer and the retailer is illuminating. The manufacturer receives higher margins and markups for high-quality products (Figure 6c and Figure 6d). In contrast, retailers appear to set uniform dollar margins within a product category, resulting in lower markups for high-quality products (Figure 6e and Figure 6f). The corresponding coefficients from the linear models of Figure 6 are reported in Table A.5.

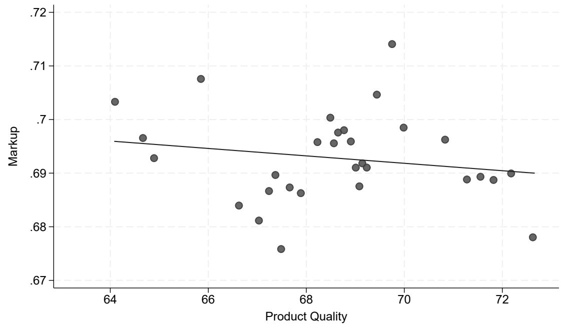
These findings suggest contrasting equilibrium strategies between the manufacturer and retailers regarding quality differentiation. For the manufacturer, higher quality products yield higher markups. This can arise in equilibrium due to downstream consumer preferences, less threatening substitutes, and/or a better bargaining position vis-a-vis the retailer. Conversely, in equilibrium, variation in product quality within a category does not predict retailer margins.

These results highlight the importance of considering separate stages of the supply chain for questions related to profitability, markups, and price levels. Our results indicate that product quality matters more to the manufacturer than it does to the retailer (in equilibrium). These patterns could ultimately be driven by different incentives: the manufacturer is competing against other manufacturers that sell products at the same retailer, while the retailer is competing against other retailers that may offer a similar bundle of products.

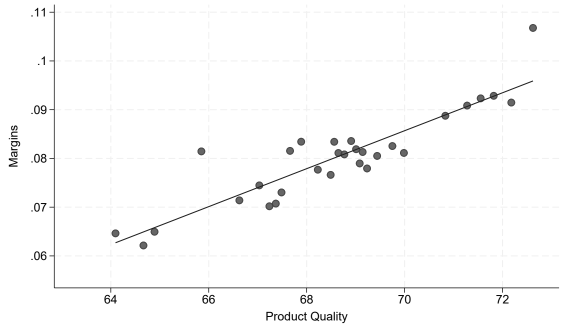
Figure 6: *Quality Differentiation Along the Supply Chain*



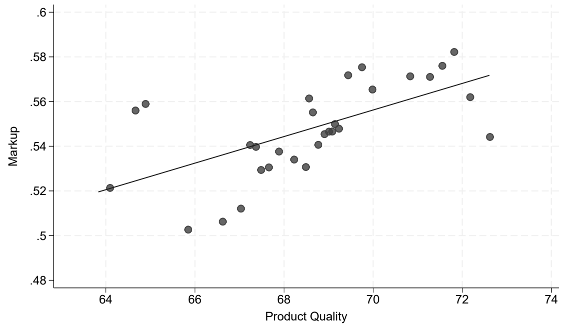
(a) *Total Margins*



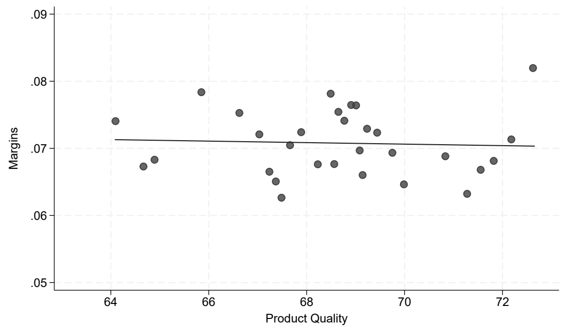
(b) *Total Markups*



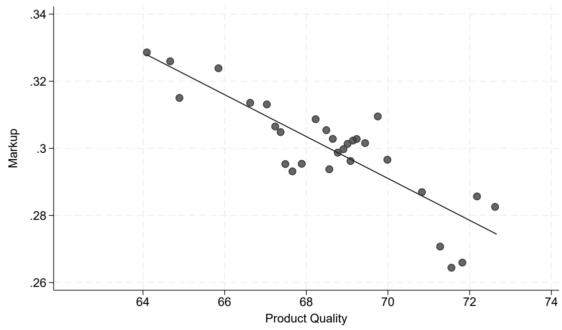
(c) *Manufacturer Margins*



(d) *Manufacturer Markups*



(e) *Retail Margins*



(f) *Retail Markups*

Notes: This figure shows the relation of product (a) total margins, (b) total markups, (c) manufacturer margins, (d) manufacturer markups, (e) retail margins, and (f) retail markups to an indicator of product differentiation. Values are residualized on linear and quadratic package size, to account for quantity discount, and on a set of fixed effect including product category interacted with periods, and retailer.

4 Cost Pass-Through

We now examine how costs are transmitted to prices. First, we look at how costs are transmitted down each stage of the supply chain. Second, we consider the differential impact of expected and unexpected cost shocks. Third, we examine whether cost transmission differs for products of higher versus lower quality.

4.1 Along the Supply Chain

We measure the pass-through mechanisms at both the manufacturer and the retail levels to unravel the complementary dynamics between manufacturing costs and retail pricing strategies. Specifically, we compute the pass-through of costs at the manufacturer level using the following specification:

$$p_{ist}^{M} = a + \sum_{z=0}^{T} \alpha_z^M \hat{c}_{ist-z}^{M} + \sum_{z=0}^{T} \beta_z^M C_{ist-z}^{M} + \phi_i + \varepsilon_{ist} \tag{1}$$

where p_{ist}^M represents the manufacturer prices for product i in category s at time t, and c_{ist}^M represents its production cost. We divide the latter into its product-specific component, $\hat{c}_{ist}^M$, by demeaning it, and the category common component, C_{ist}^M, representing the product category average. ϕ_i are product fixed effects and ε_{ist} is a mean-zero error term.

This specification, where the identification of pass-through coefficients $\{\alpha_z^M\}_{z=0}^T$ and $\{\beta_z^M\}_{z=0}^T$ is based on within-product variation over time, allows us to disentangle the effects on prices of product-idiosyncratic costs and changes in aggregate common components. This aspect is crucial for evaluating different pricing responses and comparing them along the value chain.

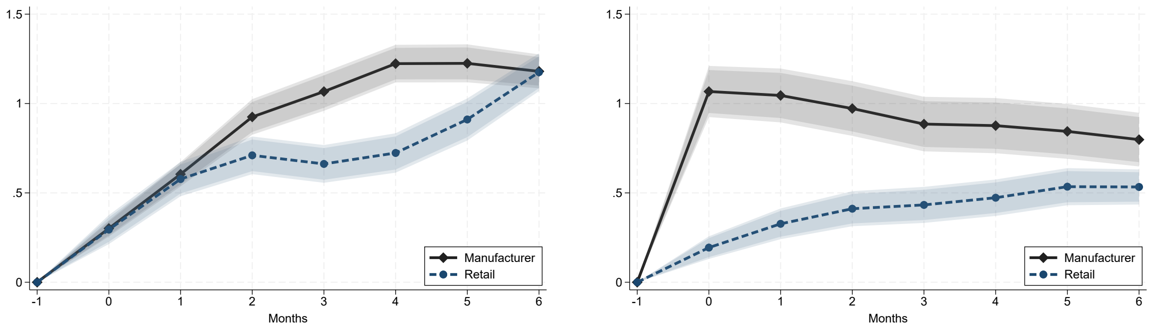
Similarly, the pass-through at the retailer level is estimated using the following specification:

$$p_{ijst}^{R} = b + \sum_{z=0}^{T} \alpha_z^R \hat{p}_{ist-z}^{M} + \sum_{z=0}^{T} \beta_z^R P_{ist-z}^{M} + \gamma_j + \gamma_i + \nu_{jist} \tag{2}$$

where p_{ijst}^R represents the price for product i in category s set by retailer j at time t, and p_{ist}^M represents the manufacturer's price, which is the cost incurred by the retailer to purchase the product. As in the wholesale analysis, we divide the latter into a product-specific component, $\hat{p}_{ist}^M$, and a common component, P_{ist}^M, representing the product category average. γ_j and γ_i are retailer and product fixed effects, respectively.

Although we study a single manufacturing firm that produces multiple products for the wholesale cost pass-through, we have information on several retailers selling the same product. Therefore, the pass-through coefficients at the retail level, $\{\alpha_z^R\}_{z=0}^T$ and $\{\beta_z^R\}_{z=0}^T$, are estimated using the variation within the product that accounts for retailer-specific components, providing insights into the differential impact of manufacturer price changes on retail pricing.

Figure 7: *Cost Pass-through Along the Supply Chain*



(a) *Aggregate* **(b)** *Idiosyncratic*

Notes: These figures show the cumulative pass-through of costs to wholesale prices (a) and of wholesale prices to retail prices (b), estimated using Equation (1) and Equation (2). Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.

Due to product attrition, we restrict our baseline specification to analyze price responses within the first six months.[9] Moreover, we include period fixed effects and run the same analysis. Table A.7 and Table A.9 show the resulting coefficients when controlling for aggregate conditions, and we find consistent results.

Figure 7a shows the cumulative price adjustments following an aggregate increase in costs, while Figure 7b examines the cumulative price responses to idiosyncratic cost changes. The figures reveal different pricing strategies both with respect to idiosyncratic and aggregate components and between the manufacturer and the retailers.

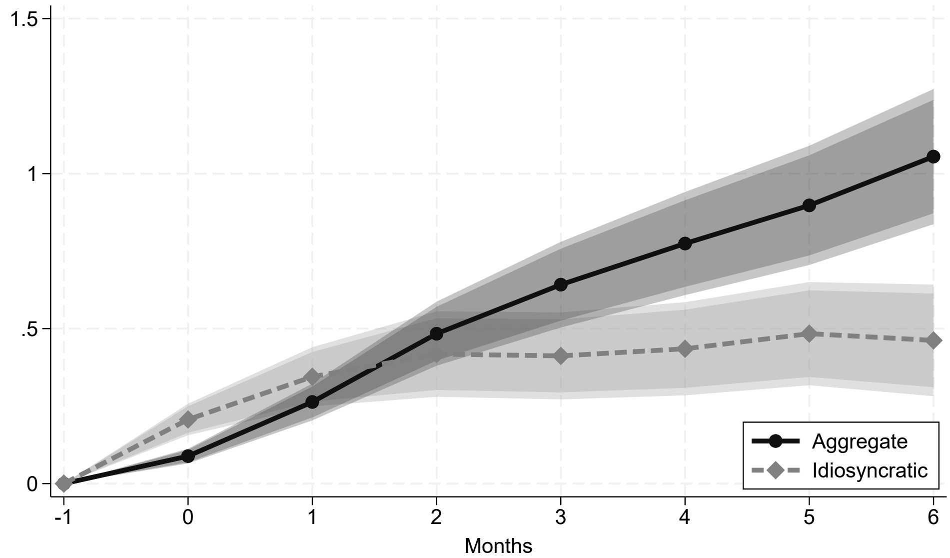
For both the manufacturer and retailers, substantial and fast price adjustments follow aggregate cost shocks. Specifically, a $1 increase in aggregate costs results in an immediate $0.30 increase at both stages of the supply chain. Despite the similar initial reactions, the figure highlights a different speed of adjustment in the following months. The manufacturer attains pass-through close to 1 (in levels) within two months of the change, while it takes retailers' five to six months to reach the same point.

The manufacturer's and retailers' price responses to idiosyncratic costs are significantly different. Figure 7b shows that the manufacturer's response when isolating product-specific costs is even more pronounced than to aggregate costs, with wholesale prices increasing by $1.10 immediately following a $1 increase in manufacturing costs. In contrast, retailers adopt a more conservative pricing strategy not fully passing through product-specific costs even after six months.[10] This behavior is consistent with the uniform margins we observed along the quality distribution within a category, suggesting that retailers may make pricing decisions primarily at the product category level and in equilibrium put less weight on product-specific

[9] Table A.6 and Table A.8 present pass-through coefficients for different lags, showing cumulative price responses over extended periods.

[10] Table A.6 shows that idiosyncratic cost components are not passed through even after one year.

Figure 8: *Pass-through from Production Cost to Retail Price*



Notes: This figure shows the cumulative pass-through of production costs to retail prices. The cumulative responses are calculated as $\gamma_t^{\text{AGG}} = \sum_{i=0}^{t} \beta_i^R (\sum_{j=0}^{t-i} \beta_j^M)$, and as $\gamma_t^{\text{IDIO}} = \sum_{i=0}^{t} \alpha_i^R (\sum_{j=0}^{t-i} \alpha_j^M)$, with γ_t^{AGG} and γ_t^{IDIO} being the cumulative retail price adjustment at time t to aggregate or idiosyncratic costs, and α^X and β^X with $X = \{M, R\}$ recovered from Equation (1) and (2). Standard errors are constructed by bootstrapping 100 times with replacement.

conditions.

To further contextualize these dynamics, we use pass-through estimates to calculate the change in retail price due to a $1 increase in production cost, incorporating adjustments at both the manufacturing and retail levels, as shown in Figure 8. This cumulative response is calculated as $\gamma_t^{\text{AGG}} = \sum_{i=0}^{t} \beta_i^R (\sum_{j=0}^{t-i} \beta_j^M)$, and as $\gamma_t^{\text{IDIO}} = \sum_{i=0}^{t} \alpha_i^R (\sum_{j=0}^{t-i} \alpha_j^M)$, with γ_t^{AGG} and γ_t^{IDIO} being the cumulative retail price adjustment at time t to aggregate or idiosyncratic costs, and α^X and β^X with $X = \{M, R\}$ recovered from Equation (1) and (2).[11] The figure indicates that an aggregate shock to manufacturing costs, affecting the entire product category, is passed on to the final consumer within 5 to 6 months, with delays due to temporary cost absorption attributable to both the manufacturer and the retailers. Importantly, two months after the shock, when the manufacturer has already passed it through completely, retail prices have changed only by $0.50, underscoring the role played by retailers and the supply chain in general in delaying cost transmission (Minton and Wheaton, 2023). Furthermore, while the manufacturer responds to product-specific shocks with immediate and complete price adjustments, these changes do not fully reach the final consumer, due to the pricing behavior of the retailers. In fact, retail prices increase only by $0.50 throughout the six-month period.

[11]This method of calculating the cumulative response accounts for delayed adjustments in both the manufacturing and retail sectors. For instance, a $1 increase in production cost results in an immediate pass-through at period 0 will be $\gamma_0 = \alpha_0\beta_0$; after one month, $\gamma_1 = \gamma_0 + \alpha_0\beta_1 + \alpha_1\beta_0 = \beta_0(\alpha_0 + \alpha_1) + \beta_1\alpha_0$, and so on.

The observed differences in pass-through behavior between the manufacturer and the retailers have several implications. The manufacturer's ability to quickly adjust prices in response to cost shocks suggests a high degree of pricing power and flexibility. Conversely, the gradual pass-through by retailers indicates a distinct approach. Policymakers need to consider the different speeds at which cost changes are transmitted through the supply chain. Quick adjustments by manufacturers can lead to immediate inflationary pressures, while the slower response by retailers can smooth out these effects over time. Understanding these dynamics can help regulators identify potential areas where market interventions might be necessary to prevent excessive price volatility and protect consumer interests. The limited pass-through to final retail prices suggests that consumers might be partially shielded from immediate cost shocks, but prolonged cost increases could eventually filter through, affecting affordability. By considering these factors, policymakers can better manage the impacts of cost changes on the economy and ensure that market dynamics remain balanced and fair for all stakeholders.

4.2 Expected and Unexpected Cost Shocks

The period under examination was characterized by significant global shocks that were largely unforeseen. In Figure 9, we leverage the detailed cost breakdown from the dataset to illustrate the shifts in overall, expected, and unexpected costs. As highlighted by the coefficient of variation in Table A.2, unexpected costs, despite having an average close to zero, significantly contributed to the overall cost variation, similarly to expected costs. Given the significant impact of unexpected shocks during this period, we investigate whether the manufacturer reacts differently to expected and unexpected shocks, potentially influencing the observed dynamics of cost pass-through.

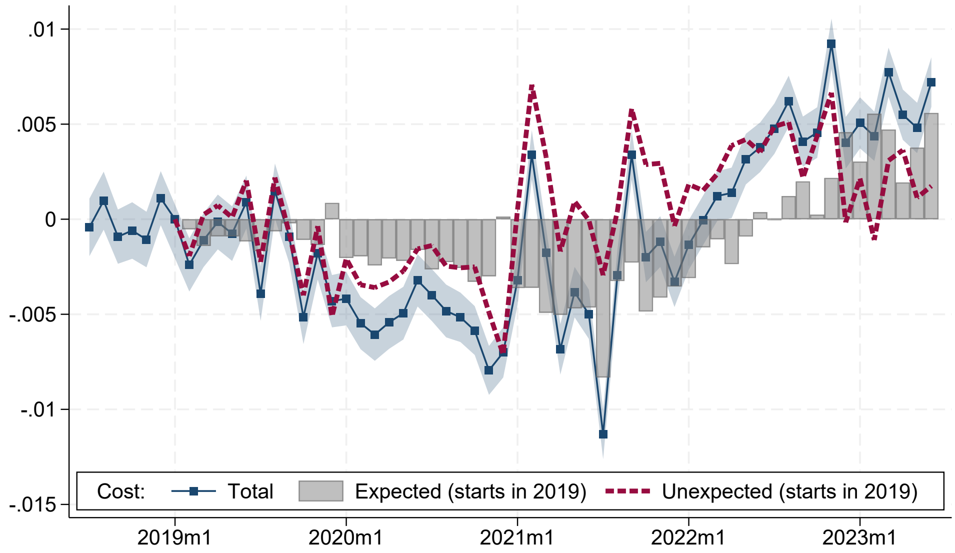
To explore potential deviations in pass-through from normal conditions, we use information on expected and unexpected cost shocks to estimate the differential price responses with the following specification:

$$p_{ist}^{M} = a + \sum_{z=0}^{T} \left\{ \alpha_{e,z}^{M} \hat{c}_{ist-z}^{e,M} + \beta_{e,z}^{M} C_{ist-z}^{e,M} + \alpha_{u,z}^{M} \hat{c}_{ist-z}^{u,M} + \beta_{u,z}^{M} C_{ist-z}^{u,M} \right\} + \phi_i + \varepsilon_{ist} \tag{3}$$

where $c_{it}^{e,M}$ represents the expected price change at time t and $c_{it}^{u,M}$ the unexpected one, which we split into a demeaned component and the product category average. Given that we do not have the cost breakdown for retailers, we limit our focus to the manufacturer and assume retailers cannot distinguish between expected and unexpected cost changes.

Figure 10 shows the cumulative pass-through from production costs to retail prices, combining the responses at both the manufacturing and retail stages, following the approach used in

Figure 9: *Expected and Unexpected Costs Changes Over Time*



Notes: The figure displays the change in production, expected and unexpected costs compared to January 2019. Units on the y-axis are US Dollars. Averages and 95% (robust) confidence intervals calculated using a regression with monthly fixed effects and weighting each product with period-country specific sales weights. Product fixed effects are included to control for composition effects.

Figure 8.[12] The analysis reveals that expected costs, both aggregate and idiosyncratic, are transmitted faster to retail prices, while unexpected costs take up to three months to reach the same level of pass-through as for expected costs.

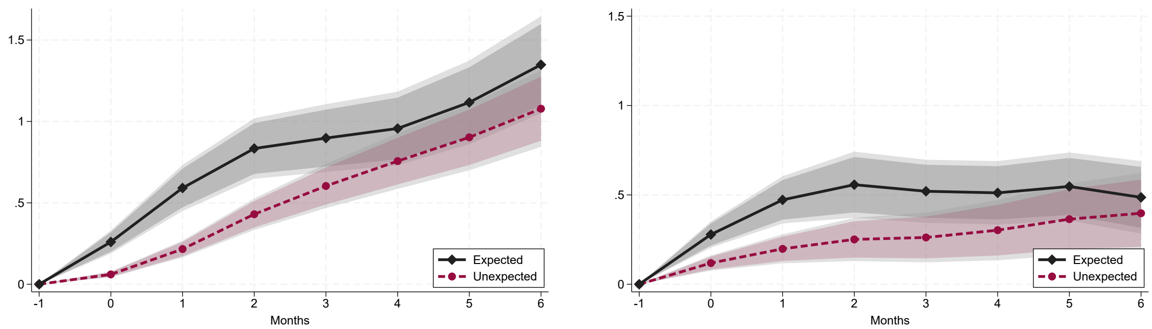
The results indicate that for aggregate costs, expected shocks are transmitted to retail prices almost immediately, reaching full pass-through within two months. In contrast, the pass-through of unexpected costs is complete only after five months. For idiosyncratic costs, where the transmission to retail prices is only partial, each $1 increase in expected costs leads to a $0.50 increase in retail prices after just one month, whereas it takes significantly longer for unexpected costs to reach that level.

These findings highlight the differential behaviors throughout the supply chain in response to both the type of shock (aggregate or idiosyncratic) and its nature (expected or unexpected). The manufacturer, which achieves full pass-through for both aggregate and idiosyncratic costs, responds more strongly to expected changes, possibly indicating prudence or delays caused by nominal rigidities.[13] Retailers' slower price adjustments, as seen in Figure 7, further exacerbate the delay in price adjustment when the manufacturer responds more gradually to unexpected costs.

[12]While the manufacturer exhibits heterogeneous responses depending on the nature of the shock recovered from Equation (3), we apply the coefficients for retailers estimated from Equation (2).

[13]Figure A.5 shows the individual estimated responses.

Figure 10: *Pass-through from Production Cost to Retail Price by Cost Type*



(a) *Aggregate Cost* **(b)** *Idiosyncratic Cost*

Notes: These figure show the cumulative pass-through of production costs to retail prices for expected and unexpected costs. The cumulative responses are calculated separately for expected and unexpected costs as $\gamma_{y,t}^{\text{AGG}} = \sum_{i=0}^{t} \beta_i^R (\sum_{j=0}^{t-i} \beta_{y,j}^M)$, and $\gamma_{y,t}^{\text{IDIO}} = \sum_{i=0}^{t} \alpha_i^R (\sum_{j=0}^{t-i} \alpha_{y,j}^M)$, with $\gamma_{y,t}^{\text{AGG}}$ and $\gamma_{y,t}^{\text{IDIO}}$ being the cumulative adjustment of the retail price at time t to aggregate or idiosyncratic costs with $y = \{e, u\}$ for expected and unexpected changes. α_e^X and α_u^X are recovered from Equation (3), and β^X from Equation (2) with $X = \{M, R\}$. Standard errors are constructed by bootstrapping 100 times with replacement.

4.3 The Role of Quality

Finally, after uncovering the role of quality differentiation for profitability, we investigate its role in the transmission of cost shocks to prices. For that, we use the following specification for the manufacturer:

$$p_{ist}^M = a + \sum_{z=0}^{T} \left\{ \alpha_z^M \hat{c}_{ist-z}^M + \beta_z^M C_{ist-z}^M + \mathrm{I}_{q,i} \times \left(\alpha_{q,z}^M \hat{c}_{ist-z}^M + \beta_{q,z}^M C_{ist-z}^M \right) \right\} + \phi_i + \varepsilon_{ist} \qquad (4)$$

and for retailers:

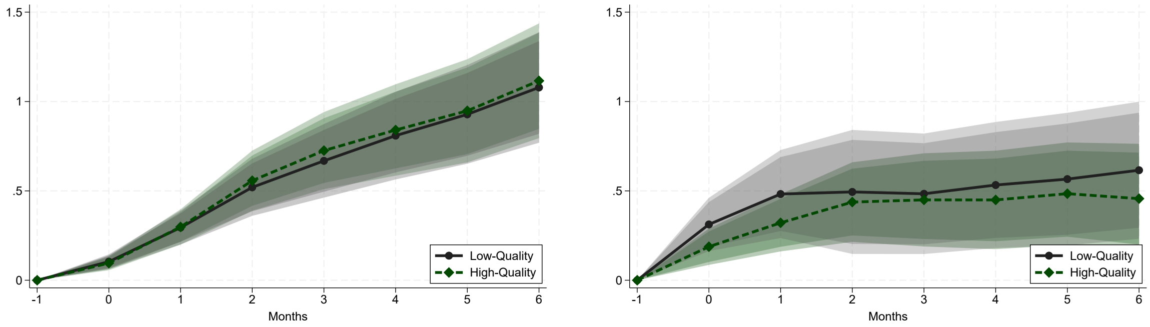
$$p_{ijst}^R = b + \sum_{z=0}^{T} \left\{ \alpha_z^R \hat{p}_{ist-z}^M + \beta_z^R P_{ist-z}^M + \mathrm{I}_{q,i} \times \left(\alpha_{q,z}^R \hat{p}_{ist-z}^M + \beta_{q,z}^R P_{ist-z}^M \right) \right\} + \gamma_j + \gamma_i + \nu_{jist} \qquad (5)$$

with $\mathrm{I}_{q,i}$ being a dummy variable taking value 1 for products with quality above the average within a category, else 0.

We find similar pass-through estimates for high- and low-quality products in response to aggregate and idiosyncratic cost shocks. Thus, while quality appears to play an important role in the distribution of markups between the manufacturer and retailers, we do not find evidence that it significantly influences the degree of pass-through for the products in our sample, as shown in Figure 11.[14]

[14] The manufacturer's and retailers' individual responses are provided in Figure A.6.

Figure 11: *Pass-through from Production Cost to Retail Price by Product Quality*



(a) *Aggregate Cost* **(b)** *Idiosyncratic Cost*

Notes: These figure show the cumulative pass-through of production costs to retail prices by product quality. The cumulative responses are calculated as $\gamma^{\text{AGG}}_{q,t} = \sum_{i=0}^{t} \tilde{\beta}^{R}_{q,i}(\sum_{j=0}^{t-i} \tilde{\beta}^{M}_{q,j})$ and $\gamma^{\text{IDIO}}_{q,t} = \sum_{i=0}^{t} \tilde{\alpha}^{R}_{q,i}(\sum_{j=0}^{t-i} \tilde{\alpha}^{M}_{q,j})$ with $\gamma^{\text{AGG}}_{q,t}$ and $\gamma^{\text{IDIO}}_{q,t}$ being the cumulative adjustment of the retail price at time t to aggregate or idiosyncratic costs and q = 1 for high-quality products, else 0. The coefficients are recovered from Equation (4) and Equation (5) with $\tilde{\alpha}^{X}_{q,t} = \alpha^{X}_{t} + \text{I}_{q,t} \times \left(\alpha^{X}_{q,t}\right)$ and $\tilde{\beta}^{X}_{q,t} = \beta^{X}_{t} + \text{I}_{q,i} \times \left(\beta^{X}_{q,t}\right)$ with $\text{I}_{q,i} = 1$ if product i has above average quality, else 0, and $X = \{M, R\}$. Standard errors are constructed by bootstrapping 100 times with replacement.

5 International Comparison

In this section, we extend our analysis to an international context by comparing markup levels and pricing behaviors across different countries. We document potential heterogeneity in the split of total markups between the manufacturer and retailers and pass-through dynamics, providing a broader perspective on the findings observed in the US market. Table 1 presents a summary of the key findings for the United States, alongside a comparative analysis with the results from the other countries in our sample. Most, but not all, of our qualitative findings from the US are also found in the UK and Canada, while Mexico stands out as distinct in several respects.

5.1 Markups

Figure 12 presents the distributions of manufacturer and retail markups in all countries. Despite the similarity in the total markups shown in Figure 1, there are significant differences in how these markups are distributed along the supply chain. In Canada, manufacturer and retailer markups are more evenly distributed than the US, with the retailer having slightly higher markups. In the UK, retail markups are even higher. Mexico demonstrates a more extreme pattern, with relatively low manufacturer markups and the highest retailer markups. In contrast to the US, retailers capture a higher share of total markups in these three countries (see Figure A.3).

Total markups remain relatively stable over time in all countries, as shown in Figure 13. This stability reflects, in part, the negative correlation between manufacturing and retail

Table 1: *International Comparison*

	Countries			
	US	UK	Canada	Mexico
Average Total Markup (μ_t^T)	0.66	0.64	0.65	0.60
Larger Margin Share	Manufacturer	Retailers	Retailers	Retailers
Negative Time Series Corr(μ_t^M,μ_t^R)	Yes	Yes	Yes	No
Negative Cross-Sectional Corr(μ_{it}^M,μ_{it}^R)	Yes	Yes	Yes	No
Slower Retail PT (1M)	Yes	Yes	Yes	Yes
Larger PT of Expected Costs (1M)	Yes	Yes	Yes	No
Aggregate Manufacturer PT (6M)	1.18	0.46	0.81	0.37
Aggregate Retail PT (6M)	1.18	1.26	0.92	0.31
Idiosyncratic Manufacturer PT (6M)	0.80	0.71	0.42	0.61
Idiosyncratic Retail PT (6M)	0.53	0.38	0.44	0.42

Notes: This table summarizes the main results across the countries included in our sample. Slower retail pass-through is assumed when the estiamated pass-through of idiosyncratic and aggregated shocks after one month are larger for the manufacturer than for the retailers.

markups observed along the supply chain, similar to the pattern seen in the US. Figure 13 illustrates this dynamic relationship, showing that increases in manufacturer markups are often associated with decreases in retailer markups, and vice versa. This dynamic adjustment mechanism helps maintain overall market stability by balancing markup fluctuations between different stages of the supply chain.[15] Mexico shows the greatest volatility in markups over this period. Total markups are higher in 2023 than 2019, primarily due to an increase in manufacturer markups.

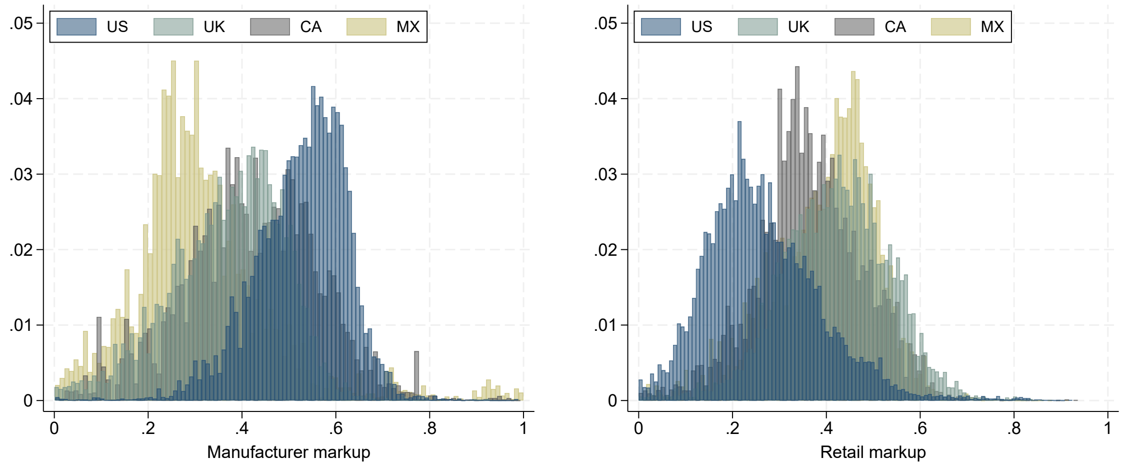
5.2 Cost Transmission

Finally, we study cost transmission in the United Kingdom, Canada, and Mexico. While the matched manufacturer-retailers dataset allows us to infer markup dynamics from the cross-section of products, focusing on the time series dimension requires data imputation for these countries. The primary challenge lies in the time series data, where gaps in the time series for each product result in significant data attrition. Given that we estimate cost pass-through over a six-month period, these gaps lead to a significant reduction in the sample. To address this, we impute missing data by bringing forward production costs and wholesale prices for gaps up to 90 days.

Table 2 shows the extent of data imputation by country. The table highlights that the imputed observations are actually very small compared to the total number of observations, averaging around 10% for the manufacturer data and 5% for retailers. However, the imputed data significantly increase the number of observations available for the regression analysis,

[15]Figure A.2 in the Appendix shows that the negative correlation is also present in the cross-section.

Figure 12: *Markups Distributions*



(a) *Manufacturer Markup* **(b)** *Retail Markup*

Notes: This figure shows the sales-weighted frequency distribution of markups along the supply chain. The manufacturer markup is defined as the Lerner index of wholesale prices and production costs, $\frac{p^M - c}{p^M}$, while the retail markup is defined as the Lerner index of retail prices and wholesale costs, $\frac{p^R - p^M}{p^R}$.

where products need to be observed for six continuous months. For instance, in Canada, the 13% imputed data increase the number of manufacturer regression observations from 9,063 to 16,101 and the retailer regression observations from 4,571 to 6,311. Similarly, in Mexico, the imputed data increase the manufacturer regression observations from 3,039 to 5,293 and the retailer regression observations from 2,060 to 2,930.

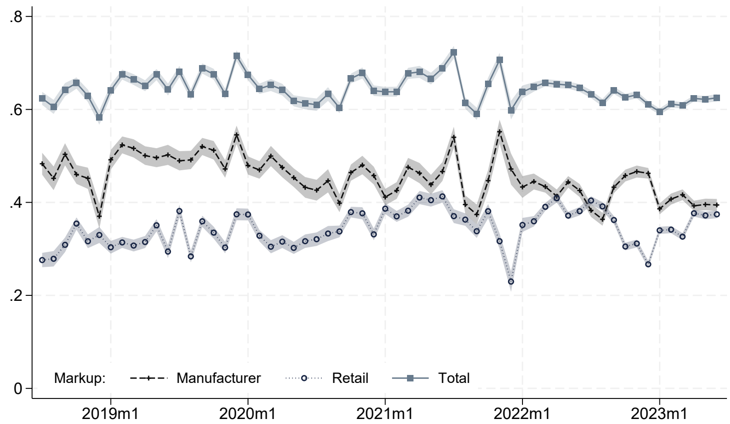
To analyze the cost pass-through dynamics in Canada, Mexico, and the United Kingdom, we use the same specifications as in the US: Equation (1) for the manufacturer and Equation (2) for the retailers. This ensures consistency and comparability across countries. We estimate pass-through jointly by interacting coefficients and fixed effects with country dummies to capture country-specific dynamics.

Figure 14a, Figure 14d, and Figure 14g illustrate the cumulative pass-through of production costs to wholesale prices at the manufacturer level for the United Kingdom, Canada, and Mexico, respectively. In line with the US results, the manufacturer in these countries react immediately to idiosyncratic cost shocks, achieving almost complete pass-through within the first month with no further adjustments. For aggregate cost shocks, the pass-through is more gradual, aligning with the pattern observed in the US. This immediate reaction to idiosyncratic shocks suggests that manufacturers aim to quickly adjust prices to maintain competitiveness and margins in response to specific cost changes.

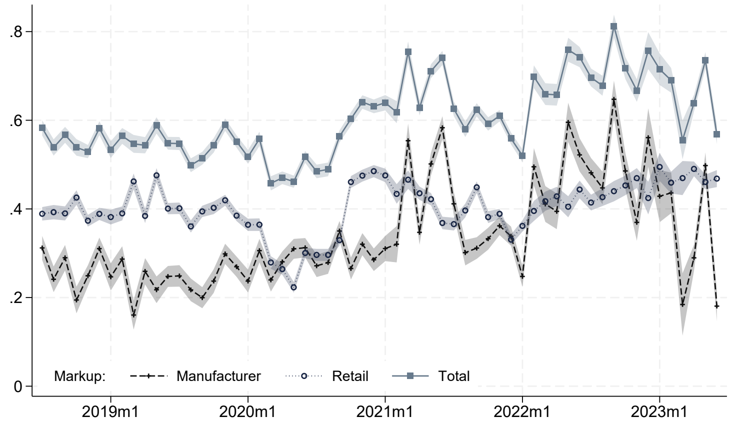
Figure 14b, Figure 14e, and Figure 14h present the cumulative pass-through of costs to retail prices at the retailer level for the United Kingdom, Canada, Mexico, respectively.

Figure 13: *Markup Dynamics*

(a) *United Kingdom*



(b) *Canada*



(c) *Mexico*

Notes: This figure shows the levels of markups in the United Kingdom, Canada, and Mexico. Manufacturer markups ($\frac{p^M - c}{p^M}$), total markups ($\frac{p^R - c}{p^R}$), and retailer markups ($\frac{p^R - p^M}{p^R}$). Averages and 95% (robust) confidence intervals resulting from a regression on period and product fixed effects using sales weights.

Table 2: *Imputed Data*

	Manufacturer Data				Retail Data			
	Observations		6M-Observations		Observations		6M-Observations	
	No fill	Fill	No fill	Fill	No fill	Fill	No fill	Fill
UK	11,512	12,389	6,311	8,530	17,839	18,498	9,635	11,181
CA	19,695	22,163	9,063	16,101	9,773	10,341	4,571	6,311
MX	7,316	8,522	3,039	5,293	4,923	5,381	2,060	2,930

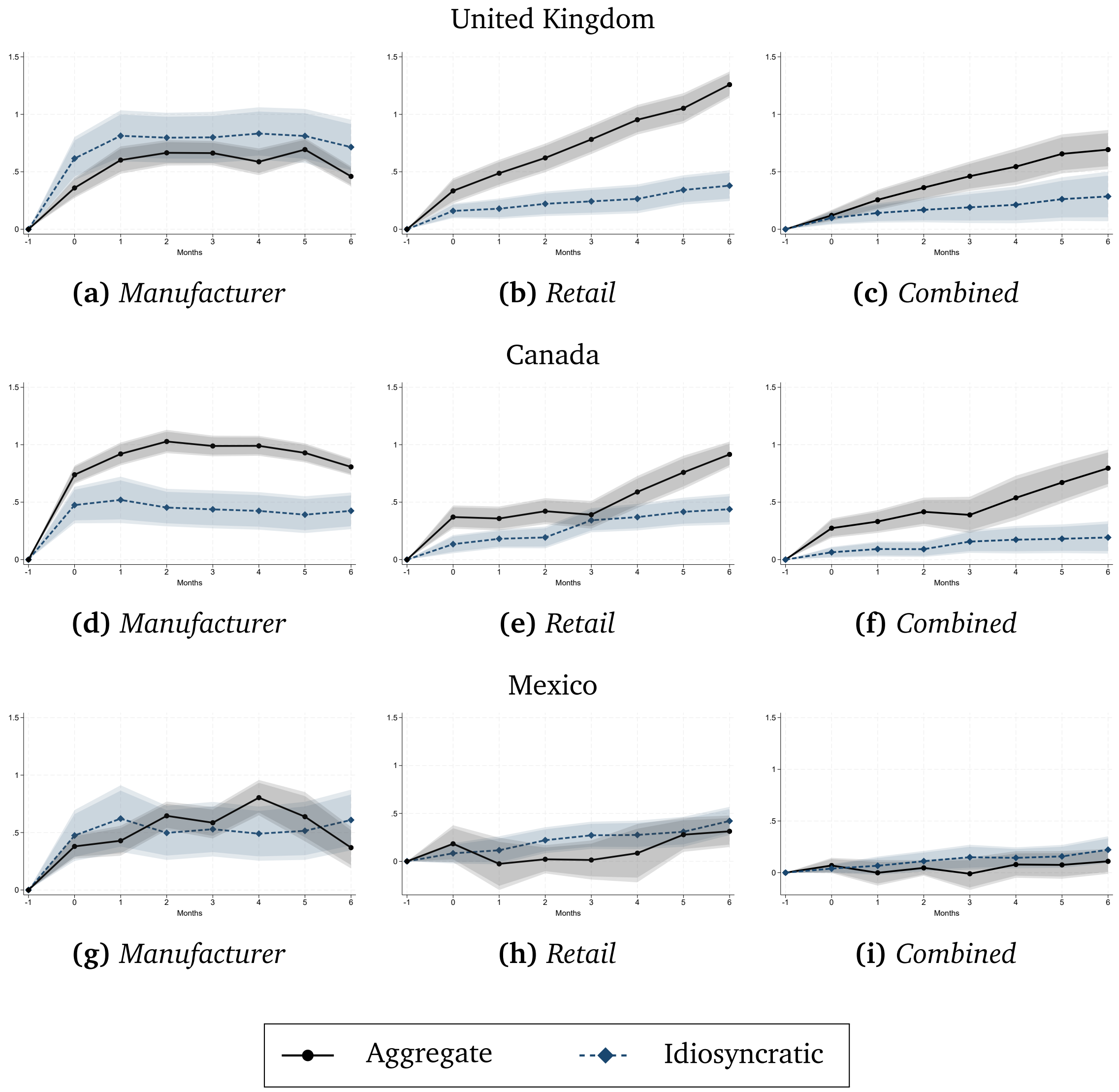
Notes: This table shows the number of observations for all products ("Observations") and only for products continuously observed during a 6-month period ("6M-Observations"). The latter represents the sample used in the cost transmission analysis. For each set of products, we show the observations in the data, and the total after imputing missing values bringing forward costs and prices for gaps in a product's time series up to 90 days.

Retailers in the United Kingdom and in Canada show strong reactions to aggregate cost shocks, similar to the US, achieving substantial pass-through within a few months. However, their response to idiosyncratic shocks is limited, indicating a focus on uniform category pricing despite short-term fluctuations in costs. An exception is observed in Mexico, where retailers exhibit a more muted response to both idiosyncratic and aggregate cost shocks, suggesting different pricing strategies or market conditions compared to the other countries.

Figure 14c, Figure 14f, and Figure 14i depict the combined effect of cost pass-through from both the manufacturer and retailer levels on the final retail price for the United Kingdom, Canada, Mexico, respectively. We build this combined effect using the same calculation as for Figure 8. As in the US, we find that aggregate shocks are passed on more than idiosyncratic shocks. For idiosyncratic cost shocks, the initial faster pass-through at the manufacturer level results in quicker adjustments in retail prices initially. However, this difference dissipates over time, leading to similar cumulative responses within a short period. For aggregate cost shocks, the cumulative retail price adjustments are more substantial, indicating a uniform strategy by both manufacturers and retailers to pass through these shocks more completely.

Overall, the patterns observed in the US largely hold for Canada and the United Kingdom, with the manufacturer reacting immediately to idiosyncratic shocks and gradually to aggregate ones, and retailers reacting strongly to aggregate costs and limitedly to idiosyncratic ones. The exception is Mexico, where retailers show a more muted response to both types of cost shocks, suggesting different market dynamics or competitive pressures. These findings underscore the role of retailers in moderating the impact of changes in production cost on consumer prices and maintaining price stability within product categories.

Figure 14: *Cost Pass-through Along the Supply Chain*



Notes: These figures show the cumulative pass-through of costs to wholesale prices on the left, of wholesale prices to retail prices in the center, and of production costs to retail prices on the right. Coefficients are estimated using Equation (1) and Equation (2), jointly for all countries, using country dummies. The top panel includes results for the United Kingdom, the second for Canada, and the third for Mexico. Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.

6 Conclusion

This study analyzes markups and pricing strategies along the supply chain in the United States, the United Kingdom, Canada, and Mexico. We created a unique dataset combining detailed product price and cost information from a major global manufacturer with corresponding retail prices collected online. With data from around 2,000 products, we measure markups for both the manufacturer and retailers without relying on strong assumptions.

Our findings reveal that markups are consistent across countries, averaging around 0.65, but significant heterogeneity exists along the supply chain. This indicates substantial market power at both the manufacturer and the retailer levels and suggests that economic models that assume a single sector or perfect competition in upstream or downstream sectors may not be well-suited to capture the richness of markup patterns in the real world.

Total markups are stable and shared between the manufacturer and retailers. We do not find evidence that inflation is driven by higher markups; in the time series, higher prices are driven by higher costs and overall markups are fairly stable. These findings are not consistent with the "greedflation" hypothesis, which suggests that in recent years inflation was driven by firms increasing their markups.

We show that both the manufacturer and retailers adjust their prices (and markups) in response to cost shocks, albeit imperfectly, leading to variations in their markups. However, overall markups remain stable over time due to their negative correlation. This stability is achieved because adjustments in the manufacturing and retail sectors are not synchronized but move in opposite directions.

Differences in the pass-through along the supply chain have significant implications for the transmission of various shocks. Idiosyncratic shocks are passed on quickly in the short run due to full pass-through by the manufacturer, but overall pass-through is smaller because retailers often ignore these shocks. In contrast, aggregate shocks are passed on more slowly, but long-run pass-through is larger as both the manufacturer and retailers eventually fully pass on these costs. The manufacturer is quicker than retailers in passing on aggregate shocks as well. Additionally, the more unexpected the shock, the slower the pass-through.

From a policy perspective, these findings highlight the need for regulators to consider the different speeds at which cost changes are transmitted through the supply chain. Quick adjustments by manufacturers can lead to immediate inflationary pressures, while the slower response by retailers can help smooth out these effects over time. Understanding these dynamics can inform potential regulatory measures to manage inflationary pressures and ensure fair pricing practices, ultimately protecting consumer interests.

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A Additional Tables and Figures

Table A.1: *The Matched Manufacturer-Retailer Dataset*

		Obs.	N_i	N_{ir}	% of firm sales	N of brands
US	*Manufacturer*	39,785	1,490	-	100	9
	Retailers	56,028	969	3,269	93.34	8
UK	*Manufacturer*	11,512	692	-	100	6
	Retailers	17,839	418	1,166	93.13	5
CA	*Manufacturer*	19,695	919	-	100	6
	Retailers	9,773	285	585	70.83	5
MX	*Manufacturer*	7,316	455	-	100	9
	Retailers	4,923	230	374	81.69	7
ALL	*Manufacturer*	78,308	3,556	-	100	17
	Retailers	88,563	1,902	5,394	86.40	13

Notes: This table shows the summary statistics of the manufacturer data and of the matched retailers dataset including only observations with a matched manufacturer observation. Reported are the matched number of observations and shares of sales for all countries pooled and for each country separately. Observations reports the number of observed product-month and product-retailer-month combinations, in the manufacturer and retail datasets, respectively. The % of firm sales reports, weighting using the firm sales, the share of products for which a retail match was found.

Table A.2: *Descriptive Statistics of Costs, Prices and Quality*

	Mean	p25	p75	SD	CV_i	N
Retail price	0.212	0.114	0.288	0.11	0.07	88,563
Manufacturer price	0.133	0.068	0.183	0.07	0.09	40,502
Cost	0.068	0.037	0.093	0.04	0.13	40,502
expected	0.066	0.036	0.090	0.03	0.09	37,315
unexpected	0.002	-0.001	0.005	0.01	0.09	37,315
Differentiation	66.59	64.67	70.75	4.31	-	921
Perceived Quality	84.47	83.00	87.00	4.18	-	921

Notes: This table shows the summary statistics of costs, prices and quality statistics in the matched sample. N reports either the number of retailer-product-month observed prices in the retail data, the number of product-month observed prices in the manufacturer data or the number of products with quality information. All prices and costs are translated first in 2019m1 US Dollars. SD reports the standard deviation across all observations. As a measure of time-series variation, we calculate the coefficient of variation for each product across time and report the average coefficient of variation across products in CV_i. Since unexpected costs have a mean close to zero, in order to help with the interpretation, for expected and unexpected costs the coefficient of variation is computed relative to the total costs. Expected and unexpected costs statistics are based on less observations because this data starts in January 2019. Data are winsorized at the 1% level. Quality information is only available for the US.

Table A.3: *Markup Descriptive Statistics*

		Average			Time-Series Variance (x1000)			Corr(μ,cost)			
	N_{irct}	μ^{TOT}	μ^{M}	μ^{R}	μ^{TOT}	μ^{M}	μ^{R}	μ^{TOT}	μ^{M}	μ^{R}	Corr(μ^M,μ^R)
US	56,028	0.66	0.54	0.26	0.26	0.76	0.45	-0.73	-0.79	0.41	-0.64
UK	17,839	0.64	0.38	0.41	0.68	1.52	1.10	-0.80	-0.73	-0.16	-0.30
CA	9,773	0.65	0.46	0.35	0.92	2.00	1.04	-0.72	-0.74	-0.04	-0.24
MX	4,923	0.60	0.34	0.40	5.79	10.68	3.01	-0.88	-0.85	-0.41	0.14

Notes: This table shows summary statistics of the markups for the sample of analysis. The number of used product-retailer combinations are displayed in the first column (N_{irct}). $\mu^{TOT}, \mu^{M}, \mu^{R}$ refer to the total, manufacturer, and retailer markup, respectively. The averages are computed weighting each country-period equally and each product with their respective sales weight. The variances reports the variances of the monthly average of the markup multiplied by 10^3 for readability. The columns under Corr(μ,cost) display the correlation of the different markups with the average cost. Corr(μ^M,μ^R) reports the correlation of the average manufacturer and retail markups.

Table A.4: *Average Total Markup by Year*

	2018*	2019	2020	2021	2022	2023*
US	0.65	0.67	0.68	0.66	0.65	0.65
UK	0.62	0.62	0.65	0.66	0.61	0.64
CA	0.64	0.66	0.65	0.66	0.64	0.61
MX	0.57	0.55	0.54	0.63	0.66	0.65

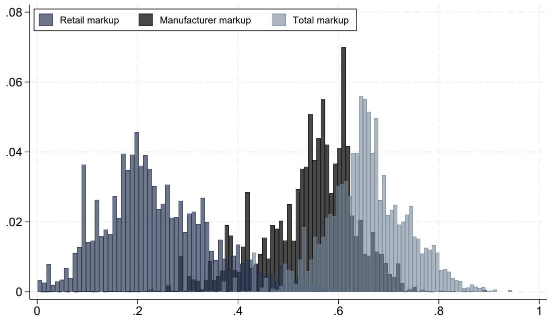
Notes: This table shows average markups by year. Our data starts in June 2018 and ends in June 2023 so that the years 2018 and 2023 include only two quarters.

Table A.5: *Quality Differentiation*

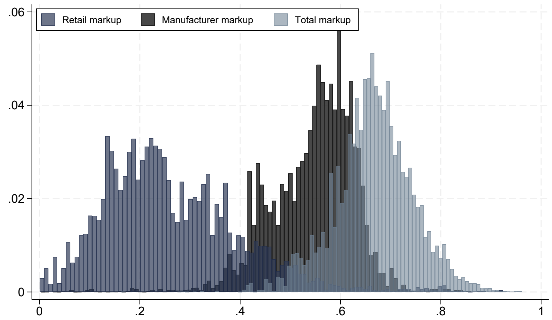
	Total		Manufacturer		Retail	
	(1)	(2)	(3)	(4)	(5)	(6)
	Margins	Markup	Margins	Markup	Margins	Markup
Quality	0.004***	-0.000**	0.003***	0.008***	-0.000	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R2	0.71	0.39	0.86	0.46	0.52	0.46
N	44,526	44,526	44,526	44,526	44,526	44,526

Notes: This table shows the linear relation between margins or markups and product quality estimated from the following linear model: $y_{ijt} = a + \alpha q_i + \beta X_{it} + \phi_{ijt} + \varepsilon_{ijt}$, with y_{ijt} being the variable of interest, margins or markups, for product i sold by retailer j at time t, q_i product quality, X_{it} controls including linear and quadratic package size to account for quantity discounts, ϕ_{ijt} fixed effects including product category and retailer interacted with time, and ε_{ijt} a mean zero error. For the analysis for the manufacturer, we drop the subscript j. Robust standard errors are reported in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

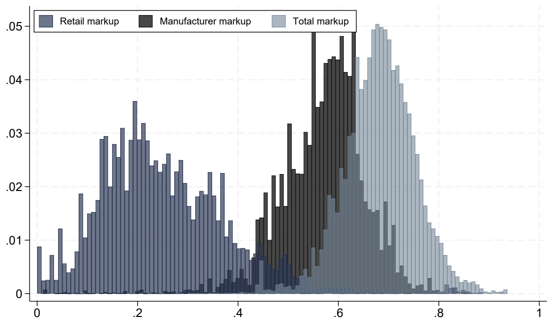
Figure A.1: *Markups Along the Supply Chain by Year (United States)*



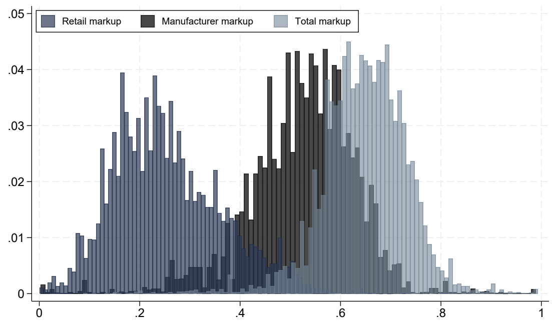
(a) *2018*



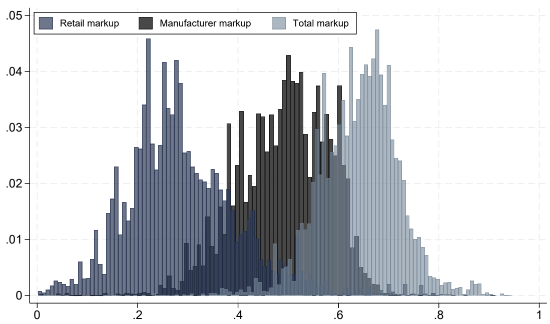
(b) *2019*



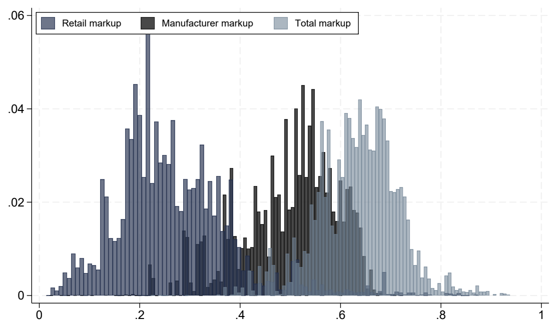
(c) *2020*



(d) *2021*



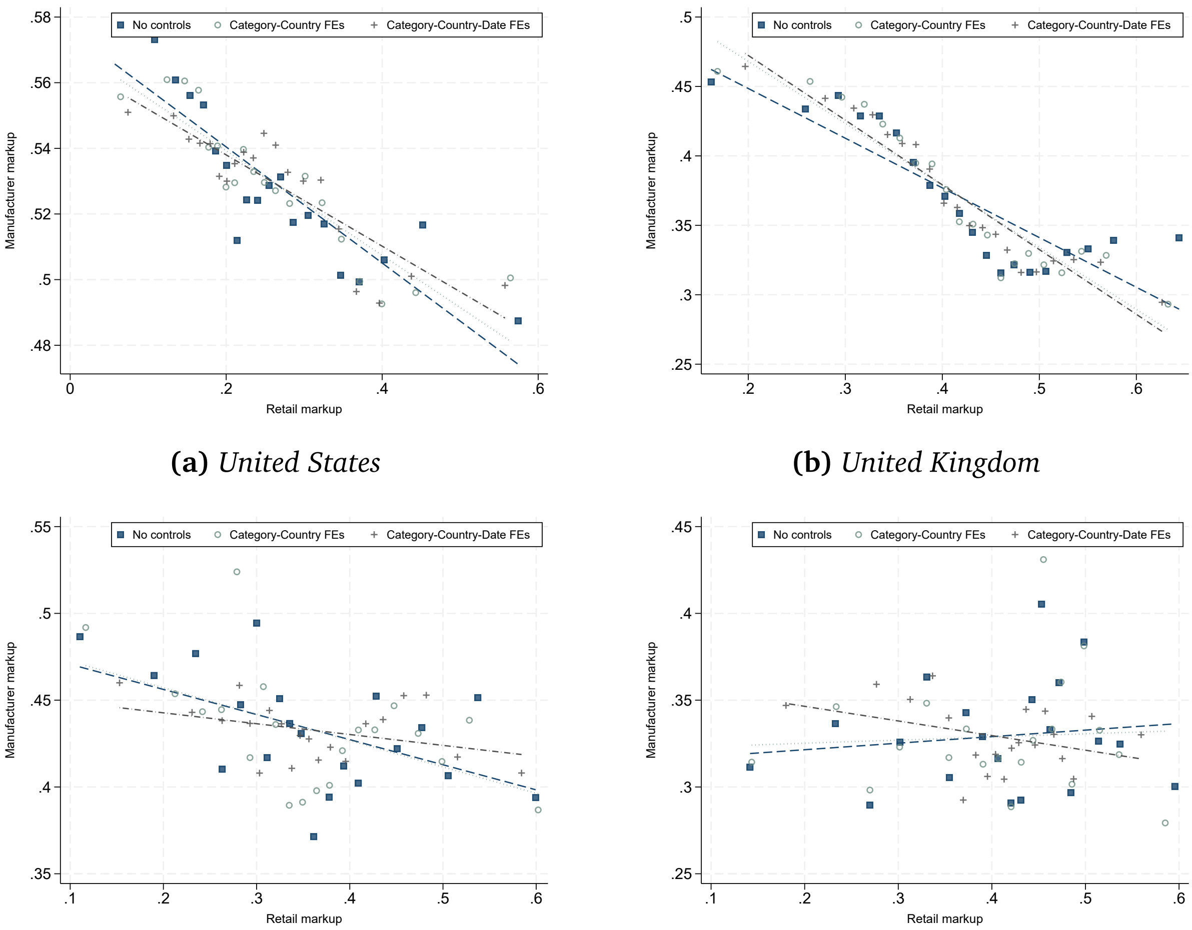
(e) *2022*



(f) *2023*

Notes: This figure shows the sales-weighted frequency distribution of markups along the supply chain in the United States by year. Retail markups ($\frac{p^R - p^M}{p^R}$) are shown in dark blue, manufacturer markups ($\frac{p^M - c}{p^M}$) in dark grey, and total markups ($\frac{p^R - c}{p^R}$) in light blue.

Figure A.2: *Manufacturer and Retailer Markup Relation*

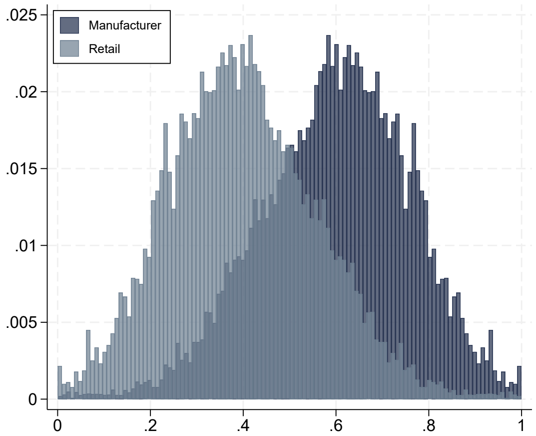


(a) *United States* **(b)** *United Kingdom*

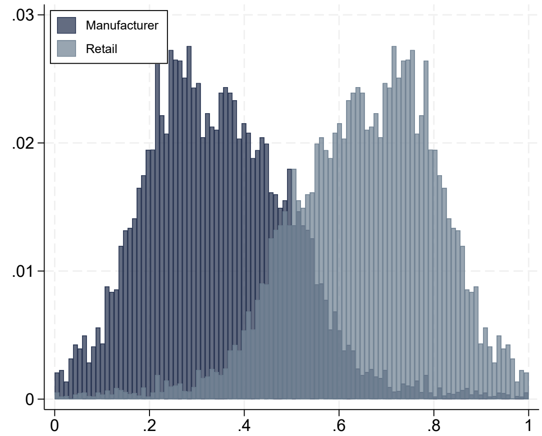
(c) *Canada* **(d)** *Mexico*

Notes: This figure shows the correlation of markups along the supply chain in every country. Bins include sales-weighted values residualized on product and category times period fixed effects.

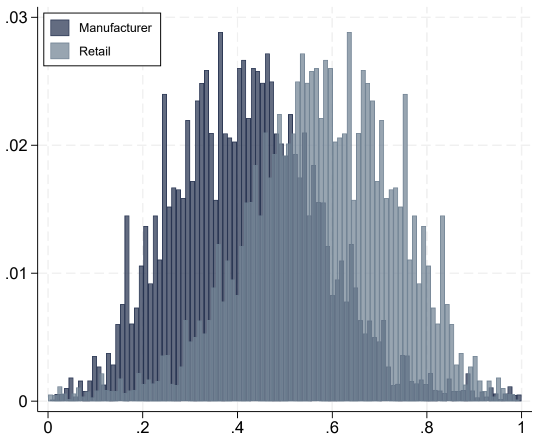
Figure A.3: *Manufacturer and Retailer Margin Share*



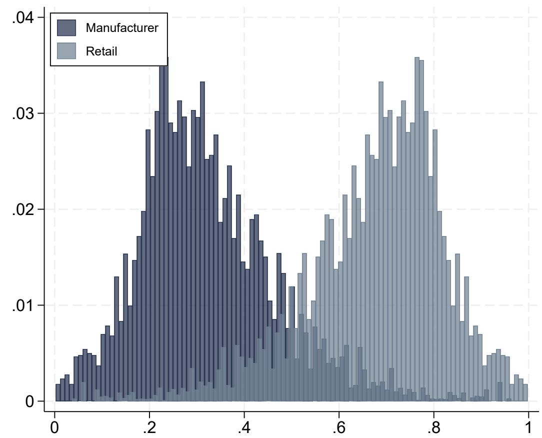
(a) *United States*



(b) *United Kingdom*



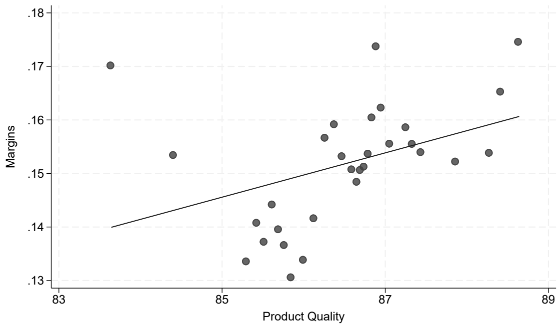
(c) *Canada*



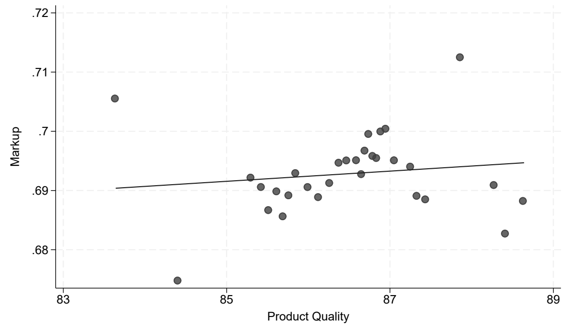
(d) *Mexico*

Notes: This figure shows the sales-weighted frequency distribution of margin shares along the supply chain for all years separately by country. Manufacturer margin share defined as the ratio of the manufacturer margin to the total margin $\frac{p^M - c}{p^R - c}$. Retailer margin share defined as the ratio of the retail margin to the total margin $\frac{p^R - p^M}{p^R - c}$.

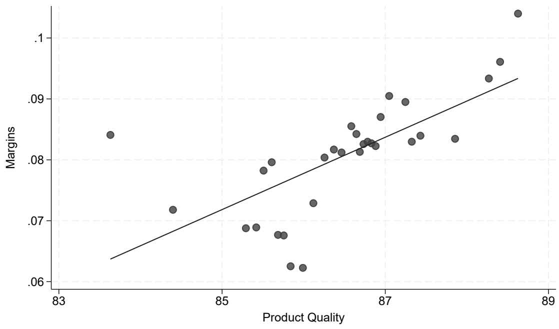
Figure A.4: *Quality Differentiation Along the Supply Chain*



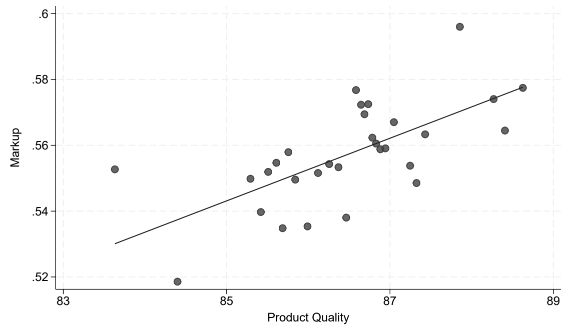
(a) *Total Margins*



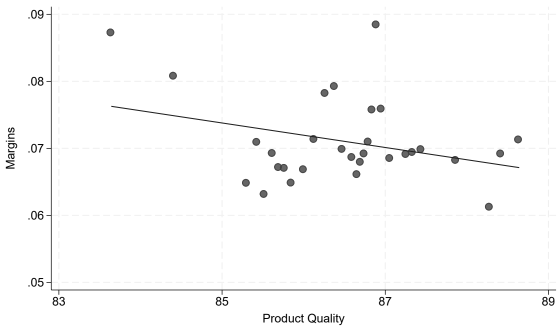
(b) *Total Markups*



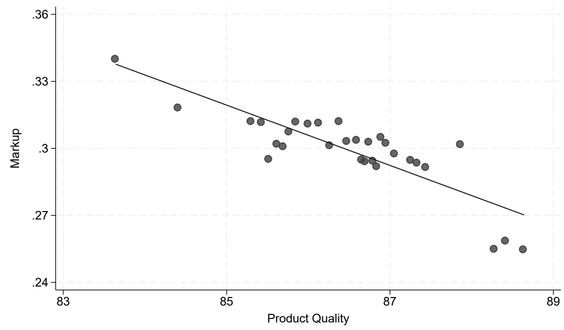
(c) *Manufacturer Margins*



(d) *Manufacturer Markups*



(e) *Retail Margins*



(f) *Retail Markups*

Notes: This figure shows the relation of product (a) total margins, (b) total markups, (c) manufacturer margins, (d) manufacturer markups, (e) retail margins, and (f) retail markups to an indicator of perceived quality. Values are residualized on linear and quadratic package size, to account for quantity discount, and on a set of fixed effect including product category interacted with periods, and retailer.

Table A.6: *Manufacturer Pass-through*

	Idiosyncratic					Aggregate			
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
$\hat{c}$	1.071***	1.008***	1.067***	1.067***	C_t	0.470***	0.307***	0.301***	0.300***
	(0.056)	(0.067)	(0.073)	(0.091)		(0.022)	(0.022)	(0.023)	(0.028)
$\hat{c}_{t-1}$		-0.008	-0.022	0.020	C_{t-1}		0.319***	0.304***	0.321***
		(0.039)	(0.045)	(0.048)			(0.024)	(0.026)	(0.033)
$\hat{c}_{t-2}$		-0.078*	-0.073*	0.022	C_{t-2}		0.294***	0.320***	0.280***
		(0.030)	(0.035)	(0.040)			(0.033)	(0.032)	(0.041)
$\hat{c}_{t-3}$		-0.045	-0.087**	-0.051	C_{t-3}		0.174***	0.142***	0.117*
		(0.027)	(0.033)	(0.037)			(0.039)	(0.043)	(0.054)
$\hat{c}_{t-4}$			-0.009	0.049	C_{t-4}			0.156***	0.108
			(0.037)	(0.038)				(0.045)	(0.058)
$\hat{c}_{t-5}$			-0.032	-0.039	C_{t-5}			0.002	0.005
			(0.026)	(0.032)				(0.042)	(0.050)
$\hat{c}_{t-6}$			-0.046	-0.058	C_{t-6}			-0.045	-0.010
			(0.025)	(0.032)				(0.038)	(0.050)
$\hat{c}_{t-7}$				0.021	C_{t-7}				-0.092**
				(0.032)					(0.035)
$\hat{c}_{t-8}$				-0.044	C_{t-8}				-0.037
				(0.044)					(0.039)
$\hat{c}_{t-9}$				-0.042	C_{t-9}				-0.008
				(0.050)					(0.035)
$\hat{c}_{t-10}$				-0.055	C_{t-10}				0.042
				(0.055)					(0.030)
$\hat{c}_{t-11}$				0.061	C_{t-11}				0.198**
				(0.063)					(0.072)
$\hat{c}_{t-12}$				-0.101	C_{t-12}				0.024
				(0.058)					(0.039)
Long-term PT	1.071	0.877	0.798	0.850		0.470	1.094	1.180	1.249
s.e.	0.056	0.067	0.077	0.109		0.022	0.039	0.048	0.083
Product FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Date FE	No	No	No	No		No	No	No	No
N	39,749	31,169	25,389	17,088		39,749	31,169	25,389	17,088

Notes: These figures show pass-through of costs to wholesale prices estimated using Equation (1). Coefficients for idiosyncratic and aggregate shocks are estimated jointly. Robust standard errors are shown in parentheses. Long-term pass-through estimates are constructed using the Delta method.

Table A.7: *Manufacturer Pass-through with Fixed Effects*

	Idiosyncratic					Aggregate			
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
$\hat{c}$	1.079***	1.018***	1.081***	1.081***	C_t	0.256***	0.186***	0.191***	0.208***
	(0.054)	(0.066)	(0.071)	(0.088)		(0.021)	(0.021)	(0.022)	(0.027)
$\hat{c}_{t-1}$		-0.008	-0.027	0.012	C_{t-1}		0.218***	0.222***	0.252***
		(0.038)	(0.044)	(0.048)			(0.024)	(0.025)	(0.032)
$\hat{c}_{t-2}$		-0.078*	-0.074*	0.013	C_{t-2}		0.226***	0.253***	0.228***
		(0.030)	(0.035)	(0.040)			(0.035)	(0.031)	(0.041)
$\hat{c}_{t-3}$		-0.033	-0.071*	-0.034	C_{t-3}		0.075	0.063	0.058
		(0.027)	(0.033)	(0.037)			(0.040)	(0.043)	(0.053)
$\hat{c}_{t-4}$			-0.029	0.031	C_{t-4}			0.096*	0.062
			(0.037)	(0.038)				(0.045)	(0.058)
$\hat{c}_{t-5}$			-0.039	-0.038	C_{t-5}			-0.042	-0.044
			(0.025)	(0.031)				(0.042)	(0.050)
$\hat{c}_{t-6}$			-0.049*	-0.060	C_{t-6}			-0.082*	-0.058
			(0.024)	(0.031)				(0.039)	(0.051)
$\hat{c}_{t-7}$				0.003	C_{t-7}				-0.148***
				(0.031)					(0.037)
$\hat{c}_{t-8}$				-0.057	C_{t-8}				-0.066
				(0.043)					(0.038)
$\hat{c}_{t-9}$				-0.046	C_{t-9}				-0.017
				(0.050)					(0.035)
$\hat{c}_{t-10}$				-0.054	C_{t-10}				0.010
				(0.055)					(0.029)
$\hat{c}_{t-11}$				0.068	C_{t-11}				0.193**
				(0.063)					(0.073)
$\hat{c}_{t-12}$				-0.076	C_{t-12}				-0.040
				(0.057)					(0.039)
Long-term PT	1.079	0.900	0.792	0.842		0.256	0.705	0.701	0.639
s.e.	0.054	0.066	0.075	0.105		0.021	0.053	0.064	0.121
Product FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
N	39,749	31,169	25,389	17,088		39,749	31,169	25,389	17,088

Notes: These figures show pass-through of costs to wholesale prices estimated using Equation (1). Coefficients for idiosyncratic and aggregate shocks are estimated jointly. The specification includes date fixed effects and robust standard errors are shown in parentheses. Long-term pass-through estimates are constructed using the Delta method.

Table A.8: *Retailer Pass-through*

	Idiosyncratic					Aggregate			
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
$\hat{c}$	0.225***	0.182***	0.194***	0.149***	C_t	0.741***	0.361***	0.295***	0.313***
	(0.023)	(0.028)	(0.032)	(0.039)		(0.031)	(0.036)	(0.041)	(0.058)
$\hat{c}_{t-1}$		0.095**	0.133***	0.100*	C_{t-1}		0.307***	0.283***	0.287***
		(0.032)	(0.038)	(0.047)			(0.037)	(0.041)	(0.052)
$\hat{c}_{t-2}$		0.084*	0.084*	0.045	C_{t-2}		0.196***	0.133**	0.100
		(0.035)	(0.040)	(0.044)			(0.037)	(0.041)	(0.052)
$\hat{c}_{t-3}$		0.061	0.021	0.003	C_{t-3}		0.119**	-0.048	-0.037
		(0.031)	(0.034)	(0.042)			(0.038)	(0.043)	(0.054)
$\hat{c}_{t-4}$			0.040	0.032	C_{t-4}			0.061	0.060
			(0.032)	(0.042)				(0.043)	(0.054)
$\hat{c}_{t-5}$			0.062*	0.031	C_{t-5}			0.188***	0.195***
			(0.030)	(0.040)				(0.043)	(0.055)
$\hat{c}_{t-6}$			-0.002	0.066	C_{t-6}			0.264***	0.213***
			(0.032)	(0.043)				(0.042)	(0.054)
$\hat{c}_{t-7}$				0.072*	C_{t-7}				0.046
				(0.037)					(0.057)
$\hat{c}_{t-8}$				0.042	C_{t-8}				0.121*
				(0.039)					(0.061)
$\hat{c}_{t-9}$				0.032	C_{t-9}				0.029
				(0.040)					(0.060)
$\hat{c}_{t-10}$				0.049	C_{t-10}				0.105
				(0.036)					(0.065)
$\hat{c}_{t-11}$				0.001	C_{t-11}				0.045
				(0.035)					(0.062)
$\hat{c}_{t-12}$				-0.033	C_{t-12}				-0.015
				(0.032)					(0.065)
Long-term PT	0.225	0.422	0.533	0.588		0.741	0.982	1.175	1.461
s.e.	0.023	0.039	0.050	0.086		0.031	0.043	0.054	0.086
Product FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Retailer FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Date FE	No	No	No	No		No	No	No	No
N	56,160	42,472	32,760	19,878		56,160	42,472	32,760	19,878

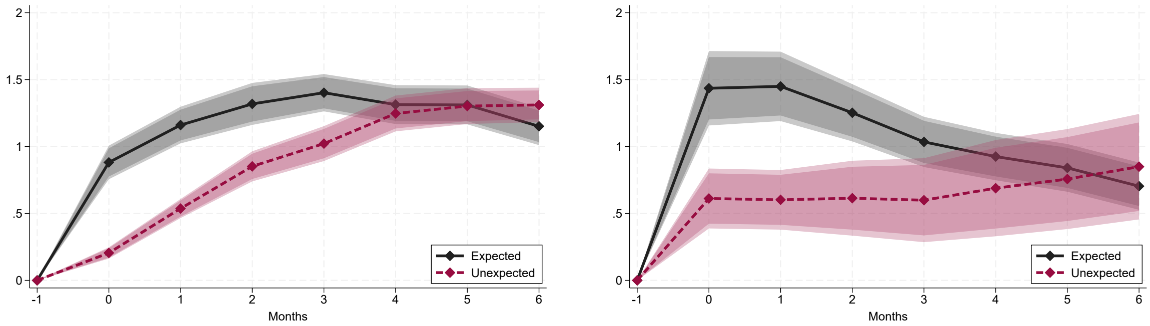
Notes: These figures show pass-through of wholesale prices to retail prices estimated using Equation (2). Coefficients for idiosyncratic and aggregate shocks are estimated jointly. Robust standard errors are shown in parentheses. Long-term pass-through estimates are constructed using the Delta method.

Table A.9: *Retailer Pass-through with Fixed Effects*

	Idiosyncratic					Aggregate			
	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
$\hat{c}$	0.192***	0.146***	0.149***	0.111**	C_t	0.393***	0.265***	0.227***	0.295***
	(0.023)	(0.028)	(0.033)	(0.040)		(0.040)	(0.053)	(0.062)	(0.081)
$\hat{c}_{t-1}$		0.063	0.091*	0.058	C_{t-1}		0.217***	0.187**	0.220**
		(0.032)	(0.038)	(0.048)			(0.056)	(0.064)	(0.077)
$\hat{c}_{t-2}$		0.054	0.050	0.008	C_{t-2}		0.082	0.103	0.014
		(0.035)	(0.041)	(0.045)			(0.057)	(0.064)	(0.080)
$\hat{c}_{t-3}$		0.044	-0.002	-0.029	C_{t-3}		0.048	-0.033	-0.070
		(0.031)	(0.034)	(0.042)			(0.056)	(0.067)	(0.086)
$\hat{c}_{t-4}$			0.026	0.015	C_{t-4}			0.028	0.028
			(0.032)	(0.042)				(0.064)	(0.083)
$\hat{c}_{t-5}$			0.051	0.020	C_{t-5}			0.115	0.198*
			(0.030)	(0.040)				(0.064)	(0.083)
$\hat{c}_{t-6}$			0.002	0.046	C_{t-6}			0.160**	0.174*
			(0.032)	(0.043)				(0.061)	(0.085)
$\hat{c}_{t-7}$				0.056	C_{t-7}				0.004
				(0.037)					(0.088)
$\hat{c}_{t-8}$				0.037	C_{t-8}				0.164
				(0.040)					(0.092)
$\hat{c}_{t-9}$				0.039	C_{t-9}				-0.020
				(0.039)					(0.092)
$\hat{c}_{t-10}$				0.058	C_{t-10}				0.090
				(0.035)					(0.094)
$\hat{c}_{t-11}$				0.016	C_{t-11}				-0.076
				(0.035)					(0.090)
$\hat{c}_{t-12}$				-0.010	C_{t-12}				-0.107
				(0.032)					(0.086)
Long-term PT	0.192	0.306	0.366	0.425		0.393	0.611	0.789	0.913
s.e.	0.023	0.040	0.054	0.091		0.040	0.057	0.074	0.114
Product FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
N	56,160	42,472	32,760	19,878		56,160	42,472	32,760	19,878

Notes: These figures show pass-through of wholesale prices to retail prices estimated using Equation (2). Coefficients for idiosyncratic and aggregate shocks are estimated jointly. The specification includes date fixed effects and robust standard errors are shown in parentheses. Long-term pass-through estimates are constructed using the Delta method.

Figure A.5: *Manufacturer's Cost Transmission by Cost Type*

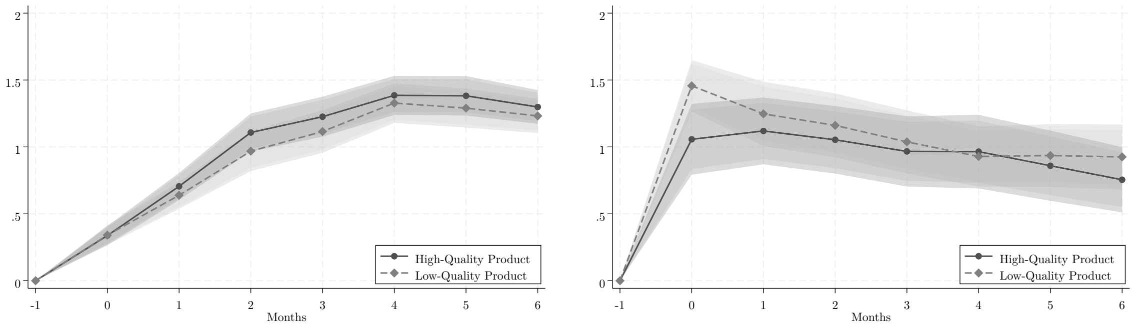


(a) *Aggregate Cost* **(b)** *Idiosyncratic Cost*

Notes: These figures show the cumulative pass-through of aggregate costs (a) and of idiosyncratic costs (b) to wholesale prices, differentiating by expected and unexpected costs, and estimated using Equation (3). Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.

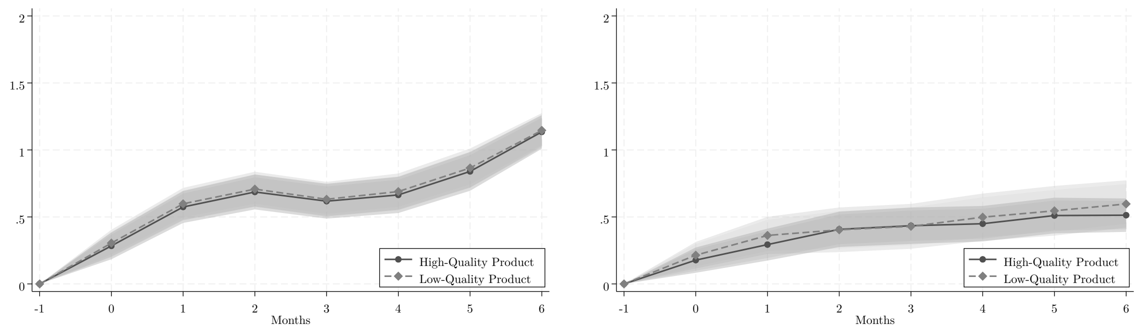
Figure A.6: *Cost Transmission Along the Supply Chain by Product Quality*

Manufacturer



(a) *Aggregate Cost* **(b)** *Idiosyncratic Cost*

Retailers



(c) *Aggregate Cost* **(d)** *Idiosyncratic Cost*

Notes: These figures show the cumulative pass-through of costs to wholesale prices (a-c) and of wholesale prices to retail prices (b-d), estimated using Equation (4) and Equation (5). Blue represents high-quality products, and orange represents low-quality ones. Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.