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. We propose a model of supply chain pricing behavior that rationalizes key patterns in our data, and we use the model to quantify factors that determine relative bargaining power between the manufacturer and retailers. Finally, we consider the dynamics of cost pass-through. The manufacturer adjusts prices in response to cost shocks more quickly than retailers and appears to more fully incorporate idiosyncratic cost shocks to specific products. Differential pass-through patterns along the supply chain can arise from bargaining power that adjusts dynamically in response to shocks.

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. Motivated by our descriptive analysis, we propose a model of supply chain pricing behavior that rationalizes several of the patterns in our data, and we use the model to quantify factors that determine relative bargaining power between the manufacturer and retailers.

The dataset originates from a collaboration between a large global manufacturer that is 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]

[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.

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 consumer prices was an increase in production costs, rather than a net increase in markups.[2]

However, when we examine each stage of the supply chain separately, we 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. As a result, although manufacturer and retail markups vary over time, total markups are remarkably stable.

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. Retailer dollar margins, on the other hand, are roughly uniform 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.

Building on the results from the US, we observe similar stability in total markups across the United Kingdom, Canada, and Mexico, despite notable differences in their distribution along the supply chain. Unlike the US—where manufacturer markups consistently exceed those of retailers—in the United Kingdom and Mexico, retailers capture a larger share of total markups, while in Canada manufacturer markups remain higher than those of retailers. The negative correlation between manufacturer and retail markups observed in the US is also present across these countries, indicating a compensatory mechanism where changes at one stage of the supply chain are partially offset by adjustments at the other. This dynamic ensures stability in total markups, even as individual stages experience fluctuations.

We propose a model of supply chain pricing behavior based on our findings. Prices are determined in two stages. In the first stage, the manufacturer sets retail prices to maximize overall supply chain profits for the manufacturer's products. In the second stage, the supplier and the buyer negotiate the wholesale price, splitting the supply chain profits according to Nash bargaining. This model allows us to rationalize several key facts in our data, including the negative correlation in markups along the supply chain, which standard models of vertical

[2]Discrete changes in markups can arise from changes in firm conduct. The recent media discussion of "greedflation" considers the hypothesis that firms increased markups during our period, which we do not find evidence for.

conduct do not account for.

We use the model to recover estimate bargaining weights for each product-county-month combination. Our estimates indicate the manufacturer holds greater bargaining power in the US, whereas retailers have higher bargaining power in all other countries. Since 2019, the manufacturer's bargaining power has declined in both the US and Canada. In contrast, no significant changes were observed in the United Kingdom, while the manufacturer experienced a substantial increase in bargaining power in Mexico in 2020.

We run descriptive regressions to understand different factors that predict bargaining power across products, countries, and time. Our analysis indicates that the manufacturer captures larger margin shares in markets characterized by greater market penetration and higher income levels. In contrast, retailers secure larger margin shares in response to higher production costs and to inflation, which may proxy for overall consumer demand.

Finally, we consider the dynamic aspect of pricing behavior. We start by studying 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).[3] Our findings reveal that, in the US, 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.

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 adjustment to cost shocks.

Across the United Kingdom, Canada, and Mexico, we observe cost pass-through patterns that align closely with the findings in the US, albeit with some notable differences. In all three countries, the manufacturer reacts rapidly to idiosyncratic cost shocks, with an immediate response within the first month and no further adjustments thereafter, while adopting a more gradual approach for aggregate shocks. However, the magnitude of pass-through varies. In the UK, the manufacturer achieves complete pass-through for idiosyncratic shocks but not for aggregate shocks, whereas in Canada, aggregate shocks are fully passed through, but idiosyncratic shocks see only partial adjustment. In Mexico, both idiosyncratic and aggregate

[3]An advantage of this specification is that we do not need to make assumptions on the size of local or distribution costs when estimating pass-through.

costs are passed through only partially by the manufacturer.

Retailers in these countries adjust prices more slowly than the manufacturer, achieving full pass-through of aggregate shocks only by the end of six months, while responding only partially to idiosyncratic shocks. In Mexico, retailers exhibit an exceptionally low level of pass-through for both types of shocks, reflecting distinct market dynamics. These findings collectively underscore the consistent interplay between the manufacturer and retailers in shaping cost transmission across countries, while highlighting regional differences in market outcomes.

We use our estimates of bargaining weights to study how bargaining power between the manufacturer and retailers evolves dynamically. By introducing lagged costs into our analysis, we find that changes in production costs affect bargaining power gradually rather than immediately. Moreover, when distinguishing between expected and unexpected costs, we find that expected cost changes have persistent negative effects on manufacturer bargaining power, while unexpected cost changes show only temporary effects. Taken together with the reduced-form findings, our analysis identifies dynamic changes in bargaining power as a novel mechanism that generates dynamics in cost pass-through.

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).

Our paper contributes to the empirical literature on markups and cost pass-through. In relation to the first, our total markup values are consistent in magnitude with structural estimates resulting from the demand approach in the United States (Döpper et al., 2022) and the production approach in the United States (De Loecker et al., 2020), in Canada, Mexico, and the United Kingdom (De Loecker and Eeckhout, 2018).[4] We complement this literature by presenting unique evidence of the breakdown of markups along the supply chain, and of the relatively stable evolution in total markups over recent years, therefore a changing trend with respect to the previous decades. This provides further support in rejecting the hypothesis that the high level of inflation during the 2021-23 period was generated by firms increasing markups (Leduc et al., 2024, Bilyk et al., 2023).

In addition, our results may be relevant for methodological and empirical papers related to the estimation of 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), which clash with our evidence of frequent and active changes in markups in both sectors. We provide insights about pricing behaviors and statistics about markups along the supply chain that can help inform appropriate assumptions for future work.

[4] In magnitudes, our markups are also consistent with those from publicly listed firms found by Díez et al. (2021).

Given the high-frequency nature of our data, we also relate to the literature focusing on 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 markups adjusting differently to similar shocks. This complements the aggregation results in Burstein et al. (2020), which highlight the different cyclical behavior of firm-, sector-, and aggregate-level markups, by adding a new dimension that distinguishes between producers and retailers.

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.[5] Minton and Wheaton (2023) highlights the role of supply chain networks in delaying the transmission of shocks. 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, and Meyer and Sheng (2024) highlighting the importance of expected costs for price setting.

The paper proceeds as follows: Section 2 presents the data and evidence on total markups. Section 3 focuses on time series and cross-sectional patterns of markups, documenting the negative correlation along the supply chain and investigating pricing behaviors along the quality distribution. Section 4 presents a supply chain pricing model to rationalize the findings. We use the model to recover bargaining weights and assess the factors that predict them. Section 5 examines dynamic pricing aspects, providing empirical evidence on cost pass-through

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

at different stages of the supply chain and expanding the analysis in the theoretical framework. 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 measure of costs we obtained reflects variable costs, including raw materials, packaging, manufacturing operating expenses, transportation, and warehousing.

The manufacturer dataset features two additional 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, are available only for products sold in the United States. 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. These features of the data allow us to examine how pricing behaviors vary with quality and 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.[6] 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.[7]

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 (p_{it}^R) and production cost (c_{it}), $\mu_{it}^{TOT} = \frac{p_{it}^R - c_{it}}{p_{it}^R}$. 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 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.

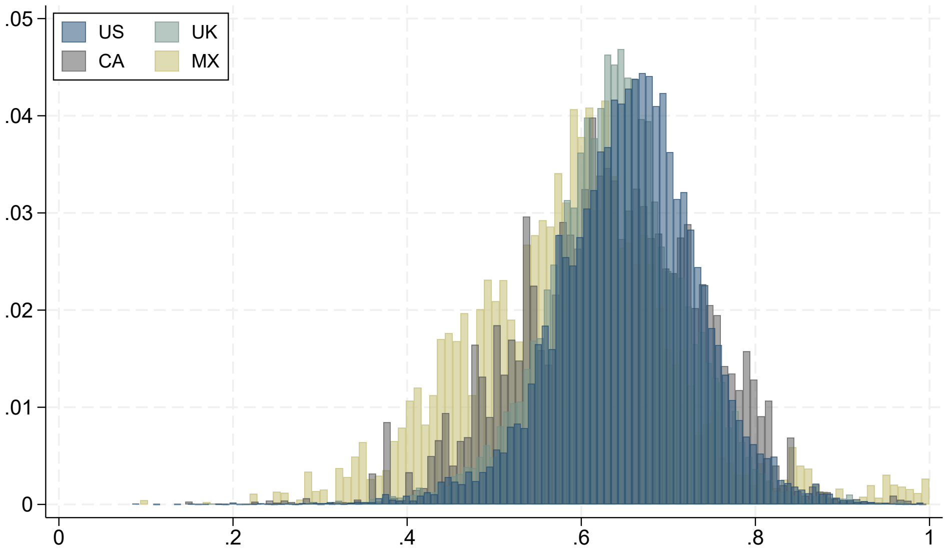
Our data also allow us to construct markups at the manufacturer and retailer level separately for individual products. We compute manufacturer markups as the Lerner index in terms of wholesale prices (p_{it}^M) and production costs, $\mu_{it}^M = \frac{p_{it}^M - c_{it}}{p_{it}^M}$. We note that our 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, $\mu_{it}^R = \frac{p_{it}^R - p_{it}^M}{p_{it}^R}$, following other papers that study retail markups (e.g., Aguirregabiria, 1999, Eichenbaum et al., 2011, Anderson et al., 2018). 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

[6]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).

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

Figure 1: *Total Markups*



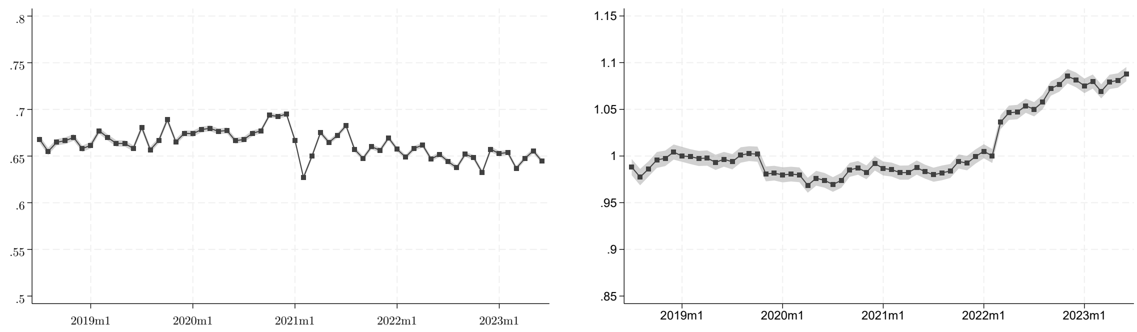
Notes: This figure shows the sales-weighted frequency distribution of total markups ($\frac{p^R_{it}-c_{it}}{p^R_{it}}$) along the supply chain for each country.

over short horizons (Gopinath et al., 2011). To the extent that additional variable retailing costs (such as home delivery costs) exists, our measure of retail markups will be biased upward. In that case, our retail markups may be interpreted as upper bounds.[8] Similarly, our measure of total markups omits these additional retailer marginal costs and may also be biased upward. In our regressions, we employ fixed effects to control for certain types of unobserved costs that are common across products.

3 Markups and Pricing Behavior Along the Supply Chain

In this section, we analyze markups and pricing behavior in four countries: the United States, the United Kingdom, Canada, and Mexico. We begin by documenting the level and stability of markups and examining the heterogeneity along the supply chain in the largest market in our sample, the US market. Subsequently, we expand the analysis by comparing it with the UK, Canadian, and Mexican markets.

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.

3.1 Markups Over Time in the United States

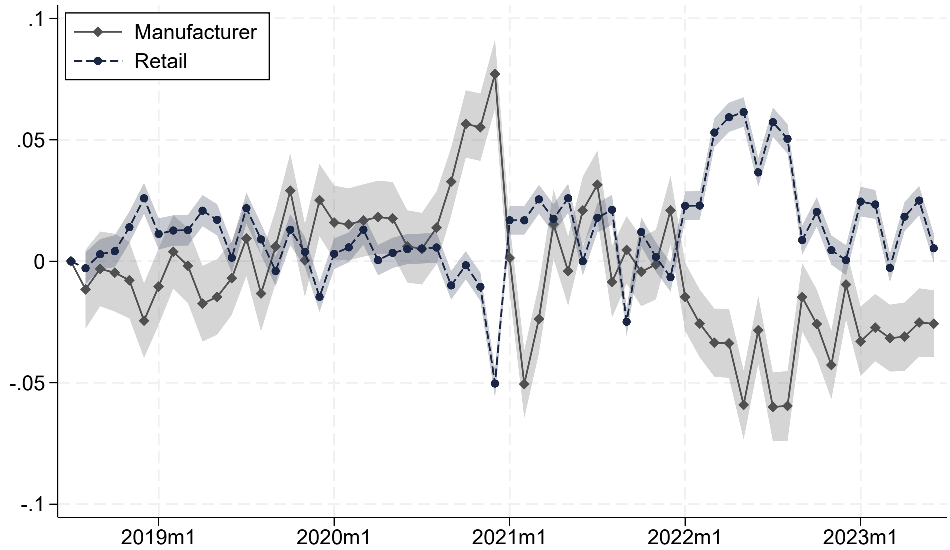
Figure 2a shows that the average total markup in the US is fairly stable over time.[9] The average value is 0.66, with slightly higher values in 2020 a slight decline starting in 2021. By contrast, retail prices (Figure 2b) rise sharply in 2022, coinciding with the inflationary period in the United States. 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 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

[8]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.

[9]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.

relatively higher for retailers and relatively lower for the manufacturer.

3.2 Cross-Sectional Patterns in the United States

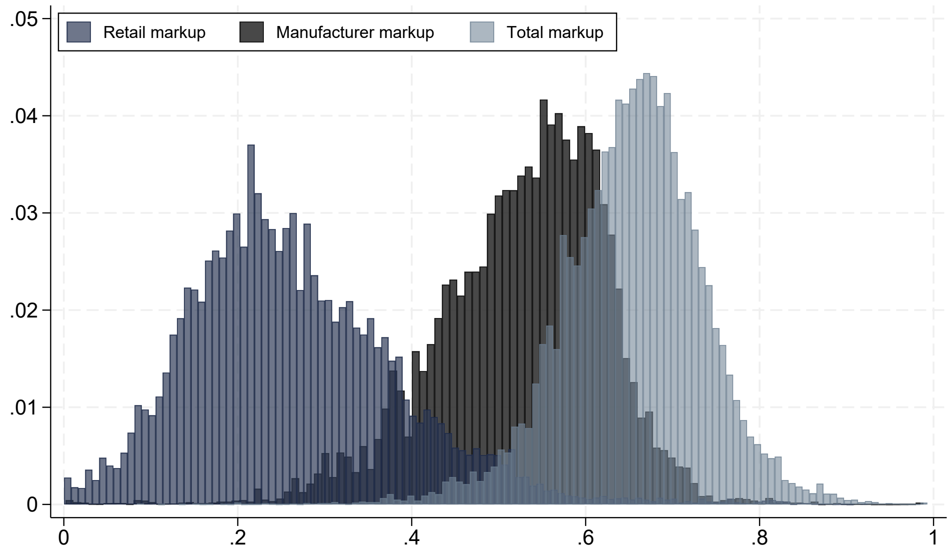
In Figure 4, we plot the distribution of markups for each stage of the supply chain in the US. The figure indicates substantial heterogeneity in both sectors. This is particularly striking because the products in our study come from a single manufacturer in a limited set of product categories. Thus, we document meaningful within-firm markup heterogeneity, which may be an important fact to accommodate when using economic models to understand equilibrium outcomes. Figure A.1 shows 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 0.53, compared to a retailer markup of 0.26.[10] 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

[10]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.

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.

period fixed effects, indicating that the negative correlation is a feature of the cross section.

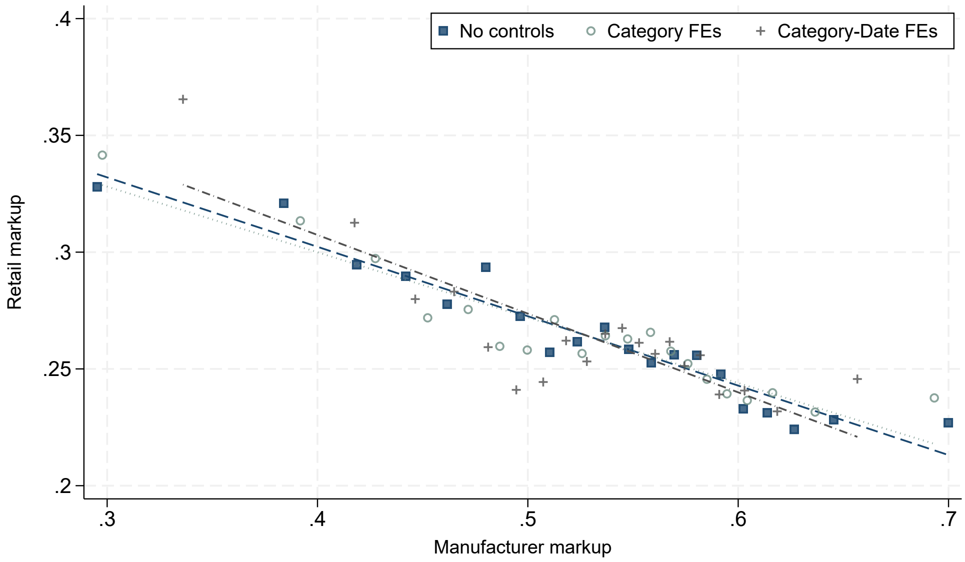
To inform the determinants of these patterns, we focus on one mechanism that can drive heterogeneity in markups: product quality. In our data, product quality and total margins, defined as retail prices minus production costs, are positively correlated, as documented in Figure 6a.[11] Intuitively, this 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 correlation between markups and quality, as costs also increase with quality.

Examining the patterns separately for the manufacturer and the retailer reveals stark differences in pricing behavior. The manufacturer receives higher margins and markups for high-quality products (Figure 6c and Figure 6d). In contrast, retailers set roughly 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

[11] 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.

equilibrium, variation in product quality within a category does not predict retailer margins.

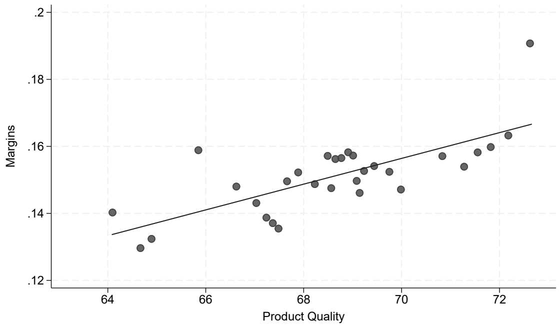
These results highlight the importance of considering separate stages of the supply chain for questions related to profitability, markups, and price levels. Our results indicate that product quality matters more to the manufacturer than it does to the retailer (in equilibrium). These patterns could ultimately 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.

3.3 The UK, Canada, and Mexico

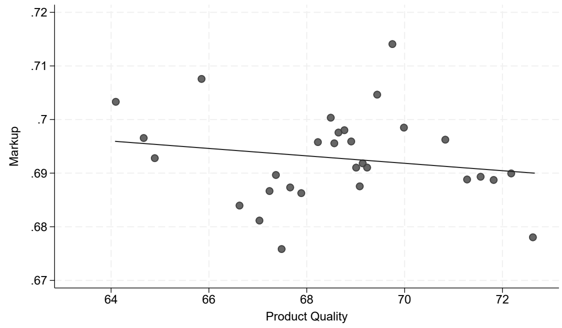
Figure 7 presents the distributions of manufacturer and retail markups in all countries. Despite comparable total markup levels documented in Figure 1, we find substantial heterogeneity in the distribution of markups along the supply chain between the US and other countries. In Canada, manufacturer and retailer markups are more evenly distributed, with the manufacturer having slightly higher markups on average. This pattern intensifies in the UK, where retail markups are systematically higher than manufacturer markups. Finally, Mexico presents the most pronounced divergence, characterized by the lowest manufacturer markups and the highest retailer markups in the sample. These findings stand in stark contrast to the US market structure, as retailers in these three countries capture a substantially larger proportion of total markups (see Figure A.3).

Total markups remain relatively stable over time in all countries, as shown in Figure 8. This

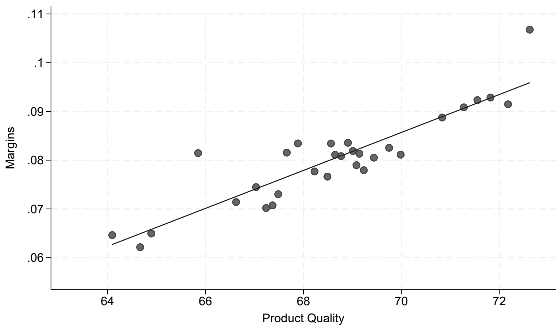
Figure 6: *Quality Differentiation Along the Supply Chain*



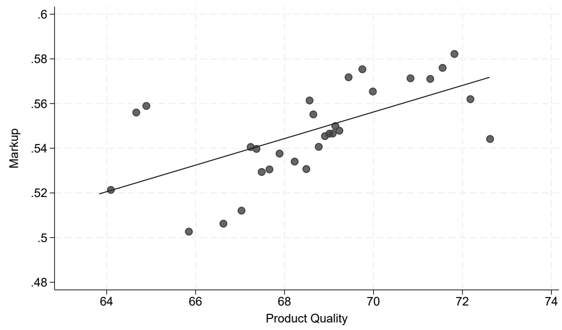
(a) *Total Margins*



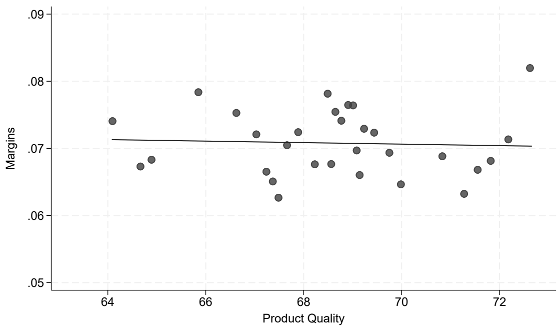
(b) *Total Markups*



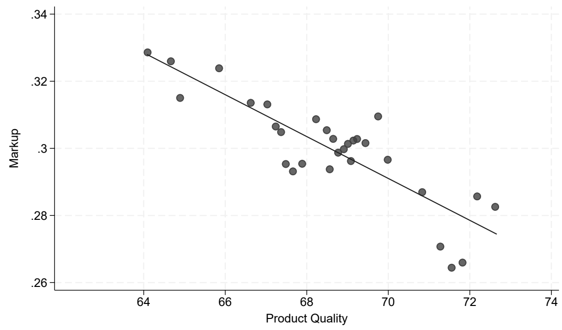
(c) *Manufacturer Margins*



(d) *Manufacturer Markups*



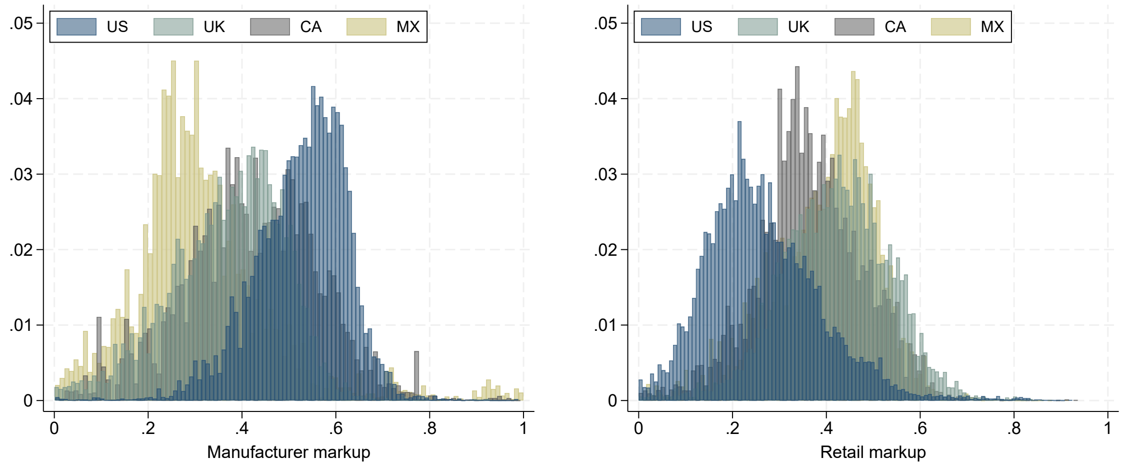
(e) *Retail Margins*



(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.

Figure 7: *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, $\frac{p^R-p^M}{p^R}$.

stability reflects the negative correlation between manufacturing and retail markups over time, confirming the pattern documented for the US. Figure 8 displays this dynamic relationship, where increases in manufacturer markups correspond to decreases in retailer markups, and vice versa. This compensatory mechanism helps maintain overall markup stability by balancing fluctuations between different stages of the supply chain.[12]

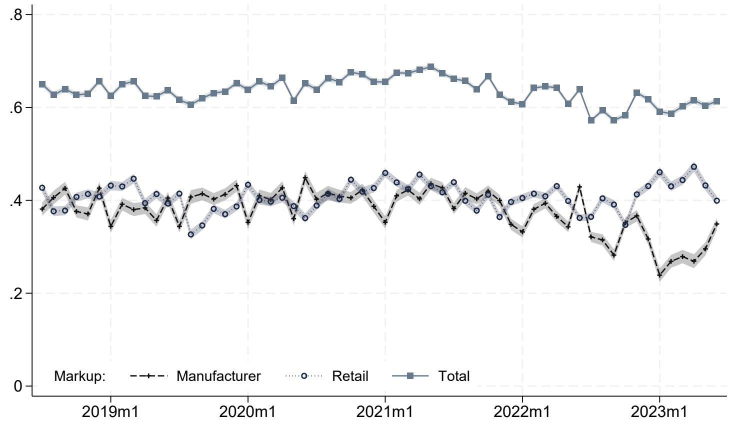
However, important differences emerge in the magnitude and volatility of these dynamics when comparing Mexico to the US. While the US exhibits the most stable patterns, Mexico shows substantially higher markup volatility throughout the sample period and displays an upward trend in total markups from 2019 to 2023, primarily driven by rising manufacturer markups.

Table 1 summarizes our findings across countries. We report means of our measures of markups, as well as the manufacturer and retailer margin share—the share of total markups (or dollar margins) that are obtained by each stage of the supply chain. Margin shares are calculated as $\frac{p^M-c}{p^R-c}$ and $\frac{p^R-p^M}{p^R-c}$. To illustrate the difference in the two measures, note that an increase in cost while holding fixed wholesale and retail prices will increase the retail margin share but leave retail markups unchanged. The margin share patterns are similar to the markup patterns, with the exception of Canada: retailers have a lower markup than manufacturers but a higher margin share.[13]

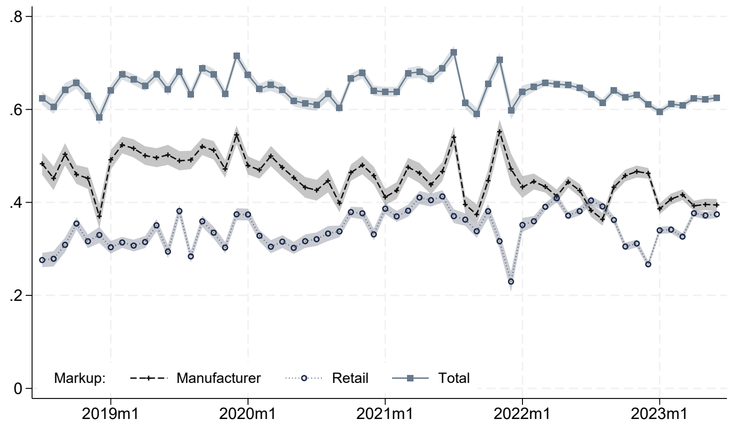
[12]Figure A.2 in the Appendix demonstrates that this negative correlation persists in the cross-sectional analysis across all countries.

[13]As an example, consider $P^R = \$2.75$, $P^M = \$1.75$, and $c = \$1.00$. The retailer has a higher margin share

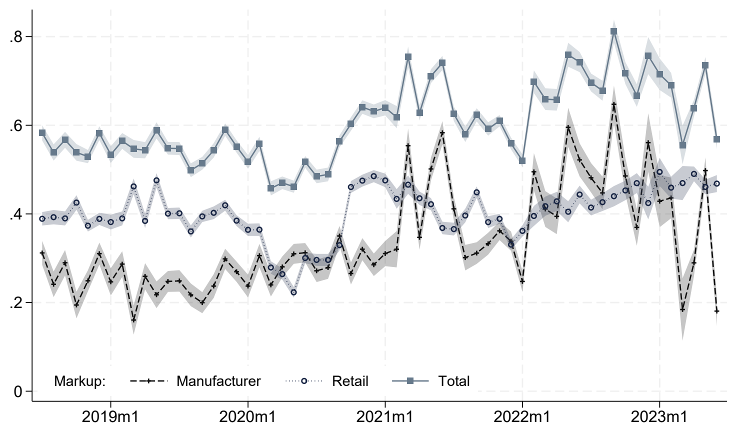
Figure 8: *Markup Dynamics*



(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 1: *International Comparison*

	Countries			
	US	UK	Canada	Mexico
Average Total Markup (μ_t^T)	0.66	0.64	0.64	0.60
Average Manufacturer Markup (μ_t^M)	0.53	0.37	0.43	0.33
Average Retail Markup (μ_t^R)	0.26	0.42	0.36	0.41
Average Manufacturer Margin Share ($\tilde{M}_t^M$)	0.60	0.35	0.43	0.32
Average Retail Margin Share ($\tilde{M}_t^R$)	0.40	0.65	0.57	0.68
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

Notes: This table summarizes the main results across the countries included in our sample. Margin shares are computed as manufacturing or retail margin over total margins, i.e., $\tilde{M}_t^M = M_t^M/(M_t^M + M_t^R)$ and $\tilde{M}_t^R = M_t^R/(M_t^M + M_t^R)$.

4 Model

We propose a model of supply chain pricing behavior that rationalizes several of our key findings. The framework considers a manufacturer that supplies a set of products, $\mathcal{I}$, to multiple retailers. The supplier-buyer network is fixed, and pricing occurs in two stages. First, the manufacturer determines the optimal retail prices (p_i^R) that maximize joint manufacturer-retailer profits for the set of products $\mathcal{I}$. Second, the manufacturer and the retailer negotiate wholesale prices (p_i^M) through a bargaining process for each product separately. The model is consistent with conversations with the manufacturer and captures features of our data that standard models do not readily account for, including the negative correlation between manufacturer and retailer markups described in Section 3.

A feature of our model is that the second-stage bargaining process does not influence retail prices, quantities, or joint profits. Thus, our model allows us to assess the determinants of manufacturer and retailer bargaining power without imposing additional structure on demand, supply, or competition. We quantify the Nash bargaining weights that determine equilibrium wholesale prices while taking retail prices and quantities as given. We then exploit variation across products, counties, and time to examine the different factors that predict relative bargaining power in our model.

4.1 Supply Chain Pricing

In the first stage, the manufacturer determines the retail prices that maximize supply-chain profits for its own products:

$$\max_{\{p_i^R\}} \sum_{i \in \mathcal{I}} \left(p_i^R - c_i\right) q_i \tag{1}$$

($1.00 out of the $1.75 total margin) but a smaller markup.

where p_i^R is the retail price, c_i is the production cost, and q_i is the total retail quantity for product i. Without loss of generality, we write the model as if there is a single downstream retailer.

In practice, manufacturers often avoid directly setting retail prices through contracts. Instead, they incentivize retailers to adhere to preferred prices using a combination of "list prices" at the retail level and "promotional" rebates to the retailer. Moreover, manufacturers tend to focus on the behavior of the end consumer and spend extensive resources on its analysis.[14] Our specification is consistent with these dynamics and captures them in a reduced form.

At this stage, the manufacturer internalizes downstream consumer substitution patterns across products in $\mathcal{I}$, to products of other manufacturers sold by the retailer, and to the outside option. In general, one could put additional structure on demand to estimate substitution patterns and conduct counterfactuals. For our current purposes, no additional structure is necessary.

In the second stage, the manufacturer and the retailer bargain over the split of profits for each product. Because total profits are set in the first stage, it suffices for the manufacturer and retailer to negotiate over the wholesale price. The negotiation between the manufacturer and retailer follows a Nash bargaining protocol, which maximizes the following Nash product:

$$\max_{p_i^M} \left[\left(p_i^M - c_i\right) q_i\right]^{\tau_i} \left[\left(p_i^R - p_i^M\right) q_i\right]^{1-\tau_i}, \ \forall i \in \mathcal{I}, \tag{2}$$

where p_i^M is the wholesale price. The first component represents the profits of the manufacturer, expressed as manufacturer margin $(p_i^M - c_i)$ times quantity. The second component is retailer profits, expressed as retail margins $(p_i^R - p_i^M)$ times quantity. Here, τ_i and $(1 - \tau_i)$ represent the bargaining weights of the manufacturer and retailer, respectively, reflecting their relative bargaining power.

The quantity of the product, q_i, is determined by prices set in the first stage and thus is taken as given in the second stage. Therefore, the bargaining problem simplifies to a negotiation over margins:

$$\max_{p_i^M} \left(p_i^M - c_i\right)^{\tau_i} \left(p_i^R - p_i^M\right)^{1-\tau_i}, \ \forall i \in \mathcal{I}. \tag{3}$$

In equilibrium, the solution to the bargaining problem yields a share of margins for the

[14] As one typical example, in a March 2023 earnings call, the executives of General Mills discuss pricing and elasticities several times, referring to retail consumer behavior. https://seekingalpha.com/article/4589620-general-mills-inc-gis-q3-2023-earnings-call-transcript

manufacturer that are equal to the bargaining weight, τ_i. This can be expressed as

$$\frac{p_i^M - c_i}{p_i^R - c_i} = \tau_i. \tag{4}$$

Using our data on retail prices, wholesale prices, and production costs, we can recover the manufacturer's bargaining weights directly from the data.

4.2 Quantifying Manufacturer-Retailer Bargaining Power

Using the expression derived from our model, we can examine the relative shifts in markups between manufacturers and retailers and changes in bargaining power. We construct the sales-weighted average bargaining weights for the manufacturer at the monthly level for the US and at the annual level for cross-country comparisons.

Figure 9 plots the time series of manufacturer bargaining weights. In the US (Figure 9a), the manufacturer consistently holds higher bargaining power than retailers, averaging 0.62 over the observed period. Moreover, the bargaining weight remained relatively stable until late 2020, when it experienced a sharp increase and subsequent decline due to changes in production costs. By 2022, bargaining power decreased significantly, coinciding with rising production costs.

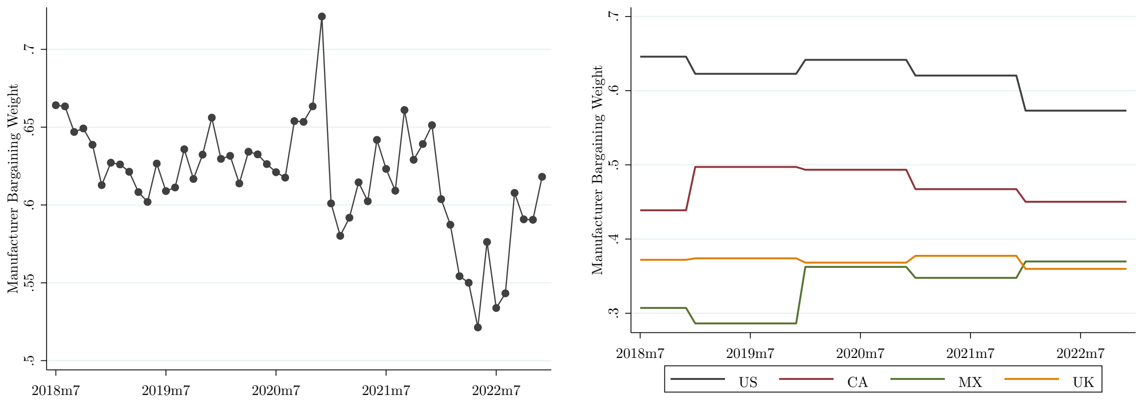
The manufacturer exhibits lower bargaining power outside of the US (Figure 9b) when negotiating wholesale prices. The average bargaining weights are 0.47 in Canada, 0.33 in Mexico, and 0.36 in the United Kingdom. The evolution over time also varies across countries: in Canada, bargaining power has steadily declined since late 2019; in the United Kingdom, it remained unchanged over the period; while in Mexico, the manufacturer's bargaining power increased substantially in 2020.

We examine the correlation between bargaining weights and economic factors to identify potential determinants of the manufacturer's bargaining power. Factors considered include production costs (which reflect supply shocks), total margins (which reflect market structure and competition), product-level sales per capita (market penetration), GDP per capita (income levels)[15], and the Consumer Price Index (CPI) as a proxy for overall demand (once production costs and margins are controlled for). Using variation across product, time, and country, this analysis aims to provide qualitative insights into the predictors of bargaining power.

The results in Table 2 shed light on the economic factors that influence the manufacturer's bargaining power and their relative importance in different contexts. All variables are in logs, allowing for the interpretation of coefficients as elasticities. The first column shows that production costs are negatively correlated with bargaining weights. This suggests that higher production costs, such as those observed during the post-pandemic surge in input costs, are linked to lower manufacturer bargaining power. A 10 percent increase in production costs

[15] We adjust GDP per capita for PPP to compare across countries.

Figure 9: *Manufacturer Bargaining Power*



(a) *The United States* **(b)** *All countries*

Notes: This figure shows the time series of the manufacturer's bargaining weights in the US (a) and across all countries (b). Bargaining weights are calculated using (4) and aggregated at the country-month level, weighted by sales.

is associated with a 4.7 percent decline in margin share. Conversely, total margins show a positive relationship with bargaining weights. Because higher margins persist for products with fewer close substitutes, this suggests that lower competition in the downstream sector strengthens the manufacturer's position.

The coefficients of product-level sales per capita and GDP per capita show that higher market penetration and higher income are also associated with higher manufacturer's bargaining power. This suggests that products with a larger presence in the market and access to wealthier consumer bases may increase leverage in negotiations. Finally, the coefficient of CPI shows that higher demand, as captured by aggregate price levels after accounting for costs and product-specific margins, is associated with lower manufacturer's bargaining power. This suggests that positive aggregate demand shocks may lead to disproportionate gains for retailers. Together, these factors help explain 60% of the variation in bargaining weights.

In columns (2) through (4), we examine alternative specifications by introducing country fixed effects, restricting the sample to non-U.S. countries, and focusing solely on the U.S. Across all specifications, the estimated coefficients are remarkably stable. In column (2), the inclusion of country fixed effects emphasizes within-country variation. Relative to our baseline specification, there is a decrease in the magnitude of the coefficients on GDP per capita and CPI, with almost no change in R^2. The stability in the other coefficients and R^2 suggests that our chosen variables effectively capture persistent cross-country differences in bargaining power. In column (3), we limit the analysis to Canada, Mexico, and the UK, while column (4) narrows the focus to the US. The coefficients are very similar across these specifications, underscoring the robustness of our results.

Finally, in column (5) we introduce our measure of product quality, which we only have for

Table 2: *Bargaining Weight Predictors*

	(1)	(2)	(3)	(4)	(5)
Production Cost	-0.467***	-0.467***	-0.457***	-0.408***	-0.431***
	(0.002)	(0.002)	(0.004)	(0.003)	(0.004)
Total Margin	0.546***	0.517***	0.613***	0.412***	0.400***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)
Sales per Capita	0.046***	0.054***	0.076***	0.054***	0.047***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
GDP per Capita	0.367***	0.107***	0.447***	0.395***	0.470***
	(0.005)	(0.030)	(0.011)	(0.055)	(0.063)
CPI	-0.177***	-0.081***	-0.217***	-0.200***	-0.127***
	(0.018)	(0.021)	(0.030)	(0.036)	(0.041)
Quality					2.291***
					(0.079)
Country FEs		X			
Non US			X		
US Only				X	X
Observations	88151	88151	32252	55899	40037
R^2	0.596	0.603	0.629	0.352	0.387

Notes: This table shows the outcome of regressing (log) bargaining weights on (log) production costs, (log) total margins, (log) product sales, (log) GDP per capital, and (log) CPI. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the U.S. Our earlier evidence indicated that higher product quality is associated with higher manufacturer markups but lower retailer markups (Section 3). Our analysis here provides corroborating evidence in terms of bargaining power: higher quality is associated with higher manufacturer bargaining power.

5 Price Dynamics Along the Supply Chain

Thus far, we have treated pricing behavior as static. However, it is well known that prices may take time to reflect upstream cost shocks. Here, we consider the dynamics of cost pass-through. We provide reduced-form estimates of how cost shocks propagate along each part of the supply chain, and we document dynamic patterns that differ between the manufacturer and retailers. As in Section 3, we start with evidence from the United States before extending our analysis to the United Kingdom, Canada, and Mexico. We close this section by adding dynamic adjustments to bargaining weights in our model of supply chain pricing. Our estimates illustrate how dynamics in bargaining power can generate dynamics in cost pass-through.

5.1 Cost Pass-Through Along the Supply Chain

We begin by examining how costs are transmitted to prices in the United States. 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.

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:

$$p_{ist}^{M} = a + \sum_{z=0}^{T} \alpha_z^M \hat{c}_{ist-z}^{M} + \sum_{z=0}^{T} \beta_z^M C_{st-z}^{M} + \phi_i + \varepsilon_{ist} \tag{5}$$

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_{st}^M, representing the product category average cost. 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.

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

$$p_{ijst}^{R} = b + \sum_{z=0}^{T} \alpha_z^R \hat{p}_{ist-z}^{M} + \sum_{z=0}^{T} \beta_z^R P_{st-z}^{M} + \gamma_j + \gamma_i + \nu_{jist} \tag{6}$$

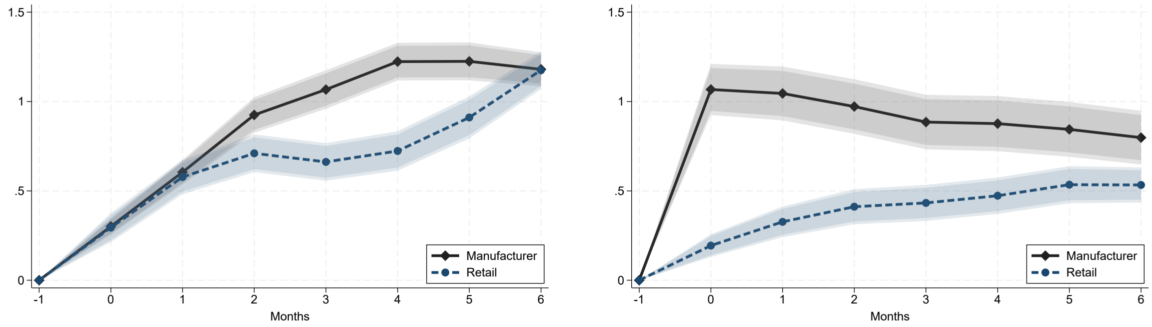
where p_{ijst}^R represents the price for product i in category s set by retailer j at time t, and p_{ist}^M represents the manufacturer's price, which is the cost incurred by the retailer to purchase the product. As in the wholesale analysis, we divide the latter into a product-specific component, $\hat{p}_{ist}^M$, and a common component, P_{st}^M, representing the product category average cost. 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 $\{\beta_z^R\}_{z=0}^T$, reflect the average impact across retailers for the same product.

Due to product attrition, we restrict our baseline specification to analyze price responses within the first six months.[16] 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 10a shows the cumulative price adjustments following an aggregate increase in costs, while Figure 10b examines the cumulative price responses to idiosyncratic cost changes. The figures reveal different pricing strategies both with respect to idiosyncratic and aggregate

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

Figure 10: *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 (5) and Equation (6). Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.

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.

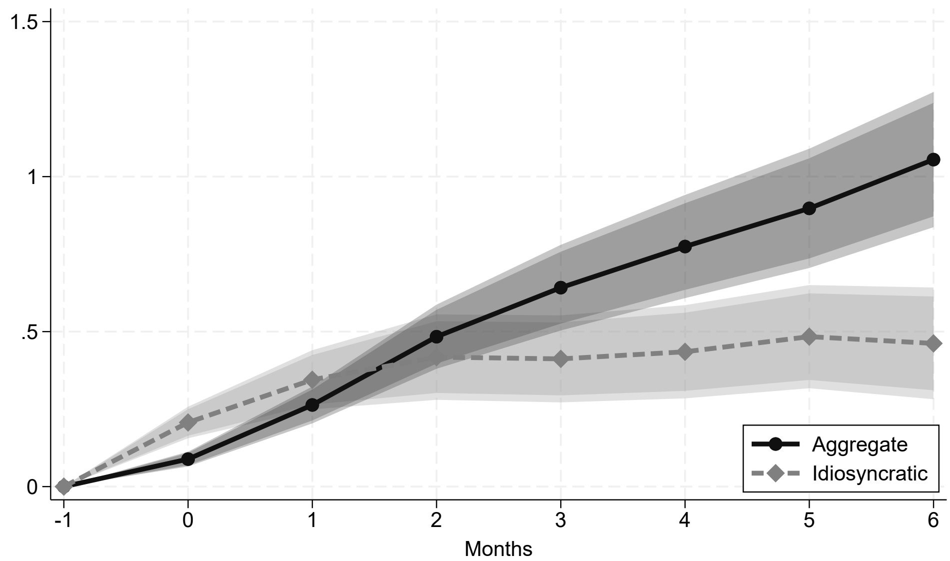
The manufacturer's and retailers' price responses to idiosyncratic costs are significantly different. Figure 10b shows that the manufacturer's response when isolating product-specific costs is even more pronounced than to aggregate costs, with wholesale prices increasing by \$1.10 immediately following 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.[17] This behavior is consistent with the near-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 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 11. This cumulative response is calculated as $\theta_t^{\text{AGG}} = \sum_{i=0}^{t} \beta_i^R (\sum_{j=0}^{t-i} \beta_j^M)$, and as $\theta_t^{\text{IDIO}} = \sum_{i=0}^{t} \alpha_i^R (\sum_{j=0}^{t-i} \alpha_j^M)$, with θ_t^{AGG} and θ_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 (5) and (6).[18] The figure

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

[18] This method of calculating the cumulative response accounts for delayed adjustments in both the manufacturing and retail sectors. For instance, a \$1 increase in aggregate production cost results in an

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



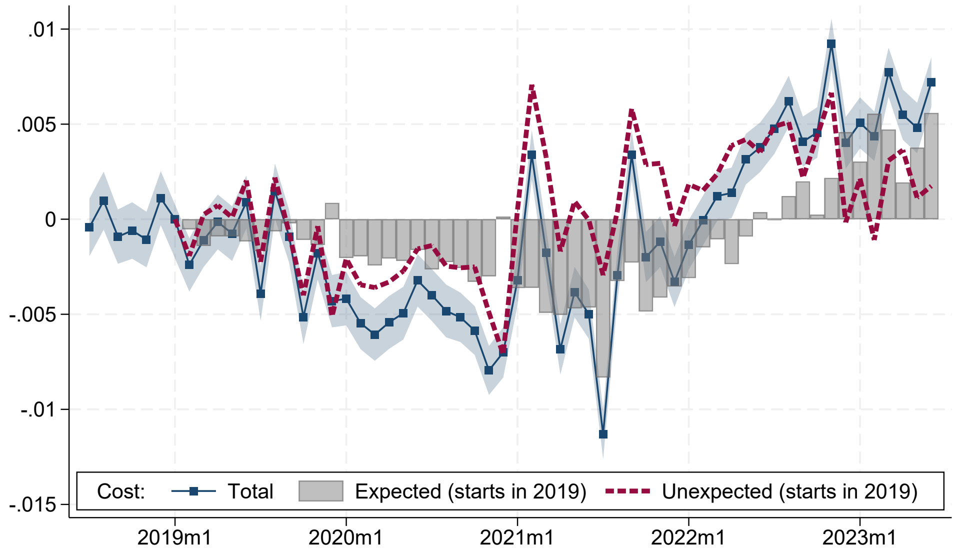
Notes: This figure shows the cumulative pass-through of production costs to retail prices. The cumulative responses are calculated as $\theta_t^{\text{AGG}} = \sum_{i=0}^{t} \beta_i^R (\sum_{j=0}^{t-i} \beta_j^M)$, and as $\theta_t^{\text{IDIO}} = \sum_{i=0}^{t} \alpha_i^R (\sum_{j=0}^{t-i} \alpha_j^M)$, with θ_t^{AGG} and θ_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 (5) and (6). Standard errors are constructed by bootstrapping 100 times with replacement.

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.

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

immediate pass-through at period 0 will be $\theta_0^{\text{AGG}} = \beta_0^R \beta_0^M$; after one month, $\theta_1^{\text{AGG}} = \theta_0^{\text{AGG}} + \beta_0^R \beta_1^M + \beta_1^R \beta_0^M = \beta_0^R(\beta_0^M + \beta_1^M) + \beta_1^R \beta_0^M$, and so on.

Figure 12: *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.

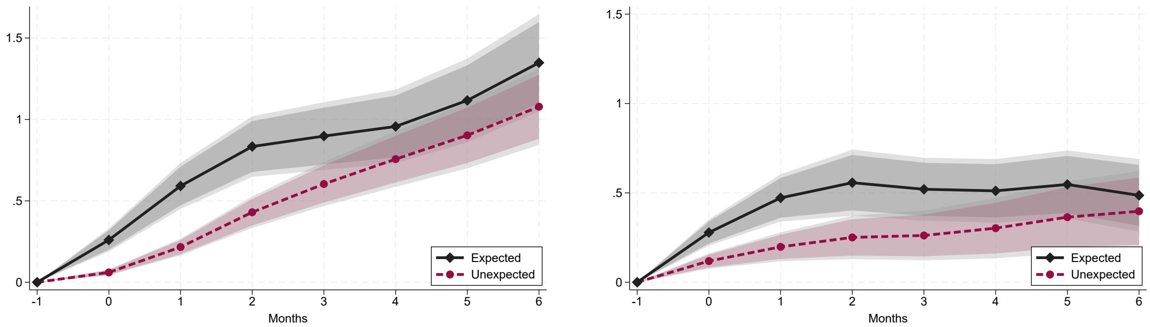
final retail prices suggests that consumers might be partially shielded from immediate cost shocks, but prolonged cost increases could eventually filter through, affecting affordability. By considering these factors, policymakers can better manage the impacts of cost changes on the economy and ensure that market dynamics remain balanced and fair for all stakeholders.

Expected and Unexpected Cost The period under examination was characterized by significant global shocks that were largely unforeseen. In Figure 12, 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:

$$p_{ist}^{M} = a + \sum_{z=0}^{T} \left\{ \alpha_{e,z}^{M} \hat{c}_{ist-z}^{e,M} + \beta_{e,z}^{M} C_{st-z}^{e,M} + \alpha_{u,z}^{M} \hat{c}_{ist-z}^{u,M} + \beta_{u,z}^{M} C_{st-z}^{u,M} \right\} + \phi_i + \varepsilon_{ist} \tag{7}$$

Figure 13: *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 $\theta^{\text{AGG}}_{y,t} = \sum_{i=0}^{t} \beta^R_i (\sum_{j=0}^{t-i} \beta^M_{y,j})$, and $\theta^{\text{IDIO}}_{y,t} = \sum_{i=0}^{t} \alpha^R_i (\sum_{j=0}^{t-i} \alpha^M_{y,j})$, with $\theta^{\text{AGG}}_{y,t}$ and $\theta^{\text{IDIO}}_{y,t}$ 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^X_e and α^X_u are recovered from Equation (7), and β^X from Equation (6) with $X = \{M, R\}$. Standard errors are constructed by bootstrapping 100 times with replacement.

where $c^{e,M}_{ist}$ represents the expected price change at time t and $c^{u,M}_{ist}$ 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 13 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 11.[19] 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.

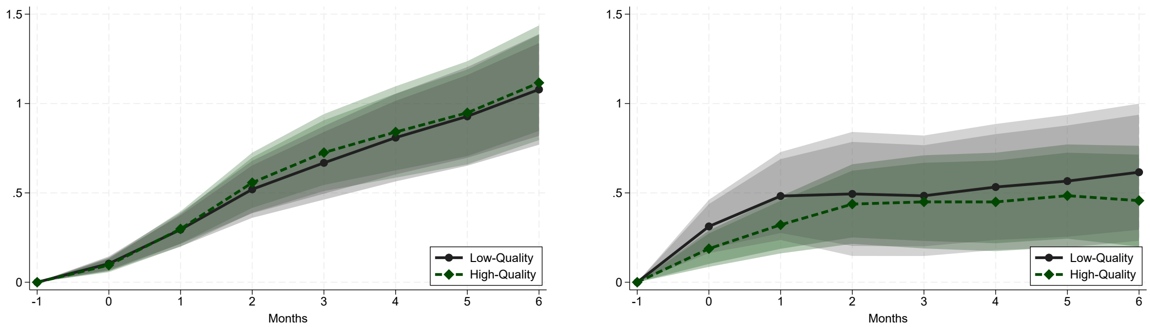
The results indicate that for aggregate costs, expected shocks are transmitted to retail prices almost immediately, reaching full pass-through within two months. In contrast, the pass-through of unexpected costs is complete only after five months. For idiosyncratic costs, where the transmission to retail 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.[20] Retailers' slower price adjustments, as seen in Figure 10, further exacerbate the delay in price adjustment when the manufacturer responds more gradually to

[19] While the manufacturer exhibits heterogeneous responses depending on the nature of the shock recovered from Equation (7), we apply the coefficients for retailers estimated from Equation (6).

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

Figure 14: *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 $\theta_{q,t}^{\text{AGG}} = \sum_{i=0}^{t} \tilde{\beta}_{q,i}^{R} (\sum_{j=0}^{t-i} \tilde{\beta}_{q,j}^{M})$ and $\theta_{q,t}^{\text{IDIO}} = \sum_{i=0}^{t} \tilde{\alpha}_{q,i}^{R} (\sum_{j=0}^{t-i} \tilde{\alpha}_{q,j}^{M})$ with $\theta_{q,t}^{\text{AGG}}$ and $\theta_{q,t}^{\text{IDIO}}$ 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 (8) and Equation (9) with $\tilde{\alpha}_{q,t}^{X} = \alpha_t^X + \text{I}_{q,t} \times \left(\alpha_{q,t}^{X}\right)$ and $\tilde{\beta}_{q,t}^{X} = \beta_t^X + \text{I}_{q,i} \times \left(\beta_{q,t}^{X}\right)$ 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.

unexpected costs.

Product 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:

$$p_{ist}^{M} = a + \sum_{z=0}^{T} \left\{ \alpha_z^M \hat{c}_{ist-z}^{M} + \beta_z^M C_{st-z}^{M} + \text{I}_{q,i} \times \left(\alpha_{q,z}^{M} \hat{c}_{ist-z}^{M} + \beta_{q,z}^{M} C_{st-z}^{M} \right) \right\} + \phi_i + \varepsilon_{ist} \tag{8}$$

and for retailers:

$$p_{ijst}^{R} = b + \sum_{z=0}^{T} \left\{ \alpha_z^R \hat{p}_{ist-z}^{M} + \beta_z^R P_{st-z}^{M} + \text{I}_{q,i} \times \left(\alpha_{q,z}^{R} \hat{p}_{ist-z}^{M} + \beta_{q,z}^{R} P_{st-z}^{M} \right) \right\} + \gamma_j + \gamma_i + \nu_{jist} \tag{9}$$

with $\text{I}_{q,i}$ 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 14.[21]

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

Table 3: *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.

5.2 Pass-through in the UK, Canada, and Mexico

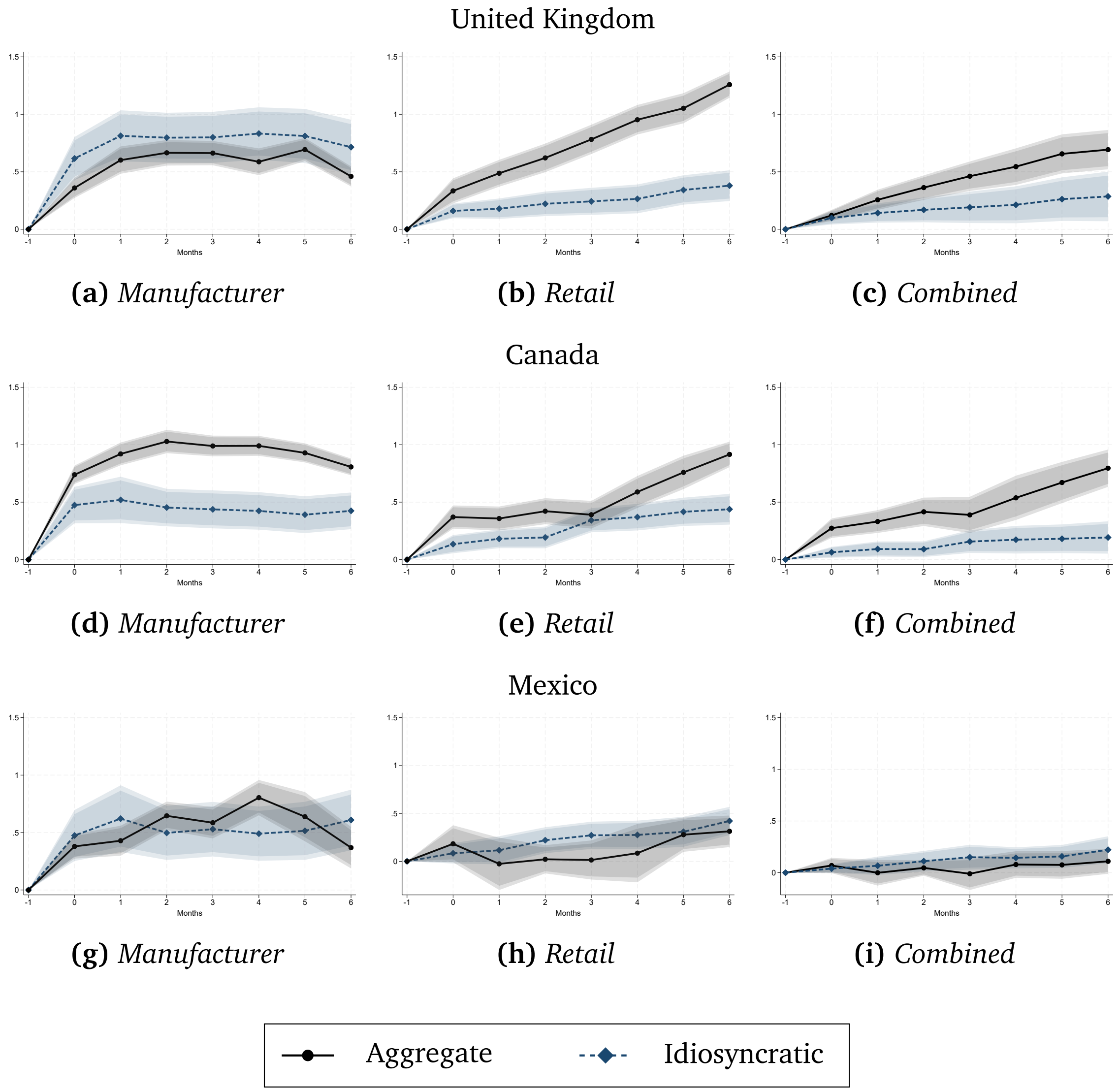
Finally, we study cost transmission in the United Kingdom, Canada, and Mexico. While the matched manufacturer-retailers dataset allows us to infer markup dynamics from the cross-section of products, focusing on the time series dimension requires data imputation for these countries. Indeed, gaps in the time series for each product lead to a significant reduction in the sample used to estimate cost pass-through over a six-month period.

We address this by imputing missing data by bringing forward production costs and wholesale prices for gaps up to 90 days. Table 3 shows the extent of data imputation by country. The table highlights that the number of imputed observations is actually rather 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, 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 dynamics of cost pass-through in Canada, Mexico and the United Kingdom, we use the same specifications as in the US: Equation (5) for the manufacturer and Equation (6) 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 15a, Figure 15d, and Figure 15g present the cumulative pass-through of production costs to wholesale prices at the manufacturer level for the United Kingdom, Canada, and Mexico, respectively. As in the US, the manufacturer in these countries responds quickly to idiosyncratic cost shocks, with no significant adjustments beyond the first month. Similarly, the pass-through of aggregate cost shocks follows a more gradual pattern across all countries.

Figure 15: *Cost Pass-through Along the Supply Chain*



(a) *Manufacturer* **(b)** *Retail* **(c)** *Combined*

(d) *Manufacturer* **(e)** *Retail* **(f)** *Combined*

(g) *Manufacturer* **(h)** *Retail* **(i)** *Combined*

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 (5) and Equation (6), 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.

However, important differences in the magnitude of pass-through are observed. In the UK, the manufacturer achieves full pass-through for idiosyncratic shocks but falls short of complete adjustment for aggregate shocks. In Canada, the manufacturer fully passes through aggregate shocks, but exhibits incomplete pass-through for idiosyncratic changes. The most distinct pattern is observed in Mexico, where the manufacturer exhibits incomplete pass-through for both types of shocks, reflecting a more conservative pricing strategy overall.

Figure 15b, Figure 15e, and Figure 15h present the cumulative pass-through of costs to retail prices at the retailer level for the United Kingdom, Canada, and Mexico, respectively. In all three countries, similar to the US, retailers respond more slowly than the manufacturer, achieving full pass-through of aggregate cost shocks only by the end of the six-month period. Responses to idiosyncratic shocks are also more limited, consistent with the patterns observed in the US. However, Mexico stands out with an exceptionally low level of pass-through for both idiosyncratic and aggregate shocks, indicating a distinct pricing strategy or unique market dynamics compared to the other countries.

Figure 15c, Figure 15f, and Figure 15i 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 construct these combined effects using the same calculation as for Figure 11. 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 the manufacturer 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.

5.3 Dynamic Evolution of Bargaining Power

The results in this section indicate that wholesale and retail prices adjust dynamically to cost shocks, while our earlier results showed there was a negative correlation in markups between the manufacturer and the retailer. Taken together, this suggests that dynamic adjustments in bargaining power may explain the divergence between manufacturer and retailer cost pass-through.

To explore this more directly, we use our estimates of bargaining weights from the model of Section 4, we examine how these weights evolve over time in response to cost changes. Given the differences in estimated pass-through in response to expected and unexpected costs, we include these costs separately when examining dynamics. We follow closely the descriptive regressions from Section 4 and add lags to the measures of cost shocks.

Table 4 presents specifications with increasing lags in costs. Column (1) replicates the contemporaneous effects studied in Section 4. In column (2), we split costs into expected and unexpected components. In magnitudes, we find a slightly larger response to expected costs (-0.525) and a much smaller response to unexpected costs (-0.077), compared to the coefficient of -0.467 on production costs in column (1). The coefficient in column (1) reflects a weighted average of these two coefficients, with expected costs comprising a greater portion of total cost. This asymmetry parallels our previous finding that expected costs are transmitted more rapidly through the supply chain, and may be driven, for example, if retailers raise prices by more when wholesale price increases are expected.

We introduce lags up to two months in column (3) and lags up to six months in column (4). The introduction of lagged cost shocks shrinks the contemporaneous coefficient on expected costs. With six month lags, this coefficient is nearly zero. The lagged coefficients in both cases are negative, statistically significant, and economically meaningful. The sum of the expected cost coefficients is -0.548 in column (3) and -0.571 in column (4), which are similar to the estimated contemporaneous effect in column (2). This indicates that the immediate effect captured in our baseline specification reflects the combined impact of current and past cost changes. These coefficients suggest that changes in production costs affect bargaining power gradually rather than immediately. Dynamic adjustments to bargaining power may lead to differential speeds of price adjustment between the manufacturer and retailers, as our earlier evidence indicated.

When incorporating lagged shocks, contemporaneous unexpected cost changes show a positive effect on manufacturer bargaining power. However, this dissipates over the following months and the longer-run effect of a permanent unexpected cost shock is negative, as indicated by the sum of the current and lagged unexpected cost coefficients.

One possible explanation for this pattern is the following: at the arrival of an unexpected cost shock, the retailer can immediately push for higher wholesale prices that the retailer does not immediately pass through. Given some time to respond, the retailer adjusts retail prices or pushes back against these cost increases. The net long-run effect of unexpected cost shocks is directionally the same as expected cost shocks: higher costs are correlated with reduced manufacturer bargaining power, even if a cost shock may temporarily improve the manufacturers' margin share.

These dynamic patterns may help explain the observed stability in total markups despite significant cost fluctuations. When costs increase, the manufacturer's bargaining power decreases gradually, leading to a smoother adjustment of margins between supply chain participants.

Table 4: *Bargaining Weight Predictors with Dynamics*

	(1)	(2)	(3)	(4)
Production Cost$_t$	-0.467***			
	(0.002)			
Total Margin	0.546***	0.586***	0.599***	0.615***
	(0.002)	(0.002)	(0.002)	(0.003)
Sales per Capita	0.046***	0.045***	0.043***	0.043***
	(0.001)	(0.001)	(0.001)	(0.001)
GDP per Capita	0.367***	0.298***	0.245***	0.187***
	(0.005)	(0.005)	(0.006)	(0.007)
CPI	-0.177***	-0.325***	-0.330***	-0.464***
	(0.018)	(0.019)	(0.021)	(0.027)
Expected Cost$_t$		-0.525***	-0.143***	0.010
		(0.003)	(0.009)	(0.013)
Expected Cost$_{t-1}$			-0.164***	-0.076***
			(0.010)	(0.014)
Expected Cost$_{t-2}$			-0.241***	-0.110***
			(0.009)	(0.014)
Expected Cost$_{t-3}$				-0.089***
				(0.014)
Expected Cost$_{t-4}$				-0.063***
				(0.012)
Expected Cost$_{t-5}$				-0.082***
				(0.013)
Expected Cost$_{t-6}$				-0.161***
				(0.012)
Unexpected Cost$_t$		-0.077***	0.027***	0.078***
		(0.007)	(0.008)	(0.009)
Unexpected Cost$_{t-1}$			-0.021**	0.006
			(0.008)	(0.009)
Unexpected Cost$_{t-2}$			-0.058***	-0.015
			(0.008)	(0.010)
Unexpected Cost$_{t-3}$				-0.010
				(0.010)
Unexpected Cost$_{t-4}$				-0.021**
				(0.010)
Unexpected Cost$_{t-5}$				-0.028***
				(0.010)
Unexpected Cost$_{t-6}$				-0.051***
				(0.010)
Observations	88151	80596	65029	43499
R^2	0.596	0.611	0.599	0.595

Notes: This table shows the outcome of regressing (log) bargaining weights on (log) total margins, (log) product sales, (log) GDP per capital, (log) CPI, present and lagged (log) production costs. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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 total markups are similar in magnitude across countries, averaging around 0.65, but there is significant heterogeneity 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 total 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. Total markup stability over time is due to the negative correlation along the supply chain, where adjustments in the manufacturing and retail sectors are asymmetric and partially offset each other.

We develop a two-stage supply chain pricing model to rationalize these findings. Our model fits key facts in our data that are not readily explained by standard models in the industrial organization and macroeconomic literature. This model can be adapted for future research on how supply chain relationships influence various economic phenomena.

Our model allows us to quantify the relative bargaining power between the manufacturer and retailers. The analysis reveals that the manufacturer holds greater bargaining power than retailers in the US, while retailers have greater bargaining power than the manufacturer in other countries. Over time, the manufacturer's bargaining power has declined in the United States and Canada, remained stable in the United Kingdom, and increased significantly in Mexico in 2020.

Using variation across products, countries, and time, we analyze different predictors of bargaining power. We find that the manufacturer bargaining weights increase with income and market penetration and decrease with production costs and inflation. Manufacturer bargaining weights also increase with the total margin of a product, indicating the manufacturer captures a greater share when fewer close substitutes are available.

Finally, we show that the manufacturer and the retailers adjust their prices at different rates and magnitudes. 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. Our model of supply chain pricing can rationalize these patterns as dynamic changes in bargaining power in response to cost shocks.

From a policy perspective, these findings underscore the importance of considering supply chain dynamics when addressing inflation and market power. The differing speeds at which cost changes propagate through the supply chain can delay consumer price responses to supply-side shocks. Furthermore, shifts in economic conditions can reshape the bargaining positions of suppliers and buyers, affecting price setting and market outcomes. Accounting for these factors is crucial to developing effective strategies that promote price stability and competitive markets.

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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	-	674
Perceived Quality	84.47	83.00	87.00	4.18	-	674

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}). μ^{TOT}, μ^M, μ^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

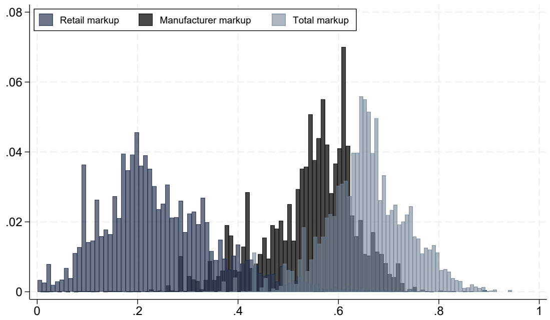
Notes: This table shows average markups by year. Our data starts in June 2018 and ends in June 2023 so that the years 2018 and 2023 include only two quarters.

Table A.5: *Quality Differentiation*

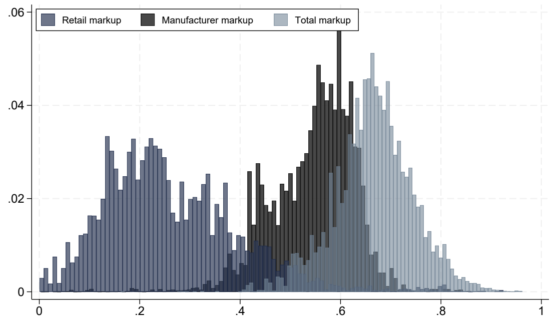
	Total		Manufacturer		Retail	
	(1) Margins	(2) Markup	(3) Margins	(4) Markup	(5) Margins	(6) Markup
Quality	0.004***	-0.000**	0.003***	0.008***	-0.000	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R2	0.71	0.39	0.86	0.46	0.52	0.46
N	44,526	44,526	44,526	44,526	44,526	44,526

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. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

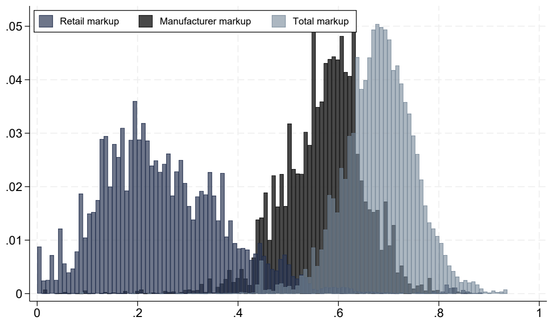
Figure A.1: *Markups Along the Supply Chain by Year (United States)*



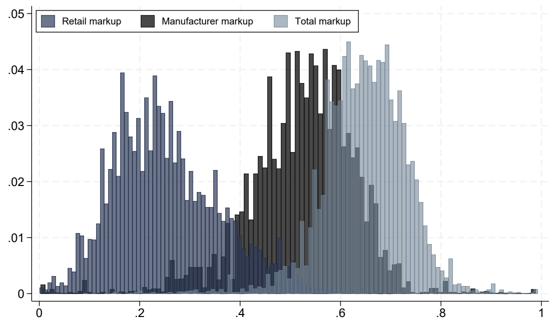
(a) *2018*



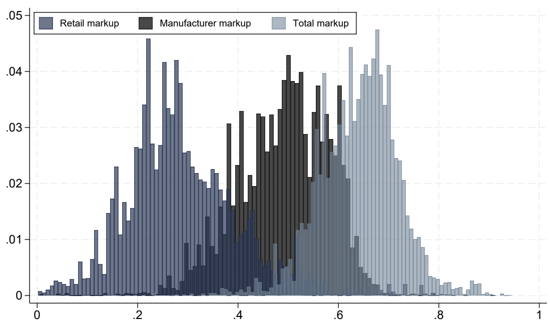
(b) *2019*



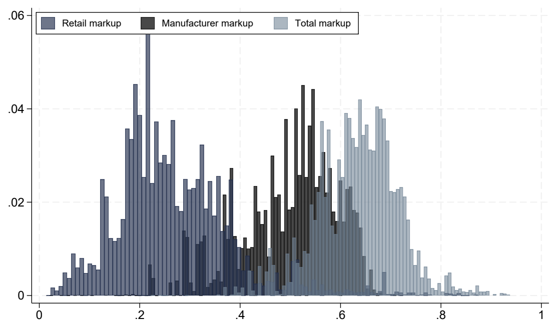
(c) *2020*



(d) *2021*



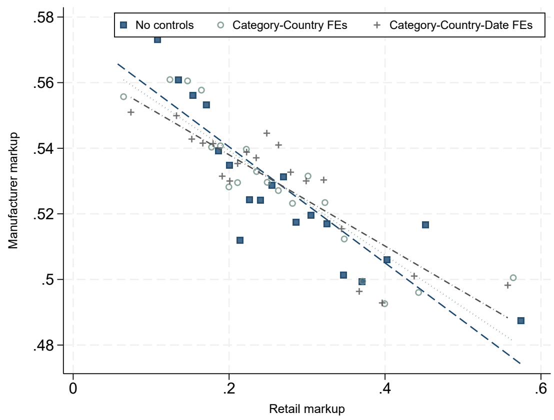
(e) *2022*



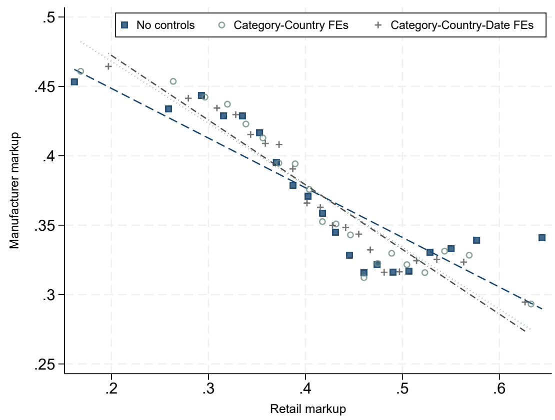
(f) *2023*

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.

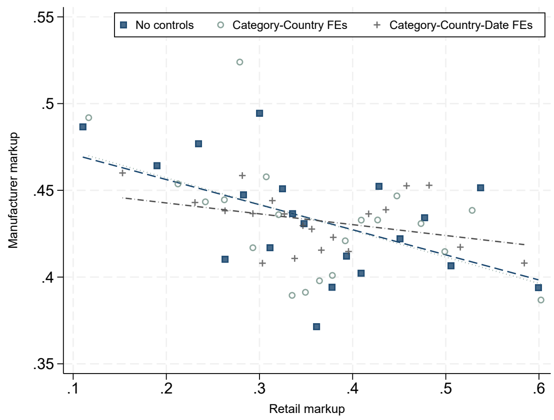
Figure A.2: *Manufacturer and Retailer Markup Relation*



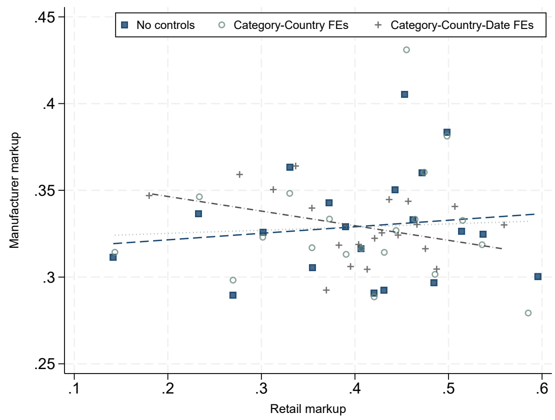
(a) *United States*



(b) *United Kingdom*



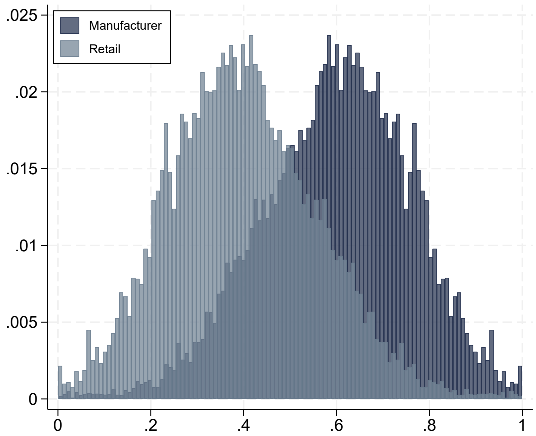
(c) *Canada*



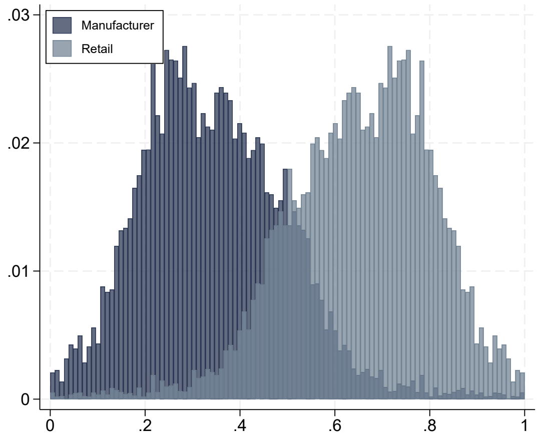
(d) *Mexico*

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.

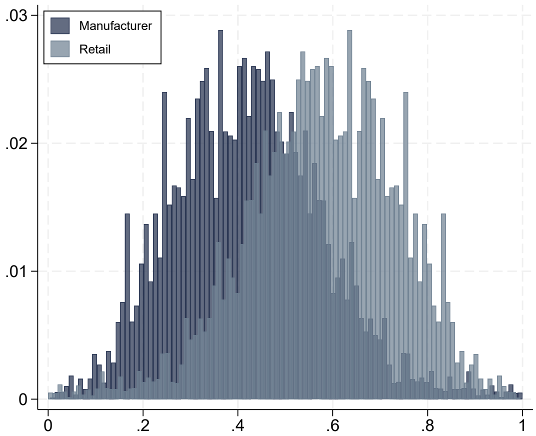
Figure A.3: *Manufacturer and Retailer Margin Share*



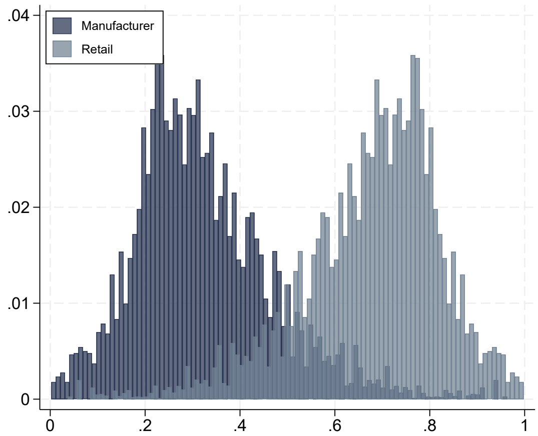
(a) *United States*



(b) *United Kingdom*



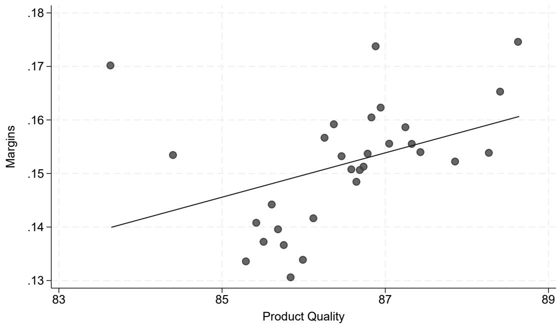
(c) *Canada*



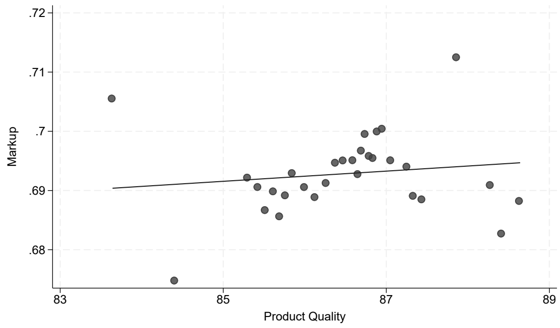
(d) *Mexico*

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 $\frac{p^R - p^M}{p^R - c}$.

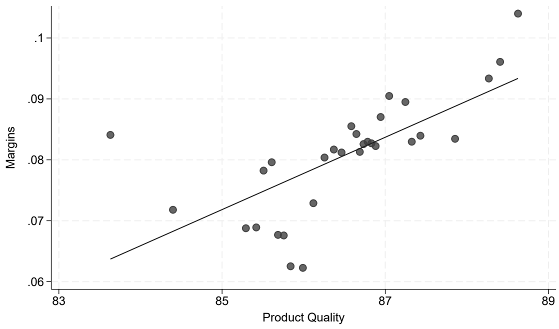
Figure A.4: *Quality Differentiation Along the Supply Chain*



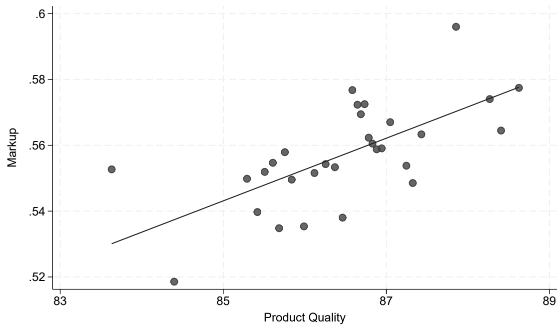
(a) *Total Margins*



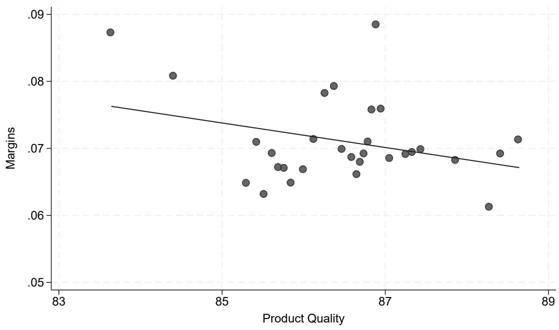
(b) *Total Markups*



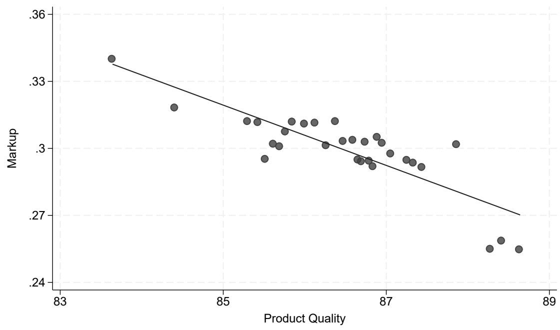
(c) *Manufacturer Margins*



(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 (5). 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 (5). 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

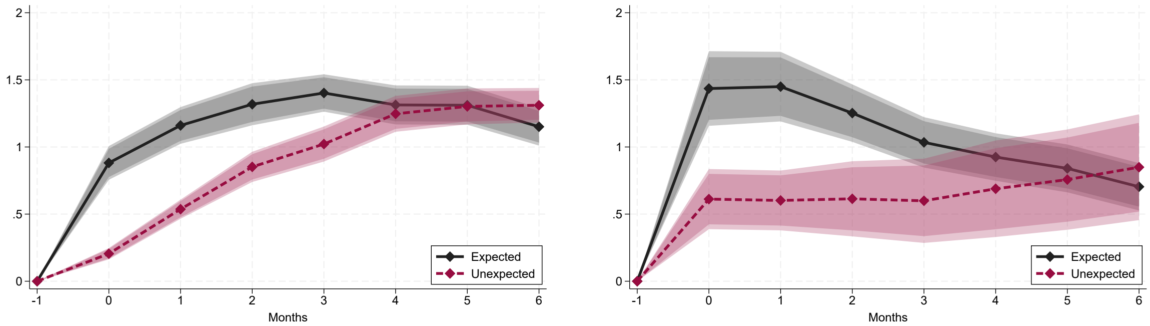
Notes: These figures show pass-through of wholesale prices to retail prices estimated using Equation (6). Coefficients for idiosyncratic and aggregate shocks are estimated jointly. Robust standard errors are shown in parentheses. Long-term pass-through estimates are constructed using the Delta method.

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 (6). 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*

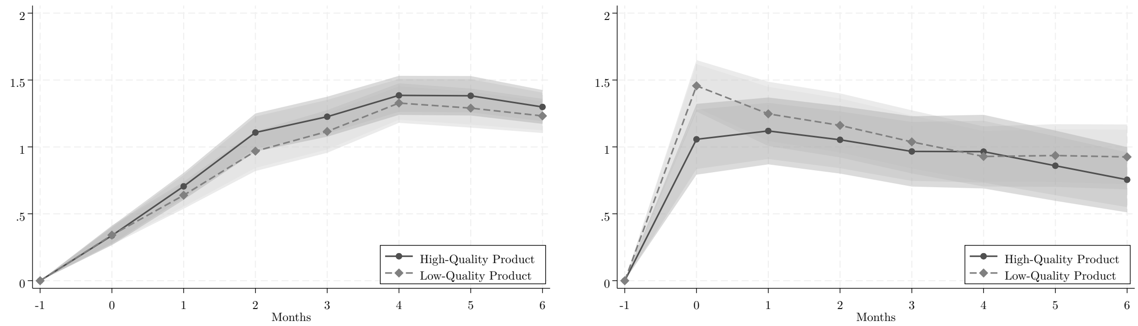


(a) *Aggregate Cost* **(b)** *Idiosyncratic Cost*

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 (7). Solid lines are the point estimates, and shaded areas are the 95 and 90 percent confidence bands computed using the delta methods.

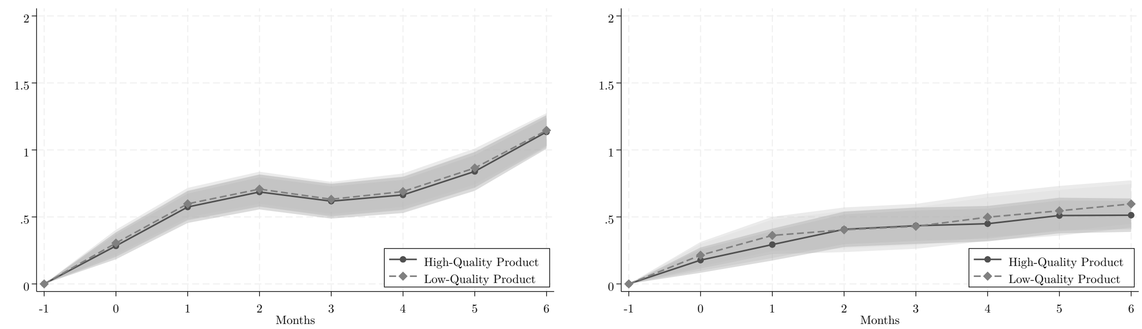
Figure A.6: *Cost Transmission Along the Supply Chain by Product Quality*

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 (8) and Equation (9). 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.