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# Materials prices, market power, and the rise in processed food inflation in emerging markets: Evidence from Colombia

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# Materials prices, market power, and the rise in processed food inflation in emerging markets: Evidence from Colombia

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## Abstract

This paper estimates the transmission of materials price shocks to producer and consumer prices in the processed food industry in Colombia between 2016 and 2023. Using monthly sector-level data for 9 food-processing sectors in Colombia, and an empirical strategy that exploits variation in both time-series and cross-sectoral exposure to materials price shocks, we estimate reduced form effects on prices along the production and retail stages of the supply chain. We find that a 1% increase in materials prices raises producer prices by about 0.6% and consumer prices by 0.3%. These effects materialize gradually, which is consistent with frictions in price adjustment. We also find that transmission rates are lower in more concentrated sectors of the food industry, consistent with theoretical predictions linking market power and incomplete pass-through. Our findings provide new evidence on the role of materials price shocks and their interaction with market structure in shaping food prices in developing countries.

**Key words:** Materials prices, costs tramisision, processed food, food inflation.

**JEL classification:** E31, L13, L16, L66, Q18.

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# Precios de materias primas, poder de mercado y el aumento de la inflación de alimentos procesados en países en desarrollo: evidencia para Colombia

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## Resumen

Este documento cuantifica la transmisión de choques en los costos de los insumos a los precios al productor y al consumidor en la industria de alimentos procesados en Colombia entre 2016 y 2023. Utilizando datos mensuales a nivel sectorial para 9 sectores que procesan alimentos y una estrategia empírica que explota la variación tanto temporal como entre sectores en la exposición a choques en los precios de los insumos, estimamos efectos de forma reducida a lo largo de los segmentos de producción y comercialización de la cadena valor de los alimentos procesados. Encontramos que un aumento del 1% en los precios de los insumos incrementa los precios al productor 0,6%, y los precios al consumidor en 0,3%. Estos efectos se materializan de manera gradual, lo que es consistente con la presencia de fricciones en el ajuste de precios. Por último, mostramos que las tasas de transmisión son menores en los sectores más concentrados de la industria de alimentos, en línea con las predicciones teóricas que vinculan el poder de mercado con una transmisión incompleta de los costos. Nuestros hallazgos aportan nueva evidencia para países en desarrollo sobre la importancia de los choques en los precios de los insumos—y su interacción con la estructura de mercado—en la determinación de los precios de los alimentos.

**Palabras clave:** Precios de las materias primas, transmisión de costos, alimentos procesados, inflación de alimentos.

**Clasificación JEL:** E31, L13, L16, L66, Q18.

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# 1 Introduction

Agri-food value chains in developing countries have undergone rapid transformation in recent decades, including the expansion of modern food retail and the increasing importance of processed foods in household consumption (Barrett et al., 2022; Reardon, Timmer and Berdegue, 2012). The food processing industry has grown alongside urbanization and rising incomes (Reardon et al., 2009; Gómez and Ricketts, 2013), accompanied by larger production scale and deeper integration into global value chains (Wilkinson, 2012). These change influence the food industry's exposure to cost shocks and their transmission to consumer prices. Yet, little is known about this transmission and its determinants in developing countries.

In this paper, we study how cost shocks in the food processing industry are transmitted to producer and consumer prices in Colombia, and how industry concentration shapes this transmission. Understanding these mechanisms became especially salient in the aftermath of the COVID-19 pandemic and Russia's invasion of Ukraine, when global food inflation surged to historic highs. Evidence, largely based on high-income countries, suggests that the price increase was driven by a combination of demand pressures and supply-side disruptions, including supply chain bottlenecks and rising commodity prices.[2] At the same time, several of the world's largest corporations reported record profits, sparking widespread debate over the role of firms in amplifying inflationary pressures and contributing to persistently high prices.[3]

Academic research on this issue has largely focused on rising markups and their effects in high-income countries (see, for example, Hansen, Toscani and Zhou, 2023; Bilyk, Grieder

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[2] See for example, Çakır et al. (2024); Linde and Sims (2023); Grigsby, Kuchler and Stroebel (2024); Jasmine Chang et al. (2024); Wunderlich (2021); Kornher, Balezentis and Santeramo (2024); Serova and Yanbykh (2023)

[3] This phenomenon was widely covered in the media as "greedflation." See, for example, `https://www.theguardian.com/business/2023/dec/07/greedflation-corporate-profiteering-boosted-global-prices-study`.

and Khan, 2023; Leduc, Li and Liu, 2024; Alvarez-Blaser et al., 2025).[4] However, how cost shocks propagate along the supply chain in developing countries, and the role of local firms in the transmission of such shocks, ultimately influencing producer and consumer prices remain understudied.

Food prices are a critical determinant of welfare, specially in developing countries, where households devote a larger share of their income to food consumption. In these contexts, increases in food prices can significantly reduce real incomes and contribute to higher levels of poverty and food insecurity (Marson and Saccone, 2025; Cudjoe, Breisinger and Diao, 2010; Wood, Nelson and Nogueira, 2012; Amolegbe et al., 2021; Headey et al., 2024). Understanding how cost shocks are transmitted to consumer food prices is therefore central to the design of policies aimed at protecting the most vulnerable population during periods of supply constraints.

Colombia offers a particularly well-suited environment for this analysis. As a middle income country, Colombia participates in global markets for inputs and final goods. The country is a net importer of some products and a net exporter of others. This structure generates direct competition between domestically produced and imported food in local markets, allowing international price shocks to affect domestic prices through both cost and strategic interaction channels. Following the pandemic, processed food prices in Colombia increased sharply, with producer and consumer inflation rising well above pre-pandemic levels from 2021 onward. This episode coincided with a strong surge in input costs, reflecting the high exposure of the food processing industry to international price shocks due to its reliance on imported materials such as cereals, oils, and animal feed.

We use firm-level data to construct a detailed index of material costs, which we combine with sector-level data on producer and consumer prices to estimate the reduced-form effects

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[4] A common finding in this literature is that aggregate markups remained broadly stable during the high-inflation period, with firms largely passing through cost increases to consumer prices.

of material price growth on output price inflation along the value chain. We estimate the dynamic transmission of materials prices to producer and consumer prices with a specification at the sector-month level including multiple lags of material prices, and sector and time fixed effects to account for time-varying economy-wide demand factors and time-invariant sector characteristics. Our baseline specification follows previous literature on pass-through estimates (Gopinath, Itskhoki and Rigobon, 2010). We complement this specification with OLS and IV local projection estimates (Jordà and Taylor, 2025), which we use as robustness checks to account potential misspecification of the lag structure and possible endogeneity of material prices.

Our results show that material's price shocks are only partially passed through along the supply chain. On average, a 1% increase in material prices raises producer prices by about 0.6%, while consumer prices increase by only 0.3%. These effects unfold gradually over time. For producer prices, about two thirds of the adjustment occurs in the first month, with the transmission reaching its long-run level after about four months. For consumer prices, the response is more delayed, with estimates close to zero at the beginning and increasing smoothly over a year.

Using these estimates and the observed average monthly change in material prices over the sample period, we quantify the contribution of material prices to the observed variation in producer and consumer prices. We find that material prices can account, on average, for 84% and 30% of the post-COVID surge in producer and consumer prices, respectively.

We also document substantial heterogeneity across sectors. The transmission of material price shocks to producer prices is significantly lower in more concentrated industries, suggesting that market power dampens the pass-through of cost shocks to producer prices and, in turn, limits cost pressures and price volatility further down the supply chain. These findings highlight the role of market structure in shaping inflation dynamics in Colombia's processed food industry. While we focus on a specific country to achieve our goal, our findings are readily generalizable to other developing economies with broadly similar patterns of exposure to international trade and domestic market structure.

Due to data limitations, we do not explicitly account for distribution margins or retail market power, so the estimated transmission to consumer prices should be interpreted as a reduced-form measure of the transmission of materials price shocks that captures both production and distribution-side adjustments. Despite this limitation, our approach allows us to estimate the magnitude and dynamics of this transmission along the processed food value chain and to assess how market concentration in the processing stage shapes these effects.

This paper contributes to the literature studying agri-food value chains in developing countries. While there has been several works understanding food supply at the farm level, other aspects of the chain beyond the farm remain unexplored (Barrett et al., 2022). A broad literature has shown that supply decisions at the farm level are influenced by market frictions, and other institutional and technological constraints (Janvry, Fafchamps and Sadoulet, 1991; Barrett, 2008; Key, Sadoulet and Janvry, 2000). These factors can weaken supply responses to price shocks and exacerbate price volatility. The expansion of the food processing industry has the potential to transform these price dynamics. However, little is known about the factors underlying processed food prices and their exposure to cost shocks. This paper contributes to filling this gap.

More specifically, we contribute to the literature exploring the determinants of food prices in developing countries. Previous work has shown that weather shocks, energy prices, and input prices are key drivers of domestic food price dynamics, both through supply conditions and production costs (Brown and Kshirsagar, 2015; Mawejje, 2016; Dillon and Barrett, 2016). Other studies have emphasized the role of international price transmission, documenting how global food prices affect domestic markets through food imports (Emediegwu and Rogna, 2024; Bekkers et al., 2017; Chen and Villoria, 2019). However, this literature has largely focused on unprocessed foods, with limited attention to processed food prices. In this paper, we show that materials prices are an important determinant of processed food prices in developing countries, and that market power attenuates this realtionship. This may reduce price volatility by dampening price increases during periods of rising costs, but also limiting price declines when costs ease.

We also contribute to the literature that studies the sources of nominal rigidity in end-consumer prices. One strand of this literature focuses on exchange rate pass-through and shows that the degree of transmission depends on factors such as the invoicing currency and the share of traded costs (Campa and Goldberg, 2005; Gaulier, Lahrèche-révil and Méjean, 2008; Gopinath, Itskhoki and Rigobon, 2010; Nakamura and Zerom, 2010; Ben Cheikh and Louhichi, 2015; Rincón-Castro, Rodríguez-Niño and Castro-Pantoja, 2017). Another strand emphasizes the role of market power in explaining the incomplete pass-through of exchange rate and cost shocks to consumer prices (Sexton, 2000; Burstein, Nevo and Parker, 2005; Nakamura and Zerom, 2010; Goldberg and Hellerstein, 2013; Bonnet et al., 2013; De Loecker et al., 2016; Hong and Li, 2017; Sexton and Xia, 2018; Carranza et al., 2024; Clavijo and Florez, 2026). We extend this literature by providing new empirical evidence that firm market power can reduce the extent at which cost shocks are transmitted to end-consumer prices, even in a context of sizable international input price shocks and strong global inflationary pressures.

This paper is structured as follows. Section 2 provides background information on the processed food industry in Colombia, outlines the conceptual framework that guides the empirical analysis, and describes our data sources and key variables. Section 3 details the empirical strategy used to estimate the degree and dynamics of cost transmission. Section 4 presents the results, quantifying the transmission of materials price shocks to producer and consumer prices and highlighting the role of market concentration. Finally, Section 5 concludes.

# 2 Background and data

## 2.1 The processed food industry in Colombia

Figure 1 presents the annual growth rates of average consumer, producer, and material price indices across food industry sectors in Colombia. The figure shows a strong correlation among these prices, with producer and consumer prices following changes in material prices with a lag and smoother variations. The figure also illustrates the sharp increase in processed food prices in Colombia following the global inflation shock. Both producer and consumer prices began to rise rapidly in early 2021, reaching peaks in March 2022 and March 2023, respectively. During this period, annual inflation rates in consumer prices exceeded 20%—approximately four times their pre-pandemic average. This surge in output prices closely followed a steep increase in input costs, with materials prices reaching an annual inflation rate of 31% in January 2022.

The inflation dynamics observed in Colombia mirror patterns documented in other countries, suggesting a role of international shocks shaping local food prices in Colombia. The country's processed food industry is exposed to international shocks for two reasons. First, many sectors depend heavily on imported inputs. Industries such as edible oils, cereals, and dairy products rely extensively on global commodity markets for raw materials, making production costs sensitive to fluctuations in international prices and exchange rate movements.[5] Second, Colombia participates actively in international food trade, acting as a net importer of some products, such as pork and milk powder, and a net exporter of others, such as coffee. As a result, international price shocks can affect domestic food prices through its effects on production costs and through changes in the relative prices of domestically produced and imported foods that compete in local markets.

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[5] The animal feed sector in Colombia relies heavily on imported soybeans and maize. Although its output is not directly consumed by households, it supplies key inputs to meat processing and is therefore indirectly captured in the analysis.

**Figure 1:** Annual inflation in the food industry

Source: DANE. Authors' calculations.
Notes: The vertical axis reports year-over-year growth rates, while the horizontal axis shows the month. Consumer and producer price indexes correspond to the annual percentage change in prices of manufactured food product sectors, and the materials price index reflects the annual variation in the prices of inputs used in each manufactured food sector.

The strength of these channels varies substantially across sectors. Differences in input requirements and each sector's position in international markets generate heterogeneous exposure to external shocks. Appendix Section A describes the value chain of each sector, highlighting its main inputs, outputs, and sources of price variation, while Appendix Table C.1 summarizes the main sources of price variation.

Figure C.1 illustrates large differences in material use across sectors, reflecting variation in production technologies and the degree of processing required. Sugar manufacturing, coffee threshing, and grain milling and starches rely more heavily on raw agricultural inputs, whereas bakery and the manufacture of chocolate and sugar confectionery depend more on processed inputs, including starches and dairy products. Market concentration also differs markedly across sectors. Figure C.3 shows that sugar manufacturing, chocolate and confectionery, and bakery are the most concentrated sectors, while meat processing and grain milling and starches are the least concentrated.

In the empirical strategy we propose below, we use this heterogeneity across sectors in shock exposure and market structure to estimate the effects of material price shocks on output prices and to explore how this transmission varies by market power. Before presenting the empirical strategy, the next section introduces the conceptual framework that guides our empirical analysis and describes our data.

## 2.2 Conceptual framework

Cost pass-through refers to the extent to which final prices respond to changes in input costs. In a perfectly competitive market, one would expect complete pass-through, whereby any increase in production costs is fully reflected in the prices paid by consumers. In contrast, in markets with imperfect competition where the price elasticity of demand facing the firms increases with prices, firms' ability to set and adjust markups leads to incomplete pass-through.[6] A common finding in the literature that examines the role of market structure and firms' relationships along the value chain in exchange rate and cost pass-through is that greater market power leads to lower pass-through, as firms can partially or fully absorb shocks (Goldberg and Verboven, 2001; Nakamura and Zerom, 2010; Bonnet et al., 2013; Goldberg and Hellerstein, 2013; De Loecker et al., 2016; Hong and Li, 2017; Clavijo and Florez, 2026).

We follow this conceptual framework and test whether market concentration is a significant predictor of lower cost pass-through in our context. Our empirical analysis is guided by the value chain illustrated in Figure 2, which provides a simplified representation of the main stages of the processed food value chain, from the procurement of raw materials to final sales to consumers.

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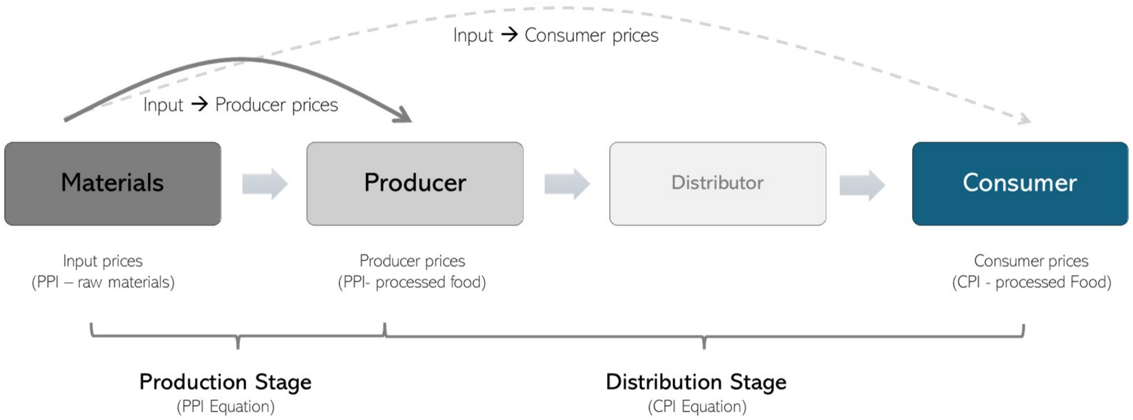
[6] For detailed discussions on the relationship of variable markups and incomplete pass-through, see Goldberg and Hellerstein (2013) and De Loecker et al. (2016).

**Figure 2:** Typical value chain



Source: Authors' own diagram.
Notes: The figure provides a stylized representation of a typical value chain within a production segment. Consumers purchase final goods from distributors, who in turn acquire them from producers that use materials as inputs.

Given the structure of the available data, we organize the analysis into two stages. First, in the *production stage*, we examine the transmission of changes in materials costs to processed food producer prices. This stage identifies the extent to which input cost shocks are passed through during the industrial transformation process and assesses the role of market structure in shaping pass-through. Second, in the *distribution stage*, we evaluate the transmission of material cost changes to final consumer prices. Due to data limitations, we do not explicitly account for distribution margins; accordingly, this stage captures only the direct transmission from industrial input costs to consumer prices.

## 2.3 Data

We combine multiple sources of data to analyze the dynamics of prices and costs in the food processing industry in Colombia. Our dataset integrates firm-level information on material use with sector-level data on producer prices and product-level data on consumer prices, import prices, and international commodity prices. Using harmonized product and sector classifications, we aggregate these data to construct price indices for consumer, producer, and material prices at the sector-month level spanning January 2015 to December 2023.

We define sectors using the International Standard Industrial Classification, Revision 4, adapted for Colombia (ISIC Rev. 4 A.C.). We focus on processed food activities, which include the processing and preservation of meat, fish, and seafood; the manufacture of vegetable and animal oils and fats; dairy products; grain mill products, starches, and starch derivatives; coffee threshing; sugar; bakery products; cocoa, chocolate, and confectionery; and other food products. In Appendix A, we provide a detailed description of the value chain for each of these sectors in the Colombian context.

Our data come from several sources. Producer prices are obtained from the Monthly Manufacturing Survey (EMMET), materials prices from the Producer Price Index (PPI), material use from the Annual Manufacturing Survey (EAM), consumer prices from the Consumer Price Index (CPI), commodity prices from the World Bank's Pink Sheet database, and import prices from customs records. All datasets are collected by the Colombian Bureau of Statistics (DANE). Below we describe the construction of our main variables using these data. Summary statistics of these variables are reported in Appendix Table C.2. Additional details on the data sources and variable construction are provided in Appendix B.

**Processed food price indices.** Our outcome variables are food price indices at two stages of the value chain: (i) the producer level and (ii) the consumer level. The producer price index is constructed as the ratio of sector-level nominal to real production indices from EMMET. The consumer price index is obtained by aggregating product-level CPI series using ISIC industry classifications.

**Material price index.** Our main explanatory variable is a sector-level materials price index, which we construct as a weighted average of material-specific PPIs. Weights reflect each material's average share in sector purchases over 2014–2021, based on firm level EAM data. Appendix Table C.1 reports the materials with the largest weights in each sector. To illustrate our calculation, consider the meat processing and preservation sector. According to the EAM, during the period of analysis, firms allocated approximately 70% of their material purchases to live animals, 15% to meat and oils, 6% to fish, and the remaining 9% to other products. Since monthly PPIs are available for each of these material categories, we construct a sector-level index by applying the corresponding input shares as weights to the respective PPIs and taking the weighted average.

**Commodity price index.** We compute a sector-level commodity price index as a weighted average of international commodity prices (in U.S. dollars), where weights reflect the share of imported materials reported in EAM by firms in each sector. Appendix Figure C.2 shows that agricultural commodities, meats and oils, and starch products are the main imported inputs across sectors. As explained below, in alternative specifications we use this measure as an instrumental variable for the materials price index.

**Import prices.** Our specifications control for the prices of imported food. We follow Garavito, López and Montes (2011) and construct an imported food price index using product-level information on import prices from customs data, which we aggregate at the sector level with a modified Paasche index.

**Market concentration.** A key variable in our analysis is market power, which is not directly observed. Following the literature, we proxy it using a sector-level Herfindahl–Hirschman Index (HHI), a measure of market concentration computed from firm-level gross output in the EAM for 2014. Specifically, let $s$ denote sectors; the HHI is computed as:

$$HHI_{st_0} = \sum_{i=1}^{N_s} \varsigma_{it_0}^2,$$

where $\varsigma_{it_0}$ denotes firm $i$'s market share at the beginning of the sample period, and $N_s$ is the total number of firms in sector $s$.[7]

# 3 Empirical strategy

This section presents the econometric specifications we use to estimate the transmission of materials prices to processed food prices along the value chain and the role of market structure in shaping this transmission. We introduce our baseline specification, discuss the identification challenges, and describe alternative specifications we present to check the robustness of our results.

## 3.1 Transmission to producer prices

We estimate the transmission of materials prices to producer prices, following the standard approach in the pass-through literature (e.g., Gopinath, Itskhoki and Rigobon (2010)) with the specification

$$\Delta pp_{st} = \beta_0 + \underbrace{\sum_{j=0}^{J} \beta_1^j}_{\text{Pass-through}} \Delta PPI_{st-j}^M + \sum_{j=0}^{J} \theta^j \Delta P_{st-j}^* + \gamma_s + \gamma_t + \epsilon_{st}, \tag{1}$$

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[7] The Herfindahl–Hirschman Index (HHI) is a widely used measure of market concentration in both academic research and policy analysis. In our analysis, HHI is normalized to lie between 0 and 1. Antitrust authorities such as the U.S. Department of Justice typically report HHI on a 0–10,000 scale; under that convention, markets are classified as unconcentrated if HHI $<$ 1500, moderately concentrated if 1500 $\leq$ HHI $<$ 2500, and highly concentrated if HHI $\geq$ 2500 (see Department of Justice (2010)).

where $\Delta$ denotes the first-difference operator, $pp_{st}$ is the log of processed foods producer price index for sector $s$'s at month $t$. $PPI^M_{st-j}$ is the log of sector $s$'s materials price index, and $P^*_{st-j}$ is the log of sector $s$'s imported food price index at month $t-j$ with $j = 0, 1, \ldots, J$. $\gamma_s$ and $\gamma_t$ denote sector and time fixed effects, respectively; and $\epsilon_{st}$ is an error term.

Sector fixed effects account for systematic differences across sectors in the growth rates of materials and output prices, while time fixed effects capture aggregate shocks common to all sectors, such as aggregate demand shocks. Identification therefore relies on sector-specific deviations in the growth of materials prices relative to each sector's mean over the sample period. We interpret these deviations in the growth rate of material prices, relative to the sector-specific mean and net of aggregate factors, as shocks to material prices.

The cumulative effect of a materials cost shock on producer prices is captured by the sum of coefficients $\sum_{j=0}^{J} \beta_1^j$. To capture one year long transmission dynamics, in our main specification we include 11 lags of our explanatory variable (i.e., we set $J = 11$). Following Gopinath, Itskhoki and Rigobon (2010), we also estimate cumulative effects using up to $J = 1, \ldots, 11$ lags to assess differences in the transmission across different time horizons.

### The role of market structure

To assess the role of market structure in shaping the transmission of material price shocks, we augment equation (1) by interacting materials price changes with a measure of sector-level concentration. Specifically, we estimate:

$$\begin{aligned}\Delta pp_{st} = \beta_0 + \sum_{j=0}^{J} \beta_1^j \Delta PPI^M_{st-j} + \sum_{j=0}^{J} \beta_2^j \, HHI_{s0} \times \Delta PPI^M_{st-j} \\ + \sum_{j=0}^{J} \theta^j \Delta P^*{}_{st-j} + \gamma_s + \gamma_t + \epsilon_{st}.\end{aligned} \tag{2}$$

where $HHI_{s0}$ is equal to 1 if sector $s$ has a Herfindahl–Hirschman Index above the median in

2014, the beginning of our sample period.[8] As before, $\sum_{j=0}^{J} \beta_1^j$ captures the mean $J$-month transmission of materials prices in low-concentration sectors, while $\sum_{j=0}^{J} \beta_2^j$ measures the differential effect in high-concentration sectors. Therefore, for a high-concentration sector the total transmission is $\sum_{j=0}^{J} \beta_1^j + \sum_{j=0}^{J} \beta_2^j$. A negative $\sum_{j=0}^{J} \beta_2^j$ implies that more concentrated sectors exhibit a lower transmission of materials price variations to producer prices.

## 3.2 Transmission to consumer prices

We next examine the transmission of materials price shocks to consumer prices by estimating a specification analogous to Equation (1), using the change in the log of the consumer price index as the dependent variable. This exercise provides an estimate of the transmission of materials price shocks to final consumers.

These results should be interpreted with caution. Due to data limitations, we are unable to explicitly account for key cost components and pricing decisions at the retail stage of the value chain. As a result, the estimated transmission to consumer prices reflects the reduced-form effect of industrial input cost shocks to final prices and does not allow us to separately identify pricing behavior at the retail level or the role of retail market power in the pass-through dynamics.

## 3.3 Identification and robustness

Our empirical strategy aims to estimate reduced-form effects rather than a fully structural parameter. A common identification challenge across all specifications is the potential simultaneity between materials prices and processed food prices. Sector-specific demand shocks may simultaneously affect input prices, producer prices, and consumer prices along the value

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[8] Firm-level markups would provide a direct measure of market power; however, these are not observable in our data. We therefore use the HHI as a proxy for market power.

chain. For instance, an unexpected increase in demand for dairy products may increase both the demand for raw milk and its price, as well as the final product price. In this case, the coefficient estimates from a regression of output prices on input prices would yield biased estimates by capturing both cost transmission and demand-driven price changes.

A natural approach would be to instrument the materials price index using exogenous variation in international commodity prices. However, implementing this strategy in a distributed-lag framework like the one proposed above presents important challenges. Because our baseline specification includes up to eleven lags of materials prices, the corresponding IV specification requires instrumenting a large number of endogenous regressors simultaneously. In practice, this leads to a weak first stage, as serial correlation in commodity prices limits the sources of independent variation to strongly predict each lagged component.

To address this limitation, we complement our baseline specification with a local projections approach, which reduces the dimensionality of the IV estimation by relying on a single contemporaneous endogenous regressor at each horizon, and has been shown to be more robust to misspecification in the lag structure (Jordà and Taylor, 2025). We estimate a local projection specification both with OLS and IV, and compare these results with those in our baseline specification. Appendix Section D provides details of the local projection estimation. As instrumental variables, we use the contemporaneous sector-level commodity price index and its lags as instruments for the materials price index.

Our preferred specification remains the distributed-lag model estimated by OLS, which follows the standard approach in the pass-through literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). We use the local projections results, estimated by both OLS and IV, as a robustness check. Several features of the data and empirical design mitigate identification concerns in our OLS estimations. First, the use of fixed material weights reduces the endogeneity arising from input substitution. Second, the inclusion of sector and time fixed effects absorbs common demand shocks. Third, Colombia's price-taker status in international materials markets, together with the importance of imported inputs in the food processing industry, makes it plausible that, conditional on sector and time fixed effects, and import prices, most of the variation in the growth rate of material prices is driven by international shocks that are exogenous to local conditions.

## 3.4 Discussion of limitations

Our empirical analysis is subject to several limitations that should be considered when interpreting the results. First, we rely on sector-level price indices rather than price levels, which limits our ability to draw inferences about absolute price differences across products, firms, or stages of the supply chain. Consequently, our estimates capture relative price adjustments over time rather than absolute changes in price levels.

Second, sectoral coverage is constrained by data availability in the EMMET survey, which determines both the set of industries included in the analysis and the level of aggregation at which prices and costs can be observed. While the EMMET provides detailed and high-frequency information on production and prices, it does not allow us to study firm-level heterogeneity in pass-through behavior.

Finally, our framework does not explicitly account for distribution margins or retail market power, which may play an important role in shaping the transmission of cost shocks from producers to consumers. As a result, estimated transmission to consumer prices should be interpreted as a reduced-form measure that reflects both production-side cost adjustments and pricing behavior along the distribution segment of the supply chain. Despite these limitations, the empirical strategy is well suited to estimate the dynamics and magnitude of cost transmission at different stages of the processed food value chain and to assess how market concentration mediates these dynamics.

# 4 Results

In this section, we present the results of our empirical analysis. We begin by documenting the transmission of materials prices to producer prices, including the role of market concentration at this stage of the supply chain. We then report the estimates of the transmission from material prices to consumer prices. Our baseline results come from the distributed-lag specification in Equation (1), which we estimate by OLS. We also report OLS and IV estimates from the local projection specification. The descriptive statistics of all variables included in our estimations are reported in Appendix Table C.2.

## 4.1 Effects on producer prices

Table 1 reports the results of the estimation of Equation (1) with the change in log producer prices as outcome. Column (1) reports the OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). Columns (2) and (3) report the OLS and IV local projections estimates (Jordà and Taylor, 2025), respectively.

We find a transmission of materials prices to producer prices that is positive and statistically significant. In the baseline OLS specification (column 1), a 1 percent increase in materials prices leads to a cumulative increase of approximately 0.62 percent in producer prices over a one-year horizon. That is, a 1% increase in materials prices leads to a 0.62% increase in producer prices accumulated over a one-year horizon.

We find similar results in the OLS and IV local projection specifications reported in columns (2) and (3), with cumulative transmission, slightly larger in the IV estimates, but not statistically different across specifications. Moreover, Appendix Table C.3 shows that the cumulative effects of import prices of processed food are smaller in magnitude than that of material prices and not always statistically significant, underscoring the dominant role of materials costs faced by domestic firms in shaping processed food price dynamics.

**Table 1:** Transmission of materials prices to producer prices

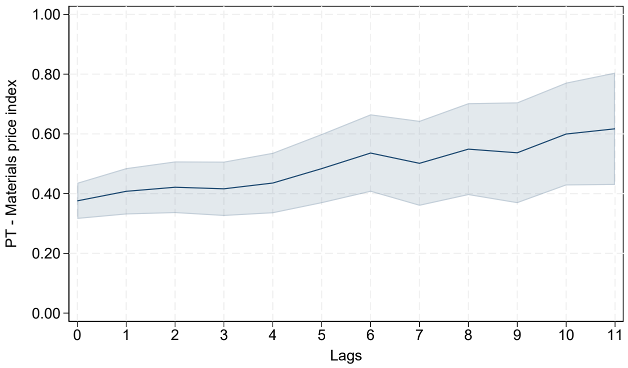
|  | (1)<br>OLS | (2)<br>OLS-LP | (3)<br>IV-LP |
|---|---|---|---|
| $\beta_1^{h=11}$ |  | $0.614^{***}$<br>(0.138) | $0.836^{**}$<br>(0.423) |
| $\sum_{j=0}^{11} \beta_1^j$ | 0.617***<br>(0.096) |  |  |
| F-first |  |  | 11.601 |
| Obs. | 921 | 921 | 906 |

Notes: This table reports the estimated transmission of materials prices to producer prices over a one year horizon. It is calculated as the cumulative effect $\sum_{j=0}^{11} \beta_1^j$ from Equation (1) (col. 1), as well as the coefficient at horizon $h = 11$ ($\beta_1^{h=11}$) for the local projection estimates (cols. 2 and 3). The dependent variable is change in the log producer price index for processed foods and the change in the log materials price index is the main explanatory variable. Column (1) reports standard OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). Columns (2) and (3) report the OLS and IV local projections estimates (Jordà and Taylor, 2025) (see Appendix Section D for details). The instrument is the change in the log of international commodity price indices relevant to each sector, including lags 0 to 3. All specifications include import prices as a control variable, as well as time and sector fixed effects. Standard errors for cumulative effects ($\sum_{j=0}^{11} \beta_1^j$) are computed using the delta method; all other standard errors are heteroskedasticity-robust. Standard errors are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To characterize the dynamics underlying the cumulative transmission, we estimate a sequence of 12 regressions, progressively increasing the number of lags included for the materials price index ($J \in \{0, 1, 2, \ldots, 11\}$). Figure 3 displays the cumulative effects obtained from these regressions, analogous to the estimate reported in column (1) of Table 1. Each point in the figure corresponds to the cumulative effect associated with a given number of lags. The final point, corresponding to eleven lags, coincides with the OLS regression estimate reported in column (1) of Table 1.

The figure shows that the immediate transmission of a materials cost shock to producer prices is close to 0.4. In other words, a 1% increase in materials prices raises producer prices by approximately 0.4% in the same month. The remaining of the total response is delayed, with the transmission reaching its long-run level of 0.6 after about five months. Appendix Figure C.4 shows similar transmission dynamics using local projection estimates, with relatively larger short-run transmission under the IV specification that declines over time.

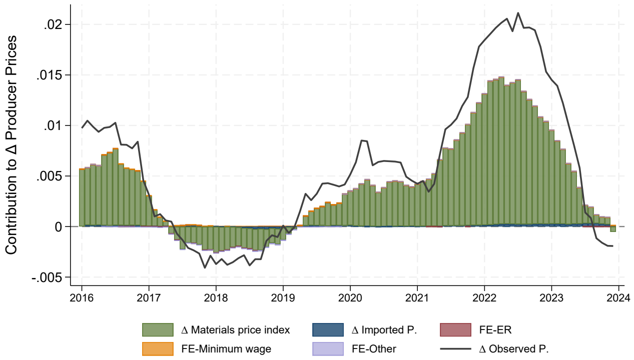
**Figure 3:** Transmission of materials prices to producer prices



Sources: DANE. Authors' elaboration.

Notes: The figure reports cumulative sums $\sum_{j=0}^{J} \beta_1^j$ obtained from $J$ estimations of equation (1). The solid line depicts the sum of coefficients, while the shaded area represents the 95% confidence interval, computed using the delta method. The horizontal axis represents the number of lags from $j = 0$ up to $j = J$ of the change in the materials price index. The dependent variable is the change in the producer price index for processed foods. Figure C.4 presents the corresponding estimates based on local projections.

**Figure 4:** Contributions to observed producer prices



Sources: DANE. Authors' elaboration.

Notes: Each bar represents the 12-month moving average of the contribution of different components to the cross-sector mean of monthly changes in the producer price index for processed foods. Contributions are computed using the estimated coefficients from equation (1) with eleven lags. For each variable, we first compute its cross-sector mean and then apply a 12-month moving average; contributions are obtained by multiplying these smoothed series by the corresponding estimated coefficients. Fixed effects (including exchange rate, minimum wage, and other factors) and residual components are incorporated analogously. Positive and negative contributions are shown separately. The solid line shows the corresponding 12-month moving average of the cross-sector mean of observed monthly changes in producer prices.

Figure 4 presents a decomposition of producer price changes based on the estimated coefficients from specification in column (1) of Table 1. The figure provides a visual representation of the relative importance of materials prices, import prices, and common time effects in explaining observed price dynamics.[9] Following Cruces, Porto and Viollaz (2018), we further decompose the estimated time fixed effects into contributions from exchange rate fluctuations and changes in the statutory minimum wage. Specifically, we regress the time fixed effects from equation (1) on the monthly exchange rate and the statutory minimum wage and use the estimated coefficients to compute the contribution of each variable.

The figure shows that materials prices account for the largest share of monthly price changes, contributing, on average, 68%. Import prices contribute approximately 1.4%, and less than 1% is attributed to common time- and sector-specific factors. Among these common factors, exchange rate movements and changes in the minimum wage explain approximately 36% and 7% of the average time fixed effect, respectively.

The results also indicate indicate that material prices were the primary driver of processed food inflation in the post-COVID period, accounting for about 84% of the cumulative price increases between March 2021 and March 2022.

### 4.1.1 Industry concentration

Figure 5 presents the estimated transmission of materials prices to producer prices over a one-year horizon, distinguishing between high- and low-concentration sectors. We estimate equation (2), where $HHI_{s,t_0}$ is an indicator for sectors above the median. The cumulative effect equals $\sum_{j=0}^{11} \beta_1^j$ for low-concentration sectors and $\sum_{j=0}^{11}(\beta_1^j + \beta_2^j)$ for high-concentration sectors. Figure 5 reports these estimates with 95% confidence intervals. Regression results are reported in Appendix Table C.4. We classify sectors into high- and low-concentration

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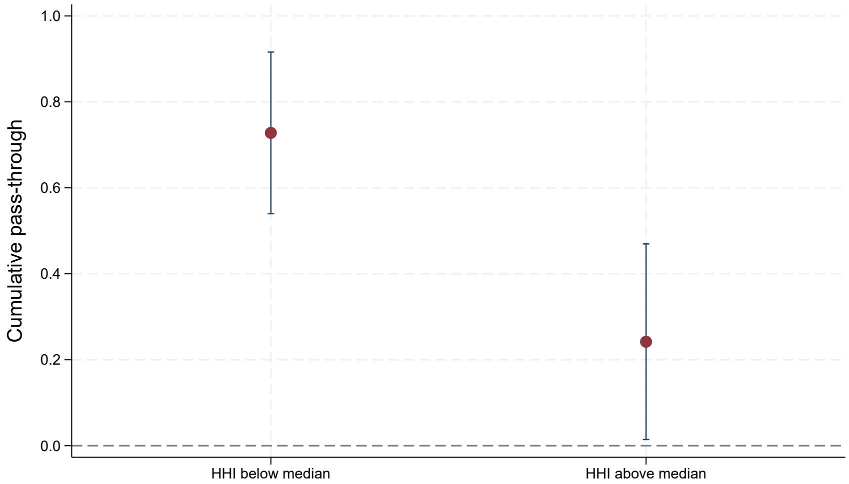
[9] For each variable, we first compute the cross-sector mean at each point in time and then smooth the resulting series using a 12-month moving average.

**Figure 5:** Cumulative transmission for low- and high-HHI sectors



Notes: The figure shows cumulative transmission of material prices to producer prices for sectors with below- and above-median HHI. The estimate for high-HHI sectors is obtained as the sum of the baseline cumulative coefficient and the cumulative interaction effect. Vertical lines represent 95% confidence intervals computed using the delta method. Estimates are based on the OLS specification reported in Table C.4.

groups based on the median HHI.[10]

The results indicate that, on average, more concentrated sectors exhibit lower transmission of materials price changes to producer prices than less concentrated sectors. In low-concentration sectors, a 1 percent increase in materials prices raises producer prices by about 0.7 percent over one year, compared to 0.3 percent in high-concentration sectors. This is consistent with the literature showing that lower competition—proxied by higher concentration—dampens the transmission of cost shocks to output prices.

## 4.2 Effects on consumer prices

We next turn to the transmission of materials cost shocks to final prices paid by consumers. Table 2 reports the estimates obtained from a specification analogous to Equation (1), using the change in log consumer prices as the dependent variable. As before, column (1) reports

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[10] See Figure C.3 in the appendix for the list of sectors in each group.

standard OLS estimates based on the baseline specification, and columns (2) and (3) present the OLS and IV local projection estimates, respectively. The cumulative transmission is estimated for a one year horizon, as the sum of the contemporaneous and lagged coefficients over a eleven-month horizon for column (1) and the cumulative impulse response over the eleven month horizon for columns (2) and (3).

The transmission from materials prices to consumer prices is lower than to producer prices. Since we observe only the prices of materials used in production and not the full cost structure at the distribution and retail stages, the estimated transmission of materials prices to consumer prices is more limited. The baseline OLS result implies that a 1% increase in materials prices leads to an increase in consumer prices of around 0.3% over eleven months. OLS local projection estimates yield similar results, whereas IV estimates are larger in magnitude.

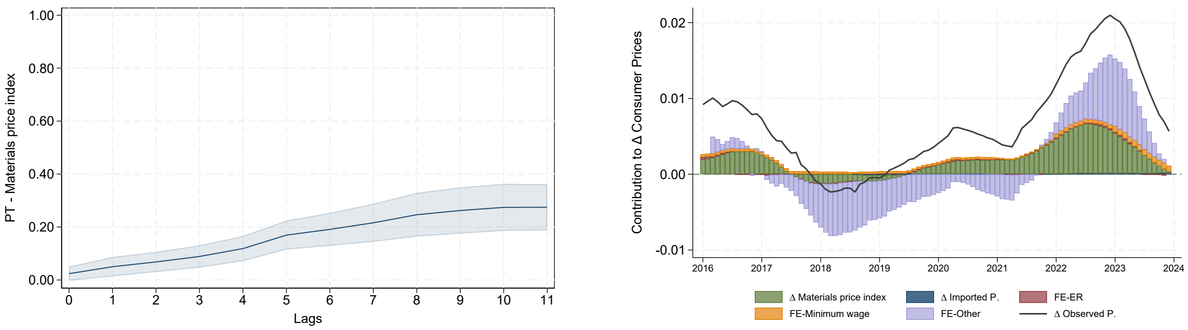
**Table 2:** Transmission of materials prices to consumer prices

| | (1) OLS | (2) OLS-LP | (3) IV-LP |
|---|---|---|---|
| $\beta_1^{h=11}$ | | $0.283^{***}$ | $0.847^{***}$ |
| | | (0.0871) | (0.290) |
| $\sum_{j=0}^{11} \beta_1^j$ | 0.275*** | | |
| | (0.044) | | |
| F-first | | | 11.601 |
| Obs. | 921 | 921 | 906 |

Notes: This table reports the estimated transmission of materials prices to consumer prices over a one year horizon. It is calculated as the cumulative effect $\sum_{j=0}^{11} \beta_1^j$ from Equation (1) (col. 1), as well as the coefficient at horizon $h = 11$ ($\beta_1^{h=11}$) for the local projection estimates (cols. 2 and 3). The dependent variable is change in the log consumer price index for processed foods and the change in the log materials price index is the main explanatory variable. Column (1) reports standard OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). Columns (2) and (3) report the OLS and IV local projections estimates (Jordà and Taylor, 2025) (see Appendix Section D for details). The instrument is the change in the log of international commodity price indices relevant to each sector, including lags 0 to 3. All specifications include import prices as a control variable, as well as time and sector fixed effects. Standard errors for cumulative effects ($\sum_{j=0}^{11} \beta_1^j$) are computed using the delta method; all other standard errors are heteroskedasticity-robust. Standard errors are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel (a) of Figure 6 illustrates the dynamic response of consumer prices to materials price shocks. Each point corresponds to the cumulative effect obtained from regressions with an increasing number of lags. The final point, corresponding to $J = 11$, matches the OLS estimate reported in column (1) of Table 2. We find that materials price shocks do not immediately translate into higher consumer prices, suggesting a marked delay in the transmission of cost shocks to final prices at the retail stage. The contemporaneous transmission is close to zero; as the time horizon increases, the transmission to consumer prices rises smoothly, reaching around 0.3 after about 9 months. This slower transmission of materials prices to consumer prices is consistent with previous findings for the food industry in other countries (see, e.g., Nakamura and Zerom, 2010; Goldberg and Hellerstein, 2013; Alvarez-Blaser et al., 2025; Clavijo and Florez, 2026).

**Figure 6:** Transmission of materials prices to consumer prices



**(a)** Pass-through **(b)** Contributions

Sources: DANE. Authors' elaboration.
Notes: The solid line in Panel (a) depicts the estimated transmission from materials prices to consumer prices (the cumulative sums $\sum_{j=0}^{J} \beta_1^j$ obtained from estimating equation (1) with change in the log of consumer price index as dependent variable). The shaded area represents the 95% confidence interval, computed using the delta method. Each point on the horizontal axis ($J$) corresponds to a specification that includes lags from $j = 0$ up to $j = J$ of the change in the materials price index. Each bar in panel (b) represents the 12-month moving average of the contribution of different components to the cross-sector mean of monthly changes in the consumer price index for processed foods. Contributions are computed using the estimated coefficients from equation (1) with twelve lags. For each variable, we first compute its cross-sector mean and then apply a 12-month moving average; contributions are obtained by multiplying these smoothed series by the corresponding estimated coefficients. Fixed effects (including exchange rate, minimum wage, and other factors) and residual components are incorporated analogously. Positive and negative contributions are shown separately. The solid line shows the corresponding 12-month moving average of the cross-sector mean of observed monthly changes in producer prices.

Panel (b) of Figure 6 decomposes changes in consumer prices over the sample period into the contributions of each explanatory variable, based on the estimated coefficients reported in column (1) of Table 2.[11] As before, the contribution of each variable is constructed

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[11] As in the production stage, for each variable we first compute the cross-sector mean at each point in

by multiplying its smoothed cross-sector mean by the corresponding estimated coefficient. Relative to the production stage, the unexplained component associated with time fixed effects is substantially larger, reflecting the more complex and partially unobserved cost structure at the distribution stage. Nevertheless, materials prices still account approximately 30% of the consumer price surge in the post-COVID period.

Appendix E further shows the transmission from producer prices to consumer prices, with dynamics similar to those observed for the transmission from materials prices to consumer prices.

# 5 Conclusions

This paper examines the transmission of materials price changes to processed food prices along the value chain in developing economies, taking Colombia's processed food industry as a case study. The analysis relies on sector-level price indices constructed from detailed administrative and survey data and on an empirical strategy that allows us to characterize both the magnitude and the dynamics of price transmission.

Our results show that changes in materials prices have had a significant effect on both producer and consumer prices, although transmission is incomplete and occurs with lags along the supply chain. Transmission rates are higher at the production stage than at the distribution stage. In the production stage, a 1% increase in input prices is associated with an increase of approximately 0.6% in producer prices over a year. In contrast, transmission to consumer prices is more limited—on the order of 0.3%—reflecting the more complex cost structure at the distribution stage and the role of additional factors in consumer price formation.

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time and then smooth the resulting series using a 12-month moving average.

The analysis also contributes to the literature on the relationship between market concentration and cost pass-through. Using sector-level concentration as a proxy for market power, we find that producers operating in more concentrated sectors pass on a smaller fraction of input cost shocks, consistent with previous literature showing that market power dampens pass-through.

These findings are particularly relevant for understanding the recent dynamics of processed food prices in developing economies, a period characterized by large exogenous shocks associated with the COVID-19 pandemic and disruptions in global supply chains. More broadly, the results highlight the importance of accounting for both incomplete pass-through and transmission lags when analyzing food price dynamics and their distributional and welfare implications. In this context, policies that affect input cost volatility or market structure may play an important role in shaping food inflation outcomes.

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# Appendix

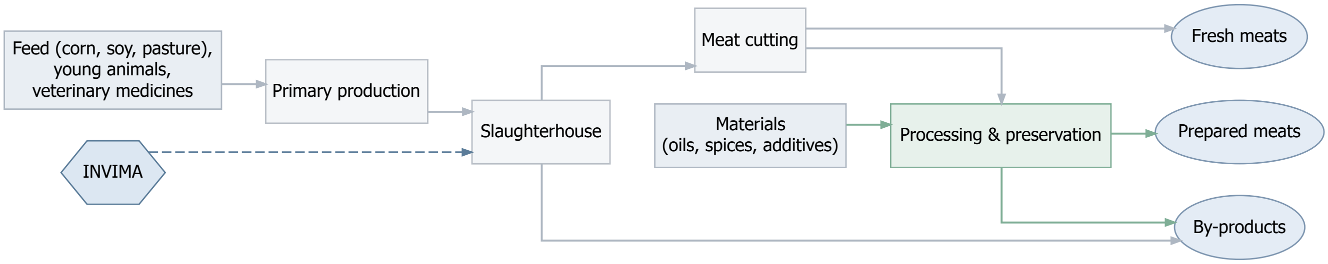
## A The food processing industry in Colombia

This appendix provides a sector-by-sector description of the value chains of the processed food industries included in the analysis. Its objective is to offer an intuitive overview of the activities encompassed by each sector, the main inputs involved in the production process, and the channels through which cost shocks may affect prices. The descriptions are intentionally concise and descriptive and are not intended to provide an exhaustive technological characterization of each industry. This appendix complements the empirical analysis by providing intuition on sector-specific exposure to cost shocks.

**Processing and preservation of meat, fish, crustaceans, and mollusks (ISIC 1010).** Comprises activities related to the transformation of animal-based products into goods suitable for human consumption, including fresh, refrigerated, frozen, and processed products. The production chain begins with livestock and fishing activities and continues through slaughtering, processing, preservation, and packaging stages (see Figure A.1 for a graphical representation of the production chain). A key component of production costs in this sector is animal feed, which relies heavily on grains such as corn and soybeans that are largely imported. As a result, production costs are exposed to international price fluctuations and exchange rate movements, although the adjustment of output prices may be influenced by production cycles, inventories, and contractual arrangements.

**Manufacture of vegetable and animal oils and fats (ISIC 1030).** Includes the production of refined oils and fats intended for final consumption. The production process is based on the processing of oilseeds and crude oils, which may originate from both domestic and international markets (see Figure A.2). Because input prices are closely linked to global

**Figure A.1:** Value Chain: Processing and Preservation of Meat, Fish, Crustaceans, and Mollusks



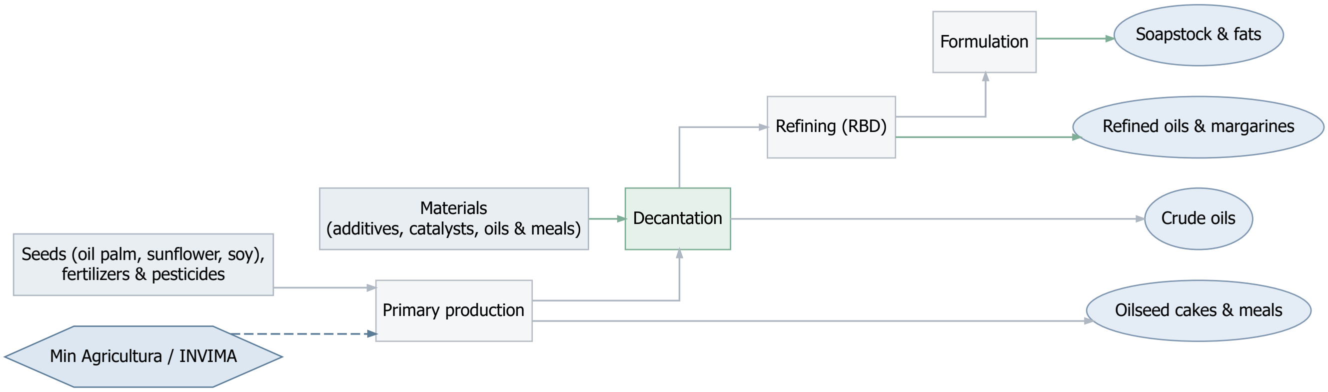
Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1010 sector, illustrating the main stages from raw material inputs to final consumption.

commodity markets, production costs in this sector are strongly influenced by international price dynamics and energy costs.

**Manufacture of dairy products (ISIC 1040).** Encompasses the production of pasteurized milk, cheese, yogurt, and other dairy derivatives. The production chain relies primarily on raw milk as the main input, complemented in some cases by powdered milk, energy, and packaging materials (see Figure A.3). While a significant share of raw milk is sourced domestically, the use of imported powdered milk introduces exposure to international prices. In addition, contractual relationships with suppliers and regulatory features that impose price floors to raw milk may influence the timing and extent of price adjustments.

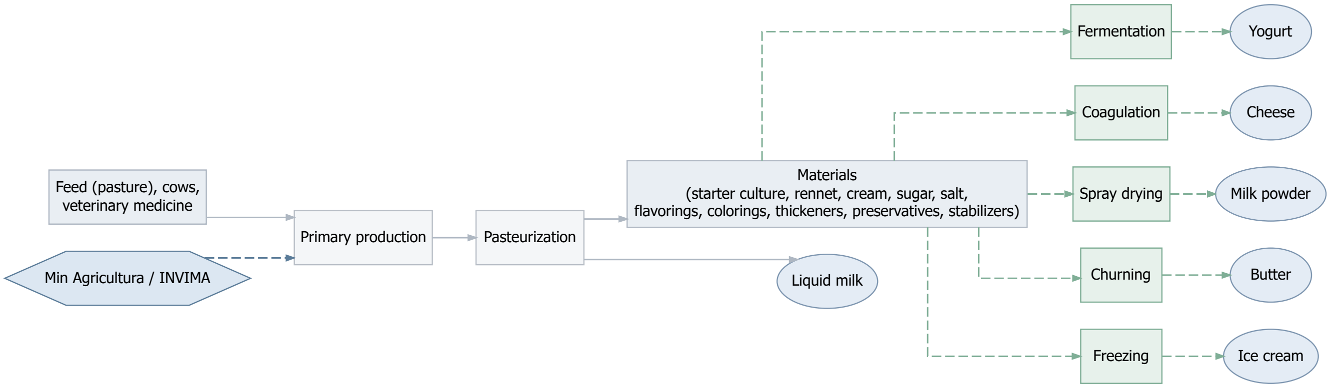
**Manufacture of grain mill products, starches, and related products (ISIC 1050).** Includes the production of wheat and corn flours, starches, and other intermediate goods widely used in food processing. This sector depends heavily on grain inputs, particularly wheat, which is largely imported in Colombia (see Figure A.4). Consequently, production costs are closely tied to international grain prices and exchange rate fluctua-

**Figure A.2:** Value Chain: Manufacture of vegetable and animal oils and fats



Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1030 sector, illustrating the main stages from raw material inputs to final consumption.

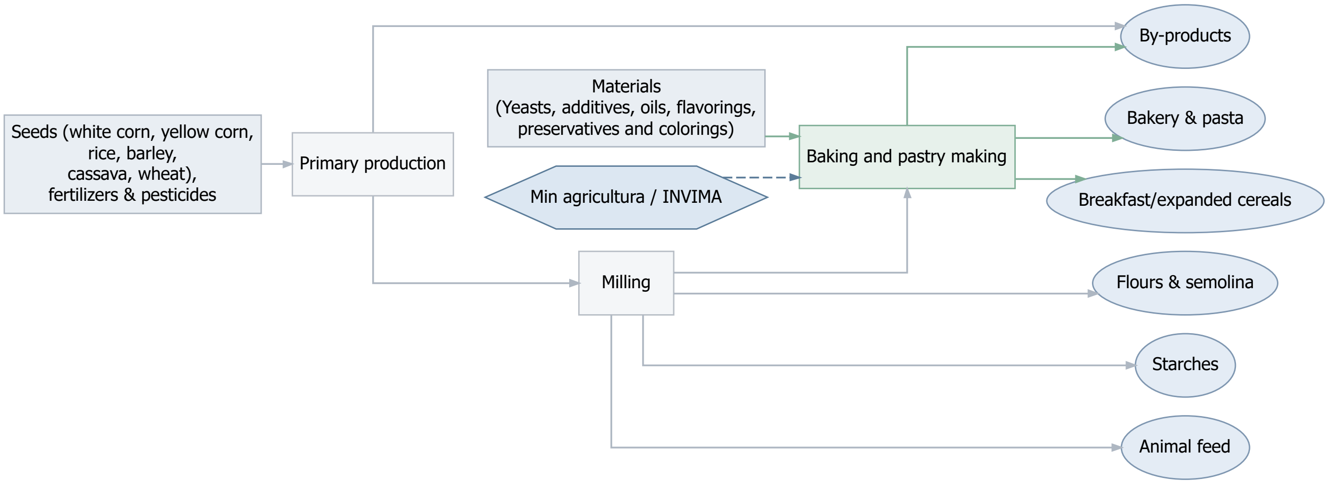
**Figure A.3:** Value Chain: Manufacture of dairy products



Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1040 sector, illustrating the main stages from raw material inputs to final consumption.

tions. Although inventories and procurement contracts may smooth short-term adjustments, changes in input costs represent a key driver of cost dynamics in this sector.

**Figure A.4:** Value Chain: Manufacture of grain mill products, starches, and related products



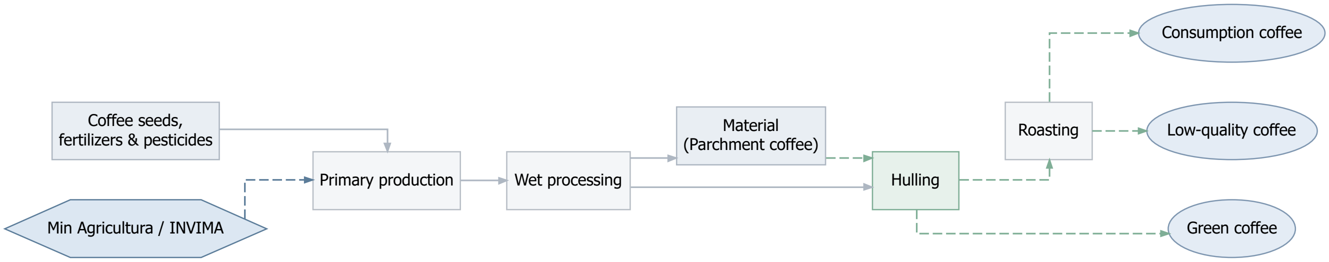
Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1050 sector, illustrating the main stages from raw material inputs to final consumption.

**Coffee threshing (ISIC 1061).** Involves the transformation of parchment coffee into green coffee for domestic roasting and export. In contrast to other processed food sectors, its main input is domestically produced coffee (see Figure A.5), which limits direct exposure to imported intermediate inputs. Nevertheless, prices in this sector are strongly influenced by international coffee markets, implying that external shocks may affect price dynamics.

**Manufacture of sugar (ISIC 1070).** Involves the processing of sugarcane into refined sugar. The production chain relies predominantly on domestically sourced sugarcane and is intensive in energy and transportation services (see Figure A.6). The structure of the sector, characterized by a limited number of large producers and specific institutional arrangements regarding import tariffs, may influence the way changes in international prices are reflected in consumer prices.

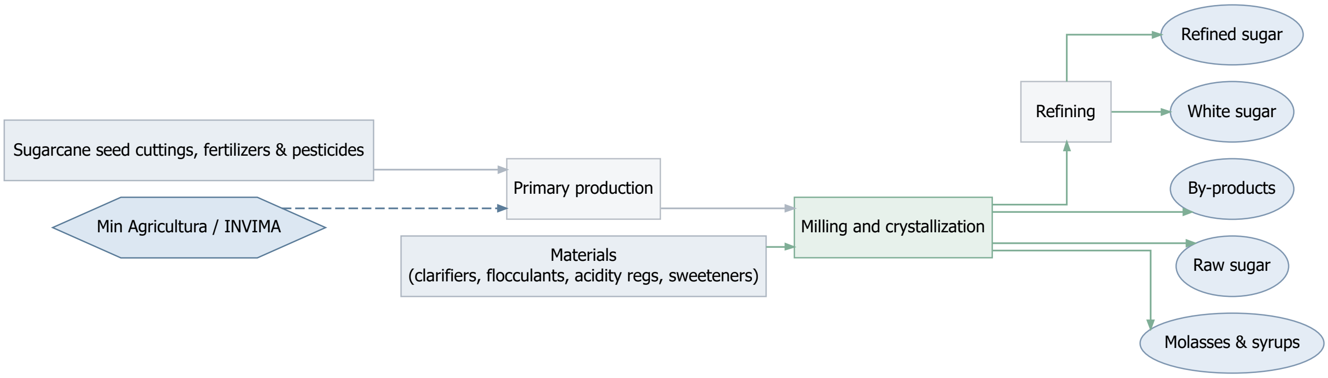
**Manufacture of bakery products (ISIC 1081).** Includes the production of bread,

**Figure A.5:** Value Chain — ISIC 1061: Coffee threshing



Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1061 sector, illustrating the main stages from raw material inputs to final consumption.

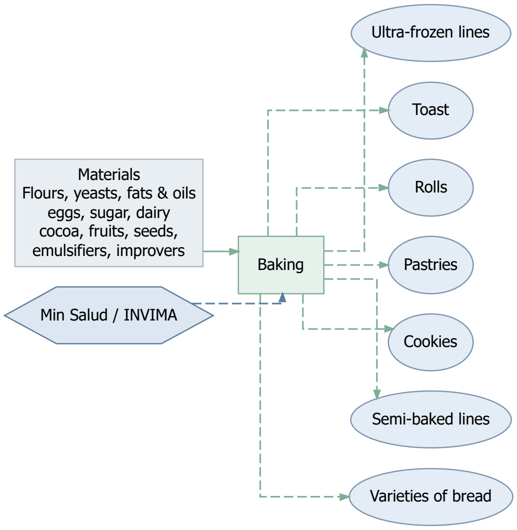
**Figure A.6:** Value Chain: Manufacture of sugar



Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1070 sector, illustrating the main stages from raw material inputs to final consumption.

pastries, and other baked goods. This sector uses inputs such as flour, oils, and sugar, whose prices already embed cost variations of raw materials, such as grains and oilseeds. Production is also relatively labor- and energy-intensive, making labor costs and energy prices important determinants of overall production costs (see Figure A.7). These features contribute to heterogeneous cost dynamics and price adjustment patterns across producers.

**Figure A.7:** Value Chain: Manufacture of bakery products

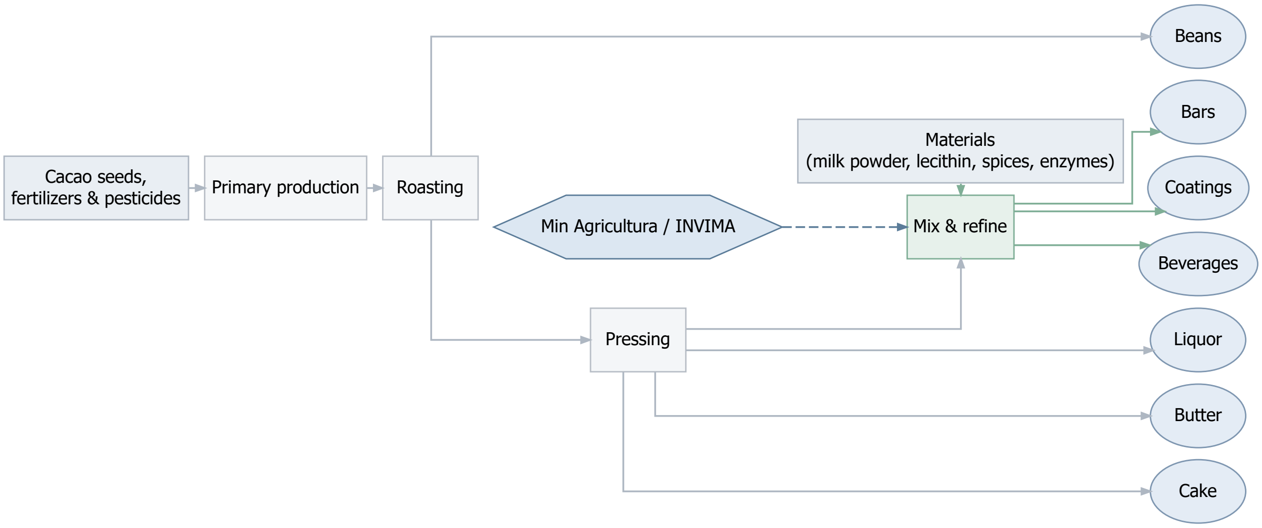


Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1081 sector, illustrating the main stages from raw material inputs to final consumption.

**Manufacture of cocoa, chocolate, and confectionery products (ISIC 1082).** Combines agricultural inputs, such as cocoa, with industrial inputs and packaging materials. Cocoa be domestically sourced and complemented by imports. Moreover, several complementary inputs are linked to international markets (see Figure A.8). The presence of product differentiation and branding implies that pricing decisions may be influenced by demand-side considerations, which can affect the transmission of cost changes to prices.

**Manufacture of other food products n.e.c. (ISIC 1089)**. Comprises a diverse set of activities, including the production of soups, sauces, condiments, and prepared foods. The heterogeneity of products and production processes in this sector translates into substantial variation in input composition and cost exposure. As a result, the channels through which

**Figure A.8:** Value Chain: Manufacture of cocoa, chocolate, and confectionery products



Source: Authors' own diagram.
Notes: The figure presents a stylized representation of the value chain for the ISIC 1082 sector, illustrating the main stages from raw material inputs to final consumption.

cost shocks affect prices are likely to differ across products within this category.

# B Data

This appendix describes the construction of the main variables used in the empirical analysis.

**Processed food price index – Producer level.** *Source:* DANE–EMMET. We compute an implicit producer price index for each sector as the ratio of nominal to real production indices:

$$pp_{st} = \frac{NPI_{st}}{RPI_{st}}, \tag{3}$$

where $PP_{st}$ denotes the producer price index for sector $s$ in month $t$, $NPI_{st}$ is the nominal production index, and $RPI_{st}$ is the real production index.

**Processed food price index – Consumer level.** *Source:* DANE. The sector-level consumer price index is constructed as a weighted average of product-level CPI indices:

$$CPI_{st} = \sum_{i \in G_s} W_{CPI,i} \, CPI_{it}, \tag{4}$$

where $CPI_{it}$ denotes the consumer price index of product $i$ at time $t$, $G_s$ is the set of products belonging to sector $s$, and $W_{CPI,i}$ corresponds to the official CPI expenditure weight published by DANE.

**Material price index.** *Source:* DANE. To construct a sector-level materials price index, we combine information of the input-use weights from the EAM and the PPI. Input-use weights are defined as

$$\omega_{si} = \frac{x_{is}}{\sum_{i=1}^{I} x_{is}},$$

where $x_{is}$ denotes total purchases of input $i$ by firms in sector $s$ over the period 2014–2021, and $I$ is the total number of inputs used by sector $s$. Given $PPI_{it}$ denotes the producer price index of input $i$ at time $t$; the materials price index is then computed as:

$$PPI^M_{st} = \sum_{i=1}^{I} \omega_{si} \, PPI_{it}. \tag{5}$$

**Commodity price index— instrumental variable.** *Sources:* EAM and World Bank. To instrument materials prices, we construct a sector-level commodity price index using international prices. We combine information of the import-based input weights from the EAM and the commodities' international price from the World Bank pink sheet. import-based input weights are defined as

$$\omega^*_{si} = \frac{m_{is}}{\sum_{i=1}^{I^*} m_{is}},$$

where $m_{is}$ denotes total **foreign** purchases of input $i$ by firms in sector $s$ over the period 2014–2021, and $I^*$ is the number of imported inputs used by sector $s$. Considering $P_{it\text{-}USD}$ denotes the international price of commodity $i$ (in U.S. dollars) at time $t$, the sector-level commodity price index is computed as:

$$P_{st\text{-}USD} = \sum_{i=1}^{I^*} \omega^*_{si} \, P_{it\text{-}USD}. \tag{6}$$

and is normalize to december 2018.

**Market concentration.** *Source:* DANE–EAM. Market concentration is measured using the Herfindahl–Hirschman Index (HHI), computed at the beginning of the sample period (2014):

$$HHI_{s,t_0} = \sum_{i=1}^{N_s} \varsigma^2_{i,t_0},$$

where $\varsigma_{i,t_0}$ denotes firm $i$'s market share in sector $s$ at time $t_0$, computed using firm-level manufacturing output values reported in the 2014 EAM, and $N_s$ is the total number of firms in sector $s$.

**Import prices.** *Source:* DANE–DIAN and CONFECÁMARAS. Following Garavito, López and Montes (2011), we construct a Paasche price index using product-level import unit values from DANE–DIAN customs records. Product-level import prices are mapped to sector-level classifications using ISIC codes, under the assumption that imported products within each sector constitute direct competitors to domestically produced goods. Specifically, for each ISIC group we compute:

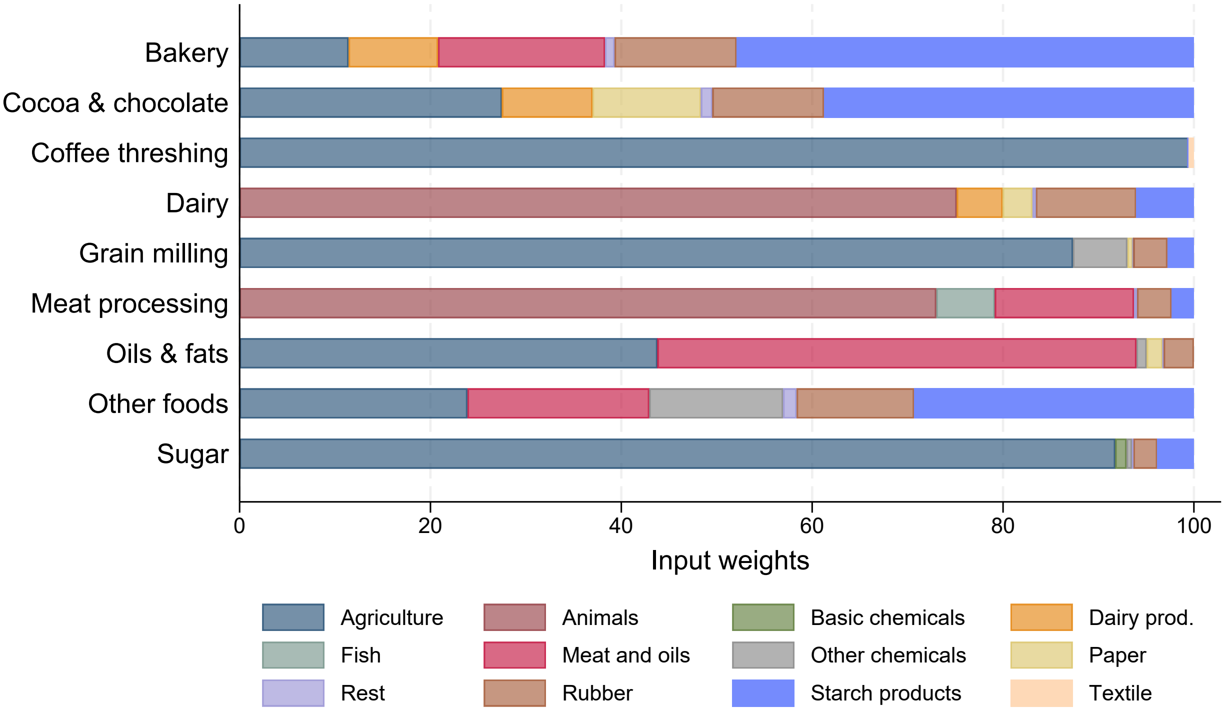
$$P_T^{ISIC} = \sum_{i=1}^{n} w_{i,2019} \frac{P_{i,T}}{\bar{P}_{i,2019}}, \qquad w_{i,2019} = \frac{\bar{P}_{i,2019}\,\bar{Q}_{i,2019}}{\sum_{i=1}^{n} \bar{P}_{i,2019}\,\bar{Q}_{i,2019}}. \tag{7}$$

Here, $i$ indexes imported products classified at the 10-digit NANDINA level, and $n$ denotes the number of products within each ISIC category. The term $\bar{P}_{i,2019}$ corresponds to the 12-month moving average of the import unit value of product $i$ during the base year 2019, while $\bar{Q}_{i,2019}$ denotes the analogous 12-month moving average of imported volumes.

The term $P_{i,T}$ denotes a 3-month moving average of the import unit value of product $i$ at time $T$, which smooths short-term price fluctuations. By construction, this index corresponds to a modified Laspeyres price index with pre-pandemic fixed weights.

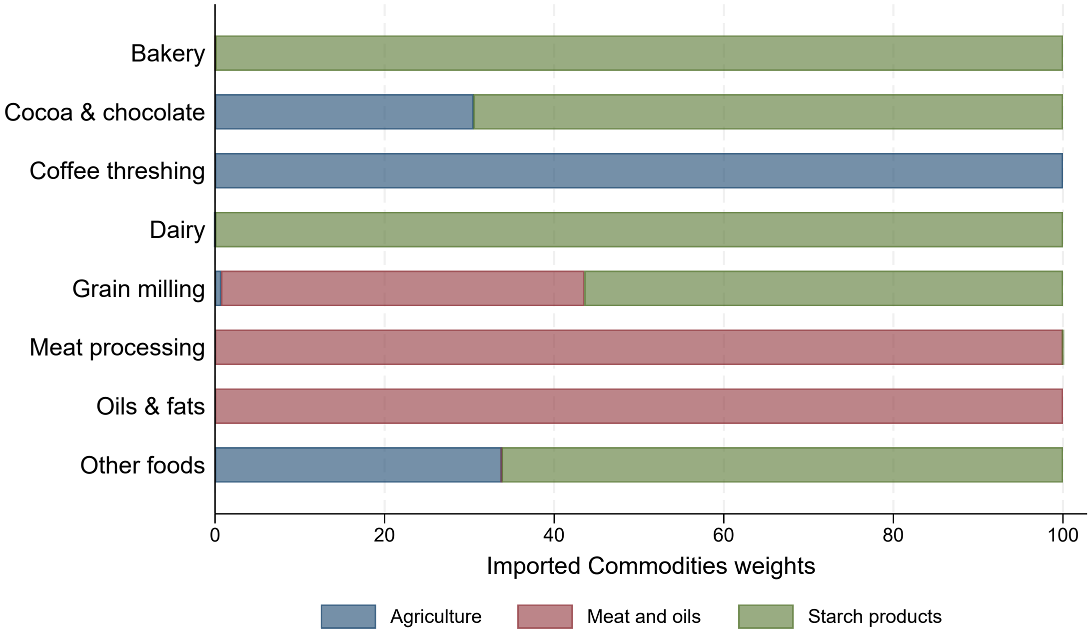
# C Additional Figures and Tables

**Figure C.1:** Inputs proportion by sector



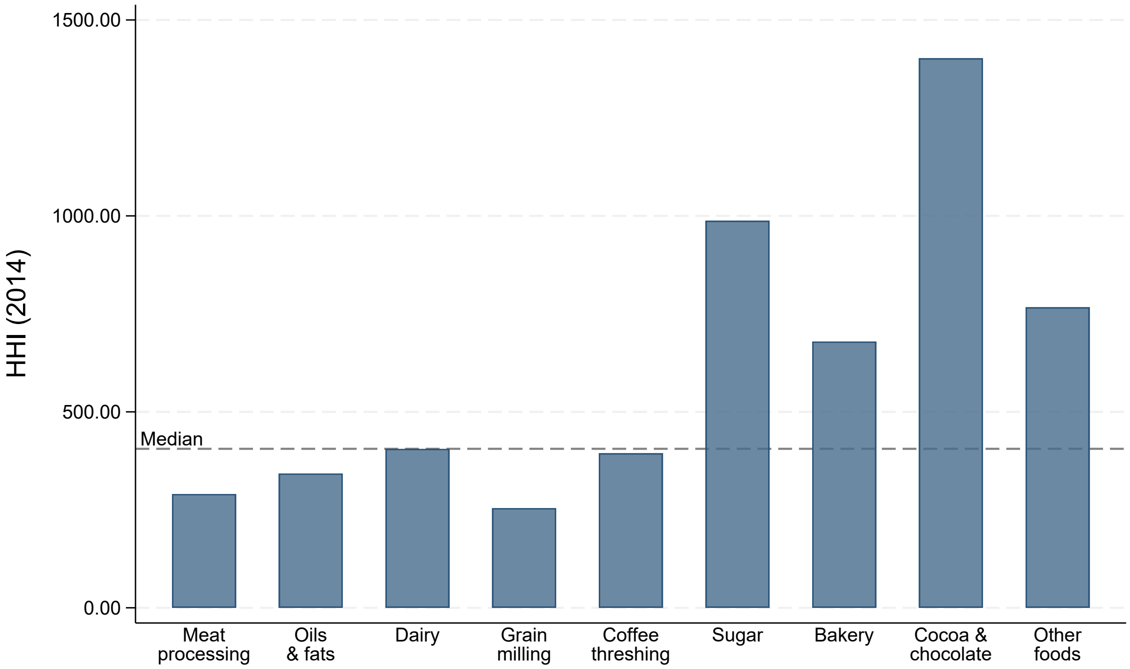
Sources: DANE. Authors' elaboration.
Notes: The vertical axis lists processed food sectors (ISIC Rev. 4 A.C. classes 1010–1089), while the horizontal axis shows the share of total input use within each sector. Colors represent different input groups. Each input corresponds to a division of the Central Product Classification Adapted to Colombia (CPC 2.1 A.C.): agriculture to Division 01, animals to Division 02, basic chemicals to Division 34, dairy products to Division 22, fish to Division 04, meat and oils to Division 21, other chemicals to Division 35, paper to Division 32, rubber to Division 36, starch products to Division 23, and textile products to Divisions 26 and 27. The category 'rest' includes products from the remaining divisions that are not among the top five within each sector. The figure highlights substantial heterogeneity in input composition across processed food industries.

**Figure C.2:** Commodities proportion by sector



Sources: DANE. Authors' elaboration.
Notes: The vertical axis lists processed food sectors, and the horizontal axis shows the proportion of commodity use within each sector. Colors represent different commodity groups. Each commodity corresponds to a division of the Central Product Classification Adapted to Colombia (CPC 2.1 A.C.): agriculture to Division 01, meat and oils to Division 21, and starch products to Division 23. The figure highlights heterogeneity in the composition of commodity inputs across sectors.

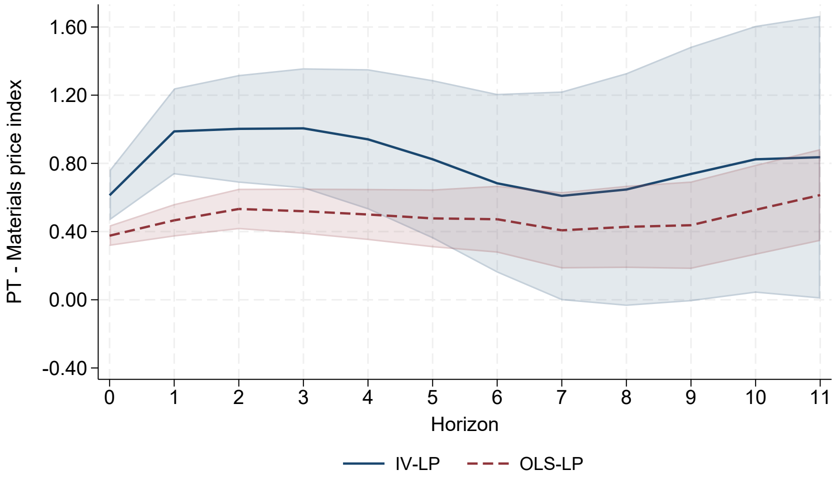
**Figure C.3:** Herfindahl–Hirschman Index across food industry sectors



Sources: DANE. Authors' elaboration.

Notes: The horizontal axis reports processed food sectors, and the vertical axis shows the HHI in 2014. Each sector corresponds to a Class of the ISIC 4.0 A.C.: meat processing to Class 1010, oils and fats to Class 1030, dairy to Class 1040, Grain milling to Class 1050, coffee threshing to Class 1061, sugar to Class 1070, bakery to Class 1081, cocoa and chocolate to Class 1082, and other foods to Class 1089.

**Figure C.4:** Transmission of materials prices to producer prices - Using Local Projections



Sources: DANE. Authors' elaboration.
Notes: The solid and dashed lines depict the estimated transmission based on local projections using instrumental variables (IV-LP) and OLS (OLS-LP). Shaded areas represent 95% confidence intervals. Each point on the horizontal axis ($h$) denotes the projection horizon ($h = 0, \ldots, 11$). For each horizon, the vertical axis reports the estimated cumulative pass-through obtained from a separate local projection regression, where the dependent variable is the cumulative change in the producer price index up to horizon $h$, and the main regressor is the contemporaneous change in the materials price index. In the IV specification, the latter is instrumented using its contemporaneous value and up to three lags of the change in the log of the sector-relevant international commodity price index.

**Table C.1:** Sectoral exposure to input cost shocks in the processed food industry

| Sector | ISIC Rev. 4.0 A.C. | Main inputs | Main transmission channels |
|---|---|---|---|
| Processing and preserving of meat, fish and seafood | 1010 | Live animals, animal feed | Imported feed prices, exchange rate, inventories |
| Manufacture of vegetable and animal oils and fats | 1030 | Oilseeds, crude oils, energy | Global commodity prices |
| Manufacture of dairy products | 1040 | Raw milk, powdered milk, energy | Imported milk powder prices |
| Manufacture of grain mill products, starches and starch products | 1050 | Wheat, corn | International grain prices, exchange rate |
| Coffee threshing | 1061 | Parchment coffee | International coffee prices |
| Manufacture of sugar | 1070 | Sugarcane | Raw sugar produce |
| Manufacture of bakery products | 1081 | Flour, oils, sugar | Input prices embedded upstream |
| Manufacture of cocoa, chocolate and sugar confectionery | 1082 | Cocoa, sugar | Imported inputs |
| Other food products n.e.c. | 1089 | Diverse inputs | Heterogeneous input exposure |

Notes: This table summarizes the main inputs and transmission channels through which input cost shocks affect prices across processed food sectors. The classification is based on sectoral production characteristics and the descriptive evidence presented in Appendix A.

**Table C.2:** Summary statistics

| | Mean | SD |
|---|---|---|
| Producer price (%) | 0.595 | 2.722 |
| Input price (%) | 0.655 | 3.467 |
| Consumer price (%) | 0.627 | 1.256 |
| Import price (%) | 0.343 | 30.595 |
| HHI | 0.061 | 0.036 |
| Commodity price (%) | 0.206 | 5.289 |

Sources: EMMET–DANE, DANE, DIAN–DANE, EAM–DANE, and World Bank.

Notes: producer, input, consumer, import and commodity prices, report average monthly growth rates. The Herfindahl–Hirschman Index (HHI) is computed using sector-level output shares.

**Table C.3:** Transmission of materials prices to producer prices

| | (1)<br>OLS | (2)<br>OLS-LP | (3)<br>IV-LP |
|---|---|---|---|
| $\beta_1^{h=11}$ | | $0.614^{***}$ | $0.836^{**}$ |
| | | (0.138) | (0.423) |
| $\sum_{j=0}^{11} \beta_1^j$ | 0.617*** | | |
| | (0.096) | | |
| $\sum_{j=0}^{11} \beta_p^j *$ | 0.010 | 0.148*** | 0.141*** |
| | (0.008) | (0.046) | (0.049) |
| F-first | | | 11.601 |
| Obs. | 921 | 921 | 906 |

Notes: This table reports the estimated transmission of materials prices to producer prices. The transmission is defined as the cumulative effect $\sum_{j=0}^{11} \beta_1^j$, as well as the coefficient at horizon $h = 11$ ($\beta_1^{h=11}$). The table also reports the cumulative effects of lagged import prices, defined as $\sum_{j=0}^{11} \beta_p^j$. Estimates are obtained from equation (1), using the change in the producer price index for processed foods as the dependent variable and the change in the materials price index as the main explanatory variable. Column (1) reports standard OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). Columns (2) and (3) report estimates based on local projections (Jordà and Taylor, 2025). Column (2) corresponds to local projections estimated by OLS, while column (3) uses an instrumental variables (IV) approach. The instrument is the change in the log of international commodity price indices relevant to each sector, including lags 0 to 3. All specifications include time and sector fixed effects. Standard errors for cumulative effects ($\sum_{j=0}^{11} \cdot$) are computed using the delta method; all other standard errors are heteroskedasticity-robust. Standard errors are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

**Table C.4:** Transmission of materials prices to producer prices: The role of market concentration

| | (1) |
|---|---|
| $\sum_{j=0}^{11} \beta_1^j$ | 0.728***<br>(0.096) |
| $\sum_{j=0}^{11} \beta_2^j$ | -0.486***<br>(0.114) |
| $\sum_{j=0}^{11} \beta_{p*}^j$ | 0.012<br>(0.008) |
| Obs. | 921 |

Notes: This table reports the estimated transmission of materials prices to producer prices across sectors with high and low HHI. Estimates are obtained from equation (1), using the change in the producer price index for processed foods as the dependent variable and the change in the materials price index as the main explanatory variable. The sum ($\sum_{j=0}^{11} \beta_1^j$) represents the sum of coefficients of materials prices without any interaction, while $\sum_{j=0}^{11} \beta_2^j$ represents the sum of coefficients of material prices interacted a dummy equal to one for sectors with above-median HHI. The specification includes time and sector fixed effects. Standard errors are computed using the delta method and are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

# D Local projections

As a robustness exercise, we complement our baseline distributed-lag specification with local projections (Jordà and Taylor, 2025). This approach provides a flexible way to estimate the dynamic response of prices to material cost shocks without imposing restrictions on the lag structure. While our baseline specification follows the standard distributed-lag approach in the pass-through literature (e.g., Gopinath, Itskhoki and Rigobon (2010)), local projections provide a flexible alternative that does not impose a specific dynamic structure and are widely used to estimate impulse responses.

Specifically, for each horizon $h = 0, 1, ..., 11$, we estimate:

$$\Delta p_{s,t+h} = \alpha_h + \beta_1^h \Delta PPI_{st}^M + \theta^h \Delta P_{st}^* + \gamma_s + \gamma_t + \varepsilon_{s,t+h}, \tag{8}$$

where $\Delta p_{s,t+h}$ $\Delta p_{s,t+h}$ denotes the change in prices between period $t$ and $t{+}h$, and $\Delta PPI_{st}^M$ is the the change in materials prices between $t-1$ and $t$. The coefficient $\beta_1^h$ captures the impulse response of prices at horizon $h$ to a one percent increase in materials prices.

We estimate these regressions using both OLS and instrumental variables. In the IV specification, the change in materials prices is instrumented using the sector-specific commodity price index and its lags, following the identification strategy described in Section 3.3.

Compared to the distributed-lag model in equation 1, local projections provide a direct estimate of the dynamic response at each horizon. The two approaches are complementary: while the distributed-lag model imposes structure through lag coefficients, local projections allow for a more flexible characterization of the transmission dynamics.

# E Transmission of Producer Prices to Consumer Prices

**Table E.1:** Transmission of producer prices to consumer prices

| | (1) |
|---|---|
| $\sum_{j=0}^{11} \beta_1^j$ | 0.752*** |
| | (0.060) |
| $\sum_{j=0}^{11} \beta_{p*}^j$ | 0.001 |
| | (0.004) |
| Obs. | 848 |

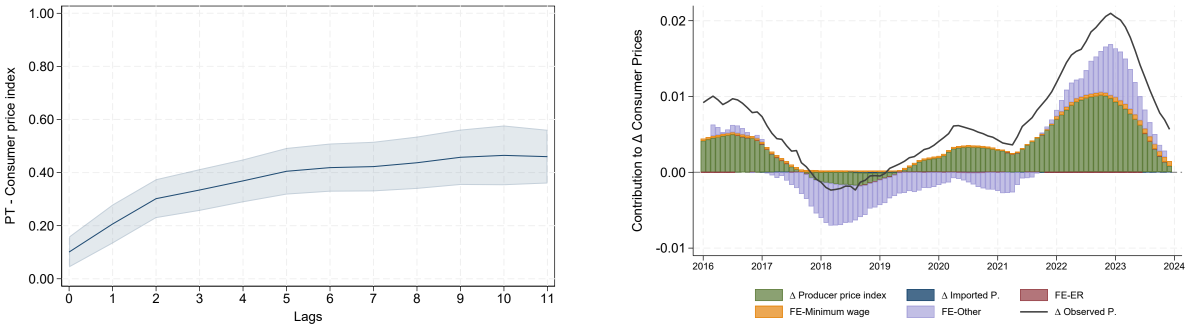
Notes: This table reports the estimated transmission of producer prices to consumer prices. The transmission is defined as the cumulative effect $\sum_{j=0}^{11} \beta_1^j$. The table also reports the cumulative effects of lagged import prices, defined as $\sum_{j=0}^{11} \beta_p^j$. Estimates are obtained from equation (1), using the change in the consumer price index for processed foods as the dependent variable and the change in the producer price index as the main explanatory variable. We report standard OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). The specification includes import prices as a control variable, as well as time and sector fixed effects. Standard errors are computed using the delta method and are reported in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table E.1 reports the estimated cumulative transmission from producer prices to consumer prices for processed food products obtained from estimating equation (1). We report the standard OLS estimates following the baseline specification in the literature (e.g., Gopinath, Itskhoki and Rigobon (2010)). The coefficient $\sum_{j=0}^{11} \beta_1^j$ represents the sum of contemporaneous and lagged effects of producer price changes over a eleven-month horizon. As in the main analysis, these results should be interpreted with caution, as producer prices do not capture distribution margins or other costs incurred at the retail stage.

The estimated transmission is positive and statistically significant at the 1% level. The cumulative pass-through is 0.75, indicating that a 1% increase in producer prices is associated with an increase of approximately 0.7% in consumer prices over the subsequent year.

Figure E.1 complements the table by illustrating both the dynamic pattern of transmission and the contribution of different components to consumer price variation. Panel (a) shows that the transimission builds gradually over time, with the cumulative effect increasing as additional lags are included. Panel (b) decomposes average monthly consumer price

**Figure E.1:** Transmission of producer prices to consumer prices



**(a)** Pass-through **(b)** Contributions

Sources: DANE. Authors' elaboration.

Notes: The solid line in Panel (a) depicts the estimated transmission, while the shaded area represents the 95% confidence interval, computed using the delta method. The figure reports cumulative sums $\sum_{j=0}^{J} \beta_1^j$ obtained from estimating equation (1). Each point on the horizontal axis ($J$) corresponds to a specification that includes lags from $j = 0$ up to $j = J$ of the change in the materials price index. The corresponding point on the vertical axis reports the cumulative pass-through, defined as the sum of the estimated coefficients up to lag $J$. The dependent variable is the change in the consumer price index for processed foods.

Each bar in panel (b) represents the 12-month moving average of the contribution of different components to the cross-sector mean of monthly changes in the consumer price index for processed foods. Contributions are computed using the estimated coefficients from equation (1) with twelve lags. For each variable, we first compute its cross-sector mean and then apply a 12-month moving average; contributions are obtained by multiplying these smoothed series by the corresponding estimated coefficients. Fixed effects (including exchange rate, minimum wage, and other factors) and residual components are incorporated analogously. Positive and negative contributions are shown separately. The solid line shows the corresponding 12-month moving average of the cross-sector mean of observed monthly changes in producer prices. By construction, the sum of all components closely tracks the observed series.

changes into the contributions of producer prices, import prices, and time fixed effects. The decomposition highlights that producer prices account for a substantial share of consumer price movements, while import prices play a more limited role. A sizable portion of the variation is captured by common time effects, reflecting broader macroeconomic forces affecting consumer prices.