



Food and Agriculture  
Organization of the  
United Nations

# Price dynamics in global beverage markets

## Trends, drivers and consequences







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# Abbreviations

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|              |                                           |
|--------------|-------------------------------------------|
| <b>BSVAR</b> | Bayesian Structural Vector Autoregressive |
| <b>CTC</b>   | crush, tear, curl                         |
| <b>ECM</b>   | error correction model                    |
| <b>EUDR</b>  | European Union Deforestation Regulation   |
| <b>EWS</b>   | Early Warning Systems                     |
| <b>FEVD</b>  | forecast error variance decomposition     |
| <b>ICO</b>   | International Coffee Organization         |
| <b>IRF</b>   | impulse response function                 |
| <b>LP</b>    | local projection                          |
| <b>NTM</b>   | non-tariff measures                       |
| <b>MUV</b>   | Manufacturers Unit Value                  |
| <b>SPS</b>   | sanitary and phytosanitary                |





# Executive summary

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Coffee, cocoa and tea are among the world's most important agricultural commodities, sustaining millions of smallholder farmers and their families, generating essential export earnings for producing countries, and supporting vast processing and retail industries across the globe. Their production and trade are deeply embedded in rural livelihoods, national economies, and global food systems. Yet, these markets are also structurally vulnerable. Output is highly concentrated in a few regions, long value chains connect distant producers and consumers, and the entire system is exposed to climate risks, logistical bottlenecks, and shifting economic and policy environments.

Recent years have demonstrated how fragile these markets can be. Global prices for coffee and cocoa have reached exceptional highs, reflecting a combination of adverse weather events, disease pressures, depleted inventories, and strong demand. Tea markets, while less exposed to global trading systems than coffee or cocoa, have also experienced periods of acute volatility due to production shocks and evolving consumption patterns. These developments renewed concerns about the drivers of the price dynamics and the consequences for the actors along global value chains.

This report examines the forces shaping global coffee, cocoa, and tea prices, presenting new evidence on the drivers of short-run price movements and the transmission of global shocks from international markets to farmers and consumers. It provides policymakers with insights to strengthen the resilience, efficiency and equity of the global beverage sector.

**Global coffee, cocoa and tea prices are driven primarily by supply and demand fundamentals. Market uncertainty can amplify price movements, while macroeconomic factors play a more limited role.**

Recently, global beverage markets have been under increasing pressure, primarily due to limited production sources and rising consumption. Coffee, cocoa, and tea production is geographically concentrated in a small number of countries. Brazil and Viet Nam dominate global coffee supply; Côte d'Ivoire and Ghana together account for more than two thirds of cocoa production; and China, India, Kenya, and Sri Lanka lead global tea output. This concentration increases global vulnerability: When harvests fail or logistics falter in any of these key regions, world markets feel the impact almost immediately. At the same time, global demand has been steadily rising. Coffee consumption has expanded particularly fast in Asia and in emerging markets, while cocoa grinding and chocolate production have grown both in consuming and producing countries. Tea consumption has risen sharply in traditional producing countries with expanding middle classes, especially China, reshaping the geography of global demand.

In recent years, global beverage commodity prices have risen much faster than other agricultural commodities. The combination of concentrated supply and growing global consumption creates fertile ground for large swings in international prices. Weather-related shocks – droughts, frosts, excessive rainfall – remain the primary triggers of price spikes. Plant diseases, rising input and labour costs, geopolitical disruptions, and shipping delays have added further pressures. In recent years, weather-related production shortfalls in Brazil

and Viet Nam have tightened global coffee availability; severe weather and the spread of cocoa swollen shoot virus sharply reduced cocoa output in West Africa; and tea production has fluctuated with droughts, fertilizer restrictions, and geopolitical instability.

These shocks have occurred against a backdrop of increasing interconnectedness. Global beverage markets are organized around internationally integrated value chains, in which midstream and downstream segments tend to exhibit a high level of market concentration, with a limited number of private actors having significant control over post-harvest activities, processing, trading and distribution up to the retail stage. Higher integration into global value chains means that a climate event in one region, a policy change in another, or a disruption in global shipping lanes can reverberate across continents within weeks.

Market fundamentals are the most dominant source of global price fluctuations. The report finds that changes in production and consumption have consistently driven short-term price fluctuations in coffee, cocoa, and tea markets. Across the three commodities, such shifts explain over 90 percent of the short-run price volatility. When harvests fall, when diseases spread, or when weather conditions reduce expected yields, markets react swiftly and sharply. The same is true in case of market-specific demand shocks, such as sudden shifts in consumer preferences or the implementation of trade and domestic policies. When stocks are low, shocks have a greater effect and markets react sharply to small disruptions, causing significant price spikes.

Recent price surges provide clear examples. Coffee prices in 2021–2022 and again in 2024–2025 rose sharply due to droughts, frosts, and poor harvests in Brazil and Viet Nam, combined with low global stocks. Cocoa prices in 2023–2025 increased to unprecedented levels because of dry weather, disease pressure in West Africa, and historically tight inventories. Tea prices, though generally more stable over time, rise sharply when large producing countries experience droughts, fertilizer shortages, or production disruptions.

Uncertainty amplifies price spikes. Although market fundamentals dominate, prices also react to uncertainty about global future conditions. When weather forecasts conflict, when disease outbreaks are suspected but not yet quantified, or when logistics become unreliable, market participants often hold back products or build inventories as insurance. These behaviours can create temporary price spikes even before production numbers are officially available to the market operators. Similarly, expectations about upcoming harvests can trigger pre-emptive reactions. If market participants anticipate a poor season or expect new regulations to tighten supply, current prices may rise. While these effects are typically short-lived, they can reinforce supply-driven spikes.

Macroeconomic trends play a secondary role. Broader trends in global economic activity – changes in income or energy prices – do influence nominal beverage prices and long-term patterns of demand. However, once inflation is accounted for, these macroeconomic forces have limited influence on short-run real price movements. Their effects tend to be modest, temporary, and far smaller than those triggered by supply disruptions or changing market fundamentals.

**Global beverage price shocks are not transmitted fully or uniformly along value chains. Pass-through is incomplete, delayed, and nonlinear. Producers are more exposed to price volatility, while effects on consumer prices are generally muted and lagged, yet highly asymmetric. Differences in market structure and policy frameworks play a central role in shaping these transmission patterns.**

Global beverage price shocks are not fully or evenly transmitted along value chains. The pass-through of international prices is often incomplete and delayed, shaped by market structure, domestic policies, transaction costs, and infrastructure constraints. As a result, the benefits and costs of global price movements are distributed unevenly, frequently reinforcing existing vulnerabilities.

The value chains for coffee, cocoa and tea are long and complex, involving multiple stages from farming to final retail. Most value addition and profits accrue downstream – to processors, brands, and retailers – while producers, particularly smallholder farmers, capture only a small share of final retail prices. This structural imbalance leaves producers highly exposed to global price volatility, while limiting their ability to benefit fully from price booms. For example, evidence from the coffee market illustrates how global price shocks affect producers unevenly. Global shocks to coffee prices are transmitted relatively quickly but incompletely to producer prices, with substantial variation across countries depending on market integration and policy frameworks. Transaction costs and other market frictions limit the propagation of small shocks, so that producer prices tend to respond primarily to larger disturbances that generate sufficient arbitrage incentives. In addition, Arabica and Robusta markets are partially integrated: Shocks affecting one market can spill over to producer prices in the other, although the magnitude of these effects remains limited.

For consumers, the impact of global beverage price shocks is generally modest and delayed. Raw commodities account for only a small fraction of final retail prices once processing, transport, branding, and retail margins are taken into account. Consequently, even large swings in international prices translate into relatively small changes in consumer prices, particularly in high-income markets with diversified and competitive downstream sectors. For example, global production and/or consumption shocks to cocoa prices are transmitted to chocolate retail prices in the European Union, but the effect is limited, reflecting cocoa beans' small share in final product costs. At the same time, allowing for asymmetric responses reveals a markedly uneven propagation of shocks: negative net-supply shocks, which raise global cocoa prices, transmit strongly and persistently to consumer prices, whereas positive net-supply shocks propagate weakly and generate only short-lived adjustments.



The transmission of global price shocks reflects a combination of structural and institutional factors. Fragmented domestic sectors, high transaction costs, weak infrastructure, and limited competition at the farm-gate level reduce the extent to which international price signals reach producers. At the same time, concentration downstream allows processors and retailers to absorb or smooth cost increases, dampening pass-through to consumers.

Domestic policies further shape these outcomes. Price stabilization schemes, administered farm-gate prices, and regulations can protect producers from sudden price collapses, but may also delay or limit their participation in global price upswings. Limited access to finance, insurance, storage, and timely market information further constrains farmers' ability to manage risk and smooth income. The policy challenge is not just to enhance price transmission, but to ensure it promotes income stability, efficiency, and long-term investment in beverage value chains.

**Building more resilient, efficient and inclusive beverage value chains is essential to reduce vulnerability to shocks and ensure long-term sustainability. This requires stronger production systems, improved price transmission and a more equitable distribution of value.**

The findings of this report point to three broad priorities for policy action. First, strengthening resilience at the production stage is essential. Because global price spikes are mostly driven by supply disruptions, policies should focus on reducing vulnerability to climate shocks, pests, and diseases. Investments in climate-resilient production systems, replanting, extension services, and risk management tools can help stabilize output and incomes, reducing the frequency and severity of extreme price movements.

Second, improving market efficiency and transparency can limit unnecessary volatility. Better information on stocks, crop conditions, and logistics reduces uncertainty and curbs expectation-driven price spikes. Digital tools, improved market information systems, and predictable trade policies can enhance price discovery and support smoother transmission along value chains.

Third, addressing structural inequities in value distribution is critical for long-term sustainability. Enabling producers to move into higher-value activities through quality upgrading, certification, processing, and branding can increase the share of value retained in producing countries and limit the vulnerability to shocks. Stronger producer organizations, targeted finance, and public–private partnerships are key to overcoming the barriers that smallholders face in accessing these opportunities.

Volatility will continue to shape global beverage markets as climate risks and production concentration intensify. Tackling these challenges demands more than improved risk management – it calls for value chains that deliver price signals transparently and equitably, empowering producers and fostering inclusive growth. Without decisive action, price surges will persist alongside deep-seated vulnerabilities for smallholder farmers, undermining long-term sustainability.



# 01

## Chapter

### Introduction

Coffee, cocoa and tea are not only among the world's most widely consumed beverages, but they also serve as vital export crops for many low- and middle-income countries. These commodities underpin the livelihoods of millions of smallholder farmers and their families and contribute significantly to national revenues, making them a cornerstone of rural economies. Fluctuations in their prices have direct implications for household income, poverty levels, food security, and government budgets, especially in countries where these crops represent a substantial share of export earnings.

A defining feature of these markets is the high concentration of production in a small number of countries, which makes global supply and prices particularly vulnerable to shocks in key producing regions. This structural characteristic, combined with the labour-intensive nature of cultivation – often reliant on manual practices – renders the sector sensitive to rising wages, labour shortages, and weather-related disruptions. Transportation plays a critical role as well, as most of the output is shipped in raw form over long distances to high- and middle-income countries for processing and consumption. The significant physical distance between producing and consuming countries increases the vulnerability of trade flows to geopolitical tensions and supply chain bottlenecks.

Global beverage markets are organized around internationally integrated value chains, in which midstream and downstream segments tend to exhibit a high level of market concentration, with a limited number of private actors having significant control over post-harvest activities, processing, and distribution up to the retail stage. On the demand side, consumption of coffee, cocoa and tea has shown steady growth over recent decades, driven by rising incomes and population growth, especially in emerging economies. While coffee and cocoa have seen broad-based increases in consumption across both traditional and new markets, tea's consumption growth has been particularly strong in emerging economies, notably China.

While price fluctuations are common in healthy agricultural markets, global beverage commodities are marked by particularly large and recurrent price swings. This inherent feature emphasizes the need to understand its origin, its impact on the actors along the value chains and how to manage its effects. This report answers these questions through a comprehensive analysis of the dynamics shaping the coffee, cocoa, and tea markets. In doing so, it also explores whether price movements and spikes in recent years can be explained by the same factors underlying past events.

Rather than limiting the focus to country-specific experiences, the report chooses to approach this subject from a global perspective for several reasons. First, the price formation process for these commodities is determined by the interplay of global supply and demand. International benchmark prices – such as those

set on major futures exchanges and/or by commodity boards – serve as reference points for transactions worldwide, including those involving smallholders. Second, for these commodities, events such as adverse weather, geopolitical tensions, regulatory changes, or logistical disruptions in one region can have immediate and far-reaching effects on markets and stakeholders around the world. Third, the journey from the farm to a cup of coffee or a chocolate bar often involves crossing international borders. The raw products are typically produced in a limited number of low- and middle-income countries, but they are processed, traded and consumed globally. Value chains for these commodities are highly internationalized, involving multiple actors – farmers, exporters, processors, traders, and retailers – across different continents. Finally, domestic policies, such as trade restrictions, subsidies, or sustainability standards, are both shaped by and have repercussions for international markets. A policy decision in one country can alter trade flows, influence global prices, or prompt regulatory responses elsewhere. Only by situating policy analysis within the global context can one fully assess its likely impacts and unintended consequences.

The structure of the report is designed to guide the reader through the key elements shaping beverage markets. **Chapter 2** provides an overview of recent price developments and examines the structural characteristics of coffee, cocoa, and tea markets, including production patterns, trade flows, and common vulnerabilities. **Chapter 3** presents an empirical analysis aimed at investigating the main drivers of the short-run real price dynamics.<sup>a</sup> While this chapter is highly technical – covering the modelling approach, data identification, and estimation strategy – it is organized so that readers who are less interested in methodological details can skip directly to the results and their interpretation. **Chapter 4** focuses on the transmission of global price shocks along the beverage value chains, assessing how shocks to global prices affect producers and consumers in different regions. Finally, **Chapter 5** presents policy recommendations aimed at building more resilient, efficient and inclusive beverage value chains.

While the report offers an in-depth analysis of short-run price dynamics and challenges in the global coffee, cocoa, and tea markets, it is important to acknowledge that several significant topics are only discussed marginally. For example, broader macroeconomic issues such as the influence of monetary and fiscal policies on commodity prices and production costs, the functioning of derivative markets and the role of non-commercial traders in shaping price dynamics, and socioeconomic concerns related to gender inequality and youth employment in the sector are not treated in detail. Similarly, environmental sustainability beyond climate adaptation, health and nutrition aspects associated with beverage consumption, and evolving consumer trends and marketing strategies in end markets are referenced only where directly relevant to the main analysis. These areas, while crucial for a holistic understanding of the beverage sectors, fall outside the primary focus of this report and are noted here to clarify the scope and boundaries of the discussion.

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<sup>a</sup> The empirical modelling presented in this report does not account for economic disruptions associated with the 2026 conflict in the Middle East. However, Chapter 3 examines how different types of shocks, including energy and broader economic shocks, can influence beverage commodity markets over the long run.

# 02

## Chapter

### Recent price developments for coffee, cocoa and tea global markets

#### KEY MESSAGES

- **Coffee, cocoa and tea are vital export crops** for many low- and middle-income countries, supporting millions of smallholder farmers and contributing significantly to national revenues. These crops are often a cornerstone of rural livelihoods, and fluctuations in their prices can directly impact household income, poverty levels, food security, and government budgets.
- **Production** of all three crops is highly **concentrated** in a small number of low- and middle-income countries. Concentration makes global supply and prices especially vulnerable to shocks in these key producing nations. As a result, these markets are prone to frequent and unpredictable price fluctuations, often triggered by weather events, supply disruptions, or geopolitical tensions.
- **Demand** for coffee, cocoa and tea has shown **steady growth** over recent decades, mainly due to rising incomes and population growth in emerging economies. For coffee and cocoa, demand growth has been driven by a relatively homogeneous increase in consumption across both traditional and emerging markets. In contrast, tea's consumption growth is concentrated in emerging economies, notably China.
- Over the past years, **global beverage commodity prices** have surged far more dramatically than have other agricultural commodities. This **exceptional increase** was primarily driven by sharp price spikes in coffee and cocoa, both caused by severe supply shortages and weather-related shocks in major producing countries. Tea experienced similar price spikes on several occasions before the COVID-19 pandemic.

Agricultural production and exports are vital to the economies of many emerging and low-income countries. These activities support numerous small-scale farmers and make up a significant share of export revenues. Commodity price changes therefore impact household income, exports, poverty, food security, government budgets and economic growth. This chapter reviews recent international price trends for coffee, cocoa and tea and the main market forces driving them. [Section 2.1](#) covers the long-term trends of agricultural commodity prices; [Section 2.2](#) examines market factors for each beverage, and [Section 2.3](#) discusses broader influences on agricultural commodities.

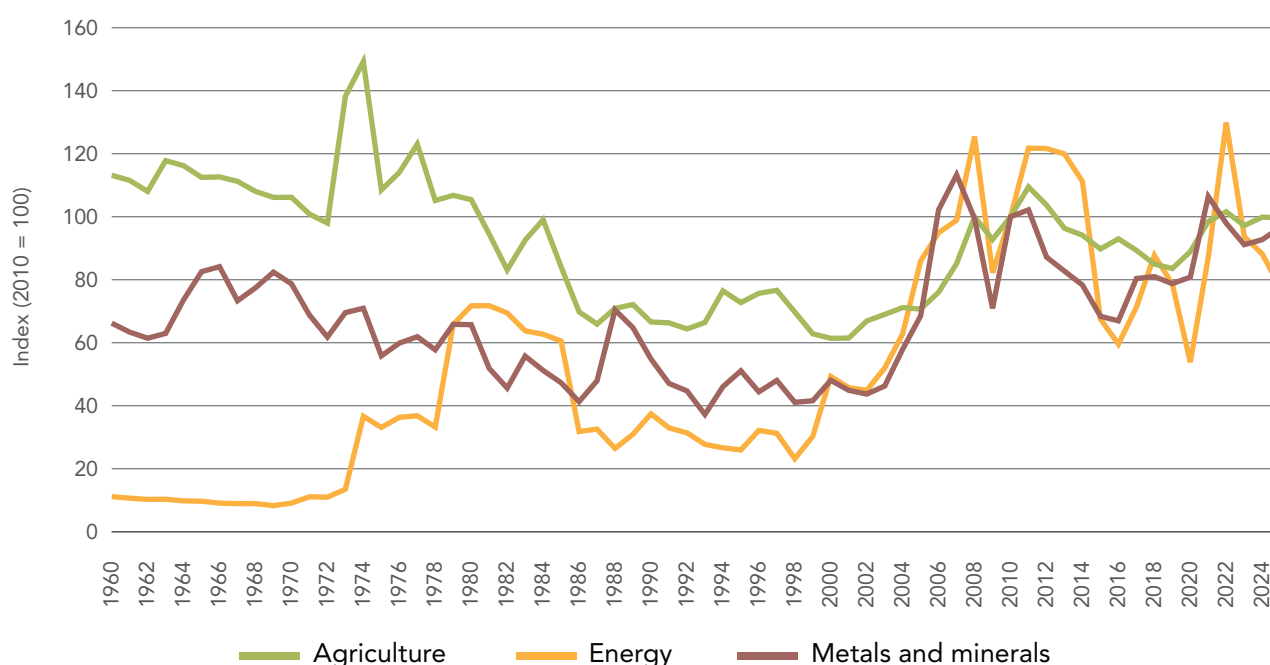


## 2.1. Stylized facts about agricultural commodity prices

Coffee, cocoa and tea are cash crops, primarily cultivated for export. Despite their specific characteristics – discussed later in this chapter – these tropical beverages exhibit broad similarities in price behaviour on international markets. Some of these trends are comparable to those observed for basic food commodities such as cereals and oilseeds, as well as for minerals and metals. Traditionally, tropical beverages have been produced and exported by low- and middle-income economies, while consumption has been concentrated in higher-income countries. More recently, exports to non-producing middle-income countries have increased steadily, driven by population growth and rising per capita incomes. Emerging economies – especially China – have significantly influenced global commodity markets by reshaping import demand for agricultural products.

The structure of trade in tropical beverages is marked by a high level of concentration on the export side, with a relatively small number of countries accounting for most of the global export volumes and values. This concentration implies that supply shocks in one or more of these key exporting countries can have a substantial effect on global supply and prices. On the import side, the market has historically been less concentrated. However, the growing influence of a small number of major importers means that economic disruptions in these economies can have far-reaching effects on global demand. As a result, shifts in these key markets increasingly shape both the level and volatility of international prices.

**Figure 2.1.** Annual real prices of energy, agriculture and metals (1960–2025)

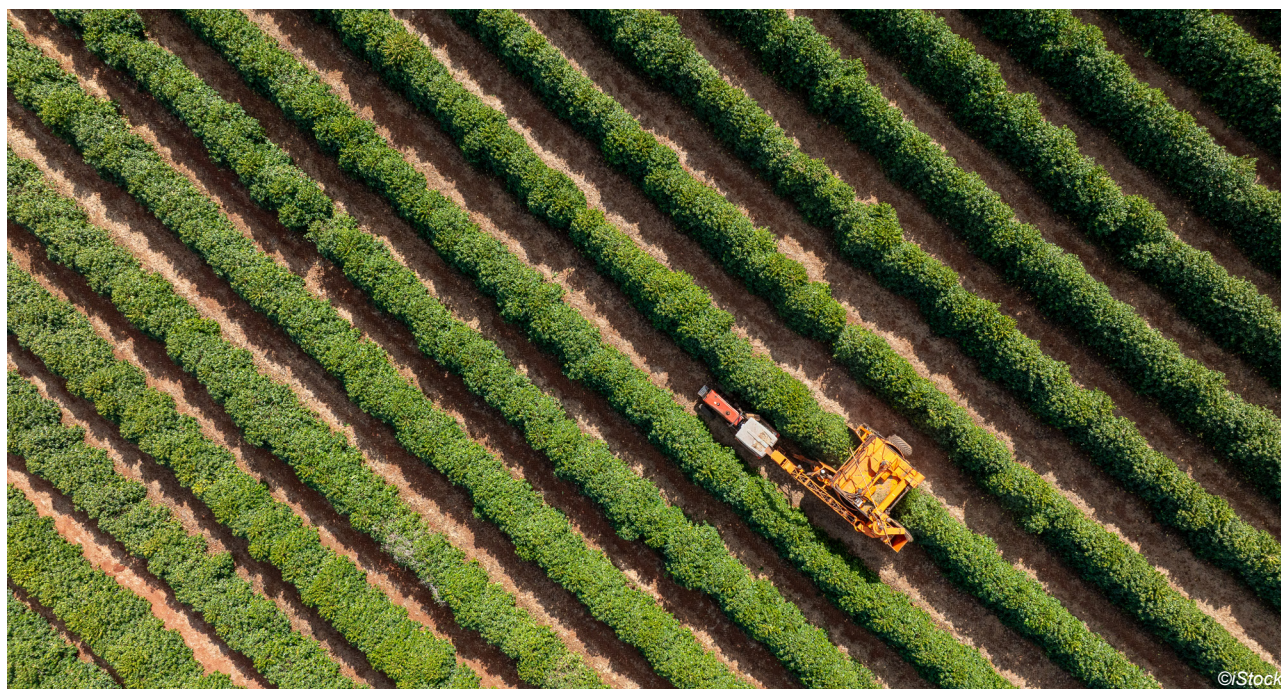


Source: World Bank. 2025. Pink Sheet: Commodity Price Data. [Accessed on 2 February 2026].

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Figure 2.1 shows the long-term trends in international prices for energy, agriculture and metals and minerals since 1960, adjusted using the World Bank's Manufacturer's Unit Value (MUV) index.<sup>b</sup> Until the early 2000s, agricultural commodity prices experienced a more pronounced downward trend compared with the other two groups. The prevailing view at the time was that agricultural prices followed a secular decline of approximately one percent per year in real terms, driven by productivity gains. This long-term decline was periodically interrupted by sharp price spikes and episodes of heightened volatility, typically triggered by unexpected supply-side shocks. Such price behaviour was often considered inevitable, contributing to a broader downward trend in the net barter terms of trade for countries reliant on commodity exports. Persistently declining real prices undermined export earnings, discouraged investment in agriculture, and perpetuated low rural incomes and poverty.<sup>1-4</sup>

Since the early 2000s, the real price trends illustrated in Figure 2.1 have shifted. Real agricultural prices reversed their long-term decline and began to rise – with similar upward movements in energy, metals' and minerals' prices. Over the past two decades, these three commodity groups have exhibited greater co-movement, increased volatility and a tendency to stabilize at higher price levels. On the one hand, this change in price dynamics has been attributed, in part, to a slowdown in yield growth, stemming from insufficient investment in agricultural research and development – both nationally and internationally, and across public and private sectors.<sup>5</sup> On the other hand, rapid income and population growth, particularly in China and other emerging economies, has significantly increased global demand for agricultural products.<sup>6</sup>

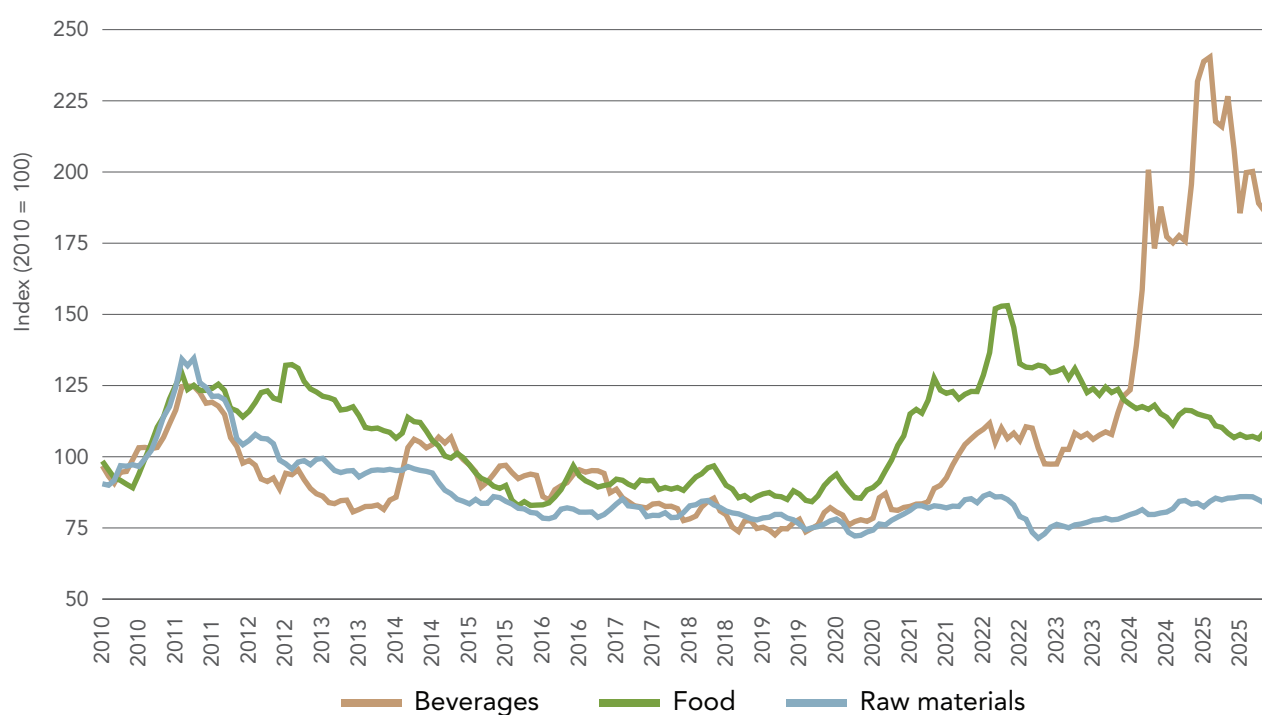


<sup>b</sup> The MUV is a trade-weighted index of the prices of exports of manufacturers in US dollars from a selection of major high to low- and middle-income economies. It is one of the main deflators used in the literature to derive real commodity prices from nominal prices (Baffes and Etienne, 2016).



High rates of economic growth in emerging economies have driven increased demand for food, particularly livestock products, which in turn has boosted demand for feed grains and raw materials used in food processing. At the same time, biofuel production expanded significantly, supported by subsidies and mandates that raised demand for key agricultural feedstocks.<sup>7</sup> This development strengthened the linkage between agricultural and energy markets, making agricultural prices more sensitive to oil price movements. These demand-side drivers are frequently cited as contributing factors to a structural shift in commodity markets, supporting the argument that the long-standing downward trend in real prices may have been reversed.<sup>8</sup> Beyond these factors, financialization and increased speculative activity in commodity markets, as well as trade policy responses by several countries seeking to shield domestic consumers from rising food prices, are also considered to have amplified price movements triggered by underlying supply and demand shocks.<sup>6, 9</sup> Regardless of the interpretation of the 2008–2011 price spikes, they gave rise to a widespread perception of heightened volatility and uncertainty, conditions that have important implications for agricultural investment and production decisions. More recently, the global disruptions caused by the COVID-19 pandemic, the war in Ukraine, and various other geopolitical tensions around the globe have added further complexity to the commodity market dynamics.

**Figure 2.2.** Monthly real prices of food, beverages and raw materials (2010–2025)



Source: World Bank. 2025. Pink Sheet: Commodity Price Data. [Accessed on 2 February 2026]. <https://www.worldbank.org/en/research/commodity-markets>. Licence: CC-BY 4.0.

Within the broader agricultural sector, however, the three subgroups, food, beverages and agricultural raw materials, followed a slightly downward trend in real prices in the years preceding the COVID-19 pandemic (Figure 2.2). After the onset of the pandemic, food prices began to rise, peaking in early 2022, before returning to levels comparable to those observed in the post 2008–2011 price spikes. In contrast, agricultural

raw materials continued their decline over the entire decade. Beverage prices remained relatively stable until the second half of 2023, when they began to rise sharply. The unprecedented surge was driven primarily by volatility in the coffee and cocoa markets, while tea experienced similar price spikes on several occasions before the COVID-19 pandemic.

Beverage commodities share several structural characteristics that expose them to these frequent and unpredictable global price fluctuations. They are predominantly cultivated in a limited number of low- and middle-income countries, where production is largely carried out by smallholder farmers. In most cases, output is exported in raw form to high-income and emerging economies for processing and distribution. The concentration of production in a few agroecological zones renders global supply highly vulnerable to localized climatic conditions and the increasing frequency and severity of weather-related shocks. Cultivation is typically labour-intensive and reliant on manual practices, which makes the sector particularly sensitive to rising wages and labour shortages. In addition, all three commodities – coffee, cocoa and tea – are differentiated by quality and origin, with premium market segments often requiring certification and traceability, thereby increasing production costs. Finally, the significant physical distance between producing and consuming countries increases the vulnerability of trade flows to disruptions in global supply chains, including those caused by geopolitical tensions and rising transportation costs.

## 2.2. Market situation and price trends for beverage commodities

### 2.2.1. Coffee

Coffee<sup>c</sup> is one of the most widely consumed beverages worldwide and ranks among the most traded commodities globally. It sustains the livelihoods of some 25 million farmers and creates employment throughout the coffee value chain.<sup>10</sup> For many low-income countries, coffee exports represent an important source of revenue, generating foreign currency reserves essential for securing access to global markets for the import of goods and services. For instance, in Africa, coffee export earnings in 2024 accounted for 27.9 percent, 20.1 percent and 19.5 percent of total merchandise exports in Ethiopia, Uganda and Burundi, respectively. In the same year, these earnings exceeded the food import bills of Uganda and Ethiopia and represented about 20 percent of Burundi's food import bill. Beyond producing countries, the coffee sector also plays a significant role in coffee-importing nations, contributing to employment in the services sector, value addition and tax revenues. In 2023, the value of global coffee production was estimated at USD 23 billion, while world trade in coffee exceeded USD 26 billion.<sup>11</sup> Overall, the coffee industry generates a global annual revenue estimated at over USD 200 billion.<sup>12</sup>

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<sup>c</sup> This section draws on and updates material from: Amrouk, E.M., Palmeri, F. & Magrini, E. 2025. *Global coffee market and recent price developments*. FAO, Rome. <https://openknowledge.fao.org/handle/20.500.14283/cd4706en>. The analysis presented here has been revised, expanded and updated for the purposes of this report.

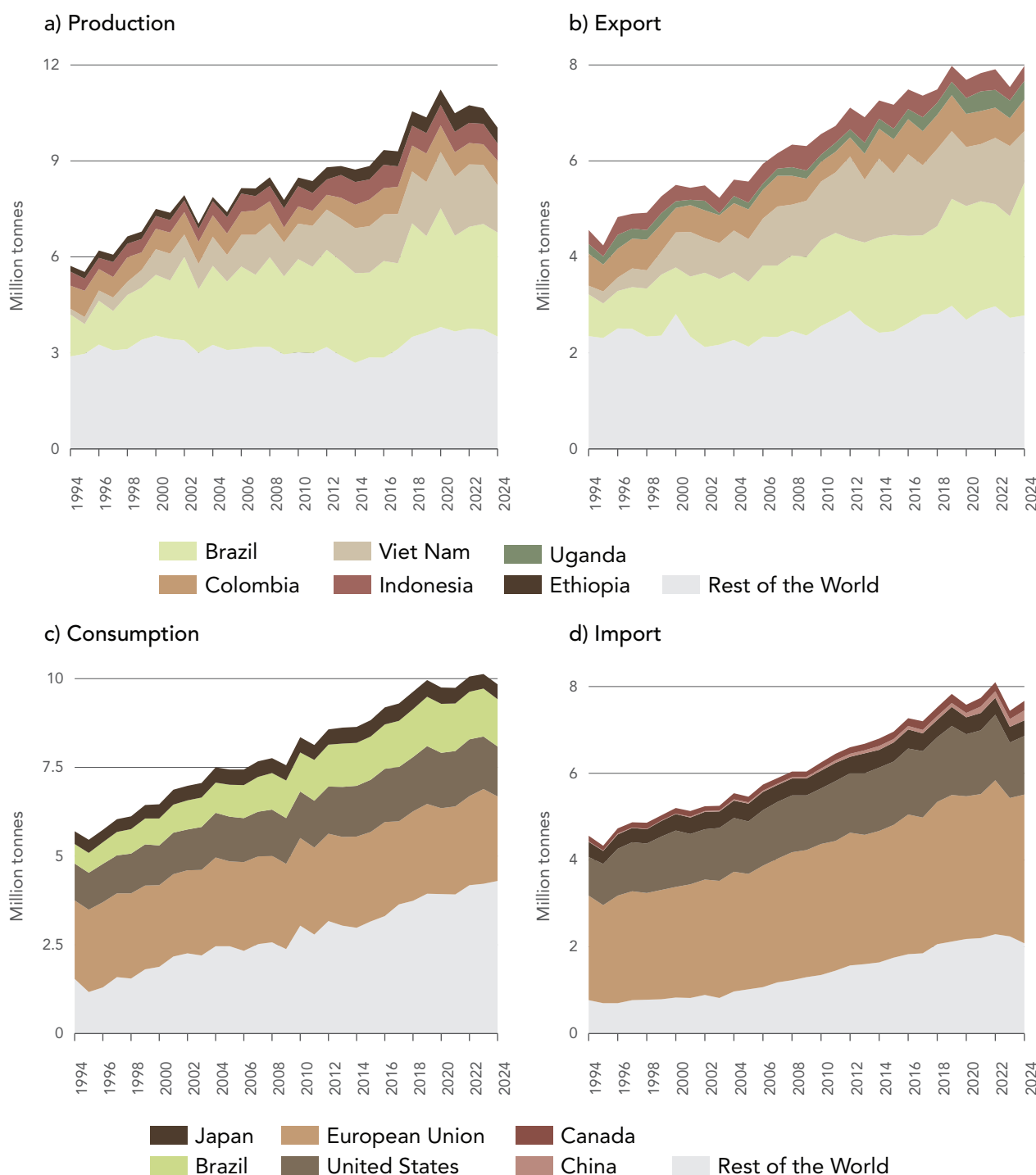


Two main coffee varieties are produced and traded worldwide: Arabica and Robusta. Arabica, accounting for approximately 60 percent of global coffee production, is a higher-quality and higher-value coffee primarily used in the roast and ground coffee market. It is also blended with Robusta to enhance the quality of instant coffee. Robusta coffee, typically lower-quality coffee and priced lower than Arabica, is mainly used in instant coffee and for blending with Arabicas.<sup>13</sup> However, its use in roast coffee blends, traditionally dominated by Arabica, has been steadily increasing.

World production of coffee beans has increased steadily over the past decades, with an average annual growth rate of 1.9 percent from 1994 to 2024 (Figure 2.3a). The sustained growth mainly reflects strong increases in Brazil and Viet Nam, currently the world's largest coffee-producing countries, accounting together for nearly 50 percent of global coffee production. Noteworthy, Viet Nam began expanding its coffee sector starting from the late 1980s, supported by broad-based economic reforms and state-led efforts to promote export-oriented agriculture, primarily through the intensive cultivation of Robusta coffee. In Brazil, sectoral reforms in the early 1990s, set against a broader liberalization of global coffee markets, led to structural adjustments that encouraged productivity gains through mechanization, cost efficiency, and expansion of high-yield Arabica cultivation.<sup>14</sup>



**Figure 2.3.** World coffee market



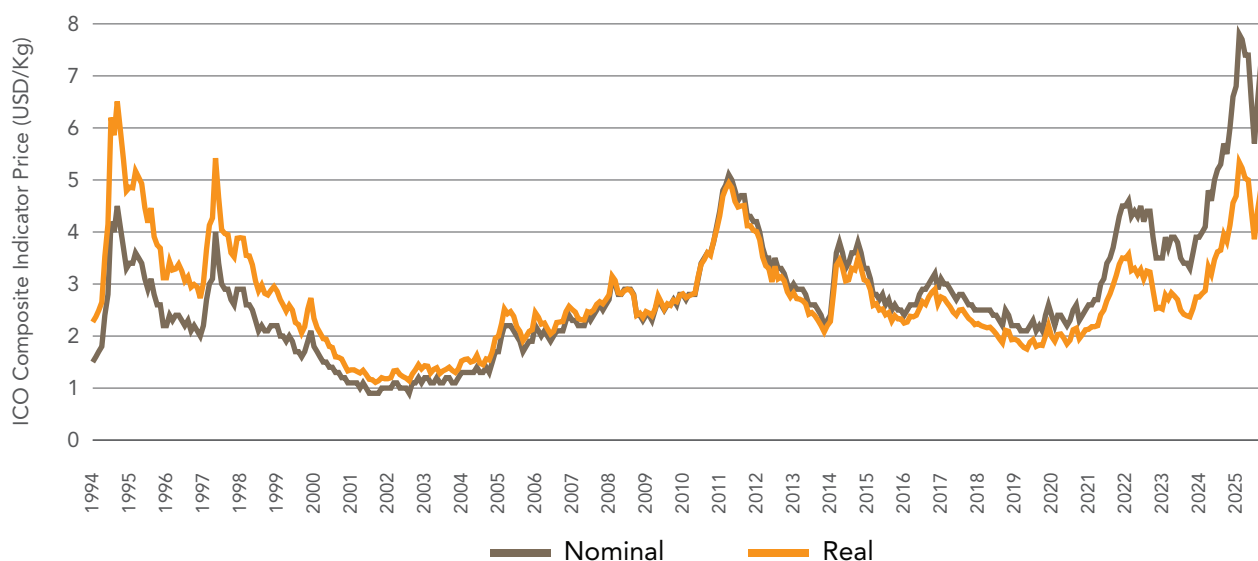
Sources: Authors' own elaboration based on data from FAO. 2026. FAOSTAT: Crops and livestock products. [Accessed 05 January 2026] <https://www.fao.org/faostat/en/#data/>. Licence: CC-BY-4.0; International Coffee Organization (ICO). 2020. World coffee statistics database. (Historical Data: Domestic consumption and Disappearance) [Accessed 04 November 2020]. <https://ico.org/what-we-do/world-coffee-statistics-database/> and USDA. 2026. Foreign agricultural service, production, supply and distribution online. [Accessed on 05 January 2026]. <https://apps.fas.usda.gov/psdonline>. Licence: CC-BY-4.0.



In addition to Brazil and Viet Nam, several other countries have strengthened their position in the global coffee market over the past decades. Colombia, Ethiopia and Honduras increased their global market position by focusing on high-quality Arabica, supported by certification schemes and origin-based branding, while Indonesia and India expanded their presence through increased productivity and competitiveness in the Robusta segment.<sup>15</sup> Brazil and Viet Nam are the world's main coffee exporters as well, followed by Colombia, Uganda and Indonesia (Figure 2.3b). Together, these five countries increased their combined share of global coffee exports from 48 percent in 1994 to 65 percent in 2024. This trend, along with the production patterns shown in Figure 2.3a, points to a growing concentration in the global coffee market, with a small number of countries now responsible for meeting the bulk of global demand. As a result, the market has become increasingly vulnerable to disruptions, such as extreme weather events, geopolitical tensions, or shifts in trade policies, affecting any of these key suppliers.

On the demand side, and in line with the steady rise in production, world coffee consumption has increased over the past decades at an annual growth rate of 1.8 percent from 1994 to 2024 (Figure 2.3c). While Brazil, the United States of America, the European Union and Japan have remained the world's largest consumers of coffee, together accounting for over half of global coffee consumption in 2024, their share of total global demand has declined in recent decades, reflecting slower growth relative to emerging markets. Much of the recent growth in global demand has been driven by rising consumption in Asian countries, which have recorded sustained increases in recent years, largely due to higher per capita incomes and growing population, particularly in China. The rapid expansion of both international and domestic coffee chains, along with the increasing popularity of instant and specialty coffee products, has further boosted demand, especially among younger consumers. In addition to China, countries in South-eastern Asia such as Viet Nam, Thailand and the Philippines have also experienced strong growth in consumption. Similarly, coffee consumption in African countries has more than quadrupled since 1994, though this remains relatively modest compared to other regions. This growth has been supported by the expansion of the middle-income population and shifting consumption patterns toward more diversified diets, particularly in urban areas.

Import trends over the past decades have mirrored the sharp rise in global coffee consumption, with Asia recording the fastest growth in imports (Figure 2.3d). The region's share of global coffee imports rose from just over 10 percent in 1994 to around 20 percent in 2024. Among Asian countries, China, Viet Nam and Thailand recorded the sharpest growth rates in coffee imports over the past three decades. In particular, coffee imports in Viet Nam and Thailand rose from negligible volumes in 1994 to over 60 000 tonnes in 2024, while in China, imports grew at an average annual rate of 13 percent over the same period. Nevertheless, the European and the North American countries remain the world's largest importers, together accounting for over 70 percent of global coffee imports in 2024.

**Figure 2.4.** World coffee prices (nominal and real)

*Note:* The ICO Composite Indicator Price (I-CIP) compiles “ex-dock” prices, which include costs for transport and unloading goods at the dock of the destination port. I-CIP is calculated by combining the prices of four distinct coffee groups – Colombian Mild Arabicas, Other Mild Arabicas, Brazilian and Other Natural Arabicas, and Robustas – applying weightings based on trade patterns. The real price is calculated by deflating the nominal prices with the US Consumer Price Index.

*Sources:* Authors’ own elaboration based on ICO (International Coffee Organization). 2026. Coffee market report, December 2025. [Accessed on 12 January 2026]. <https://ico.org/resources/coffee-market-report-statistics-section/>; and International Monetary Fund (IMF). 2026. IMF Data Explorer. United States, Consumer Price Index (CPI), All Items (2010=100). [Accessed on 12 January 2026]. [https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI\(5.0.0\)](https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI(5.0.0)). Licence: CC By 4.0.

The increase in global coffee production during the 1990s resulted in recurrent stockpiling and a downward pressure on prices. However, between 2000 and 2010, strong per capita consumption growth – particularly in some low- and middle-income countries – together with expanding high-value market segments, such as specialty coffee and product innovations in traditional markets, contributed to the sustained world prices throughout much of the first decade of the 2000s (Figure 2.4). World coffee prices began a steady decline from their peak in April 2011, a trend that continued until 2020, interrupted only by short-lived spikes in 2014 and 2016. The 2011 surge was driven by tight global supplies, particularly of Arabica coffee, coupled with strong demand.



### Box 2.1. Global price benchmarks for coffee, cocoa and tea

Global commodity prices serve as benchmarks for standardized goods with trader-recognized quality and characteristics. Since these prices are determined by worldwide supply and demand, they act as standard reference signals for most domestic and international exchanges of a specific product.<sup>i</sup> Futures prices are the primary international reference points for coffee and cocoa, serving as benchmarks in commercial transactions that are adjusted to reflect country-specific differentials. Futures prices are determined by trading on international exchanges. The Intercontinental Exchange (ICE) is the main hub for soft commodities like cotton, cocoa, orange juice, sugar, and coffee.<sup>\*.ii</sup>

The ICE Coffee C contract in New York is the world benchmark for Arabica coffee prices.<sup>iii</sup> The Robusta Coffee Futures contract on ICE Futures Europe, based in London, functions as the global benchmark for Robusta coffee prices.<sup>iv</sup> Both contracts are physically delivered, meaning the actual commodity – either green Arabica or Robusta coffee – is exchanged if the contract is held to expiration. The ICO Composite Indicator Price (I-CIP) is also a widely used reference price for coffee, but it is not derived from the ICE Coffee C or Robusta futures contracts. It compiles “ex-dock” prices, which include costs for transport and unloading goods at the dock of the destination port.<sup>v</sup> The ICO Composite Indicator Price is calculated by combining the prices of four distinct coffee groups – Colombian Mild Arabicas, Other Mild Arabicas, Brazilian and Other Natural Arabicas, and Robustas – applying weightings based on trade patterns.<sup>\*\*</sup>

For cocoa, futures contracts are traded on the ICE futures markets in London and New York. These are separate markets with different delivery specifications. The ICE London market specifies delivery in European ports, representing the benchmark for contracting for delivery in Europe.<sup>vi</sup> The New York market serves as the standard reference point for contracts involving the delivery of exchange-grade products sourced from various regions, including Africa, Asia, and Central and South America, to any of five designated US delivery ports.<sup>\*\*vii</sup> The International Cocoa Organization (ICCO) daily price, widely used as the reference prices for cocoa, is based on prices traded on the futures markets in London and New York. Specifically, it is calculated as the daily average price, denominated in US dollar, of the three nearest active futures trading months – to smooth out short-term price volatility while still capturing current market expectations – on ICE Futures Europe and ICE Futures U.S.<sup>viii</sup>



Unlike coffee and cocoa, which have futures contracts, tea does not offer this financial instrument. The auction centres in major producing countries are the basis for international tea trade and allow for price benchmarking. Although the global market could potentially support a futures market, segmentation and limited demand for hedging against price risks pose challenges to achieving the necessary volume for a futures exchange. With over 3 000 varieties, tea is difficult to trade on a futures exchange because there is no standard reference variety or unified system of discounts and premiums to support a standardized contract.<sup>ix</sup> In this report, we use as a benchmark price the FAO Tea Composite Price, a weighted average price index for black tea, which includes crush, tear, curl (CTC) and Orthodox teas in the four major auctions (Mombasa, Colombo, Calcutta and Cochin).

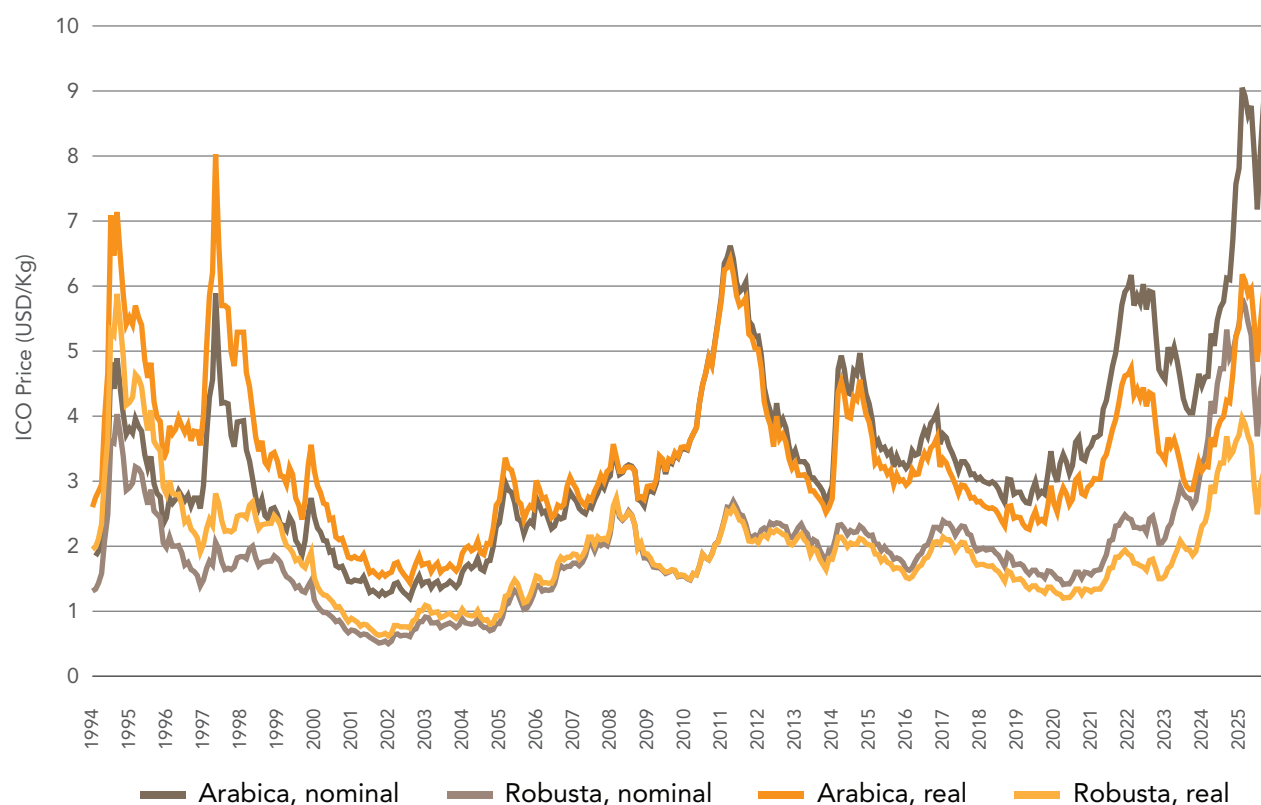
Notes: \* The latest market shares and group weightings for coffee years 2024/25 and 2025/26 can be found here. \*\* At licensed warehouses in the Port of New York District, Delaware River Port District, Port of Hampton Roads, Port of Albany or Port of Baltimore.

Sources: <sup>i</sup> Baffes, J. & Nagle, P. 2022. *Commodity markets: evolution, challenges, and policies*. Washington, DC, World Bank Publications; <sup>ii</sup> ICE. 2012. *ICE Coffee Brochure*. [https://www.ice.com/publicdocs/ICE\\_Coffee\\_Brochure.pdf](https://www.ice.com/publicdocs/ICE_Coffee_Brochure.pdf); <sup>iii</sup> ICE. 2026. ICE futures U.S.: coffee c futures. In: ICE. [Cited day month year]. <https://www.ice.com/products/15/Coffee-C-Futures>; <sup>iv</sup> ICE. 2026. ICE futures Europe: Robusta coffee futures. In: ICE. [Cited day month year]. <https://www.ice.com/products/37089079/Robusta-Coffee-Futures>; <sup>v</sup> Igami, M. 2015. Market power in international commodity trade: the case of coffee. *Journal of Industrial Economics*, 63(2): 225–248. <https://www.jstor.org/stable/44077356>; <sup>vi</sup> ICE. 2026. ICE Futures Europe. 2026.: London cocoa futures. In: ICE. [Cited day month year]. <https://www.ice.com/products/37089076/London-Cocoa-Futures>; <sup>vii</sup> ICE. 2026. ICE Futures U.S.: Cocoa futures. In: ICE. [Cited day month year]. <https://www.ice.com/products/7/Cocoa-Futures>; <sup>viii</sup> UNCTAD. 2010. International Cocoa agreement 2010. Geneva. <https://www.icco.org/wp-content/uploads/2019/07/Cocoa-Agreement-2010-English-1.pdf>; <sup>ix</sup> FAO. 2018. *Developing futures and swap markets for tea*. Intergovernmental Group on Tea, 23rd Session, 17-20 May, Hangzhou, the People's Republic of China. CCP: TE 99/2. City of publication. <https://openknowledge.fao.org/server/api/core/bitstreams/074cd463-5ce1-475f-8753-64ab65e32789/content>.

In the following years, recurring production surpluses exerted significant downward pressure on world prices,<sup>16</sup> which dropped to multi-year lows in 2019 and 2020. Prices began to increase sharply from mid-2021, reaching a multi-year high in February 2022, when they were 64 percent above their values a year earlier, in real terms. In particular, prices of Arabica coffee increased more rapidly than those of Robusta coffee driven by tighter global availabilities. This mostly reflected the production shortfall of the Arabica coffee variety in Brazil, following dry weather conditions and frost events in the southeastern key producing state of Minas Gerais. Production of Arabica coffee was also affected by poor weather in Colombia.

On the demand side, the increase in global consumption, associated with the strong recovery in the global economy after the COVID-19-related downturn in 2020, tightened further the world supply–demand balance for coffee and underpinned the sharp increase in prices. Higher freight costs in 2021 were also found to be one of the elements contributing to the increase in world coffee prices. After the high level reached in February 2022, international coffee prices experienced a general decline, with a brief uptick in early 2023, before surging again from late 2023 and climbing through early 2025 and reaching, in February, the historical value of USD 7.8/kg. This was the highest price, in nominal terms, ever registered by the ICO price index even if, in real terms, the spike was not too far from other periods observed during the 1990s or at the beginning of 2011.



**Figure 2.5.** Arabica and Robusta coffee prices (nominal and real)

*Note:* Nominal Arabica is the ICO price “other mild Arabicas”, average New York and Bremen/Hamburg markets, ex-dock; nominal Robusta is the ICO price “Robustas”, average New York and Le Havre/Marseilles markets, ex-dock. Real prices are calculated by deflating nominal prices with the US Consumer Price Index.

*Sources:* Authors’ own elaboration based on World Bank. 2026. Pink Sheet: Commodity Price Data. [Accessed on 15 January 2026]. <https://www.worldbank.org/en/research/commodity-markets>. Licence: CC By 4.0 and International Monetary Fund (IMF). 2026. IMF Data Explorer. United States, Consumer Price Index (CPI), All Items (2010=100). [Accessed on 15 January 2026]. [https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI\(5.0.0\)](https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI(5.0.0)). Licence: CC By 4.0.

The increase was mostly due to adverse weather affecting production in Viet Nam, Indonesia and Brazil. In Viet Nam, prolonged dry weather caused a 20 percent drop in the 2023/24 coffee production, with exports falling by 10 percent for the second consecutive year. In addition, farmers withholding their produce amid rising domestic prices further tightened the supply situation, adding upward pressure on global coffee prices in late 2023 and early 2024.<sup>17,18</sup> Likewise, in Indonesia, coffee production in 2023/24 was reported 16.5 percent lower than in the previous season on the back of excessive rains that damaged coffee cherries in April–May 2023, with exports falling by 23 percent. In Brazil, dry and hot weather conditions led to successive downward revisions to the 2024 production forecast, with official estimates shifting from an anticipated 5.5 percent year-on-year increase to a 1.6 percent decline.<sup>19</sup>

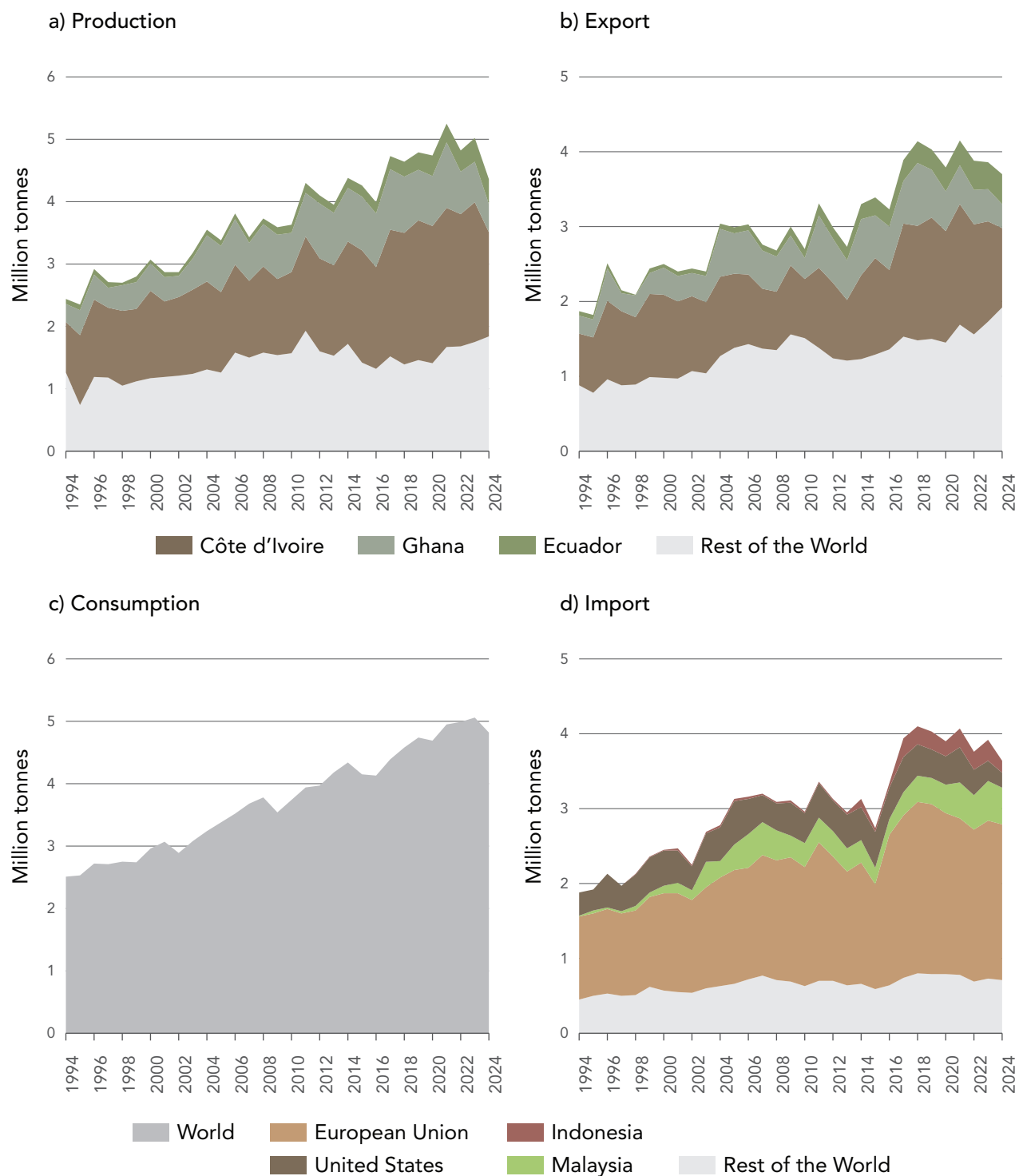
Additionally, the steady increase in shipping costs in the first half of 2024 further contributed to the overall increase in world coffee prices. Concerns over the potential impact of adverse weather on the 2025 crop in both Brazil and Viet Nam continued to underpin sharp price increases in late 2024 and early 2025, with

international coffee prices for both Arabica and Robusta reaching all-time highs of respectively 9.05 and 5.81 USD/Kg, in nominal terms, in February 2025 (Figure 2.5). After peaking in February, prices declined steadily through July, largely in response to a gradual improvement in the global supply outlook. International coffee prices then recorded some increases from August through November 2025 but declined again in December amid good 2025/26 harvest progress in Viet Nam following earlier weather-related delays and a favourable outlook for the 2026 crop in Brazil, which boosted global supply prospects. Nevertheless, international coffee prices averaged USD 6.7/kg in December 2025, 2 percent higher than their already elevated levels in December 2024.



### 2.2.2. Cocoa

Cocoa contributes to the livelihoods of approximately 40 to 50 million people worldwide across the entire value chain.<sup>20, 21</sup> More than 90 percent of the world's cocoa is produced by an estimated 5 to 6 million smallholder farmers, with land plots of 2 to 5 hectares, mainly in the tropical regions of West Africa, Latin America and Southeast Asia.<sup>22</sup> Among African countries, which together account for more than 70 percent of global cocoa production, cocoa exports represent an important revenue stream, providing foreign exchange that supports the financing of imports. In 2024, cocoa export earnings accounted for around 19.0 percent of total merchandise exports in both Côte d'Ivoire and Cameroon and 7.0 percent in Ghana. In the same year, cocoa export earnings exceeded the value of food imports in Côte d'Ivoire, accounted for nearly 70 percent of Cameroon's food import expenditures and covered over 40 percent of Ghana's food import bill.<sup>23</sup> The cocoa sector is not only important in producing countries but also contributes significantly to importing countries, where cocoa beans are often exported for processing and sold to end users, contributing to employment in the services sector, value addition and tax revenues. In 2023, the value of global cocoa production was estimated at USD 8.2 billion, while world trade in cocoa was valued at USD 9.8 billion. Although cocoa is used in various products, it is mostly consumed by the chocolate industry, which is valued at over USD 100 billion annually.<sup>22</sup>

**Figure 2.6.** World cocoa market

Sources: Authors' own elaboration based on data from FAO. 2026. FAOSTAT: Crops and livestock products. [Accessed on 6 January 2026]. <https://www.fao.org/faostat/en/#data/TCL>. Licence: CC-BY-4.0 and Refinitiv. 2026. Cocoa supply and use balance data (ICCO). Refinitiv Workspace. © Refinitiv. Accessed under licence. [Accessed on 12 January 2026].



World cocoa bean production has increased steadily over the past decades, with an average annual growth rate of 2 percent from 1994 to 2024 (Figure 2.6a),<sup>23</sup> almost entirely driven by area expansion. The growth mainly reflects a 2.5 percent annual increase in Côte d'Ivoire, traditionally the world's largest cocoa-producing country, which currently accounts for nearly 40 percent of global production. The steady rise was driven by the sectorial liberalization in the early 1990s, which created incentives for increased supply,<sup>24</sup> and was further sustained by internal labour migration and the gradual expansion into forested areas.<sup>25</sup> More recently, government measures, including a regulated pricing system that guarantees farm-gate prices, along with a growing area under cultivation and the continued availability of labour, have supported the growth in production.<sup>26</sup> Significant increases over the past decades were also recorded in Ghana, the world's second largest cocoa-producing country, which provides over 10 percent of global supply. Ecuador, the third largest producer, experienced the fastest growth, at over 5 percent annually, driven by the adoption of high-yielding cocoa varieties, strong market incentives, and both public and private investments.<sup>27</sup> In Indonesia, the world's fourth largest producer, production increased over the decades but has declined in recent years mirroring a gradual decline in cultivated area.<sup>28</sup>

Côte d'Ivoire is also the world's largest cocoa exporter, accounting for some 30 percent of global cocoa trade, followed by Ghana and Ecuador, each contributing around 10 percent in most recent years (Figure 2.6b).<sup>23</sup> Over the past three decades, while Côte d'Ivoire and Ghana have continued to account for about half of global exports, Ecuador's share has risen significantly – from just 3 percent in 1994 to over 10 percent in 2024 – reflecting strong and sustained production growth, with most of the output destined for export. Notably, in Ecuador, about two-thirds of the output growth over the past three decades has been driven by productivity gains rather than land expansion, a pattern that differs from other major producing countries.<sup>23</sup> With cocoa production and trade dominated by a handful of countries, particularly in West Africa, the global cocoa market remains heavily reliant on a few key suppliers to meet demand. The concentration of production in a limited number of countries makes the cocoa sector particularly vulnerable to external shocks, increasing the risk of supply disruptions linked to extreme weather, geopolitical tensions, or shifts in trade regulations.

On the demand side, world cocoa consumption<sup>d</sup> has increased sharply over the past decades (Figure 2.6c), in line with expansion in output driven by rising consumer demand for cocoa-based products and expanded processing capacity in producing and emerging consuming countries. Europe remains the world's largest cocoa grinding region, accounting for over 35 percent of the global total in 2024, followed by Asia and Oceania with more than 20 percent, and Africa with a similar share. North and South America together represent nearly 20 percent.<sup>29</sup> However, cocoa grinding in producing countries has risen steadily in recent years, reflecting a gradual shift in processing from consuming to producing regions as the economic conditions have become more favourable.<sup>30</sup> Indeed, after expanding its processing capacity, Côte d'Ivoire recently surpassed the Kingdom of the Netherlands to become the world's top cocoa grinding country.

<sup>d</sup> In this report, consumption refers to cocoa grindings: the volume of cocoa beans processed into semifinished products such as cocoa liquor, cocoa butter, and cocoa powder. Grindings are commonly used as a proxy for cocoa demand.

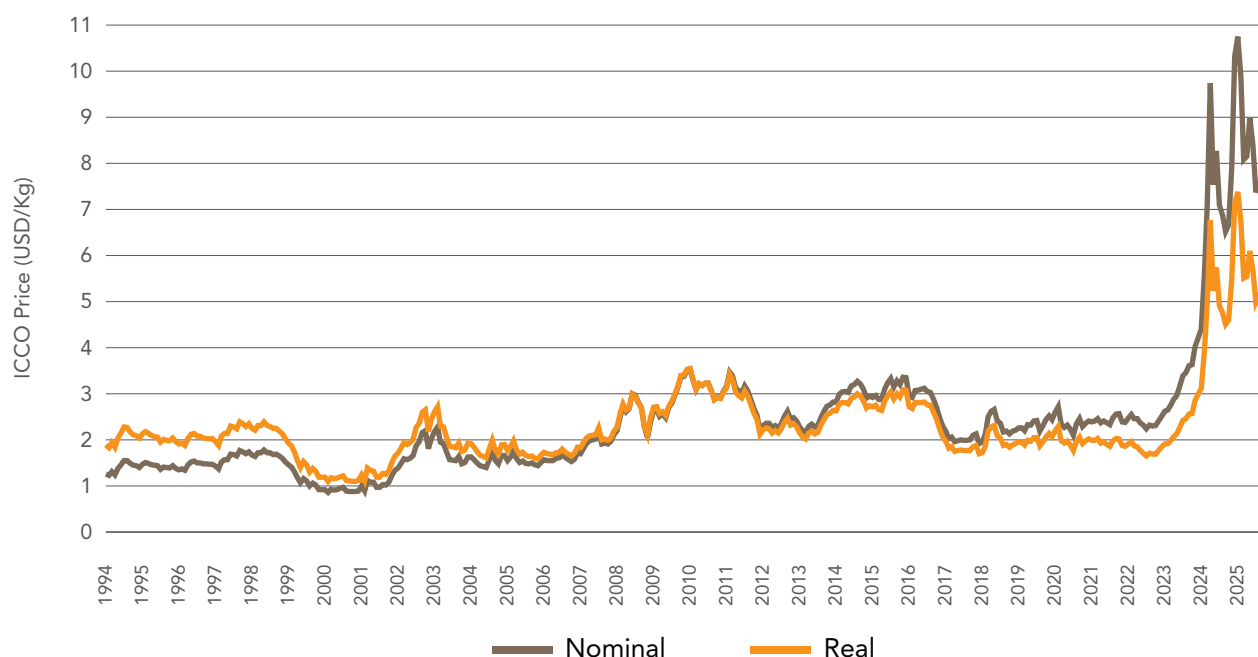


Cocoa bean imports have expanded steadily over the past decades, growing at a rate broadly in line with global cocoa consumption. Oceania recorded the fastest growth in cocoa bean imports, driven by Australia and New Zealand, with an average annual increase of around 10 percent in the past 30 years. Strong growth was also recorded across Asian countries. The European Union remains, however, the world's largest importer of cocoa beans, accounting for over 50 percent of global imports. It is followed by Malaysia, which together with Indonesia, represent around 20 percent of the total, highlighting their emergence as major importers over the past few decades amid rising per capita incomes (Figure 2.6d). The United States of America follows with a 5 percent share.<sup>23</sup>

In the 2000s, the cocoa supply and demand situation was characterized by several fluctuations: Production increased erratically, while grinding grew more steadily. Prices rose in the early 2000s and then climbed sharply from 2007, culminating in a peak in early 2010 (Figure 2.7). High prices encouraged producers to expand cultivation, particularly in West Africa, leading to a surge in production in 2011. Although production declined slightly in 2012, it remained above grindings in both years, maintaining a production surplus that exerted downward pressure on prices through 2012.<sup>31</sup> Prices then rallied from late 2013 to mid-2014, mostly due to weather-related supply concerns. They remained relatively stable through 2015 but began to weaken in 2016 as demand slowed and dropped sharply in 2017 following a global production surge that created a significant surplus. In the years that followed, international cocoa prices remained broadly stable through 2022, reflecting a relatively balanced global supply and demand situation.

Despite being substantial, these earlier fluctuations were modest when compared to the price spikes and volatility observed in the last two years. The dramatic surge in the international price of cocoa began in 2023 and continued into 2024, peaking at USD 9.7/kg in April 2024. This rally was mainly driven by tight global supplies during the 2023/24 (October–September) season. Global cocoa production is estimated to have decreased by 12.9 percent in 2023/24, falling to 4.4 million tonnes from 5.0 million tonnes in 2022/23,<sup>32</sup> and resulting in a large global production deficit. The contraction mainly reflects a 25.3 percent decline in output in Côte d'Ivoire and a 31.3 percent drop in Ghana, both of which were adversely affected by dry weather and the spread of the cocoa swollen shoot virus disease (CSSVD). Following the April peak, international cocoa prices declined on expectations of improved supplies in the 2024/25 season amid conducive weather conditions in key producing countries. Global cocoa output was forecasted to increase by more than 10 percent in 2024/25, mostly driven by Côte d'Ivoire and Ghana, where production was anticipated to rise by 10.5 percent and 33.6 percent, respectively.<sup>33</sup>



**Figure 2.7.** World cocoa prices (nominal and real)

*Note:* Nominal prices are the monthly average of the ICCO daily prices. The ICCO daily price is the average of the first three positions on the terminal markets of New York and London. The real prices are calculated by deflating the nominal prices with the US Consumer Price Index.

*Sources:* Authors' own elaboration based on World Bank. 2026. Commodity price data (The Pink Sheet). [Accessed on 15 January 2026]. <https://www.worldbank.org/en/research/commodity-markets>. Licence: CC-BY-4.0; and International Monetary Fund (IMF). 2026. IMF Data Explorer. United States, Consumer Price Index (CPI), All Items (2010=100). [Accessed on 15 January 2026]. [https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI\(5.0.0\)](https://data.imf.org/en/Data-Explorer?datasetUrn=IMFSTA:CPI(5.0.0)). Licence: CC BY 4.0.

Nevertheless, prices rebounded in late 2024 and reached an all-time high of USD 10.7/kg in January 2025, due to renewed concerns over the impact of dry weather conditions on crops in Côte d'Ivoire and Ghana. High cocoa prices caused demand to weaken, as reflected in declines in cocoa grindings reported by major regional cocoa associations in Europe, North America, and Asia. Data published by the European Cocoa Association (ECA) and the Cocoa Association of Asia (CAA) showed that grindings in the fourth quarter of 2024 were at their lowest levels since 2020, when the COVID-19 pandemic caused market disruptions.<sup>34</sup> The downward trend in demand persisted into the first quarter of 2025, though at a slower pace than expected, with ECA reporting a year-on-year decrease of 3.7 percent, the CAA 3.44 percent, and the National Confectioners Association (NCA) of the United States of America 2.45 percent.<sup>35</sup> Weaker global demand, as reflected in lower cocoa grindings, and improved rainfall in West Africa contributed to a sharp decline in cocoa prices in February and March 2025. Although concerns over bean quality in Côte d'Ivoire underpinned a rebound in April and May,<sup>36</sup> international cocoa prices declined steadily from June to December 2025, when they reached USD 5.78/kg, 44 percent down from their level a year earlier. The sharp decline in prices in the second half of 2025 was driven by improving expectations for the 2025/26 global supply outlook, supported by expanding production in Ecuador and favourable weather conditions across key West African producing countries.<sup>37</sup>

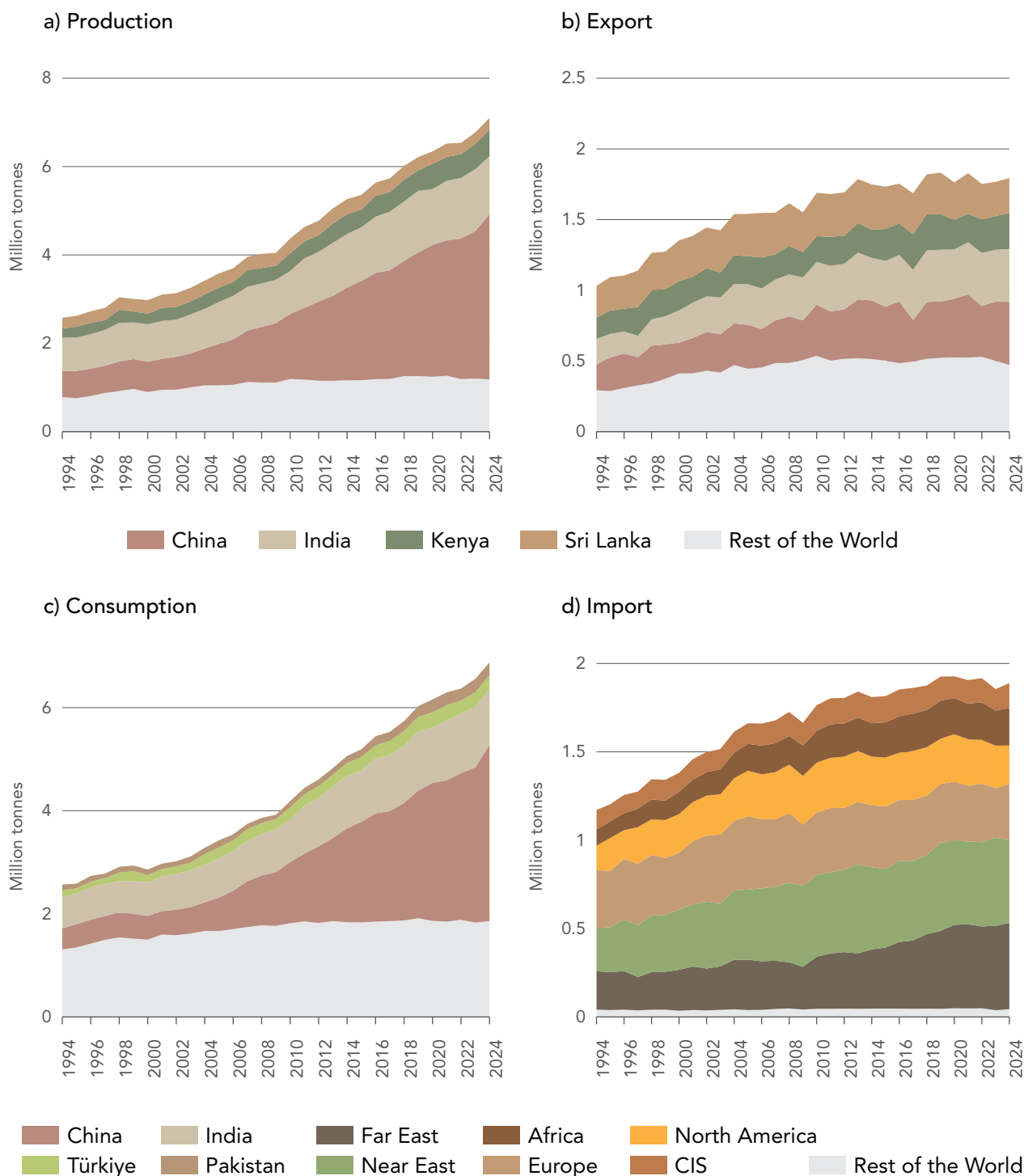
### 2.2.3. Tea

Tea is the most consumed drink in the world, after water.<sup>38</sup> Its industry plays a vital role in promoting rural development, reducing poverty, and enhancing food security in many low-and middle-income countries. For numerous poor families, it represents a crucial source of income and employment. Tea cultivation contributes to food security in rural communities by creating employment and generating income, particularly for smallholder farmers, which account for over 60 percent of total production. Globally, the value of tea production in 2024 was around USD 20 billion, while international trade was valued at around USD 9.5 billion, contributing significantly to export revenues of several countries.

Over the last three decades, global production (black, green, instant and other) grew steadily at an average rate of approximately 3.6 percent per annum, rising from around 2.5 million tonnes in 1994 to 7.1 million tonnes in 2024. Currently, the main producers are China, India, Sri Lanka and Kenya (Figure 2.8a). The significant growth in global output is sustained mostly by China, the largest tea producer in the world, which accounts for over 50 percent of global production. Harvest in China grew at an average rate of 6.8 percent per year over the last three decades and reached 3.74 million tonnes in 2024, compared to 0.6 million tonnes in 1994. The surge is attributed to several economic and social factors, including an increase in productivity due to improved agricultural practices, expansion in planted areas, supportive domestic policies, integration into the global trade network which encouraged the exports of both commodity and specialty teas, and improved access to technology and extension services. During the same period, the second largest producer, India, grew at a slower pace (i.e. 2.2 percent per annum) and reached 1.31 million tonnes in 2024, compared to 0.75 million tonnes in 1994, driven by productivity gains. Kenya, the third largest producer, experienced an average growth of 3.2 percent over the same period and reached a record high of 0.6 million tonnes in 2024, fuelled by favourable weather conditions and the government's fertilizer subsidy program.<sup>39</sup>

On the contrary, output in Sri Lanka remained relatively stable over the period 1994–2024 although it recorded a 2.4 percent decline during the last decade due to a combination of factors, such as lower yields caused by severe drought conditions and rising input costs. In addition, the ban on chemical fertilizers in 2021 directly impacted tea yields, contributing to the significant drop in production in 2022, when Sri Lanka recorded the greatest crop shortfall since 1995. The economic crisis, coupled with increased fuel prices and labour costs, which hampered logistics and factory operations, further impacted the tea industry. Sri Lanka's tea production recovered slightly in 2024 to 0.27 million tonnes, but it remained well below the volumes attained during the first half of the decade, which were steadily above 0.3 million tonnes.

**Figure 2.8.** World tea market



Source: Authors' own elaboration based on data from FAO, 2026. Tea Country Balance Sheet (TCBS) System.



Among the various types of tea derived from the *Camellia sinensis*, the tea plant, black and green teas constitute the most important varieties, differentiated mostly by their degree of oxidation and processing techniques.<sup>e</sup> According to FAO, black tea and green tea together account for approximately 88 percent of the global tea production with an average share over the last decade of, respectively, 55 percent and 33 percent.<sup>40</sup> China is the largest producer and consumer of green tea and dominates the global market, accounting for around 90 percent of green tea production and over 75 percent of green tea exports.<sup>f</sup> At the same time, black tea is mostly produced by India, Kenya and Sri Lanka which produced, respectively, 38 percent, 15 percent and 8 percent of total black tea output over the period 2015–2024.

Unlike coffee and cocoa, tea exports account for a relatively modest share of global production, as a significant portion of output is retained to meet domestic demand in major producing countries. In 2024, only 25 percent of global tea production was traded internationally, a substantial decrease from the 40 percent registered in 1994, as demand in traditional tea-producing countries expanded on the back of rising real per capita income and population growth. Tea exports increased annually by 1.7 percent over the period 1994–2024, reaching 1.79 million tonnes (Figure 2.8b). This is substantially lower than the production growth rate (3.6 percent), and it showed a marked slowdown over the last decade, where the average growth has been equal to 0.3 percent. Since the post-COVID period, global exports have remained stagnant, as geopolitical tensions and conflicts have disrupted international trade, resulting in lower shipments of tea to key importing markets. In 2024, Kenya continued to dominate the international market, accounting for 25.0 percent of global exports, followed by China (21.0 percent) and India (14.3 percent), which became the third largest exporter of tea, surpassing Sri Lanka.

Still, global tea trade represents a vital source of export earnings for some of the major producing countries. For example, exports revenues contribute significantly to financing the food import bills of Kenya and Sri Lanka, the first and third largest exporters of black tea. Although foreign exchange earnings from tea are relatively fewer for other producing countries, such as China and India, the sector remains vital for its substantial contribution to national income and employment, particularly in rural areas. The industry supports millions of smallholder farmers and plays a crucial role in agricultural development and economic resilience.

Global tea consumption, primarily driven by both traditional markets and emerging economies, has expanded by an average of 3.5 percent annually over the past thirty years, reaching 6.88 million tonnes in 2024. Over the last decade, this growth has been mainly fuelled by rising domestic consumption in major producing countries, notably China and India, which has offset weaker demand in traditional importing markets, such as the Russian Federation, Europe, the United States of America, and Canada. Growing tea consumption is mainly due to greater health awareness, higher demand for organic and premium teas, increased incomes, and evolving lifestyles in emerging regions such as Asia, Africa, and Latin America. China has been the

<sup>e</sup> Black tea undergoes full oxidation, resulting in a darker colour and stronger flavour profile, while green tea is minimally oxidized, preserving its lighter colour, and delicate taste.

<sup>f</sup> In 2024, China produced 2.06 million tonnes of green tea, followed by Viet Nam and Japan, which register considerably lower volumes.

leading contributor to this growth, with tea consumption rising by an average of nearly 8 percent annually over the past thirty years. In 2024, global tea consumption expanded by nearly 5 percent compared to 2023, and is expected to further increase in 2025, as the market continues to be underpinned by robust demand and the increasing awareness of the health benefits associated with drinking tea. Consumption in China, the largest consumer of tea, reached 3.4 million tonnes in 2024, representing a share of nearly 50 percent of global consumption. India, the second largest consumer, accounted for a share of 15.5 percent, with 1.07 million tonnes in 2024, followed by Türkiye with 0.28 million tonnes, and Pakistan with 0.25 million tonnes (Figure 2.8c). Interestingly, the share consumed by the rest of the world reduced from 50 percent in 1994 to 27.0 percent in 2024.

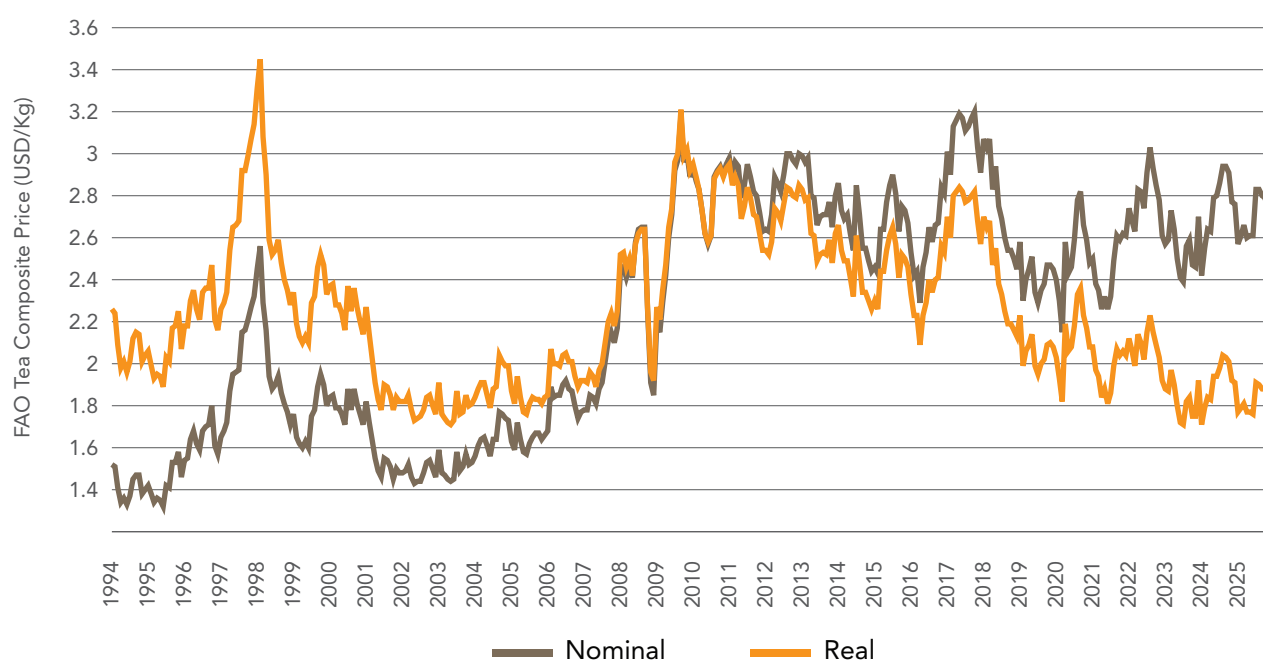
Global tea imports registered a slight increase over the past three decades (1.6 percent annually), reaching 1.89 million tonnes in 2024 (Figure 2.8d). As mentioned previously, the rising demand in emerging Asian economies, such as Pakistan and China, offset declining trends in traditional importing markets of Europe, North America and the Russian Federation. This outcome resulted from a range of factors, including evolving consumer preferences and broader economic challenges. Additionally, geopolitical tensions and conflicts disrupted tea trade flows, further constraining global trade.



Unlike coffee and cocoa, tea is not traded through futures contracts. Auction centres located in key producing countries function as the core mechanism for international tea trade and facilitate global price benchmarking (see Box 2.1). Figure 2.9 presents the trends in global tea prices over the past 30 years, adjusted for inflation, as measured by the FAO Tea Composite Price. Despite several episodes of sharp price increases linked to major supply disruptions in key producing countries, the real price exhibits a long-term downward trend, especially since the last spike in 2009. Between 1997 and early 1998, auction prices rose sharply due to drought-induced

crop losses in Kenya and Indonesia, together with a strong import demand from the Russian Federation and other former Union of Soviet Socialist Republics (USSR) countries.<sup>41</sup> After a relatively stable period, yet at relatively low level, tea prices began to rise steadily from 2006 to 2009, driven by robust global demand, particularly in emerging markets. The upward trend intensified in 2008 and 2009, because of civil unrest in Kenya and prolonged droughts in Kenya, India and Sri Lanka, which led to tightened global supply.<sup>42</sup> However, from around 2009 onward, the real price of tea declined, reflecting recurrent oversupply, which put downward pressure on tea quotations.

**Figure 2.9.** World tea prices (nominal and real)



*Note:* Nominal prices are the FAO Tea Composite Price, a weighted price index for black tea, including both crush, tear, curl (CTC) and Orthodox teas, across the four primary auction locations: Calcutta, Cochin, Colombo, and Mombasa. Real prices are calculated by deflating nominal prices with the US Consumer Price Index.

*Source:* Authors' own elaboration based on data from FAO. 2026. EST, 2026. [Accessed on 05 February 2026]. Licence: CC-BY-4.0; and International Monetary Fund (IMF). 2026. IMF Data Explorer. United States, Consumer Price Index (CPI), All Items (2010=100). [Accessed on 15 January 2026]. [https://data.imf.org/en/Data-Explorer?datasetUrn=IMF.STA:CPI\(5.0.0\)](https://data.imf.org/en/Data-Explorer?datasetUrn=IMF.STA:CPI(5.0.0)). Licence: CC By 4.0.

In recent years, downward pressure on tea prices has stemmed mainly from a global supply-demand imbalance, driven by production recoveries in key producing countries such as India, Kenya and Sri Lanka, amid subdued international demand. Tea prices declined by 2.1 percent in 2025 to USD 2.69 per kg, from USD 2.75 per kg in 2024, reflecting higher availability, weakened global demand, and a scarcity of high-quality teas; nevertheless, prices remained relatively high compared to the long-term average. Additional emerging challenges affecting tea auction sales included delays in shipments to Europe and North Africa, owing to attacks of vessels along the Red Sea route, as well as market access difficulties in key importing countries, such as Sudan.



### 2.3. Key factors impacting the beverage commodity markets

The previous section provided an overview of the market situation for the three commodities under analysis, describing the evolution over time of the fundamentals such as supply, demand, international trade and their effect on the global prices of these products. Nevertheless, global agricultural commodity prices are influenced also by a set of cross-cutting factors that shape their dynamics across time and may synchronize price movements across products. This section briefly identifies and discusses some of these elements and how they may drive global prices for coffee, cocoa and tea.

Global economic activity is one of the key drivers of international commodity prices. When economic growth and industrial production accelerate, income levels rise. Higher incomes, particularly in emerging markets, boost consumption, raise demand for commodities and, consequently, increase their prices.<sup>43, 44</sup> The empirical evidence shows that these linkages are more evident with energy and metal commodity prices.<sup>45</sup> Nevertheless, both food and beverage commodities have shown that they react to changes in the global economic activity. An example is the recent price surge observed during 2021 and 2022, mostly triggered by the strong recovery of global demand from the recession caused by the COVID-19 pandemic (see Figure 2.1 and 2.2).<sup>46</sup>

The impact of global demand on beverage prices is also shaped by the evolution of other aspects such as urbanization, demographic shifts, and changing consumer preferences. These evolving factors reflect how rising global incomes and changing consumption dynamics are driving not only the quantity but also the composition of demand, with significant implications for price dynamics, quality differentiation, and trade flows across beverage commodity markets. For example, the raising interests in specialty varieties and single-origin products in both traditional and emerging economies has driven up the global demand for beverages such as coffee and tea and, consequently, their commodity prices.

A second set of drivers relates to energy and fertilizer prices, which are crucial determinants of production costs and, consequently, producer margins. Fertilizers, including nitrogen, phosphorus, and potassium, are widely used in coffee, cocoa, and tea farming. Following the price spikes observed in 2022 due to the war in Ukraine and other supply chain disruptions, fertilizer prices declined but remained above the pre-pandemic levels in many producer countries.<sup>47</sup> Energy prices, particularly diesel and electricity, affect both on-farm operations as well as post-harvest processing and transportation. In major cocoa-producing countries, such as Ghana and Côte d'Ivoire, the costs of transportation and fertilizers increased significantly in recent years, contributing to reduce yields and final output.<sup>22</sup> Sustained increases in input costs can also reduce incentives to maintain or expand production, thereby tightening supply in the medium term.

Labour cost is another key driver affecting the beverage market. Growing coffee, cocoa and tea is a labour-intensive activity since, especially in low-income countries, harvesting and post-harvest handling are still done manually. According to the International Coffee Organization (ICO),<sup>48</sup> coffee heavily relies on manual work to pick, sort and transport green beans. In Côte d'Ivoire and Ghana, harvesting, drying, fermentation



and transportation of cocoa pods are carried out manually by smallholder farms and their families,<sup>49</sup> while tea plucking in major producing countries depends heavily on timely handpicking.<sup>50</sup> Clearly, as wages rise – driven by rural–urban migration, inflation, or increased minimum wage policies – labour costs put additional pressure on the commodity prices.



### Box 2.2. EU Deforestation Regulation (EUDR)

The EU Deforestation Regulation (EU 2023/1115), generally referred to as the EUDR, establishes binding rules for the marketing of certain commodities and products derived from them within the European Union and for their export. The regulation applies to products that contain, have been fed with, or have been made using cattle, cocoa, coffee, palm oil, rubber, soybeans, or wood. Its objective is to reduce the European Union's impact on global deforestation and forest degradation, thereby helping to reduce greenhouse gas emissions and biodiversity loss.<sup>i</sup>

To be made available on or exported from the EU market, all relevant commodities covered by the regulation, including coffee, cocoa and their derived products must meet the following conditions:<sup>ii</sup>

- **Deforestation-free:** Production must not have occurred on land that has been subject to deforestation after 31 December 2020.
- **Legally produced:** Commodities must comply with all relevant legislation in the country of production, including land tenure, environmental, labour, and human rights laws.
- **Subject to due diligence:** Operators (defined in Article 2[15] of the regulation as individuals or legal entities acting commercially that place relevant products on the EU market or export

them) must submit a due diligence statement prior to market placement or export. This statement confirms that the operator has collected all required information, documents, and data, such as geolocation coordinates of the production plots and evidence of legal and deforestation-free production, assessed and mitigated risks, and will retain records for at least five years. <sup>iii</sup>

Compliance will require operators to implement traceability systems, including the collection of geolocation data and, where appropriate, plot-level mapping. For areas at high risk of deforestation, a higher degree of traceability to the farm level may be required, often involving geolocation data and farm mapping. Compliance efforts should be supported through collaboration with business partners, industry associations, and multistakeholder initiatives, including capacity building and training. Additionally, the use of responsible purchasing practices, including longer-term contracts, or preferential sourcing, can support suppliers' efforts to implement forest-positive practices. <sup>iv</sup>

Following the adoption of Regulation (EU) 2025/2650, which amends Regulation (EU) 2023/1115, large operators and traders must comply with the EUDR from 30 December 2026, while micro- and small enterprises have until 30 June 2027. The amendment also introduces simplification measures aimed at reducing administrative burdens and facilitating compliance for operators and traders.<sup>v</sup> Non-compliance may result in penalties, including fines and withdrawal of products from the EU market. <sup>vi</sup>

*Sources:* <sup>i</sup> EU (European Union). 2023. Regulation (EU) 2023/1115 of the European Parliament and of the Council of 9 June 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation [2023] OJ L 150, Art 1. In: *EUR-Lex*. [Cited 05 December 2025]. <https://eur-lex.europa.eu/eli/reg/2023/1115/oj>; <sup>ii</sup> EU (European Union). 2023. Regulation (EU) 2023/1115, Art 3. In: *EUR-Lex*. [Cited 05 December 2025]. <https://eur-lex.europa.eu/eli/reg/2023/1115/oj/eng>; <sup>iii</sup> EU (European Union). 2023. Regulation (EU) 2023/1115, Art 8-12. In: *EUR-Lex*. [Cited 05 December 2025]. <https://eur-lex.europa.eu/eli/reg/2023/1115/oj/eng>; <sup>iv</sup> OECD & Food and Agriculture Organization of the United Nations. 2023. *OECD-FAO Business Handbook on Deforestation and Due Diligence in Agricultural Supply Chains*. OECD Publishing. <https://doi.org/10.1787/c0d4bca7-en>; <sup>v</sup> EU (European Union). 2025. Regulation (EU) 2025/2650 of the European Parliament and of the Council of 19 December 2025 amending Regulation (EU) 2023/1115 as regards certain obligations of operators and traders, Official Journal of the European Union, L 2650, 23.12.2025. In: *EUR-Lex*. [Cited 20 January 2026]. <http://data.europa.eu/eli/reg/2025/2650/oj>; <sup>vi</sup> EU (European Union). 2023. Regulation (EU) 2023/1115, Articles 24-25. In: *EUR-Lex*. [Cited 05 December 2025]. <https://eur-lex.europa.eu/eli/reg/2023/1115/oj/eng>.

Transportation and logistics disruptions affect commodity trade, including the beverage supply chains which highly depend on maritime shipping to reach final users. Coffee and cocoa frequently travel across the world from producing to consuming markets. Delays in shipment, congestion at ports, container shortages, and high freight rates directly impact commodity prices and, consequently, the balance of payment of the importing countries.<sup>51</sup> For example, a recent FAO study shows that an increase in container shipping costs has a positive and significant impact on international coffee prices within few months.<sup>52</sup> The 2026 conflict in the Middle East provides a recent example of the effects that maritime transport disruptions can have on regional beverage supply chains (Box 2.3).



**Box 2.3.** 2026 Conflict in the Middle East: Implications for coffee, cocoa and tea trade

The 2026 conflict escalation in the Middle East disrupted shipping routes and maritime trade through the Strait of Hormuz, raising transport and insurance costs and reducing shipping activity through the Strait. Although the Persian Gulf is not a production region for coffee, cocoa or tea, the United Arab Emirates serves as an important regional trading and re-export hub, particularly for tea and increasingly also for coffee. However, the direct impact on global coffee, cocoa and tea trade flows remained limited because the principal international trade routes for these commodities do not normally transit through the Strait of Hormuz.

Tea imports into the United Arab Emirates originate primarily from India, Kenya and Sri Lanka, while coffee is sourced mainly from Viet Nam, Ethiopia, Brazil and India. Re-exports from the United Arab Emirates are directed largely to neighbouring regional markets, particularly the Islamic Republic of Iran and Saudi Arabia. The conflict affected the movement of beverage commodities into and out of the region, with its impact largely confined to regional trade and logistics rather than global commodity markets, where prices continued to be driven primarily by global supply and demand fundamentals, notably production conditions in major producing and exporting countries.

Latest available trade data indicate a marked disruption in United Arab Emirates coffee and tea trade flows during the period of the escalation of the conflict. On the import side, coffee imports fell by more than half, declining from approximately 12.3 thousand tonnes in January 2026 to 5.4 thousand tonnes in March, while tea imports fell from 13.1 thousand tonnes to 4.0 thousand tonnes over the same period. The effects on cocoa are less evident, as trade in the United Arab Emirates, like that in other Gulf countries, is dominated by processed cocoa products rather than raw cocoa beans, which account for a comparatively small share of imports. On the export side, the decline appears to have been more pronounced in coffee trade. However, the reported decline in exports should be interpreted with caution, as partner-level data for some key destination markets were not available at the time of the analysis. Furthermore, short-term monthly fluctuations in trade may reflect shipment delays, customs clearance timing and inventory adjustments, and should therefore be interpreted cautiously.

A comparison with Saudi Arabia, the region's largest coffee importer, suggests that the impact of the disruptions was not uniform across the Gulf region. Coffee imports by Saudi Arabia declined in March 2026 but recovered in subsequent months, whereas tea imports were affected to a lesser extent. Unlike the United Arab Emirates, Saudi Arabia has access to ports on the Red Sea coast, providing alternative maritime trade routes.

*Sources:* i FAO. 2026. Global Agrifood Implications of the 2026 Conflict in the Middle East – Impacts on energy and fertilizer trade and food security. Rome. <https://openknowledge.fao.org/server/api/core/bitstreams/1aafb5d8-39d1-481a-b1f8-25facaec3051/content>; ii Global Trade Tracker (GTT). [Accessed on 2 July 2026]. <https://www.globaltradetracker.com/>

Global beverage commodity prices can also be affected by changes in currency values and interest rates. Most agricultural commodities, including coffee, cocoa and tea, are traded in US dollars, meaning that fluctuations in the US exchange rate with respect to major trading partners will necessarily impact their value and traded volumes.<sup>53</sup> For example, a depreciation of the US dollar with respect to a wide range of currencies increases

the dollar-denominated commodity price.<sup>54</sup> At the same time, low interest rates may impact commodity prices through the stimulus to global economic activity, the increase in demand of storable commodities and a switch from treasury bonds to commodity futures. Although these mechanisms seem plausible, research has yet to agree on how exchange rates and interest rates impact global agricultural commodity prices.<sup>45, 54</sup> The empirical specification adopts a parsimonious structure in which exchange rate and interest rate dynamics are not explicitly modelled in the global analysis presented in [Chapter 3](#), while bilateral exchange rates are included in the country-level analysis in [Chapter 4](#). Although exchange rate movements may partly co-move with global demand conditions, they also operate through distinct channels – such as production costs and pass-through effects in producer economies – that are not separately identified in the global framework. The role of exchange rate dynamics should therefore be understood as only partially captured by the global demand proxy.

Finally, global agricultural commodity prices can be affected by the domestic policies implemented by major producing and consuming countries. The set of possible interventions is broad, and it includes macroeconomic policies influencing the terms of trade of a country – such as tight/loose monetary policies – as well as trade and market-specific measures.<sup>55</sup> Tariff and non-tariff measures (NTMs) are the trade tools most used by governments to influence commodity prices and trade volumes. Among the NTMs, those most applied are import quotas, export bans, licenses, technical barriers to trade, sanitary and phytosanitary measures, export restrictions, custom surcharges, financial measures and anti-dumping measures.<sup>56</sup> Nowadays, particularly relevant for the case of cocoa and coffee is the new EU Deforestation Regulation (EUDR) (see [Box 2.2](#)). Finally, governments can adopt other market and agricultural-specific measures which influence farm gate prices and, consequently, their values on the international market. These include, among others, input and output subsidies, price control, and public procurements. Due to their economic and social importance, beverage markets attract significant attention from policymakers in major producing countries, who often support these crops with subsidies or price incentives to ensure smallholder farmers' welfare.

Building on the discussion of recent price developments and the cross-cutting market drivers, the next chapter develops an empirical framework to quantify the relative contribution of several drivers to the global beverage price dynamics.





# 03

## Chapter

### Structural drivers of global beverage prices

#### KEY MESSAGES

- Market fundamentals are the main drivers of short-run price movements in coffee, cocoa and tea markets, causing the largest and most persistent price increases. Broader macroeconomic factors, such as the global economic activity conditions and energy prices, have limited short-run effects on real beverage prices.
- Inventories are crucial in shaping coffee and cocoa price dynamics. When stocks are low, price spikes from supply shocks are amplified. Precautionary and expectation-driven demand for inventories can trigger short-lived but significant price movements. These mechanisms are less relevant for tea, which lacks organized futures markets.
- Empirical analysis shows that, on average, the variability of global coffee, cocoa and tea prices is explained by changes in net-supply, accounting for over 90 percent of price movements. This includes both disruptions to global production triggered by, for example, weather-related events and market-specific demand shocks, such as sudden shifts in consumer preferences and/or the implementation of trade and domestic policies.
- The historical decomposition of the drivers' contributions suggests that recent surges in coffee and cocoa prices were primarily driven by net-supply shocks, such as harvest losses, adverse weather in major producing regions, and low inventories. Broader macroeconomic factors exerted upward pressure during 2015–2016 and the post-COVID-19 recovery.
- During the pandemic, sluggish global economic conditions contributed to pushing coffee and cocoa prices downward. On the contrary, for tea, price increases during the COVID-19 pandemic were mainly due to a significant demand component, reflecting increased in-home consumption and perceived health benefits.

#### 3.1. Introduction

Understanding the structural drivers of global beverage prices is critical for designing effective and targeted policy responses. Chapter 2 highlighted that agricultural commodity prices are shaped by two broad categories of factors: commodity-specific market fundamentals and macroeconomic drivers. These forces interact simultaneously, making it challenging to isolate the effect of any single structural shock. A structural shock can be defined as an unexpected change in economic fundamentals, either on the supply or the demand side. Nevertheless, distinguishing between the sources of price shocks is essential to pin down

what is fundamentally driving the price movement, since each type of shock influences the beverages market differently and often calls for a different policy response. In practice, distinguishing the sources of a price shock is crucial for understanding the economic dynamics at play and for informing policy decisions. A supply disruption that leads to a surge in prices is addressed differently than a demand-driven price increase.

This chapter further develops the discussion by examining three principal questions:

- In what ways do unexpected shocks, such as climate events in West Africa or spikes in demand from processors, influence international cocoa prices?
- On average, how much of the variability in global coffee, cocoa and tea prices can be explained by a given type of shock? For instance, to what extent do changes in global economic activity or energy prices account for price movements relative to commodity specific factors?
- To what extent can a specific price spike be attributed to a particular shock? For example, how much of the coffee price surge observed during 2024–2025 can be explained by unexpected changes in global supply?



Answering these questions requires narrowing the wide range of potential explanatory factors to a manageable set of predictors and adopting a robust econometric framework capable of identifying the contribution of specific drivers while controlling for the contemporary and past influence of others. The empirical strategy adopted in this chapter builds on the structural characteristics of each commodity market. Coffee and cocoa benefit from well-developed futures markets, which facilitate price discovery and hedging, allowing the use of a competitive storage model framework. This model guides the selection of the predictors by emphasizing the role of inventories in smoothing imbalances between production and consumption over time and by incorporating expectations about future conditions. The potential role and nature of speculation in the determination of agricultural prices is discussed in [Box 3.1](#). Five key drivers are considered: global economic activity, energy costs, precautionary demand for inventories, expectation-driven demand for inventories, and



net-supply. For tea, which relies on auction systems for price discovery, a simplified demand-and-supply framework is applied. It includes global economic activity, energy costs, monthly tea production, and auction prices, with the latter capturing residual market-specific demand shocks.

To model price dynamics and disentangle the effects of different shocks, this analysis employs a Bayesian Structural Vector Autoregressive (BSVAR) model. This approach offers several advantages. First, unlike reduced-form specifications, it allows for an economic interpretation of the shocks, which can be interpreted as fundamental drivers of commodity price changes. Second, Bayesian inference incorporates prior information to better account for uncertainty, particularly when data are limited or when the model includes many parameters and identification restrictions. Moreover, it helps to prevent overfitting through commonly used shrinkage methods.

The identification strategy relies on a combination of sign and zero restrictions, ensuring that shocks are economically interpretable and uncorrelated. Three SVAR models are estimated, one for each commodity, using monthly data from January 1996 to March 2025 for coffee and cocoa and from January 2012 to December 2024 for tea. This setup allows experts to quantify the short-run impact of shocks on the set of endogenous variables, their contribution to price variability, and their historical role in major price episodes.

The results reveal three key insights. First, unexpected changes in commodity-specific market fundamentals are the main drivers of short-run price movements. In particular, negative net-supply shocks generate the largest and most persistent price increases across all three markets. Second, macroeconomic and energy shocks have limited short-run effects on agricultural commodity prices. Economic activity shocks lead to modest and short-lived increases in real prices, while energy shocks are statistically insignificant in all three markets, likely because nominal prices respond to these shocks similarly as they do to other commodity prices and closely follow overall inflation dynamics. Third, inventory-related shocks matter for coffee and cocoa. Specifically, shocks to uncertainty-driven precautionary demand and expectation-driven demand produce short lived but significant price spikes, consistent with the economic theory of competitive storage model. Although the effects of storage-related shocks dissipate within six months, they can amplify price movements when stocks are low.

Variance decomposition confirms that market fundamentals explain nearly all short-run price variability: Net-supply shocks account for 93 percent of one-month price variation in coffee and 89 percent in cocoa, while for tea, supply and market-specific demand shocks combined explain 99 percent. Macroeconomic shocks gain relevance only in the long run, especially for tea, where global activity accounts for about 46 percent of variance at a 10-year horizon. Historical decomposition further shows that recent price surges were driven by net-supply shocks that reduced global availability. The 2021–2022 and 2024–2025 coffee spikes stemmed from severe harvest losses and low inventories, later amplified by market uncertainty and expectations over the future seasons. The cocoa rally of 2023–2025 reflects poor harvests in West Africa, compounded, again, by rising uncertainty and negative expectations about the upcoming seasons. Tea price swings largely mirror supply shocks, with innovations to global economic activity playing a role mostly during the COVID-19 pandemic.

Three overarching conclusions emerge. First, supply-side resilience is paramount. Unexpected changes in commodity-specific market fundamentals are crucial in explaining the price dynamics, therefore policies should prioritize climate adaptation, pest and disease control, and efficient logistics. Second, inventory transparency reduces volatility. For coffee and cocoa, better stock data and early-warning systems can mitigate precautionary demand shocks and stabilize expectations. Third, blunt macroeconomic interventions are ineffective in the short run. Energy and global activity shocks have limited immediate effects on real prices; targeted measures are preferable to broad price controls. In sum, while macroeconomic conditions shape long-term trends, short-run volatility is overwhelmingly driven by market-specific shocks. Effective policy must therefore combine structural investments in production systems, risk management tools, and data transparency to enhance resilience and reduce vulnerability to future shocks.

### **3.2. Modelling commodity price dynamics: the role of storage and expectations**

Global agricultural commodity markets tend to exhibit large price swings. It is widely recognized that these markets experience long periods of relatively low and stable prices, disrupted by episodes of heightened volatility in which sharp price surges are often followed by equally abrupt declines toward their long-term equilibrium.<sup>57</sup> Identifying the economic forces underlying these boom-and-bust cycles is essential. The existing literature on modelling agricultural commodity prices explains this behaviour by emphasizing the role of storage in smoothing imbalances between production and consumption over time. In the standard framework, storable agricultural commodities – such as coffee and cocoa – allow traders to carry stocks from one period to the next, thereby creating an intertemporal link between current and future prices. Inventories serve as a key mechanism for balancing present supply and demand, incorporating expectations about future production and consumption, and determining the optimal quantity to store across periods. A critical assumption within this framework is that negative stock levels are not possible, as commodities cannot be consumed prior to their existence.<sup>58–61</sup>

In its simplest representation, the competitive storage model explains how rational, profit maximizing traders manage inventories to smooth commodity prices over time. Traders are assumed to be risk neutral and operate under a no-arbitrage condition: The current price cannot exceed the expected future price (discounted for interest) by more than storage costs. If future prices are expected to rise, traders store commodities today, reducing current supply and pushing current prices upward. Conversely, if prices are expected to fall, they release stocks, increasing supply and lowering current prices. This intertemporal arbitrage links prices across periods and generates serial correlation in commodity price dynamics. Also, the model features two possible regimes. When inventories are about to be exhausted, traders cannot buffer supply or demand shocks. Prices become highly sensitive to supply fluctuations, leading to sharp spikes during shortages. This regime often coincides with poor harvests or unexpected demand surges. On the contrary, when inventories are positive, and the no-arbitrage condition binds, traders adjust storage to smooth shocks, creating a stabilizing effect on prices. Price movements are less volatile, and expectations about future conditions strongly influence current prices.<sup>59</sup>

A central challenge in empirically testing the competitive storage model is the lack of reliable, high frequency data on physical inventories for most commodities. To address this, researchers use financial market data as an indirect proxy for inventory dynamics. The theoretical foundation for this approach is well established: The spread between futures and spot prices (adjusted for storage and interest costs) reflects the marginal convenience yield, which is itself a function of inventory levels. The concept of marginal convenience yield, which is the additional benefit of holding one more unit of inventory, plays a central role in this context. When inventories are low, the marginal convenience yield rises sharply, reflecting the high value of immediate access to the commodity and the increased risk of stockouts. The convenience yield is not directly observable but can be inferred from the spread since the derivative markets, particularly futures contracts, are tightly linked to these storage decisions. Futures prices incorporate market expectations about future supply and demand, and through arbitrage, they influence spot prices and storage incentives. When futures prices rise relative to spot prices, the incentive to store increases, leading to inventory accumulation. Conversely, when the convenience yield is high (typically during low inventory periods), spot prices may exceed futures prices, signalling tight market conditions and discouraging further storage.<sup>60, 61</sup>

#### Box 3.1. The role of speculation in the determination of agricultural prices

As highlighted in this report, the determination of agricultural commodity prices is a multifaceted process influenced by a wide range of interrelated factors. These include supply and demand fundamentals, global economic activity, demand for inventories, weather patterns, as well as financial market activities such as speculation. Speculation by non-commercial participants in commodity markets, whether it's crude oil, coffee, cocoa, or cotton, often spark considerable debate, especially during periods of large price swings. Recent studies offer more detailed perspectives on this issue.

In the context of agricultural markets, speculation refers to trading activities by participants who seek to profit from price movements rather than from the physical commodity itself. Speculators may include hedge funds, proprietary traders, and other financial actors. Their presence is often linked to greater market liquidity, more efficient price discovery, and enhanced market efficiency. Academic research indicates that speculation serves to absorb market shocks and enables risk transfer among participants, thereby enhancing the efficiency of both futures and spot markets.<sup>i,ii,iii</sup> Recent empirical research suggests that speculation tends to have a more pronounced impact on short-run price dynamics rather than long-term price trends. For instance, Tang and Xiong (2012) examine the financialization of commodity markets and find that speculative flows often amplify price surges or falls during periods of market stress, such as supply shocks or geopolitical events.<sup>iv</sup> However, over the longer run, fundamental factors – such as crop yields, global consumption patterns, and trade policies – remain the dominant drivers of price development.<sup>iv</sup>

A key argument in favour of speculation is its contribution to market liquidity and price discovery. By providing additional trading volume, speculators make it easier for commercial participants (such as farmers and processors) to enter and exit positions, which reduces transaction costs and improves price transparency. Studies in financial economics show that a well-functioning speculative activity can actually help align prices more closely with available information, making markets more efficient.<sup>vi</sup> Despite these benefits, speculation in agricultural markets has faced criticism. Some researchers



and policymakers argue that excessive speculative activity can distort prices, harming farmers and consumers by increasing volatility. Lagi, Bar-Yam *et al.* (2011) provide a quantitative model suggesting that investor speculation played a dominant role in sharp price spikes, while biofuel-driven demand underpinned longer-term upward trends.<sup>vii</sup> Lawson, Alam and Etienne (2021) show that the impact of speculation on food-grain prices varies by commodity, with rice and wheat less affected, while corn and soybeans are more sensitive to speculative activity.<sup>viii</sup>

There are claims, especially during periods of sharp price increases, that speculation contributes to hunger and malnutrition by making staple foods less affordable. However, the majority of econometric studies find limited evidence that speculation is the main cause of long-term price spikes or food crises, instead pointing to supply-demand imbalances and policy failures.<sup>ix</sup> Bredin, Poti and Salvador (2021) distinguish between biasing and stabilizing speculators, finding that both have limited overall influence on food commodity prices and little direct impact on long-term price levels.<sup>x</sup>

Research focused on beverages such as coffee and cocoa provides illustrative cases. For coffee, Gilbert (2010) finds that speculative flows can exacerbate short-term price volatility, but do not set prices over longer horizons.<sup>xi</sup> Similarly, for cocoa, studies indicate that while speculators may amplify price movements during times of uncertainty, fundamental crop and demand factors dominate in determining equilibrium prices.<sup>vi</sup> Staugaitis and Vaznonis (2022) also find that speculation can reduce or have no effect on short-run volatility for most agricultural commodities, with exceptions such as oats. Studies on tea are less prevalent, but available evidence suggests similar dynamics.<sup>xii</sup>

In summary, research shows, overall, that speculation plays a nuanced role in agricultural price formation. While it may amplify short-term price movements and volatility, its long-term influence is limited compared to underlying market fundamentals. Speculation supports liquidity and efficiency, but concerns about its societal impact persist, especially in the context of food security. Ongoing research and robust market regulation are essential to balance the benefits and risks of speculative activity in agricultural commodity markets.

Sources: <sup>i</sup> Irwin, S.H. & Sanders, D.R. 2012. Testing the Masters Hypothesis in commodity futures markets. *Energy Economics*, 34(1): 256–269; <sup>ii</sup> Ekeland, I., Lautier, D. & Villeneuve, B. 2019. Hedging pressure and speculation in commodity markets. *Economic Theory*, 68(1): 83–123. <sup>iii</sup> Bohl, M. T., Pütz, A. & Sulewski, C. 2021. Speculation and the informational efficiency of commodity futures markets. *Journal of Commodity Markets*, 23: 100159; <sup>iv</sup> Tang, K. & Xiong, W. 2012. Index investment and the financialization of commodities. *Financial Analysts Journal*, 68(6): 54–74; <sup>v</sup> Singleton, K.J. 2014. Investor flows and the 2008 boom/bust in oil prices. *Management Science* 60(2): 300–318; <sup>vi</sup> Brunetti, C., Büyükşahin, B. & Harris, J.H. 2016. Speculators, prices, and market liquidity. *Journal of Financial and Quantitative Analysis*, 51(5):1545–1574; <sup>vii</sup> Lagi, M., Bar-Yam, Y., Bertrand, K. Z. & Bar-Yam, Y. 2011. The food crises: A quantitative model of food prices including speculators and ethanol conversion. Cited 10 January 2026. <http://arxiv.org/abs/1109.4859>; <sup>viii</sup> Lawson, J., Alam, M.R. & Etienne, X. 2021. Speculation and food-grain prices. *Applied Economics* 53(20): 2305–2321; <sup>ix</sup> Fattouh, B., Kilian, L. & Mahadeva, L. 2013. The role of speculation in oil markets: What have we learned so far? *The Energy Journal*, 34(3): 7–33; <sup>x</sup> Bredin, D., Poti, V. & Salvador, E. 2022. Food prices, ethics and forms of speculation. *Journal of Business Ethics*, 179(2), 495–509; <sup>xi</sup> Gilbert, C.L. 2010. *Speculative Influences on Commodity Futures Prices 2006-2008*. Geneva, Switzerland, United Nations Conference on Trade and Development; <sup>xii</sup> Staugaitis, A.J. & Vaznonis, B. 2022. Financial speculation impact on agricultural and other commodity return volatility: implications for sustainable development and food security. *Agriculture*, 12(11), 1892.

While the competitive storage model provides a theoretical framework for understanding the price dynamics of storable commodities, its empirical implementation depends on the availability of futures markets to address the lack of inventory data. Both cocoa and coffee markets provide rich information on expectations, uncertainty, and storage incentives. By contrast – since tea lacks an organized futures market – a structural demand-and-supply model is employed, leveraging monthly production data for tea to capture short-term supply shocks and seasonal patterns.



### 3.3. Selection of the main drivers of the global beverage prices

The selection of drivers for modelling global beverage commodity prices reflects a synthesis of two strands of literature. The first highlights the influence of aggregate demand and energy prices in explaining commodity price co-movements across markets (see [Section 2.3](#)).<sup>62</sup> The second builds on the competitive storage model, incorporating commodity-specific factors, as discussed in the previous section. In this way, the analysis takes into account both macroeconomic forces and market-specific factors.

For coffee and cocoa, five key drivers are selected: two cross-cutting factors, the conditions of global economic activity and the energy price, and three market-specific variables capturing net-supply, precautionary demand, and expectation-driven demand for inventories. Global economic activity is proxied by using the Global Economic Conditions Indicator, developed by Baumeister, Korobilis and Lee (2019).<sup>63</sup> This indicator summarizes the state of the world economy by taking the first principal component of eight categories: real economic activity, commodity prices, financial indicators, transportation, uncertainty and expectations, weather, and energy-related measures. Therefore, it is used to capture shifts in the demand for agricultural



commodities, primarily driven by income effects. The second cross-cutting factor is the international crude oil price, measured as the U.S. refiner acquisition cost of imported crude oil, deflated by the United States Consumer Price Index (U.S. CPI). This is a proxy for energy costs, which influences production, processing and transportation expenses in agricultural supply chains. Energy cost variation is relevant because it can alter storage incentives and thus interact with the convenience yield channel identified through spreads.<sup>64</sup>

Commodity-specific dynamics are modelled through three channels. The first one is the net-supply channel, which captures the balance between current period production and consumption plus the inventories carried in from the previous period. In other words, it reflects the current scarcity of the product which cannot be addressed until the new harvest is available. For example, an adverse weather event in West Africa which destroys or reduces cocoa output or a drought in Brazil affecting coffee harvests lowers available supply, reduces inventories, and raises spot prices. This mechanism is captured by unexpected changes in real spot prices, proxied by the nearest to delivery futures contracts. For cocoa, the spot price is the nearby price on ICE London, while for coffee the nearby price is based on the ICE Coffee C contract. As common practice, both prices are deflated by the U.S. Consumer Price Index (CPI), retrieved from the FRED database.

The other two commodity-specific channels identify shocks to the demand for inventories. On the one hand, there is a precautionary demand motivated by heightened uncertainty regarding current market conditions. On the other hand, there is an expectation-driven demand motivated by changes in expectations regarding future market conditions. This distinction is important for several reasons. First, the two channels may have different effects on the real spot prices.<sup>65</sup> Second, the distinction between precautionary and expectation-driven demand is particularly suitable to the context of perennial crops, such as coffee and cocoa. Biological constraints on production limit the capacity of supply and stocks to respond rapidly to changing market conditions. Unlike annual crops, where supply can be increased in the next planting season, perennials require several years to mature, while sudden shocks to supply or demand cannot be quickly offset by increased output. In this context, any uncertainty surrounding either current or future supply and demand has direct repercussions on the price dynamics.





Precautionary demand for inventories increases when uncertainty about supply and demand of the on-going season rises. For instance, in the presence of conflicting assessments about the impact of weather events early in the season – such as droughts, frosts, or irregular rainfall – on the final harvest, market participants face uncertainty regarding the actual volume of available supply. To mitigate the risk of unexpected shortages, they may increase inventories until the extent of potential damage is clear. Similarly, cocoa trees in Ghana and Côte d'Ivoire are vulnerable to fungal infections and viruses. When outbreaks are reported but not yet quantified, market participants may increase inventories to hedge against the risk of a major supply shock. The same happens when coffee leaf rust hits in Latin America or Africa. Similarly, disruptions in transportation and logistics – such as shipping delays and port closures caused by wars and armed conflicts – can make it difficult to move commodities from producing regions to consuming markets. When the duration and severity of these disruptions are uncertain, market participants may build inventories to avoid running out of stock. Another example is given by ambiguous trade policies, which can significantly drive precautionary demand, especially when the duration, intensity and implementation of measures (e.g. export restrictions, tariff adjustments, or trade bans) are inconsistent or unpredictable. In all these cases, uncertainty raises the marginal value of holding inventories and this is reflected in a higher marginal convenience yield. When the risk of stockouts grows, market participants accumulate inventories to insure against shortages, thereby reinforcing upward pressure on prices, even if fundamentals have not (yet) changed. This mechanism is proxied in the empirical analysis by including the realized volatility of the commodity spot price among the drivers, defined as the monthly sum of daily returns based on the nearest-to-delivery futures contracts. An increased uncertainty around current market conditions is expected to lower the futures-spot price spread as the marginal convenience yield rises; in the short run, spot prices may overshoot before partially reversing as inventories adjust.

Expectation-driven demand for inventories occurs when inventories adjust in response to anticipated changes in market fundamentals over the next cropping season, rather than immediate scarcity or uncertainty in the on-going one. Unlike annual crops, where supply can be quickly adjusted, the slow cycle of perennials has the consequence that expectations about future fundamentals play a critical role in shaping inventory behaviour and price dynamics. For example, farmers growing perennial crops, especially coffee, face yield fluctuations due to the so-called alternate bearing – a cycle where high-yielding harvests are followed by low-yielding harvests. This cycle can be easily anticipated and results in expectations of lower (higher) supply, higher (lower) futures prices, and, consequently, accumulation (depletion) of inventories. Prospects about large scale tree replanting or rejuvenation, or the introduction of disease-resistant and climate resilient varieties, can influence expectation-driven demand as well. Once new trees are close to maturity, market participants may anticipate a future increase in supply and adjust their inventory strategies accordingly. Likewise, expectations about entry into force of future trade agreements, sustainability standards, or certification requirements can influence demand for inventories. If new regulations are expected to restrict supply or increase production costs in the future, market participants may accumulate inventories ahead of the anticipated changes, aiming to benefit from expected price rises. This mechanism is captured in the empirical analysis by the spread between futures contracts and spot prices, serving as a proxy for the negative of the marginal convenience yield and conveying information about the term structure of the futures curve. Specifically, the spread is calculated as the logarithmic difference between the prices of the third most-distant and the nearby futures contract, representing the incentive to hold inventories until new information on future supply and demand becomes

available. A negative spread, where the spot price exceeds the futures price, indicates a high convenience yield (“backwardation”), while a positive spread reflects a low convenience yield and an expected price increase (“contango”). Futures prices for coffee and cocoa are sourced from Refinitiv Workspace.

For tea, four drivers are selected: two cross-cutting factors, global economic activity and international crude oil prices, and two market-specific variables, monthly tea production and tea auction prices. Unlike coffee and cocoa, the international tea market does not have an organized futures exchange, which means forward-looking price signals and convenience yield proxies are unavailable. The two cross-cutting drivers are included, as previously described for coffee and cocoa, to account for macroeconomic and energy-related effects. In terms of market-specific variables, the tea sector offers an analytical advantage compared to the other two beverage commodities. Most notably, data on monthly production for black tea are available for major producers (India, Sri Lanka, and Kenya), enabling the direct identification of supply-side shocks. This possibility is a significant benefit with respect to coffee and cocoa, where information on inventory changes and net-supply must be inferred indirectly from the futures and/or spot markets. Additionally, international tea prices are represented by the FAO Tea Composite Price, which is calculated as a weighted average of auction prices across principal markets and deflated by the US CPI (see [Box 2.1](#)). Unlike the spot price for coffee and cocoa, which serves as a proxy for net-supply, the tea auction price plays a different role. Since monthly production data allow direct control for supply shocks, unanticipated changes in the spot price primarily capture the residual market-specific demand shocks, including those driven by domestic policies and other idiosyncratic factors. In this respect, this approach enables a clearer separation between the role of supply and demand, with the price variable reflecting shifts in demand that are not explained by changes in tea production, global demand or input/energy costs.<sup>9</sup>



<sup>9</sup> More details on the variables used in the analysis are provided in Annex 2 and Annex 3.

### 3.4. Estimating the dynamics of global beverage prices with a Bayesian Structural Vector Autoregressive model (BSVAR)

The econometric analysis employs a Bayesian Structural Vector Autoregressive (BSVAR) model to disentangle the effects of unexpected shocks on global beverage prices. The BSVAR model lets experts provide an economic interpretation of structural shocks in terms of unexpected changes in supply and demand of the commodities, capturing the joint dynamics of the variables. This overcomes some key limitations of the reduced-form specifications, which do not allow for causal identification.<sup>66</sup> Moreover, the Bayesian approach allows experts to incorporate prior information on supply and demand interactions in the beverage commodity markets directly into the model, yielding posterior estimates that combine prior beliefs with the likelihood of the data. Additionally, the methodology enables tracing both the contemporaneous and dynamic responses of coffee, cocoa, and tea prices to each demand and supply shock. It also decomposes price variability into contributions from distinct drivers, thereby offering insights into the relative importance of macroeconomic, energy-related, and market-specific factors. Finally, the model provides a historical decomposition of real prices, allowing experts to quantify, at each point in time, the cumulative contribution of each structural shock.

The adopted approach does not explicitly model nonlinearities, such as the state-dependent effects of shocks across different inventory regimes emphasized in the competitive storage framework. This reflects data constraints and, in particular, the limited availability of reliable high-frequency inventory measures. The reported estimates should therefore be interpreted as average effects across underlying inventory conditions, with inventories informing the economic interpretation rather than being directly incorporated through explicit nonlinear specifications. Also, while the analysis incorporates realized volatility as an endogenous variable, alternative approaches such as GARCH models explicitly capture time-varying volatility regimes that have been documented in commodity markets, particularly in the post-2008 period. The BSVAR framework abstracts from such regime shifts, and the estimated responses should therefore be interpreted as average dynamics across periods that may differ in their volatility structure.

Let  $y_t$  be a vector of  $k$  endogenous variables. The structural VAR model for each commodity is represented by:

$$B_0 y_t = b_0 + B_1 y_{t-1} + B_2 y_{t-2} + \dots + B_p y_{t-p} + w_t \quad [1]$$

where  $w_t$  denotes the vector of uncorrelated structural shocks and  $B_i$ ,  $i = 0, \dots, p$ , are the autoregressive coefficient matrices governing the contemporaneous effects and the dynamic structure of the system. Since the structural shocks cannot be observed directly, they need to be retrieved from the reduced-form VAR model representation, obtained by multiplying equation [1] by  $B_0^{-1}$ :

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + u_t \quad [2]$$

$$\text{with } A_i = B_0^{-1} B_i \quad \text{and} \quad u_t = B_0^{-1} w_t \quad [3]$$



Equation [3] shows that the residuals of the reduced form BVAR,  $u_t$ , are a weighted sum of the structural shocks,  $w_t$ , of the BSVAR representation. Unless some specific assumptions were made, equations [1], [2] and [3] cannot be used to identify the structural shocks, as the system has more parameters to estimate than available equations. To address the identification problem, the strategy is to impose a combination of sign and zero restrictions on the structural impact multiplier matrix  $B_0^{-1}$ , as proposed by Arias *et al.* (2018).<sup>67, h</sup> These restrictions bind the impact responses of each variable to each structural shock, allowing for a clear economic interpretation of the underlying innovations. This approach has become increasingly popular in applied work as an alternative to traditional identification strategies based on recursive schemes. Recursive identification requires strong assumptions that are often difficult to justify, especially when the data frequency does not support a credible causal ordering from the most exogenous to the most endogenous variable. By contrast, sign-restricted identification yields set-identified models, meaning that a sufficiently narrow set of structural models is consistent with the imposed economic assumptions. This approach is also more agnostic than recursive zero-restrictions and provides greater flexibility, as it allows the researcher to impose shape restrictions on the structural impulse response functions.<sup>68</sup>

### 3.4.1. Structural Vector Autoregressive identification for coffee and cocoa

We estimate three different models for the international markets of coffee, cocoa and tea. The two SVAR models for coffee and cocoa share an analogous specification, based on five endogenous variables: i) the global economic conditions indicator, ii) the real price of crude oil, iii) the realized volatility of the real spot price, iv) the spread between the futures and the corresponding spot price, and v) the real spot price. We set the number of lags to  $p = 4$ , based on the Akaike Information Criterion (AIC), and cover the period 1996M01–2025M03.<sup>i</sup> The mapping between the reduced form residuals and the structural shocks is captured by the combination of sign and zero restrictions reported in Table 3.1.

The first innovation corresponds to an economic activity shock, capturing unexpected fluctuations in the global business cycle that trigger an exogenous upward shift in demand for crude oil as well as industrial and agricultural commodities. A positive shock to economic activity is expected to raise the real price of crude oil and the real prices of coffee and cocoa on impact, consistent with the notion that stronger global demand increases energy consumption and stimulates commodity markets. The effects on volatility, spread and, therefore, on inventories, are ambiguous and cannot be determined a priori. For this reason, the signs of the impact responses for realized volatility and the spread to an economic activity shock are left unrestricted.

<sup>h</sup> More details on the econometric model and the algorithm are provided in Annex 1.

<sup>i</sup> To address potential concerns related to structural changes over the sample period, parameter stability has been formally assessed using OLS-CUSUM tests and a multivariate Chow test with 2022 as a candidate break date, considering the behaviour observed in most recent periods. Both diagnostics do not indicate evidence of structural instability. In addition, re-estimating the model excluding the 2022–2024 period yields impulse responses and variance decompositions that are consistent with the full-sample results, supporting the use of a constant-parameter specification.

The second innovation corresponds to an energy price shock, defined as an unexpected increase in the real price of crude oil. This shock is typically associated with a contraction in global economic activity and can be interpreted as an input cost shock, raising production and transportation costs across supply chains. As a result, higher energy costs are expected to exert upward pressure on the spot prices of cocoa and coffee. Since the impact responses of the spread and the realized volatility to an energy price shock may be either positive or negative, they are left unrestricted.

**Table 3.1.** Sign and zero restrictions for the coffee and cocoa models

| Variable                  | Shock             |        |                      |                           |                         |
|---------------------------|-------------------|--------|----------------------|---------------------------|-------------------------|
|                           | Economic activity | Energy | Precautionary demand | Expectation-driven demand | Net-supply <sup>†</sup> |
| Global economic condition | +                 | -      | 0                    | 0                         | 0                       |
| Real oil price            | +                 | +      | 0                    | 0                         | 0                       |
| Realized volatility       | *                 | *      | +                    | *                         | 0                       |
| Spread                    | *                 | *      | -                    | +                         | -                       |
| Real spot price           | +                 | +      | +                    | +                         | +                       |

*Notes:* Cells with +/- indicate a positive/negative contemporaneous impact of the shock on the variable. 0 indicates no contemporaneous impact, while \* indicates an unrestricted effect. <sup>†</sup> Since the model normalization imposes that each shock increases the spot price, the last column identifies a negative net-supply shock.

The remaining structural shocks are assumed to be market-specific and orthogonal to both energy price fluctuations and broader macroeconomic conditions. In other words, the global economic activity indicator and the real oil price are treated as weakly exogenous with respect to the coffee and cocoa markets, implying that shocks originating in these markets do not contemporaneously affect global economic conditions or energy prices. This assumption underpins the block of zero restrictions reported in Table 3.1.

Turning to the relationship among market-specific variables, the third innovation is a precautionary demand shock, which reflects an increase in inventory demand under heightened uncertainty about current demand and supply conditions.<sup>65, 69</sup> This shock captures precautionary purchases in the spot market, driven by concerns about potential shortages or disruptions. As a result, the spot price rises above the futures price as consequence of an increase in volatility, raising the convenience yield and reducing the spread.<sup>64</sup> The futures prices are expected to react less than the spot price on impact since expectations over the future market conditions remain unchanged.

The fourth innovation is an expectation-driven demand shock, and it is designed to capture purchases and inventory accumulation induced by adjustments in response to anticipated changes in future market fundamentals. It corresponds to an increase in the spread. An increase in the spread can thus be interpreted as a market signal of higher coffee and cocoa prices in the future, and it arises when buyers anticipate changes in the demand or supply conditions over the next seasons. In this context, a positive spread may be seen as an incentive for stockpiling in the current period.<sup>60</sup> Consequently, higher inventories will cause a rise in the coffee and cocoa spot price as well, but smaller than the increase in the futures prices.

The fifth structural innovation is a market-specific net-supply shock, capturing idiosyncratic factors that affect current supply and demand, such as weather events, harvest outcomes, pest infestations, consumption shifts, or trade disruptions. Since the model normalization imposes that each shock increases the spot price, the last column of Table 3.1. identifies a negative net-supply shock which raises coffee and cocoa prices. Therefore, it should be interpreted as a supply disruption or an increase in commodity-specific demand, reflecting the tightening of market conditions caused by unexpected adverse events. The negative net-supply shock is also assumed to reduce the spread, consistently with the assumption that futures prices react less than the spot. To distinguish a net-supply from a precautionary demand shock, it is also assumed that, on impact, net-supply shocks do not affect realized volatility.<sup>j</sup>

### 3.4.2. Structural Vector Autoregressive identification for tea

For modelling the real global price of tea, a different specification of the BSVAR model is adopted based on four variables: global economic activity, international crude oil prices, tea production and spot price, as previously defined. All variables are observed at a monthly frequency. Unlike the coffee and cocoa markets, inventory data or futures contract prices cannot be included. This implies requiring that market-clearing conditions hold, such that demand equals supply in every period. Given the persistence of production, we estimate the BSVAR with 12 lags.

The mapping between reduced-form residuals and structural shocks is established using the combination of sign and zero restrictions shown in Table 3.2. In the tea model, the interpretation and contemporaneous effects of economic activity and energy shocks on global economic conditions, the real oil price, and the real spot price mirror those in the coffee and cocoa models. A positive economic activity shock raises commodity prices, including tea, as stronger global demand increases energy use and beverage consumption. Unlike the coffee and cocoa models, where production data are unavailable, a positive economic activity shock increases tea production. This is because higher income growth stimulates demand, encouraging producers to expand output. A positive energy price shock, by construction, raises the price of oil while exerting a negative contemporaneous effect on global economic conditions. It is also expected to affect tea production negatively while increasing global tea prices. Both effects are transmitted through the impact of energy shocks on input and transportation costs.<sup>70</sup>

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<sup>j</sup> Beyond static sign restrictions, additional identifying constraints, such as limits on the magnitude and shape of impulse responses, are applied to narrow the set of admissible models. These restrictions serve as economically motivated priors that help discipline the model, and their influence on the results has been tested through alternative specifications that relax them, yielding consistent findings. For more details, please refer to Annex 1.



**Table 3.2.** Sign and zero restrictions for the tea model

| Variable                  | Shock             |        |        |                            |
|---------------------------|-------------------|--------|--------|----------------------------|
|                           | Economic activity | Energy | Supply | Tea market-specific demand |
| Global economic condition | +                 | -      | 0      | 0                          |
| Real oil price            | +                 | +      | 0      | 0                          |
| Production                | +                 | -      | +      | +                          |
| Real spot price           | +                 | +      | -      | +                          |

*Note:* Cells with +/- indicate a positive/negative contemporaneous impact of the shock on the variable. **0** indicates no contemporaneous impact, while \* indicates an unrestricted effect.

A positive tea supply shock represents an unexpected increase in global tea production such as, for instance, a bumper harvest due to ideal weather or expanded planted areas. In Table 3.2, this shock raises tea production and, through excess supply, lowers the tea spot price on impact. We further assume it has no immediate effect on global economic conditions or oil prices, since the tea sector is small relative to the world economy and oil market. This shock captures tea-specific supply conditions, causing output and price to move in opposite directions, consistently with economic theory.

Finally, positive tea demand shocks reflect a market-specific increase in the demand for tea at global level, not driven by global economic conditions, such as – for example – a shift in preferences toward tea or policy interventions that ease the commodity imports. This shock raises both the tea spot price and the production on impact, under the assumption that farmers can adjust their output to changes in the demand conditions at the auction centres. Also, in this case, there is no immediate effect on global economic conditions or oil prices since tea market fluctuations are too small to influence the global indices. Thus, the tea demand shocks are identified as idiosyncratic shocks that move output and prices in the same direction.





### 3.5. The impacts of global shocks on beverage commodity prices

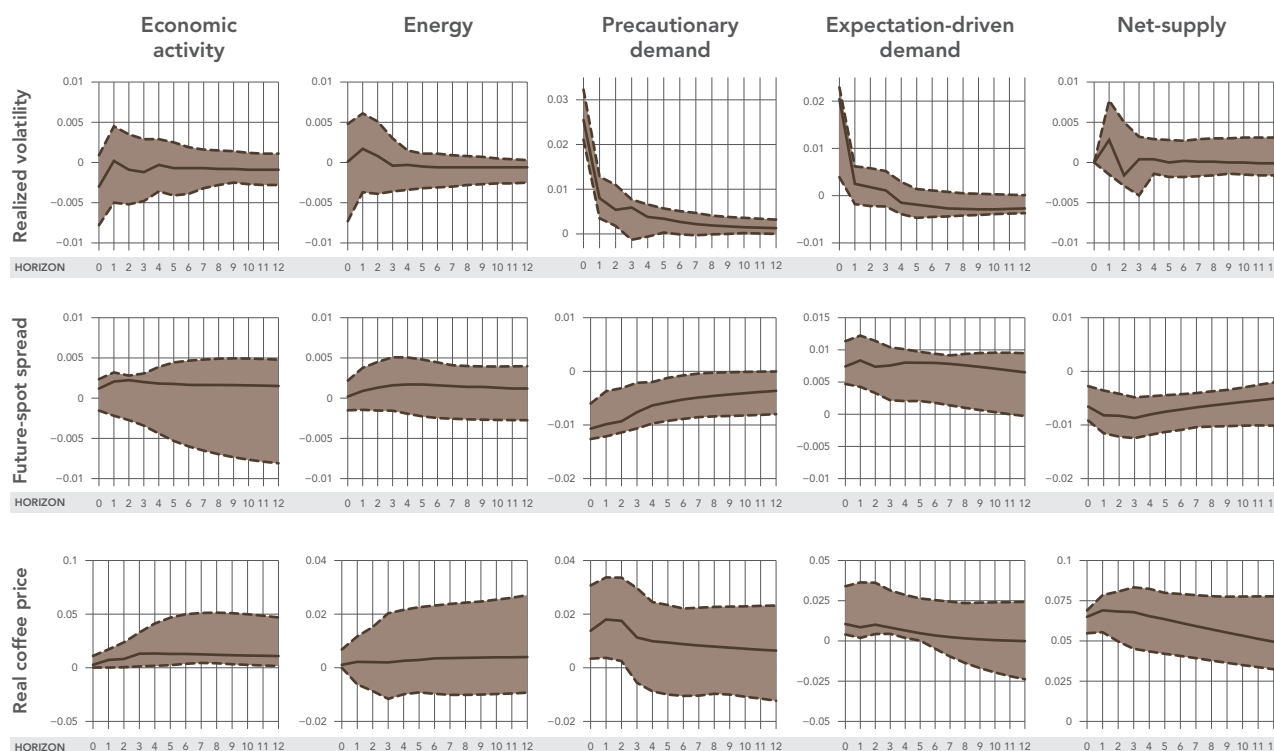
#### 3.5.1. Impulse responses of commodity-specific variables to global shocks

Figures 3.1, 3.2 and 3.3 display the impulse responses of realized volatility, futures–spot spread and real spot prices to a one standard-deviation structural shock over the first year, for coffee, cocoa and tea, respectively.<sup>k</sup>

Figure 3.1 plots the impulse response functions (IRFs) for the international coffee market. The first two columns show that both economic activity shocks and energy shocks have no significant impact on the coffee market, as the estimated responses are not statistically credible at the 68 percent confidence level. The only exception is a positive economic activity shock, which increases the real coffee price by 1.3 percent four months after the shock, before reverting slowly toward zero.



<sup>k</sup> Given the focus on global beverage markets, only the responses of the market-specific variables are reported. The responses are obtained by minimizing the expected absolute loss function over the set of admissible structural models, as in Inoue and Kilian (2022). The credibility intervals represent the 68 percent highest posterior density credibility intervals.

**Figure 3.1.** Impact of shocks on the global coffee market

*Notes:* Each IRF reports the impact of a one standard deviation shock (by column) on the commodity-specific variables of the coffee SVAR model (by row). The black line represents the response obtained by minimizing the expected absolute loss function over the set of admissible structural models while the red shaded area includes the corresponding 68 percent joint credibility set. The responses of the global economic conditions and the real oil price to the shocks are omitted since they are not relevant to the discussion.

*Source:* Authors' own elaboration.

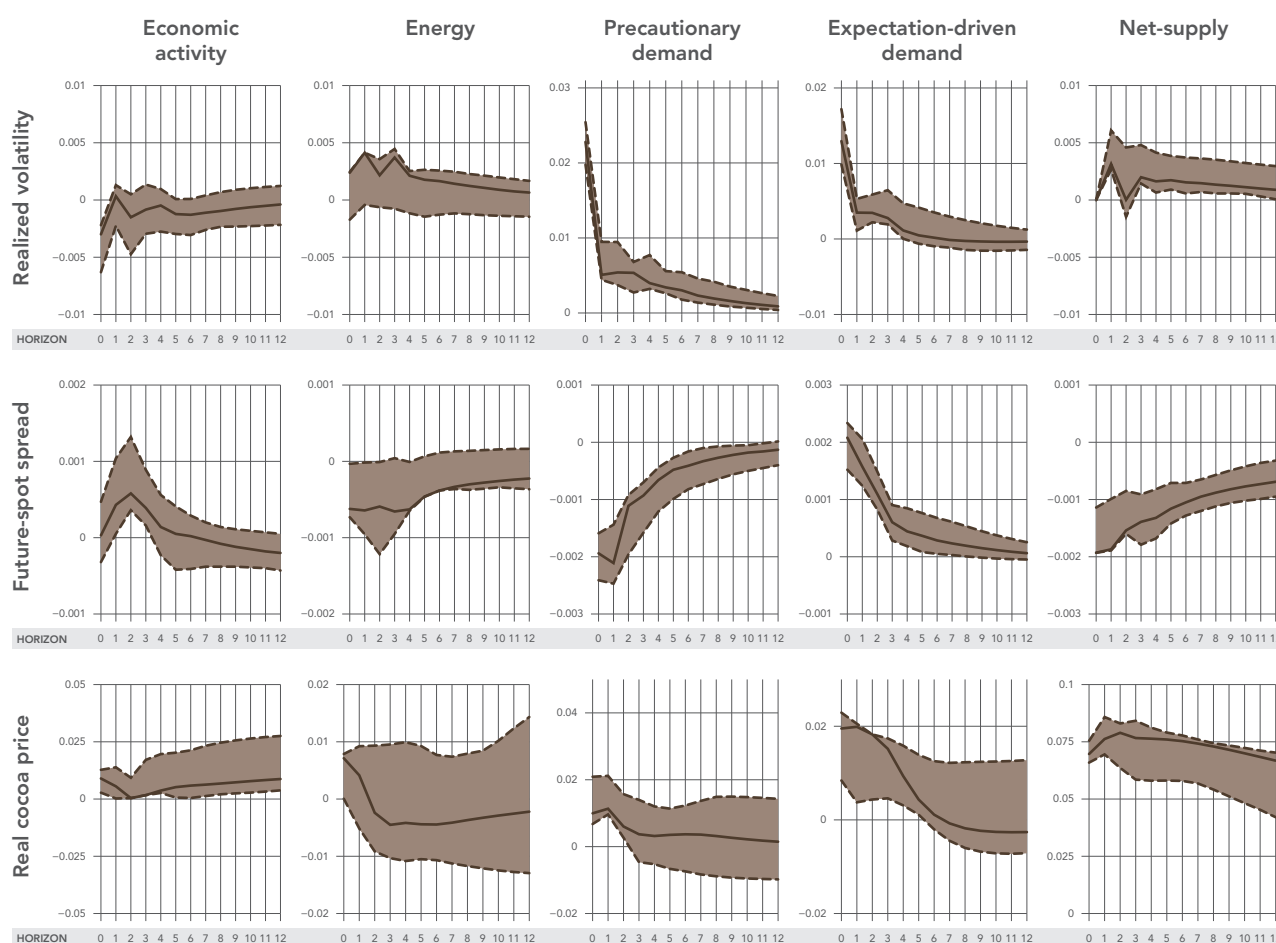
Turning to market-specific shocks, the results align with the insights provided by the commodity storage model and all response estimates are credible at the 68 percent level. More specifically, a positive precautionary demand shock raises realized volatility by 2.5 percent, which is reabsorbed after three months. As expected, the same shock generates a hump-shaped response in the real coffee price, peaking at 1.75 percent after three months, along with a decline in the spread of approximately 1.07 percent. A positive expectation-driven demand shock raises the spread by up to 0.83 percent, encouraging stockpiling, and produces an immediate 1 percent increase in the real coffee price, followed by a gradual return to equilibrium over six months. Finally, a negative net-supply shock causes a persistent increase in the real coffee price, peaking at 6.9 percent one month after the shock, accompanied by a decline in the spread of about 0.9 percent after three months. The realized volatility reacts positively to the same shock over time, but the set of statistically credible responses includes the zero.

Figure 3.2 plots the response estimates to all structural shocks identified in the international cocoa market. As for the coffee market, economic activity and energy shocks have a limited effect on market-specific variables, expressed in real terms. Once again, the only exception is a positive economic activity shock, which



increases the real cocoa price by almost 1 percent and reverts quite slowly towards zero. Different from the coffee market, an economic activity shock seems to increase the spread as well, even if the effect is limited to the first three months, after which the spot price reacts, and the spread reverts towards its equilibrium. A precautionary demand shock increases realized volatility by 2.2 percent on impact and persists beyond the first year; it also increases the real cocoa price by 1.1 percent and reduces the spread by 0.2 percent almost immediately. A negative net-supply shock causes a persistent increase in the real price of cocoa, peaking at nearly 8 percent two months after the shock, along with a 0.2 percent decline in the spread. The response of realized volatility to a negative net-supply shock is positive but almost indistinguishable from zero. Finally, a positive expectation-driven demand shock raises the spread by up to 0.2 percent, inducing stockpiling and produces an immediate 2 percent increase in the real price of cocoa, followed by a gradual return toward equilibrium after five months.

**Figure 3.2.** Impact of shocks on the global cocoa market



*Notes:* Each IRF reports the impact of a one standard deviation shock (by column) on the commodity-specific variables of the cocoa SVAR model (by row). The black line represents the response obtained by minimizing the expected absolute loss function over the set of admissible structural models while the red shaded area includes the corresponding 68 percent joint credibility set. The responses of the global economic conditions and the real oil price to the shocks are omitted since they are not relevant to the discussion.

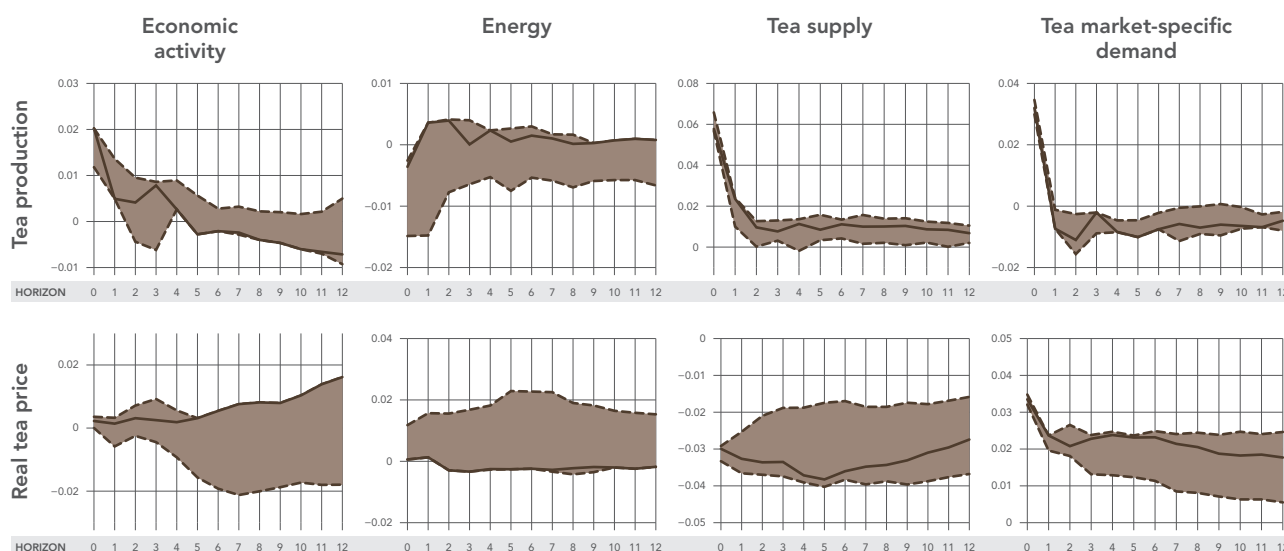
*Source:* Authors' own elaboration.

Finally, Figure 3.3 presents the impulse response functions in the international tea market. A positive shock to economic activity stimulates global tea production for at least two months, although it does not have an impact on the real global tea price. In fact, while the estimated impulse response is positive, the credible set includes zero, indicating uncertainty about the sign of the effect. This result is different from the previous two cases and could be motivated by different characteristics of the three commodity markets. While coffee and cocoa are largely traded and almost entirely exported by major producing countries, tea is mostly consumed domestically. In the short run, this may expose the global tea price less to global demand shocks. A positive energy price shock does not influence global tea production or the real global tea price. The estimated responses for these variables are very close to zero, and the credible sets include both positive and negative values, indicating a high degree of uncertainty. This result suggests that tea production is relatively less sensitive to short-term energy cost fluctuations, probably due to a relatively limited reliance on energy-intensive inputs. For the real global tea price, the results are like those observed for coffee and cocoa.

Turning to the supply and demand shocks originating specifically in the tea market, all IRFs are consistent with economic theory and display the expected signs, while the 68 percent credible intervals do not include zero. A positive tea supply shock increases production by 5.7 percent on impact, while most of the effect is reabsorbed after three months. This shock leads to a reduction in the real global tea price of about 3.8 percent after five months, before the effect gradually reverts toward zero. Finally, a positive tea market-specific demand shock increases tea production by about 3 percent on impact, with no persistent effects over time. However, this shock is associated with a rise in the real global tea price, which persists for at least 12 periods, before gradually fading after the first year. This pattern suggests a relatively inelastic tea supply in the short-term: Producers are unable to adjust output quickly in response to demand shifts, given the perennial nature of the crop, resulting in price increases rather than quantity adjustments.

In summary, the short-run price dynamics of the three beverage markets behave consistently with economic theory and exhibit important similarities. A key result is that the shape and persistence of price responses over the first twelve months vary depending on the structural nature of the shock. First, shocks to commodity-specific market fundamental – such as unexpected disruptions to current production or sudden changes in consumption – generate the largest and most persistent increases in commodity prices. Shocks driven by uncertainty (precautionary demand) or expectations do play a significant role but tend to dissipate more quickly, producing only short-run price movements. This pattern holds for tea as well, although the tea market differs in structure: The only significant drivers of the global real tea price are market fundamentals, specifically supply and demand shocks.

Second, macroeconomic factors, such as global economic activity and energy prices, have limited influence on real beverage prices in the short run. In all three markets, economic activity shocks lead to modest and/or short-lived price increases, while energy shocks have ambiguous and statistically insignificant effects. This outcome is not entirely surprising, given that US CPI – used as a deflator – may respond as quickly as the nominal beverage prices to macroeconomic shocks, keeping the ratio unchanged between the two. In other words, global beverage prices, in nominal terms, do react to macroeconomic conditions but similarly to other commodities, and these movements closely track overall inflation dynamics.

**Figure 3.3.** Impact of shocks on the global tea market

*Notes:* Each IRF reports the impact of a one standard deviation shock (by column) on the commodity-specific variables of the tea SVAR model (by row). The black line represents the response obtained by minimizing the expected absolute loss function over the set of admissible structural models while the red shaded area includes the corresponding 68 percent joint credibility set. The responses of the global economic conditions and the real oil price to the shocks are omitted since they are not relevant to the discussion.

*Source:* Authors' own elaboration.

Third, shocks to demand for storage play a key role in shaping price dynamics, especially in the coffee and cocoa markets. The IRF results show that precautionary demand and expectational shocks, both linked to inventory behaviour, trigger short-lived but significant price movements. Rising uncertainty increases volatility and prompts temporary price spikes, while a persistent spread from expectational shocks encourages stockpiling and immediate price increases that fade later. These patterns align with the competitive storage model, where inventories buffer shocks and transmit expectations into current prices. However, a better understanding of this mechanism relies on data availability: Futures prices and spreads offer indirect signals, but direct inventory data are often missing. These findings highlight the need for timely, granular inventory information to better capture shock transmission, improve price modelling and calibrate policy responses.

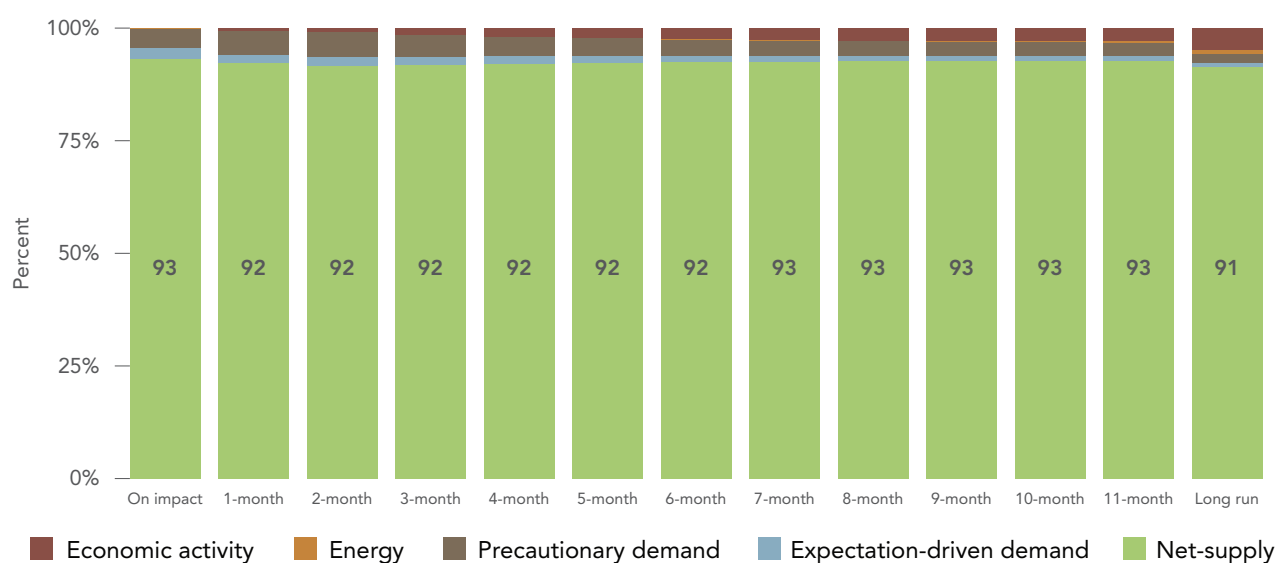
### 3.5.2. Contribution of global shocks to beverage commodity price variability

Figures 3.4, 3.5 and 3.6 present the forecast error variance decomposition (FEVD) of the real global tea price over different horizons. The FEVD is used to quantify the percentage contribution of the structural shocks to the variability of a specific variable over different horizons. The findings show a very clear pattern: Commodity-specific market fundamentals are the main drivers of the global prices. This result holds across all three markets, whether in the coffee and cocoa models, where net-supply captures the combined effect of production and consumption in one variable, or in the tea model, where supply and demand are separately



identified. More specifically, the net-supply shocks account for 93 percent and 89 percent of the coffee and cocoa price variation within one month, respectively. In the case of tea, the sum of supply and market-specific demand shocks explain almost entirely the price variability (99 percent). These findings are consistent with the existing empirical literature, which shows that shocks to market fundamentals dominate short-run price variability. The contribution of this report lies in providing a consistent assessment of these dynamics across different beverage commodities.

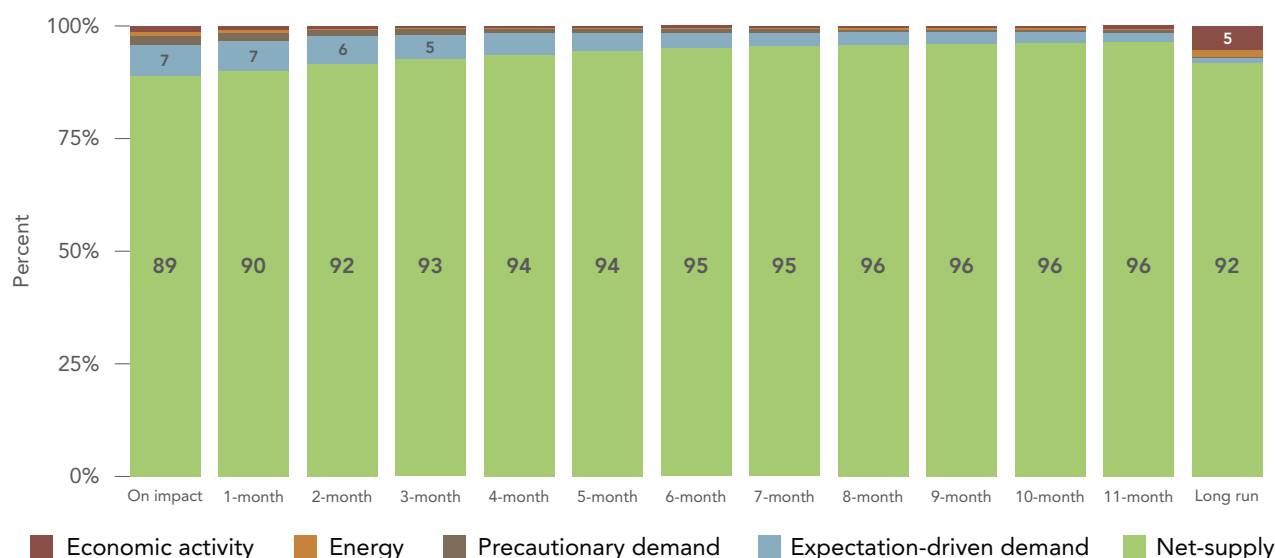
**Figure 3.4.** Contribution of the shocks to coffee price variability



*Notes:* The figure reports the estimated forecast error variance decomposition (FEVD) of the real coffee price based on the model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar reports the contribution of the five structural shocks to the mean squared forecast error at different monthly horizons, expressed as a percentage of the total mean squared error. The last bar reports the contributions at 10-year horizon.

*Source:* Authors' own elaboration.

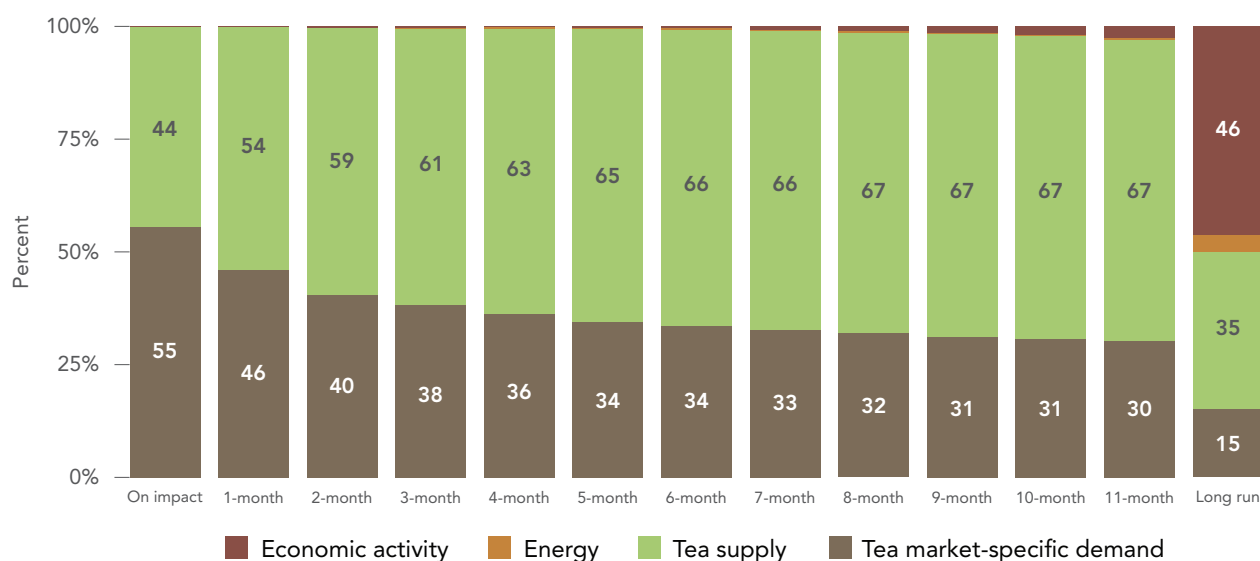
For coffee and cocoa, the other sources of variability with a noticeable contribution over the first year are the precautionary demand and expectation-driven demand shocks. In the coffee market, expectation-driven demand shocks explain around 2 percent of price variation, compared with 4 percent explained by precautionary demand shocks. In contrast, in the cocoa market, expectation driven demand shocks explain about 7 percent of price variation within the first month, while the role of precautionary demand shocks is negligible. Irrespectively from the source, demand for inventories confirms to play a role, even if limited, in shaping the price dynamics. The average one-year contribution of net-supply shocks remains high, indicating that market-specific shocks are the primary drivers of price changes. Finally, economic activity shocks become more relevant in the long run, while the impact of energy price shocks on cocoa and coffee markets remains negligible.

**Figure 3.5.** Contribution of the shocks to cocoa price variability

*Notes:* The figure reports the estimated forecast error variance decomposition (FEVD) of the real cocoa price based on the model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar reports the contribution of the five structural shocks to the mean squared forecast error at different monthly horizons, expressed as a percentage of the total mean squared error. The last bar reports the contributions at 10-year horizon.

*Source:* Authors' own elaboration.

The case of tea is different from several points of view. On impact, the variance is almost entirely explained by tea market-specific demand shocks (55 percent) and tea supply shocks (44 percent), with no contribution from global economic activity or oil price shocks. This absence reinforces the idea that nominal fluctuations follow the broader inflation dynamics. However, over the first year, the contribution of tea supply shocks increases steadily, reaching 67 percent by the 10-month horizon, while the share of tea market-specific demand declines to around 31 percent. Economic activity shocks begin to appear marginally from month six onward, but their influence remains negligible. This shift suggests that supply-side factors become increasingly important in explaining price variability over time, likely reflecting delayed production responses due to the perennial nature of the crop. More interestingly, in the long run (ten years), the decomposition becomes more balanced: Economic activity shocks account for 46 percent of the variance, tea supply shocks for 35 percent, tea market-specific demand shocks for 15 percent, and oil price shocks for 4 percent. This evolution indicates that macroeconomic conditions eventually play a role in shaping real tea price dynamics, particularly through the impact of income growth on consumption patterns. This interpretation resonates with observed tea consumption trends, where rising incomes and changing lifestyles in emerging economies have driven a sustained expansion in demand.

**Figure 3.6.** Contribution of the shocks to tea price variability

*Notes:* The figure reports the estimated forecast error variance decomposition (FEVD) of the real tea price based on the model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar reports the contribution of the five structural shocks to the mean squared forecast error at different monthly horizons, expressed as a percentage of the total mean squared error. The last bar reports the contributions at 10-year horizon.

*Source:* Authors' own elaboration.

### 3.5.3. Historical decomposition of global coffee, cocoa and tea spot prices

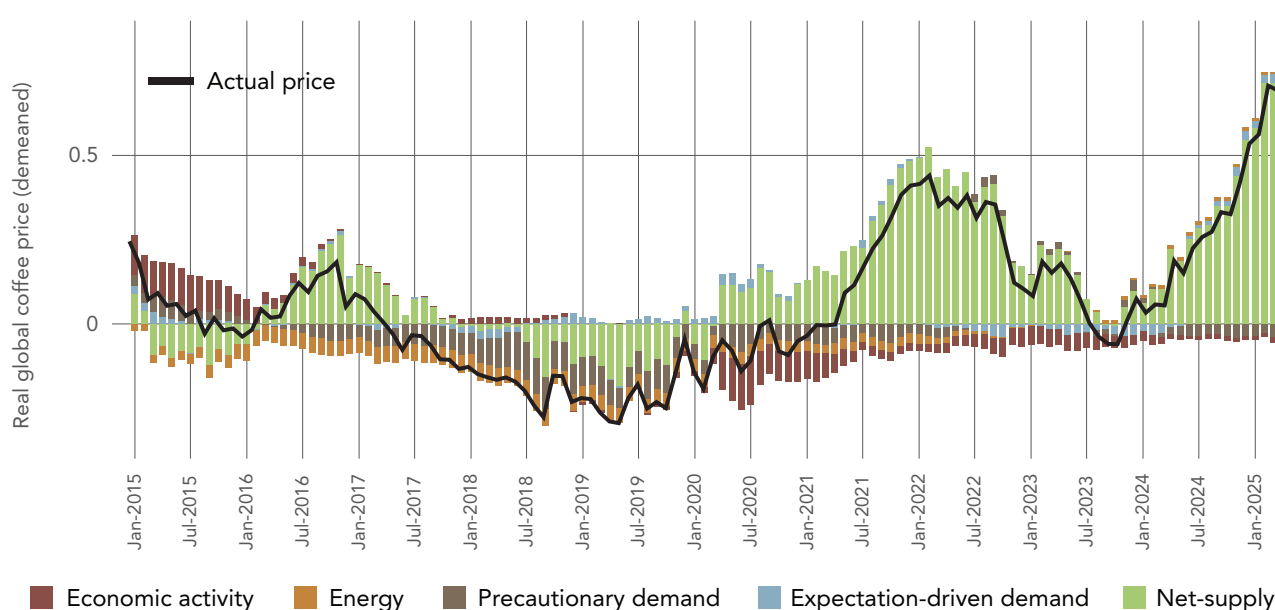
Figures 3.7, 3.8 and 3.9 show the historical decomposition (HD) of the real global prices of coffee, cocoa and tea, respectively, based on the three estimated BSVAR models. Historical decomposition quantifies the cumulative effect of each structural shock on the variable of interest.<sup>68</sup> It illustrates how the cumulative contribution of current and past shocks accounts for the observed values of a variable at each point in time, conditional on the identification assumptions.

Figure 3.7 shows that from 2015 to 2020, the real global coffee price experienced a prolonged downward trend, primarily driven by positive net-supply shocks, negative precautionary demand shocks, and negative energy shocks. Positive net-supply shocks were mostly driven by a series of favourable harvests in major Arabica-producing countries such as Brazil. The only exception during this period was the price spike in 2016, largely due to the 2015–2016 season, when adverse weather temporarily disrupted production and led to a short-lived rebound. In addition to supply dynamics, precautionary demand shocks played a significant role. As inventories accumulated and the risk of stockout reduced, the marginal value of holding additional stocks declined, resulting in negative precautionary demand shocks. These further depressed prices by weakening the incentive to store coffee and increasing available supply.



From early 2020, during the COVID-19 pandemic period, the real global coffee price remained relatively stable, with only a modest increase. This dynamic appears to result from the interaction of offsetting forces. On the supply side, the historical decomposition shows negative net-supply shocks, likely driven by global supply chain disruptions. While production itself may not have declined significantly, logistical constraints and labour shortages prevented coffee from circulating efficiently, effectively tightening market availability. At the same time, negative shocks to economic activity and energy prices pulled in the opposite direction. The pandemic triggered a sharp contraction in global activity, reducing aggregate demand across commodity markets, including coffee. These global macroeconomic shocks contributed to downward pressure on prices, especially as out-of-home consumption declined.

**Figure 3.7.** Historical decomposition of the global coffee price (2015–2025)



*Notes:* The figure reports the historical decomposition of the real coffee price based on the estimated model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar depicts the cumulative historical contribution of the five structural shocks to the deviation of the real coffee price from its mean from 2015 to 2025.

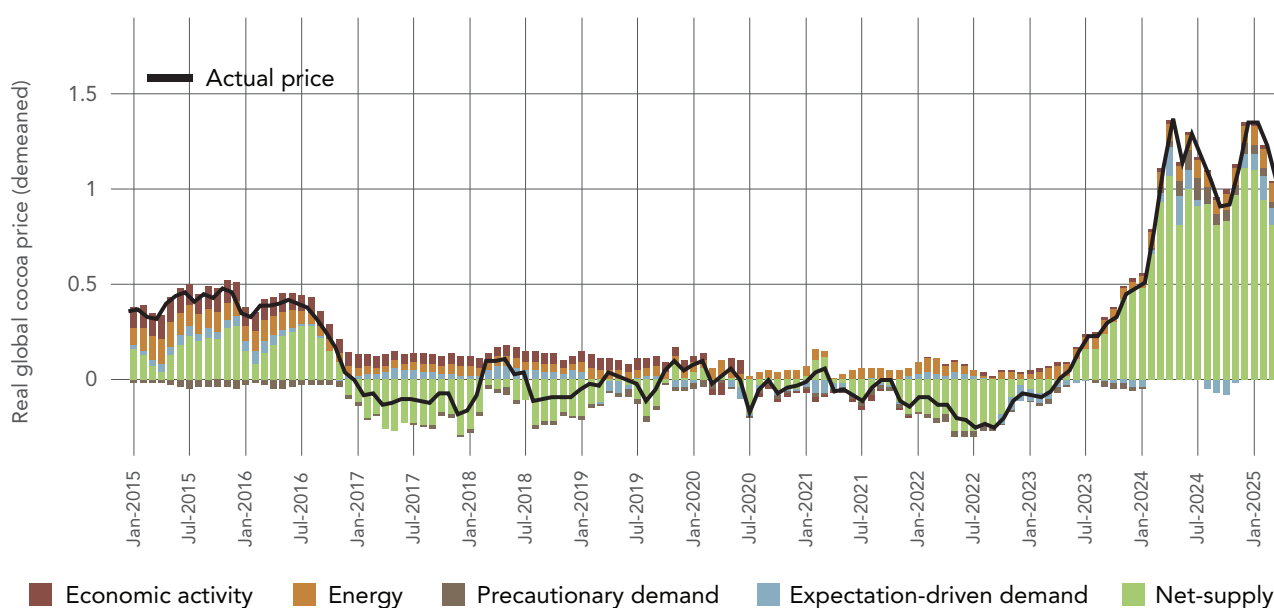
*Source:* Authors' own elaboration.

Following the COVID-19 period, the coffee market entered a phase of sharp recovery that ultimately led to the nominal price of Arabica coffee reaching its highest level on record by mid 2025. Even in real terms, this represents one of the most significant price peaks in the commodity's history (see Figures 2.4 and 2.5). The two major price spikes observed, one during the 2021–2022 season and another beginning in late 2024, are both primarily driven by negative net-supply shocks. The first spike was triggered by severe harvest losses in Brazil in 2021, which drastically reduced global Arabica availability and pushed prices sharply upward. Historical decomposition confirms that this episode was dominated by negative net-supply shocks, with minimal offsetting effects from other drivers. The second spike, starting in late 2024, reflects a different but equally impactful dynamic. Although production was close to average, global inventories had been eroded by consecutive years of deficits, leaving the market highly vulnerable. In this low-stock environment,

even modest supply shortfalls produced outsized price reactions. Historical decomposition again points to net-supply shocks as the main driver, stemming not only from crop-related factors but also from market-specific dynamics such as, for example, roasters and manufacturers accelerating procurement in response to perceived tightness, and reinforcing the impact of limited inventories on the global price. In addition – and in comparison – to the 2024 spike, energy shocks seem to have played a role, although it was relatively limited.

Figure 3.8 reports the historical decomposition for the real global cocoa price. Between 2015 and 2022, both nominal and real prices remained stable, with only moderate fluctuations. This stability was the result of counteracting forces. On one side, the market experienced persistent positive supply shocks, driven by several years of favourable harvests and stock accumulation. These supply-side pressures, which would typically push prices downward, were offset by positive shocks to economic conditions, energy prices, and expectation-driven demand for inventories. However, these anticipated demand-side pressures never fully materialized, helping to maintain equilibrium in the market. Notably, even the COVID-19 pandemic did not significantly disrupt this dynamic, as the combined effects of the different shocks continued to offset each other. The only significant exception during this period was 2015–2016, when negative supply shocks due to poor harvests in West Africa, coupled with a steadily growing demand for cocoa beans by grinders, coincided with positive energy and aggregate demand shocks, resulting in a brief upward movement in prices.

**Figure 3.8.** Historical decomposition of the global cocoa price (2015–2025)



*Notes:* The figure reports the historical decomposition of the real cocoa price based on the estimated model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar depicts the cumulative historical contribution of the five structural shocks to the deviation of the real cocoa price from its mean from 2015 to 2025.

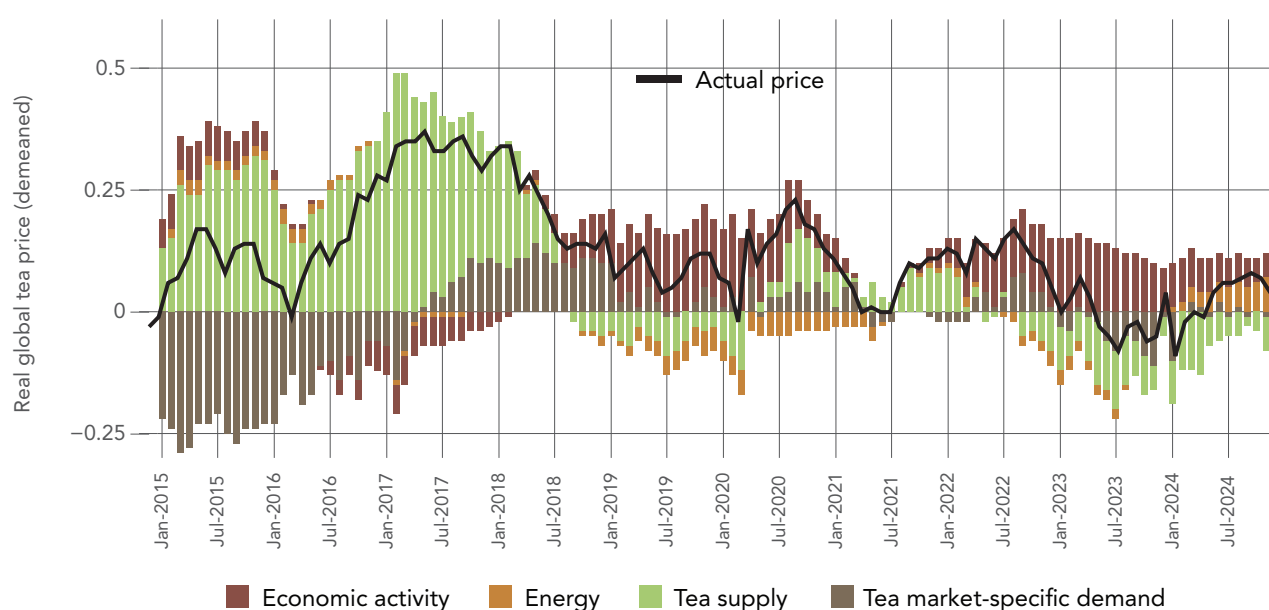
*Source:* Authors' own elaboration.

From late 2023, the cocoa market diverged sharply from the previous stability. Prices began to rise rapidly as net-supply shocks turned negative, reflecting poor harvest performance in Côte d'Ivoire and Ghana driven

by dry weather conditions and the proliferation of cocoa swollen shoot virus disease. During the first months of the rally, the historical decomposition attributes the bulk of the price increase to the net-supply, as lower output and weaker arrivals tightened the balance and drew attention to the limited capacity to rebuild stocks within a single crop year. Some effects resulting from energy shocks also contributed to the price increase, although to a lesser extent.

After this first phase, shocks to precautionary demand and expectation-driven demand for inventories started to push prices even higher. This behaviour is consistent with rising concerns over stock depletion, which raises uncertainty, and with a reassessment that tightness could persist beyond a single season, increasing the marginal value of holding inventories. In other words, once market participants internalized the risk of prolonged supply constraints, inventory demand and expectations reinforced the initial net-supply shock, further elevating prices. The analysis cannot confirm if prices overshot this time, but it remains a possible factor. By mid 2024, the rally briefly lost momentum, as improved weather news and better crop expectations for the upcoming main season tempered the effects of net-supply shocks. However, as adverse weather subsequently materialized and the stock-to-grindings ratio fell to its lowest level in three decades, Figure 3.8 shows a renewed upward pressure driven by net-supply shocks, together with a turn in expectations, which pushed up the real global price again in early 2025.

**Figure 3.9.** Historical decomposition of the global tea price (2015–2025)



*Notes:* The figure reports the historical decomposition of the real tea price based on the estimated model that minimizes the expected absolute loss function over the set of admissible structural models. Each bar depicts the cumulative historical contribution of the five structural shocks to the deviation of the real tea price from its mean from 2015 to 2025.

*Source:* Authors' own elaboration.

Finally, Figure 3.9 presents the historical decomposition for the real global tea price. Results indicate that tea supply shocks dominate price movements over most of the sample, with economic activity shocks playing a much important role in comparison to the cases of coffee and cocoa. The price spike observed between



2016 and 2018 is largely explained by the accumulation of negative supply shocks during 2015–2017, which pushed prices above expectations. Subsequently, favourable supply conditions exerted downward pressure, partially offsetting the upward influence of positive economic activity shocks, probably sustained by an above average per-capita income growth in emerging economies.



In 2020, during the COVID-19 pandemic, the rise in the global tea price appears to be primarily driven by the cumulative effects of negative supply shocks. These shocks likely reflect disruptions to global supply chains and labour markets, which constrained tea production and distribution. However, the historical decomposition also reveals a significant demand component: The pandemic period saw a notable increase in global demand for tea.<sup>50</sup> This surge in demand can be attributed to several factors, including behavioural shifts during lockdowns that led to greater in-home consumption, as well as the perception of tea as a beverage with immune system-boosting properties. Another negative supply shock that drove up the global real tea price emerged in late 2021 and in 2022, likely triggered by a decline in Sri Lankan tea production following the government's decision to ban chemical fertilizers earlier that year.

Between 2022 and 2023, the global real tea price was shaped by a combination of shocks with opposing effects. On the one hand, positive demand shocks, driven by the post-COVID-19 recovery and the rebound in global economic activity, put upward pressure on prices. On the other hand, a series of positive supply shocks during 2022 and 2023 led to historically high levels of tea production, exerting downward pressure on the real price. The net effect of these counteracting forces was negative, with supply-side factors ultimately outweighing demand-driven gains. In 2024, however, positive energy price shocks reversed this trend, contributing to a renewed increase in the global real tea price.



# 04

## Chapter

### Transmission of global beverage price shocks to producers and consumers

#### KEY MESSAGES

- Global beverage price shocks are not fully or evenly transmitted along value chains. The pass-through of international prices is often incomplete, delayed and asymmetric, influenced by market structure, domestic policies, transaction costs, and infrastructure limitations. As a result, producers and consumers experience global price changes differently, with varying impacts across countries and stages.
- The value chains for coffee, cocoa and tea are relatively long and complex, involving multiple stages from farming to final retail. Most of the value and profit is captured by downstream actors – such as processors, brands and retailers – while producers, especially smallholder farmers, receive only a small fraction of the final retail price.
- For coffee, empirical analysis shows that global net-supply shocks are transmitted quickly but incompletely to producer prices, with significant variation across countries depending on market integration and policy frameworks. Robusta and Arabica coffee markets are partially integrated; shocks in one market can affect producer prices in the other, though the effect is limited.
- Global net-supply shocks to cocoa prices are transmitted to European Union (EU) chocolate retail prices. The effect is small, around 0.12 percent for a 1 percent cocoa price increase, and reflects cocoa bean's limited share in final product costs. Countries with large, integrated chocolate industries show lower pass-through of cocoa price shocks to retail prices.
- Policy recommendations include investing in infrastructure, supporting producer organizations, and combining market-based price discovery with temporary stabilization tools to help producers benefit from global price increases and manage volatility. Certification schemes and digital tools can improve transparency, traceability, and potentially producer incomes, but high compliance costs and administrative burdens may exclude smallholders from participation.



## 4.1. Introduction

Chapter 3 shows that international prices of coffee, cocoa and tea remain primarily driven by fundamental market shocks, such as weather conditions, supply disruptions, or shifts in global demand. Nevertheless, these shocks do not affect all actors across the global value chain uniformly. This chapter turns to the question of how, and to what extent, global beverage price shocks are transmitted to producers and consumers along the beverage value chains. In theory, if markets are well connected and integrated, changes in international prices should be reflected at each level of the supply chain and across countries. In reality, however, transmission is often incomplete, delayed, or asymmetrical, implying that resources do not adjust efficiently to changes in market conditions. The main reasons for this divergence lie in the structure of the global commodity markets and the frictions emerging at the domestic level.

Frequently, potential revenue gains from higher global prices do not fully reach smallholder farmers, especially in contexts characterized by structural constraints. In many emerging and low income countries, including those producing beverage commodities, smallholders operate under limited access to market information, have weak bargaining positions, and face high transaction costs due to poor infrastructure or geographic isolation. These challenges, coupled with limited access to credit or risk management tools, often prevent farmers from fully responding to international price signals or benefiting from them. In addition, domestic policies, such as fixed farm-gate prices or the existence of commodity-specific institutional setups (e.g. marketing board), can decouple local prices from global benchmarks. While these interventions may protect farmers from short-term volatility, they also delay or even suppress the transmission of price booms, limiting potential upside gains. Conversely, a significant reduction in global beverage prices is unlikely to be immediately reflected on producers and consumers.<sup>71</sup>

Consumers in low-income countries often bear the full impact of price hikes when key food items are affected. This is less applicable to final products derived from coffee, cocoa and tea, which tend to represent a small portion of the typical consumption basket. In these cases, the degree of pass through to retail prices is often moderated by the structure of downstream markets. Commodities like cocoa and coffee usually constitute only a small share of the total cost of processed products, such as chocolate or instant coffee, where branding, packaging, marketing, labour and distribution account for a much larger portion of the final price.

Understanding the nature of shock propagation is critical for both agricultural and development policies. The direction, magnitude and speed of transmission from international commodity price shocks to domestic prices – both in exporting and importing countries – constitute the main theme of this chapter. Specifically, the analysis addresses the following questions:

- How do changes in global beverage prices impact the prices that farmers receive in producing countries? When international prices rise or fall, such as during recent peaks, do producers in developing nations see corresponding changes in producer prices?
- How do global price shocks affect consumer prices in importing countries? For instance, to what extent do retail prices of chocolate reflect changes in international commodity prices?

- How much and how quickly do shocks propagate along beverage value chains? Beyond identifying whether pass-through occurs, can its magnitude, and speed be measured?

To address these questions, the chapter proceeds as follows. Section 4.2 introduces the conceptual framework on price transmission, drawing a distinction between spatial and vertical transmission. Section 4.3 briefly outlines the structure of the coffee, cocoa, and tea value chains, highlighting the key stages where price transmission is most likely to occur or break down. Section 4.4 presents the methodology, focusing on the use of local projections (LPs) to estimate the dynamic effects of international price shocks along the value chain. Finally, Section 4.5 reports empirical results for two specific cases. The first analysis examines the impact of global coffee price shocks on producer prices across a set of producing countries. The second focuses on the transmission of global cocoa price shocks to chocolate retail prices in the European Union, the largest consuming market.

A word of caution is warranted at this point. As noted in the literature, empirical exercises such as those presented in this Chapter can assess the existence, magnitude, and speed of price transmission.<sup>72, 73</sup> However, they cannot estimate the causes of price transmission and can only speculate on the actual drivers of these results, drawing on evidence from already existing value chain studies. A full identification of these drivers would require more precise and deeper analyses, supported by detailed data on the various stages and stakeholders of the value chain.

### 4.2. Transmission of global price shocks in beverage markets

Commodities such as coffee, cocoa and tea are produced over vast geographical areas, transported internationally, and processed through multiple stages of transformation and value addition before reaching final consumers.<sup>74</sup> The market linkages across space, form and time characterize the economic literature on price transmission, defined by von Cramon-Taubadel and Goodwin (2021, p. 66) as “the extent to which localized or exogenous shocks in one market tend to generate effects in other markets”.<sup>72</sup> Transmission is often assessed along three dimensions: magnitude (how much of the shock is passed through), speed (how quickly the transmission occurs), and symmetry (whether prices respond similarly to upward and downward shocks). Each dimension is influenced by the structural characteristics of the (global) value chains, which, in turn, determine the net effects of the global shocks.

Literature typically distinguishes between spatial and vertical transmission. Spatial price transmission refers to the extent to which price changes in one location are reflected in another, based on the “law of one price”: The price of a homogeneous good in two separated markets should differ only by the transaction costs involved in moving it between locations.<sup>74</sup> For tradable agricultural commodities like coffee and cocoa, spatial price transmission is key to understanding how global benchmark prices influence farm-gate prices in producing countries. In principle, markets linked by trade should experience similar price effects from global supply or demand shocks, with changes in international prices reflected proportionally in domestic prices.<sup>71</sup> In practice, empirical evidence shows that spatial transmission is incomplete and uneven across markets because of several factors attenuating or delaying this transmission. Among these, market infrastructure



and transaction costs, such as poor roads, port inefficiencies, and high shipping costs, can widen price gaps between countries. Currency fluctuations also affect domestic price signals, as most global commodity prices are set in US dollars. Additionally, domestic policies, like minimum prices, buffer stocks, or export taxes, and the presence of dominant exporters or intermediaries can limit the pass-through of international prices.<sup>75</sup>

On the other hand, vertical price transmission refers to the way price changes at one level of the supply chain are passed through to another, from upstream actors such as producers and exporters (e.g. the price of cocoa beans) to downstream agents including processors, retailers, and final consumers (e.g. the chocolate retail price at country level). According to the standard theory on vertical price transmission in perfect competition, a shock originating at the farm level is fully transmitted to the retail prices when its impact is equal to the share of the agricultural product in the food industry's cost function.<sup>76</sup> For example, an increase in the global price of cocoa beans should be reflected in a change at retail level equal to the share of cocoa inputs in the chocolate industry cost function, which is quite low and approximately close to 10–12 percent.<sup>77</sup>

The literature identifies several factors affecting the magnitude, speed, and symmetry of vertical transmission. The most common and debated factor is based on the idea that raising concentration in the agrifood industry over the last decades, including in the chocolate–cocoa value chain,<sup>78</sup> gave the dominant firms the possibility to collude and influence the transmission of the price shocks. Nevertheless, the economic theory proved that establishing a direct link between imperfect price transmission and market power is extremely complicated because the direction and magnitude of the relationship between the two depend on many factors which cannot be observed. Several other explanations have been provided by the literature. These include, among others, menu costs, inflation, and partially informed consumers with asymmetric search behaviour. Long-term contracts and forward pricing in processing sectors can also delay or mask transmission. Finally, retail prices, especially in supermarkets, may be sticky due to consumer expectations or regulatory oversight.<sup>72, 73</sup>





### 4.3. A brief description of the beverage value chains

This section describes the structure and functioning of the global value chain for coffee, cocoa and tea. It focuses on the key characteristics of the global value chains, offering a concise overview of their structure, the principal actors involved at each stage, and the critical nodes through which international price signals are transmitted.

#### 4.3.1. The coffee value chain

The coffee global value chain can be structured into five main stages: production, processing, trade, roasting and marketing. In recent years, the supply chain has gradually shifted from linear and segmented to a more interconnected and dynamic network, with actors often assuming cross cutting roles at multiple levels.<sup>12</sup>

Coffee production begins at the farm and involves several steps before it is ready for export. Coffee cherries are harvested by hand or machine, depending on terrain and farm size. The careful selection of ripe cherries plays an important role in determining coffee quality. Once harvested, the cherries are transported to a processing facility, where they need to be processed quickly to prevent spoilage. Coffee cherries are processed through several established techniques, most commonly the dry, wet, and honey methods. In the dry (or natural process), whole cherries are dried intact, allowing fermentation to occur within the fruit before the beans are separated from the outer layers. The wet or washed method removes the skin and pulp soon after harvest, followed by controlled fermentation and drying to achieve a cleaner sensory profile. The honey process represents an intermediate approach in which the skin is removed but part of the mucilage is deliberately retained on the bean during drying, influencing the chemical and sensory characteristics of the final.<sup>79</sup> Production and post-harvest practices play a key role in determining the quality and market value of coffee products.<sup>12</sup>

Primary processing usually occurs in coffee growing countries and transforms cherries into green coffee beans ready for trade. These countries generally export the bulk of their produce. Farmers generally sell via cooperatives or local buyers to independent exporters or to large international trading houses, which are often part of multinational groups and act as key intermediaries between producers and global roasters.<sup>80</sup> There is, however, a growing trend toward direct trade, notably in specialty markets, with buyers increasingly sourcing directly from producers.

Exporting and importing coffee is a crucial part of the global coffee supply chain, influencing the overall cost of the beans. Ocean freight is the most commonly used method for shipping coffee, given the large quantities traded over long distances from major producing countries to consumer markets in Europe and North America. Coffee is typically shipped as green beans, in containers either in bulk or in bags. For bulk shipments, containers are lined with a plastic inner layer to maintain cleanliness and prevent contamination. When shipped in bags, natural fibre bags are preferred over woven polypropylene, as they help preserve the beans' quality during transit. Transporting bagged coffee cargo in standard dry containers remains the most widely used practice.<sup>12</sup>

Roasting generally takes place in importing and consuming countries and consists in heating green coffee to develop aroma and flavour. It is followed by blending, grinding and packaging. Increasingly, digital tools assist with roasting precision, quality control, and inventory management. Roasters vary from small, independent, and specialty operations to large and multinational corporations. However, in general, coffee roasting is a concentrated activity, with the world's ten largest roasters accounting for more than 35 percent of global roasted coffee volume.<sup>81</sup> Coffee exporters and roasters are increasingly vertically integrated, particularly in the case of multinational firms. Some of these firms are expanding their operations from farms to processing to shipping and handling, strengthening their position across multiple stages of the value chain. This increasing concentration of activities among large actors contributes to a buyer-driven governance structure, in which roasters and, in some cases, retailers, are the strongest actors within the coffee value chain.<sup>82</sup>

Roasters sell directly to retailers, including supermarkets and bars or restaurants, or operate their own distribution networks. At the retail level, coffee is sold either as roasted coffee (whole bean or ground) or in soluble (instant) form and reach consumers through diverse channels: supermarkets, coffee shops, e-commerce, and vending.

With nearly all coffee exported as green, unprocessed coffee beans, the largest share of the value addition occurs in importing countries among roasters and retailers. The average green coffee export value is estimated to account for less than 10 percent of the revenues generated in the global coffee retail market.<sup>81</sup> Some certifications, such as Fairtrade, aim to redistribute value along the chain by offering price premiums to compliant producers.<sup>1</sup> However, compliance costs associated with certification can be substantial and may exclude smallholders or limit their participation.<sup>12</sup>

Digital transformation is increasingly supporting supply chain transparency and traceability, farm level data collection, and virtual marketplaces, bringing producers closer to consumers. These tools can also facilitate financial inclusion by helping producers overcome limited access to services such as credit or risk management instruments. At the same time, there is a growing trend toward greater value addition at origin, such as local roasting, branding, and direct exports, enabling producers to retain a greater share of income and stimulate local economies.



<sup>1</sup> Certification is based on the idea that consumers are willing to pay higher prices for the products that meet specific standards. In return, smallholder producers must comply with these standards, and they receive higher prices for their products (Grote *et al.*, 2007).

### 4.3.2. The cocoa–chocolate value chain

The cocoa value chain includes several key stages, beginning with cocoa farming and continuing through to the final sale of chocolate products in consumer markets. These stages incorporate cocoa cultivation; the collection, warehousing, and transport of beans in producing countries; cocoa processing, primarily carried out in consumer countries; the manufacturing and commercialization of finished cocoa products by national and international brands; and, finally, retail distribution, particularly through supermarkets and other consumer outlets.<sup>77</sup>

Cocoa pods are harvested manually from the trunks and branches of cocoa trees. After harvesting, the pods are opened to extract the wet beans, which are fermented to develop flavour and then carefully dried to reduce moisture for safe storage and transport. After drying, the beans are cleaned and sorted to meet quality standards before being bagged and prepared for commercialization.<sup>83</sup> The marketing channel from cocoa farmers to exporters often involves small-scale traders. These intermediaries buy beans directly from farmers and consolidate them for sale to higher-tier buyers or exporters, a structure widely documented in West Africa. At the same time, farmer cooperatives also play an important role, often organizing collective sales and, in some contexts, engaging directly in export transactions.<sup>84</sup>

Traditionally, cocoa beans have been shipped in jute bags. More recently, the consolidation of the cocoa–chocolate value chain has led to a gradual shift away from small-scale, bagged exports toward more centralized and cost-efficient bulk-handling systems. Large multinational grinders and traders increasingly use standardized, high-volume logistical arrangements to move cocoa more efficiently from producing countries to processing hubs.<sup>20</sup>

The processing stage, mostly carried out in consuming countries, typically includes the roasting and grinding of cocoa beans. Beans are roasted to reduce moisture content and develop flavour and then ground to produce cocoa liquor – a process known as converting or grinding. The liquor may be used directly as an ingredient for chocolate, otherwise it is processed into two further intermediate products, cocoa butter, and cocoa powder. After filtration, cocoa butter is kept in liquid form for subsequent use in chocolate production. At the manufacturing stage, cocoa butter, cocoa liquor and cocoa powder are blended with other ingredients, particularly milk and sugar. This mixture is then refined through a series of rollers to achieve a smooth chocolate texture. Averaged across all chocolate types, cocoa typically accounts for about half of total raw material costs.<sup>80</sup> The final step of the value chain includes packaging, marketing and retail distribution through grocery outlets such as hypermarkets, supermarkets, convenience stores, discounters, and through online shopping.

The global chocolate–cocoa value chain has become increasingly concentrated both horizontally and vertically, driven by a series of mergers and acquisitions, particularly following the wave of market liberalization in major producing countries during the 1980s and 1990s.<sup>78</sup> Horizontal concentration in cocoa trading and processing has largely been motivated by the pursuit of cost efficiency and economies of scale in response to rising operating and production costs. These activities are now dominated by a small number of large multinational firms. In addition, vertical integration has intensified, with companies expanding their



operations from sourcing cocoa beans to manufacturing chocolate products<sup>20</sup>, consolidating control across multiple stages of the value chain. Similarly, some major chocolate producers have their own conversion capacity and can therefore purchase directly from exporters. Chocolate producers may either purchase butter and powder from cocoa processing companies or buy beans and undertake the conversion themselves. However, the downstream chocolate industry remains relatively less concentrated than the upstream cocoa segment of the value chain, while artisanal production remains important.<sup>80</sup>

According to a recent study, on average, cocoa farmers receive 11 percent of the final retail price of a cocoa product. When considering all actors in producing countries, from cultivation to export of cocoa beans, their combined share rises to about 18.6 percent of the total value. However, they capture less than 7.5 percent of the total profit margins generated along the chain. By contrast, the two final actors, brands and retailers, receive around 70 percent of the total value and retain up to 90 percent of the total profit margins.<sup>77</sup>

In addition to receiving a relatively small share of the final retail price of cocoa products, cocoa farmers are significantly exposed to international price volatility. While cocoa is traded on commodity futures exchanges in London and New York, most cocoa farmers are unable to hedge against global price fluctuations. Even cooperatives and smaller exporters often lack the financial resources and technical capacity to access futures markets. In an effort to improve the incomes and livelihoods of cocoa farmers and raising the farmgate price, the governments of Côte d'Ivoire and Ghana established the Côte d'Ivoire–Ghana Cocoa Initiative. Starting from the 2020/2021 season, they introduced a USD 400 per tonne premium on exported cocoa, known as the Living Income Differential (LID).<sup>85</sup> Moreover, certification schemes such as Fairtrade, Rainforest Alliance and organic labels aim to promote income stability, sustainability and traceability within the cocoa sector. However, smallholder farmers often face high compliance costs and administrative burdens, which can hinder their ability to participate in these schemes. In this respect, digital tools can contribute to increasing transparency and traceability in the cocoa sector. They enable the sharing of information such as farm plans, production progress, and pricing, and can also facilitate direct digital payments to farmers.<sup>22</sup>



### 4.3.3. The tea value chain

The tea value chain includes the entire process from “leaf to cup”. This integrated process includes key stages such as cultivation, harvesting, processing, packaging, distribution, and retail. Each step adds value and involves multiple stakeholders whose coordination is essential for delivering quality tea to consumers worldwide. Optimizing each stage is vital for sustainability, quality and profitability.<sup>86</sup>

Tea production begins at the farm and involves several steps before it is ready for export. The method and timing of plucking are critical, as they directly influence the quality and variety of tea that will be produced. Once harvested, the tea leaves move to the processing phase, where they are transformed into different types of tea. Primary processing involves several key steps, starting with withering, which reduces moisture content in the leaves, followed by rolling or cutting, a step that breaks the leaf cells and initiates oxidation. The fermentation or oxidation process is essential for developing the flavour and colour, especially for black and oolong teas, while green and white teas are not oxidized. Finally, the drying stage removes moisture and preserves flavour, aroma and shelf life.<sup>87</sup>

After processing, tea is graded and enters the packaging phase. Packaging not only ensures freshness but also plays a key role in branding and meeting diverse consumer preferences, whether the tea is sold as loose leaf, in tea bags, or in more specialized forms. The packaged tea is then moved through the distribution network, which includes exporters, importers, and wholesalers before it reaches retail outlets. Efficient logistics, including the use of cold chains, are vital at this stage to maintain the product’s shelf life and quality.<sup>88</sup> Primary processing takes place in producing countries, and factories are often located near plantations to preserve leaf quality and reduce costs. Value addition such as blending, flavouring, and retail packaging, frequently occurs in consumer countries before the tea is distributed to the market.<sup>87, 89</sup>

Following primary processing, a large share of “made tea” enters the market through structured auction systems, which serve as benchmark prices for the global tea trade (see Box 2.1). These auctions, held in major tea-producing countries such as Kenya (Mombasa), India (Kolkata and Guwahati), and Sri Lanka (Colombo), allow licensed brokers to present lots of tea to registered buyers in a competitive, transparent bidding environment. Auction prices are influenced by seasonal production levels, global demand, leaf quality, and prevailing market conditions. While auctions remain the dominant sales channel, direct sales through forward contracts or long-term agreements are increasingly common, particularly for high-value or specialty teas marketed under specific brands. Once sold, tea destined for export is cleaned, graded, and packed to align with international buyer specifications. It must also meet stringent quality and safety regulations, including sanitary and phytosanitary (SPS) standards, before undergoing customs clearance. Final destinations for exported tea include top consumer markets such as the United Kingdom of Great Britain and Northern Ireland, Pakistan, the Russian Federation, the United States of America, and Egypt, where demand for both bulk and specialty tea remains strong.<sup>87, 90</sup>

The final stage of the tea value chain is retail, where tea products reach consumers through supermarkets, specialty stores, cafés, and increasingly, e-commerce platforms. At this stage, branding, marketing, and consumer engagement play a critical role in shaping purchasing behaviour and enhancing product value.

Value addition is most prominent during processing, packaging, branding, and retailing, with these stages yielding the highest profit margins, particularly in premium market segments such as organic, artisanal, and flavoured teas.<sup>90, 91</sup>

Different from coffee and cocoa, the upstream segment of the tea value chain shows substantial heterogeneity across countries. Major producers differ in production scale and structure, organization, infrastructure, market orientation, policy environments, technological adoption, and the extent of value addition. These variations influence how tea is cultivated, processed, marketed, and sold, shaping the competitiveness and sustainability of each country's tea sector.<sup>92</sup>

China, the largest tea producer, is dominated by smallholders operating family-run farms and is known for its highly diverse range of teas, including green, oolong, white, black and Pu-erh. Most of China's production is consumed domestically, although high-value specialty exports are growing. China also leads in value addition through artisanal processing and technology-driven sales models, including e-commerce and blockchain for traceability.<sup>93</sup> In India, the second largest tea producer, the sector features a dual structure comprising large plantations – especially in Assam and Darjeeling – and smallholder farmers found predominantly in the South and Northeast. India is both a major producer and consumer of tea, with a diverse value chain that includes auctions (e.g. Kolkata, Guwahati, Cochin), direct sales, and strong domestic branding through companies like Tata Tea and Brooke Bond. The government plays a central role through the Tea Board of India.<sup>94</sup>

In Kenya, the tea value chain is highly organized and export focused, with smallholder farmers producing over 60 percent of the country's tea. Supported by the Kenya Tea Development Agency (KTDA), farmers grow tea in highland regions and deliver green leaves to processing factories for standard black CTC production. Most tea is sold through the Mombasa Tea Auction, with exports mainly in bulk to markets such as Pakistan, Egypt and the United Kingdom of Great Britain and Northern Ireland. The sector is regulated by institutions like the Tea Board of Kenya and supported by research agencies. Despite its strengths, the sector faces challenges including price volatility, climate change, and limited domestic consumption, but opportunities exist in diversifying products, increasing value addition, and expanding into specialty tea markets.<sup>91</sup>

Sri Lanka's tea industry is highly export-oriented and globally recognized under the Ceylon Tea label. While large estates remain important, smallholders now produce about 73 percent of national output, supplying leaves through systems such as bought-leaf and contract arrangements to processing factories.<sup>91</sup> The Colombo Tea Auction continues to be the main trading platform, but many firms have expanded into value-added packaging and branding for retail markets. Viet Nam, another important tea producer, operates a mixed production system involving both government and private players. It focuses largely on bulk exports of black and green teas, often used for blending. Although branding remains limited, Viet Nam is beginning to invest in specialty tea production. Its competitive edge lies in high mechanization and low production costs, making its tea globally price competitive.



In summary, understanding the specificities of each beverage value chain is essential for interpreting how global price shocks are transmitted to producers and consumers. The structural characteristics and market linkages identified in this section will support the interpretation of the observed differences in price transmission across countries and commodities.

#### **4.4. Estimating the transmission of price shocks in the beverage commodity markets**

Futures markets play a key role in global commodity price transmission. Derivatives markets for coffee and cocoa centralize price discovery and set standards, allowing analysts to separately evaluate producer-to-global and global-to-retail price relationships, without the need to account for the entire value chain simultaneously.<sup>80</sup> In this context, the rest of the chapter presents two analyses: one on how global coffee price shocks affect producer prices in developing countries, and another on how global cocoa price shocks influence chocolate retail prices in the European Union.

The selection of the two empirical exercises is driven by both the structural characteristics of the beverage commodity markets and practical considerations related to data availability. Among the three commodities, coffee is the only one for which monthly farm-gate prices are available across a sufficiently broad set of developing countries, allowing for a meaningful cross-country analysis of price transmission from international to producer level. In contrast, reliable monthly producer price data are largely unavailable for cocoa and tea, limiting the feasibility of comparable analyses. Additionally, the coffee sector in many leading producing countries tends to be more liberalized, allowing farm-gate prices to respond promptly to short-term fluctuations in the international market. In contrast, cocoa and tea prices in major producing nations are frequently regulated by national pricing mechanisms. In the case of cocoa, for example, farm-gate prices in Côte d'Ivoire and Ghana are administratively set through mechanisms such as the Living Income Differential with the objective to support producer incomes. These policies can limit or delay the pass-through of global price changes to producers in the short run. In the case of tea, farm-gate prices are closely linked to auctions, as farmers in major producing countries typically receive payments based on final auction prices.<sup>22</sup> Therefore, the strong correlation between auction and producer prices reduces the analytical value of examining transmission effects over this segment of the tea value chain. Finally, the second empirical exercise uses the cocoa–chocolate value chain to capture the transmission from global commodity shocks to retail prices since this sector is highly vertically integrated and globally dispersed, with production and consumption occurring in distant markets. By contrast, tea is predominantly consumed domestically in major producing countries, which would justify the decision to assess the pass-through from auction to domestic retail prices. Unfortunately, monthly retail prices from major tea-producing countries are not publicly available. Similarly, the chapter does not examine the impact of global shocks on coffee prices at the retail level, as this topic has already been addressed by FAO in a recent report.<sup>52</sup>

#### 4.4.1. Literature review

Empirical studies of price transmission commonly rely on reduced-form regressions of one price on another. Following the seminal contribution of Engle and Granger,<sup>95</sup> the combination of cointegration tests and error correction models (ECMs) became the standard empirical approach for analysing price transmission. Most of the studies employ a two-step procedure: first, testing for cointegration between two non-stationary price series of the same order, and second, estimating an ECM to capture the short-run dynamics and the speed at which prices adjust toward their long run equilibrium.<sup>72, 73</sup> In spatial price transmission analyses, these series typically represent prices from geographically distinct markets, such as international versus local markets, whereas in vertical price transmission studies, the series represent different stages of the value chain, for example, farm-gate and retail prices.

Subsequent studies on spatial price transmission criticized the simple cointegration approach for overlooking the role of transaction costs, which can partially or fully prevent the price adjustments across markets. In response, the literature shifted towards non-linear representations, employing regime-switching models, particularly threshold modelling techniques.<sup>96</sup> These models assume the existence of a neutral band within which price differences do not trigger adjustments because transaction costs outweigh potential arbitrage gains. Price transmission becomes observable only when price differentials exceed this threshold, making arbitrage profitable. Since the introduction of the first non-linear models, empirical studies on spatial transmission have expanded along this path. The literature adopted refined versions of the simple threshold model to assess market integration, including smooth transition models, threshold error correction model, non-parametric models, and generalized impulse response function to capture the dynamic behaviour of the adjustments.

Similarly, empirical studies on vertical price transmission have moved beyond the simple cointegration framework by augmenting the original bivariate regressions with additional explanatory variables, aiming to control for marketing costs, market power, and the degree of competition. Emphasis has been given to the concept of asymmetric vertical price transmission, whereby positive price shocks are rapidly and fully transmitted to consumers, whereas negative price shocks (i.e. price declines) are passed on more slowly or incompletely.<sup>97</sup> This phenomenon, commonly referred to as the “*rockets and feathers*” effect, may indicate inefficiencies within the supply chain, and several explanations have been proposed in the literature, as already mentioned in Section 4.2. Asymmetric price transmission has been empirically tested using various time series econometric techniques, including autoregressive distributed lag, partial adjustment, error correction models, regime-switching, and vector autoregressive models.<sup>98</sup> Finally, to overcome the limitations arising from the lack of suitable time-series data on key determinants of price transmission and to move beyond traditional regression methods, several authors have adopted structural modelling approaches to obtain more precise and theoretically consistent estimates of price pass-through mechanisms.

Alternative approaches such as nonlinear ARDL (NARDL) models have been widely used to capture asymmetric adjustments in long-run relationships between prices. These approaches provide a complementary perspective by focusing on equilibrium dynamics and adjustment paths. The asymmetric local projection results presented in this chapter are consistent with this broader literature, while maintaining a focus on the dynamic propagation of identified shocks.



These empirical approaches have also been applied to beverage commodities, providing valuable insights into the price dynamics of coffee, cocoa and tea. For coffee, the availability of long-term series and monthly farm-gate prices across many producing countries has enabled a relatively rich body of literature, particularly on spatial transmission. Krivonos (2004), for example, applies cointegration and error correction models (ECMs) to examine the relationship between international and domestic coffee prices in several producing countries, both before and after the dismantling of the International Coffee Agreement (ICA) and the following liberalization of several coffee markets.<sup>99</sup> She finds that while price transmission to farm-gate improved after the removal of price controls in the 1990s, it remained incomplete and heterogeneous across countries. Baffes and Gardner (2003) apply cointegration analysis across several African countries and find moderate pass-through from world to producer prices for coffee, with incomplete and often delayed adjustments attributed to structural bottlenecks and domestic insulation.<sup>100</sup> Rapsomanikis *et al.* (2003) use an asymmetric ECM to test market integration between the coffee markets of Ethiopia, Rwanda and Uganda and the international market.<sup>71</sup> They find mixed evidence and suggest that the lack of integration in Rwanda was due to domestic price policies. For cocoa, Baffes and Gardner (2003) find evidence of spatial transmission between the world price and the domestic price in Ghana only after domestic reforms adopted in 1983, which led the country towards a more liberal trade regime.<sup>100</sup> Bonjean and Brun (2016) examine the relationship between the world cocoa bean price and the price of the tablet of chocolate in France using an ECM representation.<sup>78</sup> The analysis indicated no cointegration for most of the period from 1955 to 2011, suggesting an absence of a long-term equilibrium relationship between the variables during that timeframe. However, more recently, Rogna and Tille (2025) use a vector error correction model (VECM) to investigate the price transmission along the cocoa-chocolate value chain and find that the international price of cocoa beans positively impacts chocolate prices in the European Union but with a very limited effect in magnitude.<sup>101</sup>





#### 4.4.2. Estimating transmission of price shocks using local projections

This study uses a multistep econometric method to estimate the propagation of the shocks along the value chains. While closely related, price transmission and shock transmission capture distinct aspects of market dynamics: price transmission refers to the extent and speed at which changes in global prices are passed through to domestic prices, whereas shock transmission focuses on the underlying structural drivers of those price movements and their propagation along the value chain. While the two terms are occasionally used interchangeably for expositional simplicity in the remainder of the chapter, the analysis consistently refers to shock transmission unless otherwise specified.

The empirical exercise first extracts the net-supply shocks to the global commodity prices estimated with the SVAR model in Chapter 3, then investigates how this shock affects producer and consumer prices at country level using LPs.<sup>102</sup> The use of structurally identified shocks as exogenous surprises in local projections (LPs) has been applied, among others, by studies focusing on crude oil,<sup>103, 104</sup> monetary policy,<sup>105</sup> and global food supply and demand.<sup>106, 107</sup> This chapter extends this approach by applying the SVAR-LPs framework to trace spatial and vertical transmission of price shocks in the beverage markets.

The empirical analyses focus exclusively on the transmission of net-supply shocks since, as already discussed in Chapters 2 and 3, market fundamentals are the primary drivers of global beverage commodity prices. Specifically, the pass-through to domestic prices is identified by pooling all the countries together and using the following panel specification of the LPs:

$$\Delta_h p_{i,t+h} = \alpha_{i,h} + \beta_h \epsilon_t^{NS} + \sum_{j=1}^l \theta_j^h \Delta X_{i,t-j} + \rho t + \mu_{i,t+h} \quad [\text{Eq. 4.1}]$$

where the dependent variable  $\Delta_h p_{i,t+h}$  is the time difference of a domestic price  $p$  in country  $i$  between periods  $t-1$  and  $t+h$ . Since it is expressed in logarithms, it measures the cumulative percentage change of the variable between the two periods.  $\alpha_{i,h}$  is the vector of the country fixed effects, while  $\beta_h$  measures the dynamic pass-through of the global net-supply shock  $\epsilon_t^{NS}$  at time  $t$  on the domestic price after  $h$  periods. Vector  $X$  controls for the previous history of the dependent variable and the shocks together with additional variables that contribute to drive the domestic prices. For each horizon  $h$ , a separate regression is estimated using a fixed-effects estimator and the coefficient  $\beta_h$  is retrieved to construct the dynamic response of the farm-gate price to the international shocks. Finally, Driscoll and Kraay standard errors are used since they are robust to cross-sectional and temporal dependence for fixed-effects regressions.<sup>108</sup>

For the analysis on the spatial transmission of price shocks between international coffee prices and farm-gate prices, the dependent variable  $p_i$  represents the real producer prices at country-level.  $\epsilon_t^{NS}$  denotes the net-supply shocks to the global price of Arabica coffee, taken from the structural shocks of the SVAR model for the coffee market presented in Chapter 3. The control vector  $X$  includes, beyond 12 lags of the dependent variable and the structural shock, the country-specific bilateral exchange rate with respect to the US dollar, considering its importance in shaping the pass-through from international to domestic markets, particularly for the beverages commodities. All variables are expressed in US dollars and deflated using US CPI. For the analysis on the vertical transmission of price shocks between international cocoa prices and chocolate

consumer prices in the European Union, the dependent variable  $p_i$  denotes the retail chocolate price in the EU country  $i$ .  $\varepsilon_t^{NS}$  are the net-supply shocks to the global price of cocoa, taken from the structural shocks of the SVAR model for the cocoa market presented in Chapter 3. The control vector  $X$  includes, beyond 18 lags of the dependent variable and the structural shock, 3 lags of other country-specific data such as the energy price index, the sugar price index – a fundamental ingredient used in the production of chocolate – and the real effective exchange rate of the Euro Area.<sup>m</sup> In this case, all the variables are deflated using country-specific CPI.<sup>n</sup>

Local projections are an appealing alternative to the structural VAR approach since they allow experts to estimate directly the response of an outcome variable to shocks using univariate methods without the need to impose additional structural restrictions such as, for example, in the case of the global model described in the Chapter 3.<sup>109</sup> Moreover, the flexibility of the LPs also lets experts adjust the estimates to panel data, handle non-linearities as well as better tolerate functional misspecifications with respect to SVAR.<sup>110</sup>

In this context, several features of LPs are useful. Their flexibility allows externally identified shocks – such as those from a SVAR – to enter a simple univariate regression without the need to specify a new dynamic model.<sup>111</sup> This is important because most studies on spatial and vertical price transmission rely on cointegration methods that measure the impact of global prices on domestic markets without identifying the source of shocks. The SVAR LPs framework instead enables clearer estimation of net-supply shock effects, reducing confounding influences. Local projections are also robust to omitted variable misspecification. Much of the empirical literature suffers from missing information on market structure, transaction costs, or strategic behaviour along the value chain. Because LPs do not require full structural modelling to estimate pass through, they are less sensitive to such omissions than ECM approaches. Moreover, LPs naturally accommodate panel data, allowing estimation of average responses across countries and comparison with country-specific estimates.

Finally, LPs capture potential nonlinearities, including asymmetric responses to positive versus negative shocks. The analysis also examines potential non linearities in the propagation of shocks across both spatial and vertical dimensions of price transmission, building on recent extensions of the local projection framework that allow for nonlinear and state dependent responses.<sup>112, 113</sup> These specifications move beyond average pass through to assess whether transmission depends on the size or direction of shocks, reflecting the presence of adjustment frictions. For coffee, where spatial arbitrage is likely constrained by transaction costs, Equation (4.1) is re estimated by augmenting the local projections with a piecewise linear function that allows the response to vary by shock magnitude. This approach permits the identification of inaction bands, whereby small shocks fail to propagate while larger shocks generate measurable price responses, consistent with threshold effects highlighted in the spatial price transmission literature. For cocoa, the analysis focuses

<sup>m</sup> The price of milk represents another important variable to control for in the analysis. However, the available time series data on milk prices for the selected basket of countries is limited. Including the data would reduce the number of observations by half, significantly constraining the robustness of the results.

<sup>n</sup> More details on the variables used in the analyses are provided in Annex 2 and Annex 3.

on vertical transmission along the value chain, where prior work has documented asymmetric adjustment patterns. In this case, asymmetry is examined by allowing positive and negative supply shocks to propagate differently to downstream consumer prices, capturing sign dependent shock transmission rather than purely asymmetric price movements. Overall, while these nonlinear extensions shed light on the role of frictions and value chain dynamics, the evidence does not materially alter the conclusions from the baseline linear specification.

## 4.5. The impact of global price shocks along the value chain

### 4.5.1. Impact on producers: the case of coffee

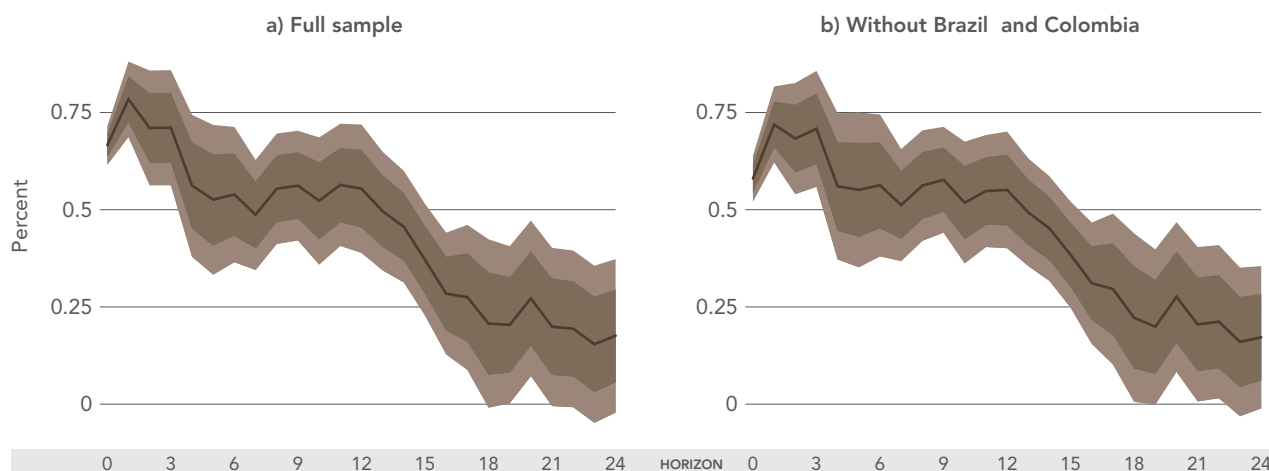
Following the collapse of the International Coffee Agreement in 1989 and the dismantling of the quota system, many producing countries liberalized the coffee sector, contributing to a fundamental shift in global market dynamics. With the removal of price control mechanisms and national marketing boards, farm-gate prices became increasingly dependent on fluctuations in international markets.<sup>80</sup> Several studies mentioned in the previous section tested how price transmission from world to domestic markets changed after the liberalization of the coffee sector. The consensus is that liberalization enhanced market integration in producing countries and made farm-gate prices more responsive to global shocks. Most of these studies were conducted in the early 2000s and motivated by what Daviron and Ponte described as the “coffee paradox”: the long standing coexistence of persistently low prices for raw coffee beans paid to farmers in producing countries despite a steadily growing global demand for more expensive coffee-based final products such as specialty, fair trade and sustainable coffees.<sup>112</sup> More recently, however, interest in the coffee sector has risen for the opposite reason. Since the end of 2023, international coffee prices have surged to unprecedented levels, driven by supply disruptions in major producing countries such as Brazil and Vietnam. This offers the rationale to revisit the evidence on the transmission of price shocks in the coffee market, using updated data and more recent empirical methodologies.

The dependent variable in Equation 4.1 is the monthly real farm-gate price expressed in US dollars, sourced from the International Coffee Organization (ICO) and complemented by data from FAOSTAT.<sup>o</sup> The final dataset comprises 11 Arabica-producing countries since the net-supply shocks calculated in Chapter 3 are specific to the global Arabica coffee market. The bilateral nominal exchange rate between the countries and the US dollar is collected from the Bank for International Settlements. All variables are expressed in logarithmic form and demeaned to take care of non-stationarity issues.

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<sup>o</sup> Countries with relevant gaps in the data are excluded from the analysis, such as those for which the last available observation is before January 2015 and/or it is not possible to build a time series of at least 100 consecutive observations.



**Figure 4.1.** The impact of net-supply shocks on the real Arabica producer prices

*Notes:* The left panel includes the full sample with 11 countries while the right panel excludes Brazil and Colombia. Estimates are normalized such that the net-supply shock increases the global Arabica coffee price by one percent on impact. The dark and light shaded areas represent the 68 and 90 percent confidence interval, respectively, and are calculated using the Driscoll and Kraay standard errors.

*Source:* Authors' own elaboration.

The left panel of Figure 4.1 presents the cumulative impact of global price shocks on producer prices across the full panel of Arabica-producing countries. To facilitate interpretation, each response is rescaled using the unit-effect normalization.<sup>110</sup> With this normalization, the size of each shock is reparametrized to induce a one percent increase on impact in the global price of Arabica coffee beans. In other words, Figure 4.1 shows the cumulative effect of a global net-supply shock – such that the international price of Arabica coffee increases by one percent – on domestic producer prices.

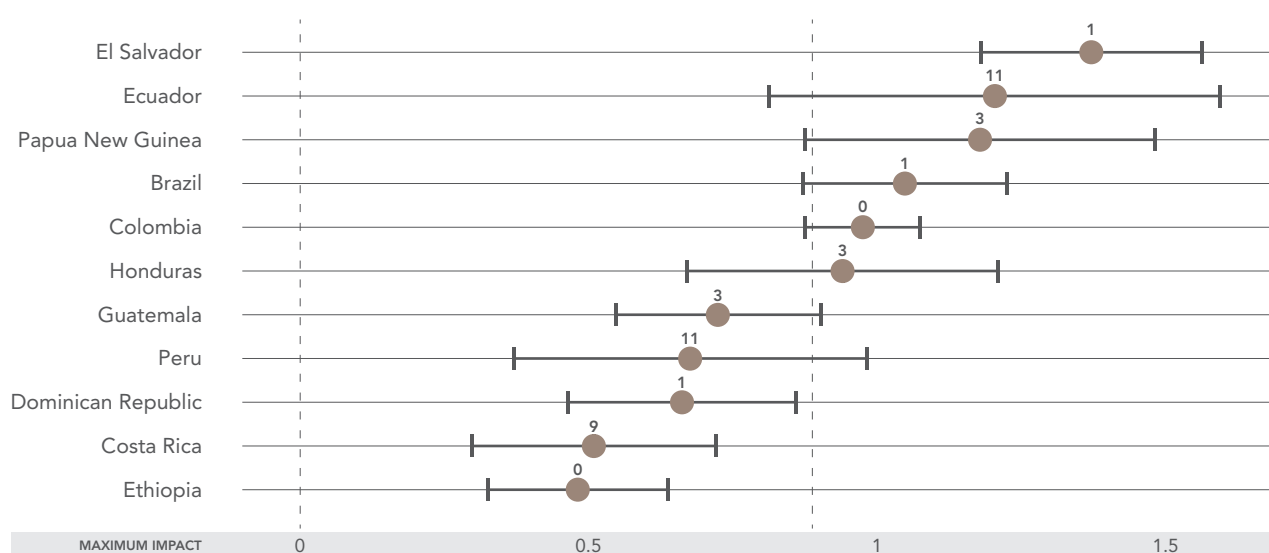
Results show that the cumulative effect of a net-supply shock is transmitted almost immediately at country level and persists for 18 months. The maximum effect is around 0.78 percent after one month, and it is highly significant. As discussed in Chapter 3, the net-supply shock almost entirely explains the variability in the international price of coffee, and therefore its impact on producer prices is the most important mechanism for understanding the transmission from international to domestic markets. Even though this is not directly comparable with previous analyses on the topic because of methodological differences, our results are in line with existing evidence on short-term price transmission after the waves of liberalization.<sup>99</sup> Therefore, farmers are impacted by global shocks to net-supply, such as weather disruption, even if the pass-through is incomplete. At the same time, the reverse is true. A reduction in the global prices triggered by unexpected bumper harvests or reduced demand from roasters reduce the real producer price by the same amount.

It is possible that the estimates suffer from endogeneity and reverse causality, since the global price is mostly determined by supply conditions in key producers such as Brazil and Colombia for Arabica. To address this concern, the right panel of Figure 4.1 reports the impact of the shocks without these countries. Results remain broadly consistent across both specifications. The only notable difference is the decrease in the transmission

of the net-supply shocks to producer prices (0.72 percent after one month), consistently with the hypothesis that bigger producers react more quickly and influence the formation of the global prices.

The existence of a neutral band is further assessed by distinguishing between the impact of small and large shocks. The band is constructed by identifying those structural net-supply shocks falling within the first decile, in absolute value. Results indicate that producer prices do not respond to shocks within this inner band, whereas shocks outside generate responses that are slightly stronger and more persistent than those obtained under the baseline specification – consistent with the presence of transaction costs that prevent arbitrage when price differentials are small (see [Figure A3.6](#)).<sup>p</sup>

**Figure 4.2.** The impact of net-supply shocks on the real coffee producer prices, by country



*Notes:* The brown dot indicates the maximum cumulative impact of a global net-supply shock on the domestic real producer price. The capped spikes around the dot represent the 90 percent confidence interval calculated using Driscoll and Kraay standard errors. The number above the brown dot indicates the month after the shock at which this peak is reached. The dashed red vertical line shows the average impact across all countries.

*Source:* Authors' own elaboration.

A more granular picture can be provided through a country-by-country analysis. To this end, [equation 4.1](#) is re-estimated separately for each country, scaled as if the global net-supply shocks raise the real global coffee price by one percent on impact. For the sake of brevity, [Figure 4.2](#) reports only the maximum cumulative impact (red dot), its 90 percent confidence interval (capped spikes), and the month after the shock at which this peak is reached in each country. The results show that the pass through from international to producer prices is positive and significant across all countries analysed, though the magnitude and speed of short-term transmission exhibit considerable heterogeneity. In some countries – namely Brazil, Colombia, Ecuador,

<sup>p</sup> Following the suggestion of Caravello and Martinez-Bruera (2024), the sign-asymmetry is tested as well to see whether the size-dependence could be affected by the positive and negative domain. [Figure A3.7](#) reports the sign-asymmetric responses and confirms that there are no noticeable differences in the transmission.

El Salvador, Honduras and Papua New Guinea – producer prices adjust fully to shocks from international markets, as indicated by a maximum cumulative effect close to or exceeding unity. Except for Ecuador, the transmission in these countries is also rapid, reaching its peak within less than one quarter. Conversely, in Costa Rica, the Dominican Republic, Ethiopia, Guatemala and Peru, the short-term pass-through remains incomplete, with maximum cumulative responses below one. For Peru and Costa Rica, the adjustment is also relatively slow and requires at least three quarters to reach its peak.

As discussed in Section 4.2, the literature provides several explanations for these results.<sup>9</sup> The most immediate relates to the relative weight of each country in global production. Major Arabica producers – Brazil and Colombia – display transmission elasticities close to one, likely reflecting their role as price makers in the international market. This high degree of pass-through is observed despite substantial differences in their domestic policy framework. In Brazil, the coffee market is fully liberalized, with producer prices determined entirely by market forces. In Colombia, by contrast, the Colombian Coffee Growers Federation (FNC) guarantees producers a base price derived from, among other factors, the New York “C” contract price, adjusted for exchange rate and quality differentials.

The policy framework can instead provide an explanation to the low transmission observed in Costa Rica, which is around 0.5. The sector is regulated by the Instituto del Café de Costa Rica (ICAFFE), a non-governmental institution which sets the price that mills must pay to farmers at the end of every harvest season, based on a revenue-sharing rule between growers, processors and exporters.<sup>115</sup> While the system guarantees competitive prices to farmers and smooths away intraseasonal risk, it probably reduces and slows down the short-term transmission of the shocks from the global to the domestic market.

Ethiopia, like Costa Rica, exhibits a relatively low short-term transmission of net-supply shocks (0.48). As described in Section 4.3, the reasons, however, could be distinct and stem primarily from a combination of policy constraints and infrastructural limitations that restrict farmers’ integration with the international market. The situation persists despite multiple policy interventions aimed at strengthening the sector’s integration with global markets, including the liberalization of the sector in 1992 and the establishment of the Ethiopian Commodity Exchange (ECX) in 2008. While ECX was designed to improve price discovery for farmers, standardize quality grading, and increase transparency, high transaction costs, poor rural infrastructure, and limited access to market have continued to constrain full integration.<sup>116, 117</sup>

The Dominican Republic, Peru and Guatemala share a slightly higher but still incomplete short term transmission of global shocks to producer prices, with cumulative effects below one and between 0.66–0.72. In all three cases, the market is liberalized, and farm-gate prices are not affected by a price-setting mechanism. Nevertheless, the presence of multilayered marketing chains, with smallholders selling mostly to local traders, may reduce the level of integration with the international market. While cooperatives and producer associations provide alternative channels that can secure premiums for specialty or certified coffees,

<sup>9</sup> For the sake of transparency, it is important to note that none of these have been tested through the empirical exercise presented here. This would require country-level and micro data. Nevertheless, the discussion in Section 4.3 on the description of the beverage value chains based on literature review provides an indication of possible causal linkages.

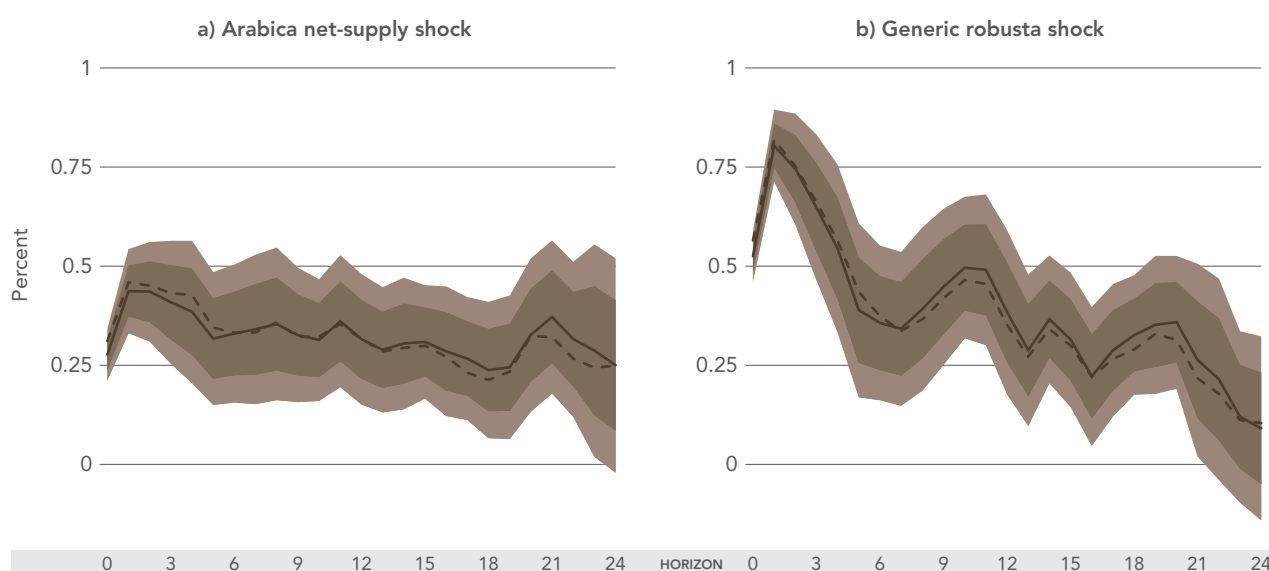


their reach is limited, and most smallholders face constraints such as high transaction costs, limited access to credit, and infrastructure gaps. Quality premiums and niche markets offer opportunities, but participation requires organization and compliance with strict standards.<sup>10, 118</sup>

Finally, El Salvador, Ecuador and Papua New Guinea show more-than-complete short-term transmission of net-supply shocks, with cumulative effects exceeding unity. A plausible explanation may lie in the combination of several features of their domestic coffee sectors. First, producer prices are determined through market-based mechanisms with minimal administrative intervention and are closely aligned with international benchmarks. Second, these three countries – together with the Dominican Republic – are the smallest Arabica producers in our sample. The limited availability of coffee increases competition among domestic buyers and exporters when international prices rise due to global shortages, thereby amplifying the pass-through to the farm-gate stage.

In summary, the analysis shows that real Arabica producer prices react significantly to market fundamental shocks, such as those – for example – caused by recent weather events in major producing countries. Although the pass-through is positive across all countries, it remains incomplete and heterogeneous in the short run in both magnitude and timing. Further adjustments may occur over time, particularly when domestic and international prices are cointegrated, as noted in Section 4.4.

**Figure 4.3.** The impact of global shocks on the real Robusta producer prices



*Note:* The left panel reports the estimated impact of an Arabica net-supply shock while the right panel reports the estimated impact of a generic Robusta net-supply shock (see footnote m). Dashed lines show the impact on the domestic producer prices of the full sample while the solid lines exclude Brazil and Colombia. The impacts on the left (right) panel are normalized such that the net-supply shock increases the global Arabica (Robusta) coffee price by one percent on impact. The dark and light shaded areas represent the 68 and 90 percent confidence interval, respectively, and are calculated using the Driscoll and Kraay standard errors.

*Source:* Authors' own elaboration.



What about Robusta? The analysis was extended to examine the transmission of two distinct global shocks to Robusta producer prices. To capture cross-market effects, the left panel of Figure 4.3 presents the impact of Arabica net-supply shocks – analysed in the previous exercise – on 9 Robusta-producing countries. The right panel of Figure 4.3 illustrates the effect of a generic shock to the global Robusta price, representing a disturbance originating within the Robusta market itself.<sup>†</sup> Results indicate that Robusta producer prices respond to both types of shocks, although the magnitude and timing of the responses differ substantially. Shocks to Arabica prices generate a moderate but statistically significant increase in Robusta producer prices, reflecting potential substitution effects and partial market integration between the two coffee varieties. As expected, the response is more pronounced and immediate when the shock originates in the Robusta market, with a stronger and faster transmission to producer prices. These findings confirm the existence of significant, though incomplete, spillovers between the two markets<sup>119, 120</sup> and demonstrate that transmission mechanisms extend to the farm-gate level. Roasters' ability to substitute between Arabica and Robusta in response to relative price changes induced by global shocks creates a linkage between the two markets. A rise in the price of one variety can increase demand for the other, thereby exerting upward pressure on producer prices across both segments.

The key policy question now is how to strengthen the benefits that producers can capture from international price increases while protecting them from excessive volatility. Investments in rural infrastructure, reduced transaction costs, and improved access to price competitive inputs and to timely price information can narrow the gap between international and farm-gate prices. Cooperative structures and producer organizations can

<sup>†</sup> The generic global Robusta price shocks are identified by regressing the global Robusta price on its own lags as well as the contemporaneous and lagged values of other variables explaining the Robusta market (global economic activities, oil price, Robusta spot price volatility and the Robusta forward curve) and treat the residuals as the shocks. This is equivalent to use an identification with short-run zero restrictions à la Cholesky.

reinforce bargaining power and enable access to higher value segments, such as specialty or certified markets. At the same time, combining market based price discovery with stabilization tools, such as countercyclical funds or insurance schemes, can help mitigate exposure to extreme shocks. In the context of increasing climate risks, international cooperation through institutions such as the ICO, FAO, and regional development banks can further contribute to ensure that global price dynamics translate into more stable and sustainable livelihoods for coffee farmers.

It is important to recognize that the methodology applied here identifies propagation patterns but does not disentangle the drivers discussed in the value chain section behind the observed heterogeneity across countries. The role of domestic institutions, policy frameworks, market organization, and infrastructure in shaping transmission is captured only indirectly. Differences in price transmission across countries may also reflect structural features of global value chains, including degrees of market concentration and pricing power in downstream segments. These factors are not explicitly modelled in the empirical framework and may influence the observed heterogeneity in pass-through alongside infrastructure and policy-related constraints. Further research is therefore needed to identify country-specific policy interventions that can improve competition, market integration while safeguarding farmers against excessive risks.

#### **4.5.2. Impact on consumers: the case of EU chocolate**

The recent shocks to the global cocoa market, triggered by severe weather-related events in West Africa, come on top of several years of persistent imbalances between global cocoa supply and demand, which have resulted in consecutive declines in end-of-season stocks.<sup>32</sup> The combination of reduced production, steady demand growth, and historically tight inventories has created a perfect storm for the sector. As international cocoa prices surged to unprecedented levels, cost pressures have rippled across the chocolate value chain, with manufacturers trying to absorb higher input costs and consumers increasingly confronted with rising retail prices.

The basket of chocolate manufacturers is highly heterogeneous, comprising large multinationals such as Mondelez, Mars, Ferrero, and Nestlé, alongside a vast number of small and medium-sized enterprises that form the backbone of the industry. Since the 1990s, global consumption of chocolate confectionery has expanded steadily, reflecting both rising incomes and changing consumer preferences. Within this value chain, raw cocoa beans and intermediate products – such as cocoa liquor, butter, and powder – constitute essential inputs into the production of chocolate and related confectioneries. The exercise presented in this section therefore examines how shocks in the global cocoa prices can propagate along successive stages of the chain and transmit to the retail markets of the European Union, the major consuming region of cocoa-related products in the world.

Equation 4.1 is estimated using monthly data over the period January 2010 to May 2024, collected from the Harmonised Index of Consumer Prices (HICP) published by Eurostat. The dependent variable is the chocolate price index (CP01183), while additional controls include important inputs used in the processing and distribution of the final products such as the energy price index (NRG) and the sugar index (CP01183),



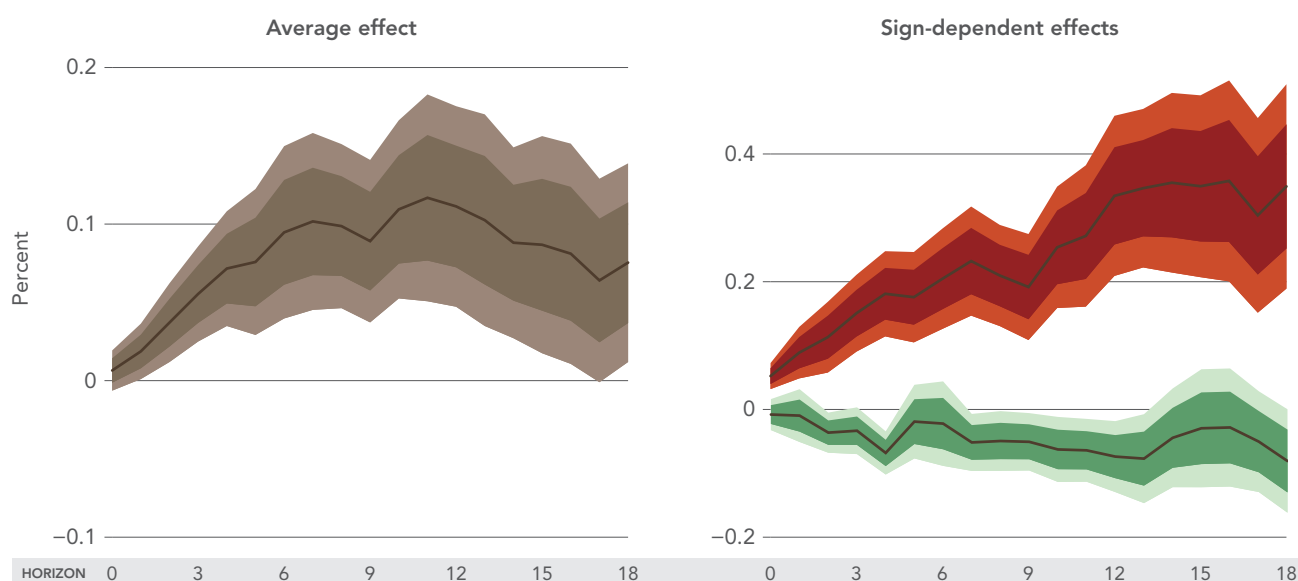
and finally, the real effective exchange rate of the Euro area. All series are deflated using the domestic CPI (CP00), demeaned and transformed into logarithmic form. Also in this case, the net-supply shocks to the global cocoa price are retrieved from the BSVAR estimated in Chapter 3. The final sample includes only EU countries with at least 120 consecutive observations, resulting in a panel of 18 countries.

The left panel of Figure 4.4 illustrates the cumulative effects of global net-supply shocks on EU chocolate retail prices, employing the panel specification of the LPs. Consistent with the approach in Section 4.5.1, each response is normalized to reflect a unit effect, and the magnitude of each shock is recalibrated to generate a one percent increase in the real global price of cocoa beans on impact. This is done to ease the interpretation of the findings. The results indicate that shocks to cocoa net-supply – such as those triggered by weather-driven supply shortages in West Africa – are transmitted positively and significantly to the consumers in the European Union. The cumulative effect of a net-supply shock starts to be significant, on average, in less than a quarter, and it is quite persistent for the first 18 months. The maximum effect is around 0.12 percent after 11 months, before reverting towards zero. This result closely aligns with the theoretical framework outlined in Section 4.2, which suggests that changes in retail prices should correspond to the share of cocoa inputs in the chocolate industry's cost structure.



Nevertheless, the right panel of Figure 4.4, which examines the sign dependence of the dynamic responses, reveals a more heterogeneous picture. Consistent with the existing empirical literature, the results point to marked asymmetry in the transmission process. Negative net-supply shocks, corresponding to reductions in global availability and increases in international prices, are associated with a large and persistent rise in retail chocolate prices, with effects peaking at around 0.35 percent after approximately one year. By contrast, positive net-supply shocks, which lower international prices, generate substantially weaker and often statistically insignificant responses, with only limited and short lived declines in retail prices. This pattern is consistent with asymmetric adjustment along the value chain, whereby cost increases propagate more strongly and more rapidly than cost decreases, in line with the “rockets and feathers” behaviour documented in the price transmission literature. However, it should be noted that the present framework does not permit identification of the specific mechanisms underlying this asymmetry, as it cannot disentangle the multiple explanations proposed in the literature, including market power, menu costs, contractual rigidities, and strategic pricing behaviour.

Figure 4.4. The impact of net-supply shocks on the real EU chocolate retail prices



*Note:* The left panel reports the estimated impact of a net-supply shock on the chocolate price index at retail level of 18 EU countries. The effect is normalized such that the net-supply shock increases the global cocoa price by one percent on impact. The right panel reports the estimated responses to net-supply shocks, distinguishing between negative (red) and positive (green) shocks. Estimates are normalized such that a negative (positive) shock raises (lowers) the global cocoa price by one percent on impact. The dark and light shaded areas represent the 68 and 90 percent confidence interval, respectively, and are calculated using the Driscoll and Kraay standard errors.

*Source:* Authors' own elaboration.

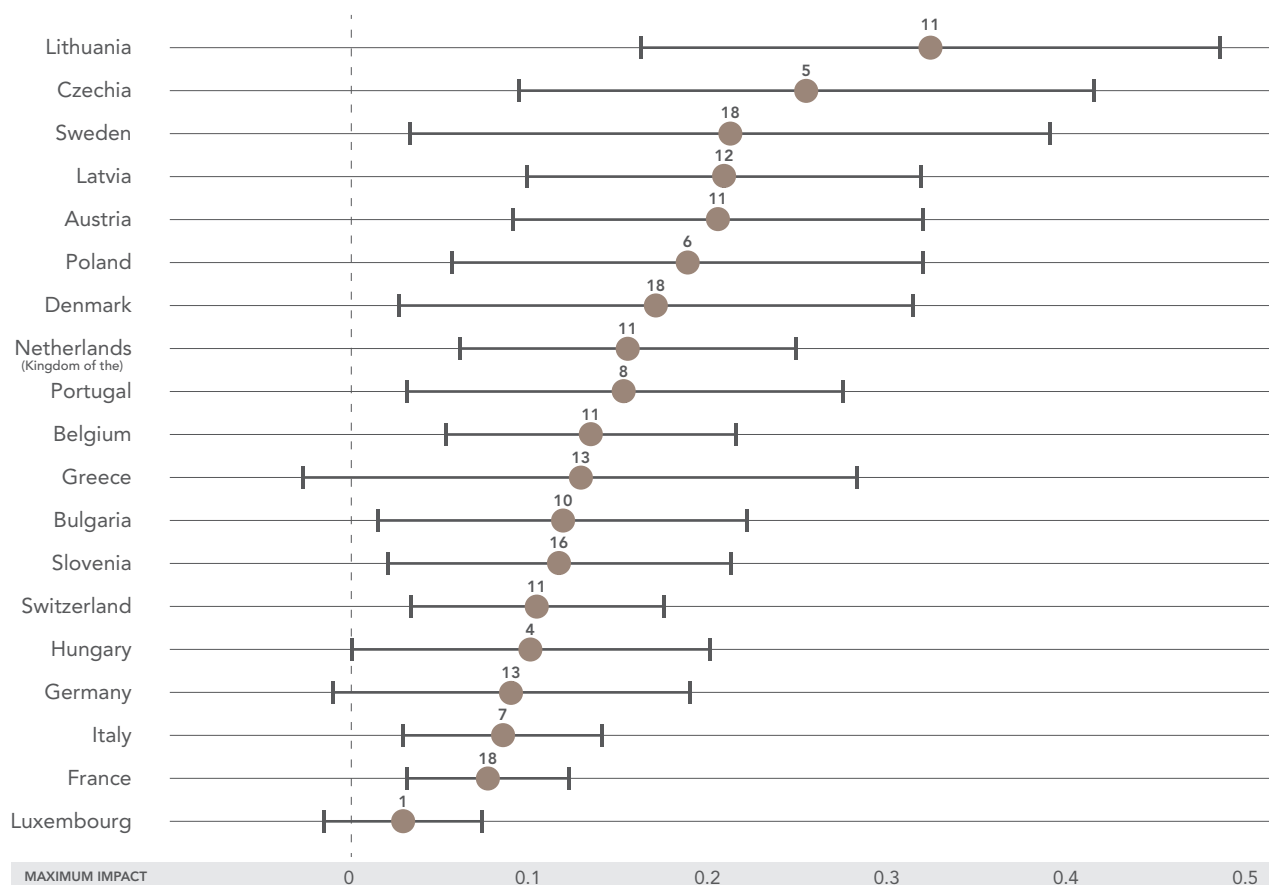
Figure 4.5 presents a country-level breakdown of the results, including the cumulative effect and the month during which the maximum response is observed.<sup>5</sup> Switzerland is added to the basket of countries due to its predominant role in the global chocolate industry. According to Figure 4.5, consumers in countries with large domestic manufacturing sectors face lower transmission. For example, the estimated impact on retail prices is only about 0.08–0.09 percent in France, Germany, and Italy, among the lowest in the sample. Other major producer/exporter countries such as Belgium, the Kingdom of the Netherlands, and Switzerland also show small peak effects. Europe's position as a leading region in chocolate production and trade helps explain why domestic markets in some countries can absorb or offset market shocks. In 2019, the European Union produced approximately 3.6 million tonnes of chocolate, making it the largest producer and exporter globally. Countries such as Belgium, Germany, Italy, the Kingdom of the Netherlands, Poland, and Switzerland host the headquarters and factories of multinational companies including Barry Callebaut, Ferrero, Lindt & Sprüngli, Nestlé, and Mondelez. As significant exporters over the past decade, these countries can also

<sup>5</sup> For this purpose, Equation 4.1 is re-estimated individually for each country, using global net-supply shocks as the exogenous variable, rescaled to simulate a one percent increase in the global price of cocoa beans upon impact. Unfortunately, the model with sign-dependent effects cannot be tested at country level because the estimation would double the number of regressors, leading to an insufficient number of degrees of freedom given the limited sample size.

leverage their production scale and export channels to moderate domestic prices when input costs increase, reducing the effects of global cocoa price shocks on local retail markets. Additionally, it could be that, in these countries, cocoa beans represent an even smaller share of the chocolate retail price, given the high cost of labour and overheads costs.

Conversely, countries with smaller chocolate industries or greater import dependence experience a higher pass-through of cocoa bean price shocks to retail prices. Several Central and Eastern European member states – for instance, Lithuania, Latvia and Czechia – exhibit significantly larger cumulative effects, in the range of 0.2–0.3 percent. Lithuania stands out with the highest observed cumulative effect (about 0.32 percent at its peak), despite being a net exporter of chocolate. In these instances, the cause may be associated with a domestic value chain that is either shorter or less diversified, resulting in global cost fluctuations being transmitted more directly to consumers.

**Figure 4.5.** The impact of net-supply shocks on the EU chocolate retail prices, by country



*Notes:* The brown dot indicates the maximum cumulative impact of a global net-supply shock on the domestic real retail price. The capped spikes around the dot represent the 90 percent confidence interval calculated using Newey standard errors. The number above the brown dot indicates the month after the shock at which this peak is reached.

*Source:* Authors' own elaboration.



These results support the existing evidence on the incomplete transmission of input cost shocks to food prices. According to the empirical literature, the heterogeneity in the pass-through to retail prices is influenced by multiple factors, including – among others – the characteristics of the industry and the presence of non-competitive market structures, the local costs to process and commercialize the product, and the short-run nominal rigidities faced by firms.<sup>121, 122</sup> A widely accepted insight is that large firms operating in oligopolistic competition, such as the major chocolate manufacturers in the European Union, can adjust and lower their markups more than smaller producers in response to cost shocks.<sup>123</sup> This ability to compress margins allows them to buffer retail prices against fluctuations in input costs, particularly in the short term. Taken together, the country-level results presented in Figure 4.5 reinforces the conclusion that domestic industry structure plays a central role in shaping the transmission of global cocoa price shocks. Countries with large, integrated chocolate manufacturing and retail sectors such as Belgium, France, Germany, Italy, the Kingdom of the Netherlands, and Switzerland, tend to exhibit lower pass-through effects, as firms in these markets are better positioned to absorb cost increases through markup adjustments. In contrast, it seems that countries with less developed processing capacity or more rigid pricing structures experience higher sensitivity to global shocks.

It is important to note that our empirical analysis does not directly test any of the underlying drivers of the observed heterogeneity in pass-through effects. A more robust investigation would require firm-level data, including information on pricing strategies, market concentration, and cost structures. For those interested in exploring these mechanisms further, future research should incorporate microeconomic evidence to validate the role of markups, competition, and value chain dynamics in shaping the transmission of global price shocks.

## A way forward: building resilient, efficient and inclusive beverage value chains

### 5.1. Key analytical insights

The report shows that short-term real price movements in coffee, cocoa and tea are mostly determined by market fundamentals. Even the latest episode of prices surges (2023–2025) was found to be caused by the same factors as those in the past. This includes unexpected shocks to supply and demand, triggered by – for example – extreme weather events, supply disruptions, and sudden shifts in consumption habits. Net-supply shocks – defined as unexpected changes to the difference between production and demand of a specific product – account for the vast majority of global real price variability, and information about inventories can further amplify their consequences. On the contrary, broader macroeconomic factors may influence long-term trends and nominal movements, or they can matter episodically such as, for example, during the post COVID-19 recovery. However, their effects on real prices remain modest and often statistically irrelevant.

The empirical analyses in [Chapter 4](#) indicate that the propagation of global shocks along domestic value chains is highly heterogeneous, incomplete, and delayed. In the coffee sector, international price shocks transmit rapidly but only partially to producer prices, with substantial cross-country variation reflecting differences in market integration, policy frameworks, and infrastructure. Transmission is also nonlinear, as transaction costs and market frictions create inaction bands within which small shocks fail to propagate. In cocoa, the vertical transmission of global net-supply shocks to retail chocolate prices is likewise heterogeneous and shaped by industrial structure, with larger and more integrated manufacturing sectors exhibiting lower pass-through. Moreover, shock transmission is asymmetric: negative net-supply shocks propagate more strongly and persistently to consumer prices than positive shocks, which generate weaker and short-lived responses.

A review of the literature on beverage global value chains finds that value added remains unevenly distributed across actors and stages. As described in [Chapter 4](#), primary producers, especially smallholders in low- and middle-income countries, capture only a small fraction of the final value, while downstream actors such as processors, leading marketing companies and retailers retain the largest share. Often, this imbalance is reinforced by additional factors such as rising input costs for producers, increasing regulatory and compliance requirements as well as economic, structural and institutional barriers that limit their bargaining power and access to higher-value market segments.<sup>122</sup>

Together, these insights highlight a beverage sector that is highly sensitive to global shocks, unevenly integrated, and characterized by inequitable value distribution. The combination of price volatility and

structural imbalances calls for concerted efforts to build resilience, enhance efficiency, and promote equity. Investing in climate-smart practices, forward-looking risk management, and technological innovation will be essential to reduce vulnerability, stabilize markets, and support all actors along the value chain.

While increasing resilience and reducing exposure to risks are necessary steps, they are not sufficient to ensure that beverage markets function efficiently and transparently. Irrespective of the degree of exposure to sudden disruptions in market fundamentals, the transmission of global price signals along domestic value chains must be improved. Market structure, domestic policies, transaction costs, and infrastructure constraints can all impede the efficient flow of information and incentives from international markets to producers and consumers. Strengthening price signal transmission is therefore critical to building efficient and transparent value chains, enabling actors at all stages to respond appropriately to changing market conditions



Finally, even a resilient and efficient market does not guarantee that its benefits are distributed equitably among stakeholders along the value chain. When the distribution of value added remains persistently skewed away from primary producers, smallholders in low-and middle-income countries are disproportionately exposed and vulnerable to global shocks. Building a resilient and efficient beverage sector must therefore be complemented by deliberate efforts to improve equity and inclusivity in value distribution. This requires targeted interventions to support value chain upgrading in major producing countries, strengthen farmers' bargaining power, and ensure that the benefits of global markets are shared more broadly.

The policy recommendations that follow are designed to advance these objectives, focusing on interventions that mitigate the adverse effects of price spikes and volatility, strengthen value-chain integration, and promote more equitable outcomes across actors. They draw on the empirical findings presented earlier, complemented by insights from the broader literature and policy experience. A key distinction is made between measures aimed at enhancing short-run resilience (Sections 5.2 and 5.3) and those addressing longer-term structural features of beverage value chains (Section 5.4). While these dimensions are often complementary, they may also entail trade-offs, as policies that dampen short-run price volatility can weaken the price signals needed to support long-run investment and supply responses. A full assessment of the effectiveness of these interventions, and of the associated trade-offs, would require dedicated empirical analysis beyond the scope of the present report.



## 5.2. Building resilience to price shocks and volatility in beverage value chains

The recommendations in this section follow directly from the empirical evidence on the dominant role of net-supply shocks in driving short-run price variability. Building resilience in agrifood value chains means strengthening the capacity to anticipate, prevent, absorb, adapt, and transform in response to a wide range of risks, including climate- and market-related shocks. This involves a combination of measures that reduce exposure and vulnerability, including climate-smart and sustainable agricultural practices, stronger market institutions and information systems, innovation and digitalization, and investment in institutional and human capacity development. Together, these measures foster more efficient resource use, strengthen risk reduction and preparedness, and help limit supply disruptions while supporting sustainable growth. These strategies are particularly relevant for coffee, cocoa, and tea value chains, which are highly exposed to climate variability, pests, diseases, and market fluctuations.<sup>125</sup>

In the coffee sector, regenerative and climate-resilient practices, such as agroforestry, intercropping, improved soil and water management, and the adoption of climate-resilient coffee varieties, can help sustain production and reduce vulnerability to climate-related shocks.<sup>126</sup> The application of integrated pest and disease management techniques, including the control of coffee leaf rust and coffee berry borer, is critical for maintaining yields and protecting crops.<sup>127</sup> Proper post-harvest handling of coffee, including sorting, washing, drying, and storage, is essential for minimizing quality deterioration and limiting post-harvest losses.<sup>128</sup> Finally, the rejuvenation and replanting of old or low-yielding coffee plantations are key for restoring production potential.<sup>13</sup> Similarly, in the cocoa sector, sustaining production requires effective control of major pests and diseases, notably cocoa swollen shoot virus, through the identification and eradication of infected trees, the implementation of spatial isolation measures to limit disease spread and the adoption of disease-tolerant varieties.<sup>129</sup> Appropriate post-harvest processes, particularly fermentation and drying, are essential to reducing quality defects and preventing spoilage-related losses.<sup>128</sup> Finally, rehabilitation and renovation are essential components of the cocoa cultivation cycle, particularly when productivity declines due to ageing, disease, or other factors, as they restore the productive capacity of cocoa orchards and support sustained long-term production.<sup>130</sup> In tea cultivation, building resilience involves selecting varieties suited to local conditions and integrating shade trees and companion crops to create a diverse, stable ecosystem. These practices help regulate microclimates, conserve soil moisture, and reduce the impact of drought and erosion. Effective management of pests and diseases is essential for maintaining yields and crop health.<sup>132</sup> Careful post-harvest handling, including timely plucking, withering, rolling, drying, and proper storage, is critical to preserving tea quality and minimizing losses. Finally, sustaining long-term productivity depends on the periodic rejuvenation or replanting of ageing or underperforming bushes.<sup>133</sup>

Beyond climate-smart production and sector-specific actions, Early Warning Systems (EWS) play an important role in helping farmers anticipate and respond to a range of risks. By providing timely alerts and information, whether about extreme weather, pest outbreaks, or other threats, EWS support informed decision-making and enhance preparedness. However, financial, technical, and capacity constraints limit the uptake of these practices and tools, particularly among smallholder farmers, thereby increasing their vulnerability to climate and market shocks. Strengthening access to affordable finance, quality inputs, and

extension services is therefore essential to enable producers, especially smallholders, to invest in resilience-building measures, improve productivity, and respond more effectively to price volatility and other shocks.<sup>124</sup> Strong institutions and coherent policies across agriculture, climate, and market regulation are also necessary to create an enabling environment for producers to invest in resilience and cope with price shocks and market volatility.<sup>134</sup> While upstream interventions are essential for reducing exposure to climate risks and supply disruptions, strengthening resilience to price shocks and volatility also requires transparent and efficient markets, as well as complementary structural measures across beverage value chains. Attempts to stabilize beverage commodity prices through producers-only agreements have repeatedly failed to achieve their objectives. For instance, International Commodity Agreements (ICAs) were established with “economic clauses” intended to mitigate price volatility; however, they proved largely ineffective. By the mid-1980s and early 1990s, interventions for major commodities like sugar (1984), coffee (1989), and cocoa (1993) had ceased. Conversely, strategies that focus on demand-side collaboration have proved more promising for managing volatility and improving how prices are passed along the value chain. Nowadays, attention has shifted towards broad-based initiatives and boosting awareness – evident in events such as the United Nations’ International Tea Day and the International Coffee Day.

### **5.3. Supporting efficiency and transparency across domestic and international markets**

While the empirical results show that uncertainty-related shocks play a secondary role compared to supply disruptions, they highlight the relevance of information gaps in amplifying short-term price movements. Transparent and timely information enables all actors, from smallholder farmers to multinational traders, to interpret supply and demand conditions accurately, respond appropriately to shocks, and make informed decisions. Improving the availability, quality, and timeliness of market data can help stabilize expectations, reduce misinformation, and prevent panic-driven surges.<sup>135</sup>

Among the various elements underpinning market transparency, inventories play a pivotal role because they act as a buffer between supply and demand, helping to absorb short-term shocks and limit excessive price volatility. As discussed in [Chapter 3](#), identical supply shocks can produce very different price outcomes depending on inventory levels and, crucially, the information available to market participants. When uncertainty about stocks is high, because reporting is incomplete, inconsistent, or delayed, markets may assume scarcity, amplifying price reactions and contributing to volatility. Transparent, standardized, and frequent public reporting of inventories in major ports and warehouses, supported by digital dashboards and independent verification, would reduce information gaps and support more accurate price discovery.

Beyond inventories, expectations related to weather conditions and their potential impact on future crop availability play a critical role in shaping price dynamics. Extreme weather events such as droughts or excessive rainfall can trigger price increases well before their actual effects on harvests materialize, as markets react to concerns over supply constraints. This pattern is evident across beverage crops, where high climate sensitivity means that expectations about future availability can strongly influence trading behaviour, whether through futures markets, forward contracting, or spot market adjustments. When information is scarce, ambiguous,

or poorly interpreted, these reactions can overshoot fundamentals, amplifying volatility relative to the actual scale of the shock. Strengthening the accuracy, frequency and accessibility of weather and crop-condition data can help moderate these expectation-driven surges and improve market stability.

These dynamics underscore the importance of well-functioning information systems. The G20 Agricultural Market Information System (AMIS) offers an example of how improved transparency and coordinated market monitoring can help mitigate risks associated with extreme price volatility. Developing a similar platform for beverage commodities can help ensure that price signals reflect to the greatest extent underlying fundamentals and reduce volatility resulting from insufficient or incomplete market information.

While improved information is essential for well-functioning markets, it must be complemented by efficient price transmission to ensure that actors along the value chain can respond appropriately to market signals. Although not empirically analysed in this report, incomplete price transmission is often associated with high transaction costs, inadequate infrastructure, and policy interventions that distort market signals. Strengthening price transmission requires reducing marketing costs and maintaining transparent, market-based price discovery. The adoption of improved market information systems, including digital platforms, can support these objectives by improving access to timely price information and enhancing market transparency.<sup>135</sup> A study in India found that adopting digital payment systems significantly improved operational efficiency and financial returns for small coffee businesses.<sup>136</sup> In the cocoa sector, formula-based farmgate pricing, as implemented in West Africa, can play a key role in aligning domestic and international markets and supporting producer incomes. In the tea sector, the digitization of auction platforms has been associated with improved transparency and operational efficiency, with outcomes influenced by the level of system automation and digital literacy among stakeholders.<sup>137</sup>

Open, rules-based trade and coherent regulatory frameworks are essential for transparent and efficient markets. When countries insulate domestic markets through export restrictions, variable levies, or abrupt policy shifts, they amplify international volatility and undermine the reliability of price signals. By contrast, predictable trade regimes, supported by effective trade facilitation measures such as streamlined customs procedures, enhance market integration and help preserve price signals that reflect underlying fundamentals. In doing so, they limit the amplification of uncertainty-driven dynamics, rather than altering the primary drivers of price fluctuations. In the coffee sector, harmonizing trade policies, taxation, and quality standards, along with streamlining customs procedures, have been identified as key priorities for reducing transaction costs and supporting more efficient intra-African coffee trade under the African Continental Free Trade Area (AfCFTA) framework.<sup>138</sup> In the tea sector, the harmonization of standards, particularly regulatory requirements such as maximum residue levels, plays a central role in reducing compliance costs and facilitating international tea trade.<sup>139</sup> Within the cocoa sector, sanitary and phytosanitary measures and technical regulations are key measures affecting international cocoa trade,<sup>140</sup> underscoring the relevance of regulatory requirements in market functioning.



## 5.4. Promoting an equitable and inclusive upgrading in the beverage value chains

The policy recommendations in this section are informed by the shock transmission analysis presented in Chapter 4, which highlights the uneven exposure to price movements and the asymmetric distribution of value along global value chains. While these findings motivate the proposed interventions, their effectiveness is not directly assessed within the empirical framework of this report. Instead, the recommendations draw on insights from the broader empirical literature and accumulated policy experience.

The dismantling of international commodity agreements and the liberalization of markets have tended to increase the disaggregation and specialization of production stages across global beverage value chains.<sup>83, 141</sup> This process has contributed to a division in which smallholders remain concentrated in low-value activities, while downstream actors capture a larger share of the value generated along the chain, as discussed in Chapter 4 of this report. At the same time, Chapter 4 shows that global beverage price shocks are transmitted asymmetrically along these value chains: producer prices respond more strongly and more rapidly to global price changes, while retail prices adjust only partially and with delay. This pattern is illustrated by the pronounced responses of producer prices in coffee-producing countries and by the limited, delayed and asymmetric pass-through to chocolate retail prices in the European Union. In this respect, the following measures should be interpreted as addressing structural characteristics of value chains rather than as direct mechanisms for reducing short-run exposure to price shocks.

Overall, the evidence shows that the actors most exposed to price volatility – typically primary producers – are also those capturing the smallest share of total value. Against this background, upgrading within beverage value chains can enable producers to shift from low-value activities into higher-value downstream functions, where exposure to global price shocks is weaker. In this way, value chain upgrading is widely recognized in the literature as a structural pathway through which producers may improve their position within the value chain and can promote both a more equitable distribution of value and greater resilience to global price volatility over the long term. On this basis, policy efforts to support producers' upgrading within beverage value chains can be framed around three complementary pathways: product, process, and functional upgrading.<sup>142</sup> Product upgrading focuses on improving quality and expanding access to certification schemes, in a manner that can lead to price premiums in higher-value markets. In coffee, this includes improving quality, differentiating production through origin-specific characteristics, and obtaining certification from internationally-recognized certification schemes and sustainability programmes.<sup>141</sup> In cocoa, it involves improving or adopting fine-flavour varieties, strengthening quality through fermentation and drying practices, and participating in certification and sustainability programmes.<sup>143</sup> In tea, product upgrading entails expanding into higher-value segments such as premium, specialty, and herbal or blended teas, with sustainability initiatives supporting smallholders to meet certification requirements.<sup>144</sup>

Process upgrading refers to improvements in the methods and technologies used to produce, harvest, and process agricultural commodities, aiming to increase efficiency, ensure product consistency, enhance quality, and reduce costs. In coffee, process upgrading includes improved harvesting, modern wet and dry milling, and enhanced sorting and grading to meet specialty and certified market requirements, supported by training and

investment in processing infrastructure.<sup>141</sup> In cocoa, process upgrading involves optimized fermentation and drying protocols and strengthened quality control at cooperative or processing levels to develop flavour and meet export and certification requirements.<sup>143</sup> For tea, process upgrading entails improved leaf handling and factory processing to support higher-quality orthodox and specialty teas, including factory modernization, quality grading, and compliance with sustainability and food-safety standards, supported by training and extension services.<sup>144</sup>



Functional upgrading enables producing countries to move beyond the supply of raw agricultural commodities into higher-value activities such as processing, packaging, branding, and direct marketing. In coffee, this includes expanding into roasting and soluble coffee production rather than exporting exclusively green beans.<sup>141</sup> In cocoa, functional upgrading can involve increasing domestic grinding capacity to produce cocoa liquor, butter, and powder, as well as developing local chocolate manufacturing.<sup>83</sup> In the tea sector, it includes shifting from bulk processed tea toward higher value-added segments such as premium, specialty, blended, and ready-to-drink products.<sup>144</sup> Although functional upgrading can increase domestic value retention, it remains highly challenging due to concentration among downstream processors and the substantial investments required in technology, skills, and finance.<sup>145</sup>

Horizontal interventions also play an important role in promoting equity and inclusion across beverage value chains. Strengthening cooperatives and producer associations is central to many of the solutions discussed above, as it can reduce information and bargaining asymmetries, support improved production practices, and enhance access to buyers through more transparent trading arrangements. Cooperatives also facilitate collective access to credit, inputs through group procurement and other resources that help stabilize incomes. Inclusive governance, ensuring the participation of women, youth, and vulnerable groups, is essential for equitable outcomes and long-term sustainability.<sup>146</sup> Evidence from the coffee sector shows that cooperatives and farmer associations can improve market access by enabling compliance with quality requirements, and enhance operational efficiency.<sup>141</sup> In cocoa, farmer organizations can play a similar role by coordinating



fermentation and drying, strengthening quality control, supporting participation in certification schemes, and improving farmers' collective capacity and market positioning.<sup>143</sup> In the tea sector, cooperative structures can help smallholders participate in highly concentrated markets and facilitate access to sustainability standards.<sup>144</sup>

Promoting equity and inclusive upgrading in beverage value chains requires combining vertical upgrading strategies with horizontal interventions. When effectively implemented, these measures can rebalance value distribution, enhance resilience, and expand sustainable livelihood opportunities for smallholders. Achieving these outcomes depends on sustained investment, as upgrading in agrifood value chains requires improvements in processing infrastructure, compliance with quality standards, and the development of new capabilities in contexts of persistent financial and informational constraints.<sup>83</sup> Blended finance, other de-risking instruments, targeted technical assistance, and multistakeholder partnerships have significant potential to mobilize resources and enable coordinated action.<sup>147</sup>

Further progress toward inclusive upgrading also requires investment in sustainability standards and digitalization. Supporting smallholders to comply with voluntary sustainability standards and related quality requirements can improve access to standard-compliant markets and support longer-term sector viability.<sup>144</sup> Digital tools that improve access to market information and coordination among producers can help reduce information asymmetries and support smallholders' participation in higher-value markets.<sup>141</sup> Upgrading strategies should also promote social inclusion, with particular attention to more vulnerable groups, including women and youth.<sup>144</sup> Finally, promoting equity and inclusive upgrading in beverage supply chains requires a holistic approach, with complementary policy measures needed to address the diverse constraints and opportunities across the value chain.<sup>147</sup>





# Annexes

## Annex 01

### Methodological note on Bayesian Structural Vector Autoregressive (BSVAR) model with zero and sign restrictions

This annex describes the methodological steps required to estimate the BSVAR presented in Chapter 3. It largely builds on Kilian and Lütkepohl (2017) and provides the technical details required to implement structural identification based on a combination of sign and zero restrictions, following the approach of Arias et al. (2018).<sup>67, 68</sup> Consider a VAR ( $p$ ) model of the form:

$$y_t = v + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + u_t$$

for  $t = 1, 2, \dots, T$ , where  $y_t$  is a  $(k \times 1)$  vector of endogenous variables and  $p$  indicates the number of lags, which captures the system dynamics.  $u_t$  is a  $(k \times 1)$  vector of reduced-form errors, with  $u_t \sim \mathcal{N}(0_{(k \times 1)}, \Sigma_u)$ .  $\Sigma_u$  is a  $(k \times k)$  reduced-form variance-covariance matrix, assumed to be positive definite. Following standard Bayesian estimation procedures for the VAR, we define  $A \equiv [v, A_1, A_2, \dots, A_p]$  a  $(k \times (kp + 1))$  matrix of reduced form parameters and specify a Normal-inverse-Wishart ( $\mathcal{NIW}$ ) prior distribution over the reduced form parameters, of the form:

- $vec(A) | \Sigma_u \sim \mathcal{N}(vec(A^*), V_{vec(A)} = V \otimes \Sigma_u)$
- $\Sigma_u \sim \mathcal{IW}_k(S_*, n)$

$vec(A^*)$ ,  $V$ ,  $S_*$  and  $n$  represent the specified prior parameters, with  $A^*$  a  $(k \times (kp + 1))$  matrix. If the prior distribution over the reduced-form parameters is  $\mathcal{NIW}$ , then the posterior distribution over the reduced-form parameters still belongs to the same family of  $\mathcal{NIW}$ , and they are given by:

- $vec(A) | \Sigma_u, \mathbf{y} \sim \mathcal{N}(vec(\bar{A}), \bar{\Sigma}_{vec(A)})$
- $\Sigma_u | \mathbf{y} \sim \mathcal{IW}_k(S, \tau)$

where  $\mathbf{y} = vec(Y)$ , with  $Y \equiv [y_1, y_2, \dots, y_T]$  denotes the observed data.

The estimation of the first and second moments of  $A$  are given by:

- $\bar{A}_{(k \times (kp+1))} = (A^* V^{-1} + Y Z') (V^{-1} + Z Z')^{-1}$
- $\bar{\Sigma}_{vec(A)} = (V^{-1} + Z Z')^{-1} \otimes \Sigma_u$ .

It is worth noting that, in the extreme case in which  $V^{-1}$  is zero, that is the inverse of the variance (or the precision is zero), the variance tends to infinity and the priors  $A^*$  become completely irrelevant or uninformative and the posterior mean converges to the classical OLS estimator. Furthermore, the first two moments of  $\Sigma_u$  after seeing the data, are:

- $S = T \bar{\Sigma}_u + S_* + \hat{A} Z Z' \hat{A}' + A^* V^{-1} A^{*'} - \bar{A} (V^{-1} + Z Z') \bar{A}'$
- $\tau = T + n$

where  $\hat{A} = YZ'(Z'Z)^{-1}$  and  $\tilde{\Sigma}_u = \frac{(Y - \hat{A}Z)(Y - \hat{A}Z)'}{T}$ , with  $Z \equiv [Z_0, Z_1, \dots, Z_{T-1}]$  with  $Z_{T-1} \equiv (1, y'_{t-1}, y'_{t-2}, \dots, y'_{t-p})'$ .

The reduced-form impulse response functions can be calculated from the top-left  $(k \times k)$  block of:

$$\mathbf{A}^h_{(kp \times kp)} = \begin{bmatrix} \underbrace{[A_1, A_2, \dots, A_p]}_{k \times kp} \\ \underbrace{\mathbf{I}}_{((p-1)k \times (p-1)k)} \quad \underbrace{\mathbf{0}}_{(p-1)k \times k} \end{bmatrix}^h$$

where  $h$  is the forecast-horizon and  $\mathbf{A}$  denotes the companion matrix of the VAR model. Thus, the response of the  $i^{th}$  variable to the  $j^{th}$  shock at horizon  $h$  corresponds to the element in row  $i$  and column  $j$  of  $\Phi_h = (JA^hJ')$ , where  $\mathbf{A}^h_{(kp \times kp)}$  is the  $h$ -th power of the companion matrix of the reduced-form VAR model and  $J \equiv [I_k, 0_{k \times k(p-1)}]$  is the selection matrix. The structural representation of model (1) is given by:

$$B_0 y_t = b_0 + B_1 y_{t-1} + B_2 y_{t-2} + \dots + B_p y_{t-p} + w_t$$

where  $B_0$  is a  $(k \times k)$  matrix of contemporaneous structural parameters,  $B_i$  governs the structural dynamics of the system, for  $i = 1, 2, \dots, p$  and  $w_t$  is a  $(k \times 1)$  vector of structural shocks, such that  $\mathbb{E}(w_t w_t') = I_k$ . Therefore, the relationship between the reduced-form VAR model and the corresponding structural model is given by:

- $A_i = B_0^{-1} B_i$ , for  $i = 1, 2, \dots, p$
- $u_t = B_0^{-1} w_t$
- $\Sigma_u = \mathbb{E}(u_t u_t') = \mathbb{E}((B_0^{-1} w_t)(B_0^{-1} w_t')) = B_0^{-1} \mathbb{E}(w_t w_t') B_0^{-1'} = B_0^{-1} B_0^{-1'}$ .

Given the impact multiplier matrix  $B_0^{-1}$ , the structural impulse response functions are obtained by premultiplying  $\Phi_h$  with  $B_0^{-1}$ , such that,  $\Theta_h = (JA^hJ')B_0^{-1}$ . Candidates draws for  $\Theta_h$  are denoted by  $L_h$ , which can be stacked and restricted to form a single matrix  $\mathbf{L}$ . For instance, if impact and dynamic sign restrictions are imposed at horizons 0 and 2,  $\mathbf{L}$  is defined as follows:  $\mathbf{L} = \begin{bmatrix} L_0 \\ L_2 \end{bmatrix}$ . In other words,  $\mathbf{L}$  contains the impulse response functions subject to both sign and zero restrictions.

We follow the algorithm proposed by Arias *et al.* (2018) to draw from the conjugate posterior distribution of the orthogonal reduced-form parameterization and then transform these draws into the structural parameterization. Specifically, the algorithm assumes a Gaussian-inverse Wishart prior for the reduced-form coefficients of the VAR model and a Haar prior for the orthogonal rotation matrix  $Q$ , such that the zero restrictions hold.  $Q$  represents the solution to the QR decomposition of  $X$ , a square matrix of order  $k$ , whose columns are independently drawn from a multivariate normal distribution with zero mean and identity covariance. Consequently, the prior for the structural impulse responses depends  $A$ ,  $\Sigma_u$  and  $Q$ .

As discussed in Arias *et al.* (2018), the key feature of the algorithm is that it combines sign restrictions with zero, or exclusion, restrictions in such a way that the class of zero restrictions on the structural coefficients maps into linear restrictions on the orthogonal matrices, conditional on the reduced-form parameters. It is important to note that the prior uncertainty regarding the impulse response functions mainly stems from



the uncertainty in the reduced-form coefficients, which is updated with the data, whereas the prior distribution of  $Q$  remains unaffected.<sup>148</sup>

The algorithm proposed by Arias *et al.* (2018) for combining zero and sign restrictions is based on five main steps, which are discussed below.

**Step-1:** Draw  $(A, \Sigma_u)$  from the posterior distribution of the reduced-form parameters.

**Step-2:** Draw an orthogonal matrix  $Q$  such that  $L_0 Q$  satisfies the exclusion restrictions.

Let  $X_{(k \times k)}$  be square matrix of order  $k$ , whose columns are independently drawn from a multivariate normal distribution with zero mean and identity variances.  $Q$  represents the solution to the QR decomposition of  $X$ . Define  $q_j \equiv Q l_j$  and  $x_j \equiv X l_j$ , for  $1 \leq j \leq k$ , where  $l_j$  denotes the  $j^{th}$  column of the identity matrix  $I_k$ .

In addition, define  $R_1 = E_1 L$  and for  $j = 2, 3, \dots, k$ ,  $R_j = \begin{bmatrix} E_j L \\ Q_{j-1} \end{bmatrix}$  where  $E_j$  is the selection matrix of zero restrictions, with the number of columns equal to the number of rows of  $L$  and  $Q_{j-1} = [q_1, \dots, q_{j-1}]$ . If the rank of  $E_j$  is  $e_j$ , then  $e_j$  is the number of zero restrictions associated with the  $j$ -th shock. The total number of zero restrictions is  $e = \sum_{j=1}^k e_j$ . The structural parameter satisfies the zero restrictions if and only if  $E_j L l_j = 0$ , for  $1 \leq j \leq k$ . Moreover, let  $E_j$  represent the zero restrictions, starting with the structural shock that implies the most exclusion restrictions, followed by the structural shock that implies the second-largest number of zero restrictions, and so on. The draw of the rotation matrix  $Q$  involves five main substeps:

- i. Let  $j=1$ .
- ii. Construct  $R_j$  and find the matrix  $N_{j-1}$  whose columns form an orthonormal basis of the null space of  $R_j$ .
- iii. Draw the  $k \times 1$  vector  $x_j$  from the  $\mathcal{N}(0_{(k \times 1)}, I_k)$  distribution.
- iv. Let  $q_j = N_{j-1} (N'_{j-1} x_j / \| N'_{j-1} x_j \|)$ , where  $\|\cdot\|$  is the Euclidian norm.
- v. If  $j = K$ , stop, construct  $Q = [q_1, \dots, q_k]$  and move to step 3 of the algorithm. Otherwise, let  $j = j + 1$  and move to step b.

**Step-3.** Accordingly,  $L_0 Q$  represents a draw from the posterior distribution of  $B_0^{-1}$ , before using any identifying restrictions on the implied structural impulse responses.

**Step-4.** Recompute  $L$  with  $L_0 Q$  replacing  $L_0$ . Retain the draw if  $S_j L l_j > 0$  is satisfied for  $j = 2, 3, \dots, k$ .  $S_j$  a selection matrix with one non-zero entry in each row. Analogously to  $e_j$ ,  $s_j = \text{rank}(S_j)$  represents the number of sign restrictions on the impulse responses associate with the  $j$ -th structural shocks. The total number of sign-restrictions is  $s = \sum_{j=1}^k s_j$ .

**Step-5.** After repeating steps 2, 3 and 4 as many times as desired, return to step 1 until the required number of draws from the posterior distribution of the structural impulse responses, conditional on the sign restrictions, has been obtained.



Beyond static sign restrictions, the literature highlights the use of additional identifying constraints, including restrictions on the absolute magnitude of impulse responses and on their shape over the relevant horizon, to further narrow the set of admissible structural models.<sup>149, 150</sup> The identification strategy implies that the price responses to cocoa- and coffee-specific shocks are larger than those to energy price or economic activity shocks. This is consistent with the idea that idiosyncratic shocks play a more important role in explaining price changes than shocks driven by energy or macroeconomic conditions. The use algorithm also imposes dynamic sign restrictions on the responses of prices and spreads to a positive expectational shock for up to six months. This reflects the view that a positive spread, driven by stockpiling, is persistent over time, and it allows experts to rule out alternative explanations for a temporary increase in prices and spreads triggered by positive arbitrage shocks. Furthermore, to distinguish precautionary demand shocks from expectational shocks, it is assumed that the impact response of the spread to a precautionary demand shock is larger than its impact response to an expectational shock. Finally, it is assumed there is a positive hump-shaped price response to a precautionary demand shock, as documented in the literature on energy and agricultural commodity markets.<sup>†</sup>

Following Inoue and Kilian (2022), we report the set of structural impulse response functions obtained by minimizing the absolute loss function in expectation over the set of admissible structural models. Let  $\theta$  represent the vector of unknown impulse responses, constructed by stacking all  $k_{irf} = k^2(H + 1)$  impulse responses of interest into a single vector, with  $H$  denoting the maximum forecast horizon under consideration. Moreover, let  $\theta \in \Theta$ , where  $\Theta$  is the set of all structural impulse response functions that satisfy the identifying sign restrictions impose on the SVAR model. The space  $\Theta$  can be approximated by drawing from the distribution of the model parameters and simulating the distribution of structural impulse responses that are consistent with the identifying assumptions. Thus, the impulse response estimator under absolute loss can be approximated by:

$\hat{\theta}_M = \underset{\theta \in \Theta}{\operatorname{argmin}} \frac{1}{M} \sum_{i=1}^M \sum_{j=1}^{k_{irf}} |\theta_j^{(i)} - \bar{\theta}_j|$  where  $\bar{\theta}_j$  is the  $j$ -th element of  $\bar{\theta} \in \Theta$ , with  $\bar{\theta}$  being an action and the expectation is with respect to the joint prior distribution  $\theta_j^{(i)} \in \Theta$ , and  $M$  is the number of prior draws.

Finally, under absolute loss, the joint credible set can be constructed by sorting  $\frac{1}{M} \sum_{i=1}^M L(\theta^{(i)}, \theta^{(1)}), \frac{1}{M} \sum_{i=1}^M L(\theta^{(i)}, \theta^{(2)}), \dots, \frac{1}{M} \sum_{i=1}^M L(\theta^{(i)}, \theta^{(M)})$  in ascending order and selecting the lowest  $(1 - \alpha)100\%$  of the draws.

<sup>†</sup> To enhance transparency, the model has also been estimated without these additional magnitude and shape restrictions. The results, available upon request, remain qualitatively unchanged, with only a marginal decrease in the contribution of the net-supply shocks (from an average 94% to 89% for cocoa and from 92% to 88% for coffee, over the first year), but at the cost of generating implausibly large demand and supply elasticities, confirming the role of the additional restrictions in ensuring economically meaningful identification.

# Annexes

## Annex 02

### Additional tables

**Table A2.1.** Data for estimating global coffee, cocoa, and tea models

| Variable                     | Description                                                               | Source                                                                                                                                                      | Sample         | Transformation                  |
|------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------|
| GECON                        | Global Economic Conditions Index from Baumeister et al. (2022)*           | Baumeister's website                                                                                                                                        | 1996M1–2025M3  | Level                           |
| Real oil price               | US refiner acquisition cost of imported crude oil deflated by the US CPI  | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Logarithmic/demeaned            |
| U.S. CPI                     | United States Consumer Price Index                                        | Federal Reserve Economic Data (FRED)                                                                                                                        | 1996M1–2025M3  | Logarithmic/demeaned            |
| Real coffee price            | ICE Coffee C nearby futures contract deflated by the US CPI               | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Logarithmic/demeaned            |
| Realized volatility (coffee) | Monthly sum of daily returns of the ICE Coffee C nearby futures contract  | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Level                           |
| Spread (coffee)              | Difference between the third-most-distant and the nearby futures contract | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Logarithmic difference/demeaned |
| Real cocoa price             | ICE London Cocoa nearby futures contracts deflated by the US CPI          | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Logarithmic/demeaned            |
| Realized volatility (cocoa)  | Monthly sum of daily returns of the ICE Cocoa nearby futures contract     | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Level                           |
| Spread (cocoa)               | Difference between the third-most-distant and the nearby futures contract | Refinitiv Workspace (LSGE)                                                                                                                                  | 1996M1–2025M3  | Logarithmic difference/demeaned |
| Tea production               | Sum of Black tea production (MT) in India, Sri Lanka and Kenya            | Sri Lanka Tea Board, Tea Board of India, and Global Tea Digest website ( <a href="https://www.globalteadigest.com/">https://www.globalteadigest.com/</a> ). | 2012M1–2024M12 | Logarithmic/demeaned            |
| Tea price                    | FAO Tea Composite Price deflated by the US CPI                            | FAO/IGG/Tea Secretariat                                                                                                                                     | 2012M1–2025M12 | Logarithmic/demeaned            |

*Note:* \*Baumeister, C., Korobilis, D. & Lee, T.K. 2022. Energy markets and global economic conditions. Review of Economics and Statistics, 104(4): 828–844.

**Table A2.2.** Data for estimating the transmission of global coffee net-supply shocks to producers

| Variable                                          | Description                                                                                  | Source                                                                           | Sample                     | Transformation       |
|---------------------------------------------------|----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------|----------------------|
| Global coffee net-supply shock                    | Structural shock retrieved from the BSVAR described in Chapter 3                             | Authors' calculation                                                             | 1996M1–2024M05             | Level                |
| Coffee producer prices (both arabica and robusta) | Prices paid to growers expressed in USD and deflated by US CPI                               | International Coffee Organization (ICO) and complemented by producer prices from | 1996M1–2024M05 (with gaps) | Logarithmic/demeaned |
| Exchange rate                                     | The bilateral nominal exchange rate between the countries and the USD deflated by the US CPI | Bank for International Settlements                                               | 1996M1–2024M0 (with gaps)  | Logarithmic/demeaned |

**Table A2.3.** Data for estimating the transmission of global cocoa net-supply shocks to consumers

| Variable                      | Description                                                                                              | Source                             | Sample                     | Transformation       |
|-------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------|----------------------|
| Global cocoa net-supply shock | Structural shock retrieved from the BSVAR described in Chapter 3                                         | Authors' calculation               | 2010M1–2024M05             | Level                |
| Chocolate retail price        | HIPC – Chocolate at country level for 18 EU countries plus Switzerland deflated by domestic CPI          | EUROSTAT                           | 2010M1–2024M05 (with gaps) | Logarithmic/demeaned |
| Energy cost                   | HIPC – Energy at country level for 18 EU countries plus Switzerland deflated by domestic CPI             | EUROSTAT                           | 2010M1–2024M05 (with gaps) | Logarithmic/demeaned |
| EUR-USD ER                    | Bilateral Exchange Rate EUR-USD                                                                          | Bank for International Settlements | 2010M1–2024M05 (with gaps) | Logarithmic/demeaned |
| Sugar retail price            | HIPC – Sugar at country level for 18 EU countries plus Switzerland deflated by domestic CPI              | EUROSTAT                           | 2010M1–2024M05 (with gaps) | Logarithmic/demeaned |
| Milk retail price             | HIPC – Sugar at country level for 18 EU countries plus Switzerland deflated by domestic CPI              | EUROSTAT                           | 2010M1–2024M05 (with gaps) | Logarithmic/demeaned |
| Consumer Price Index          | HIP – All items at country level for 18 EU countries plus Switzerland used to build real terms variables | EUROSTAT                           | 2010M1–2024M05             | –                    |

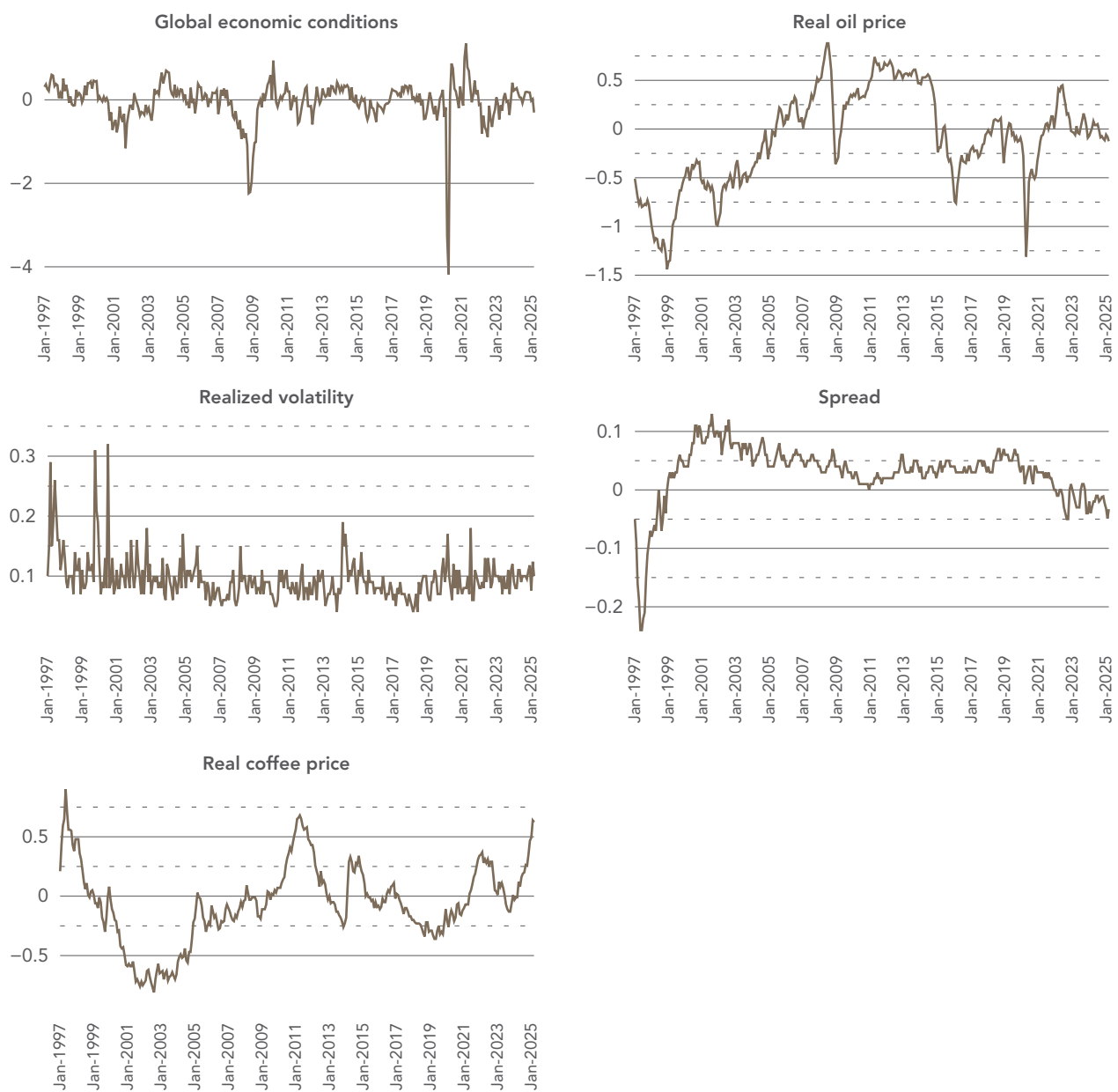


# Annexes

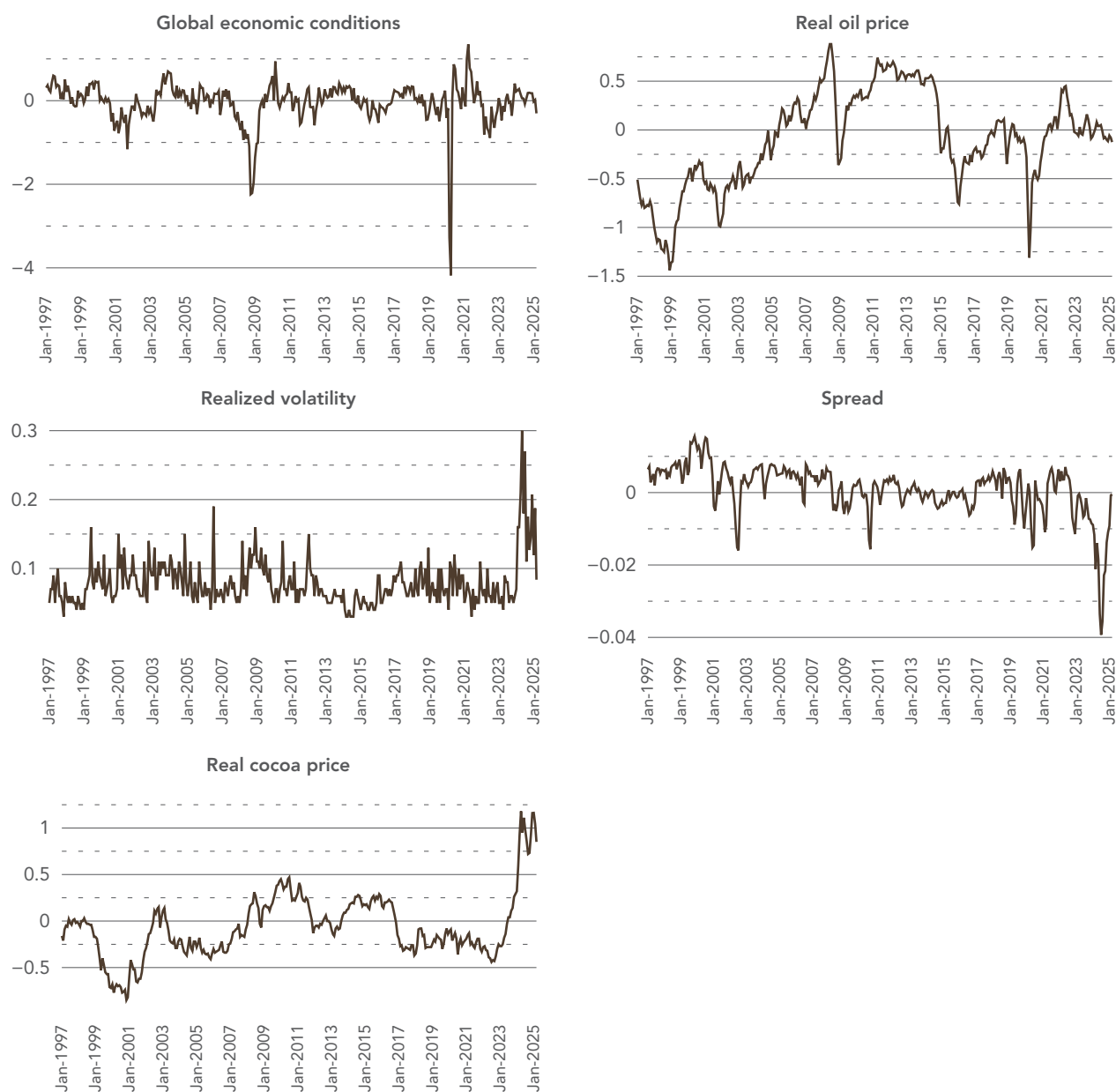
## Annex 03

### Additional figures

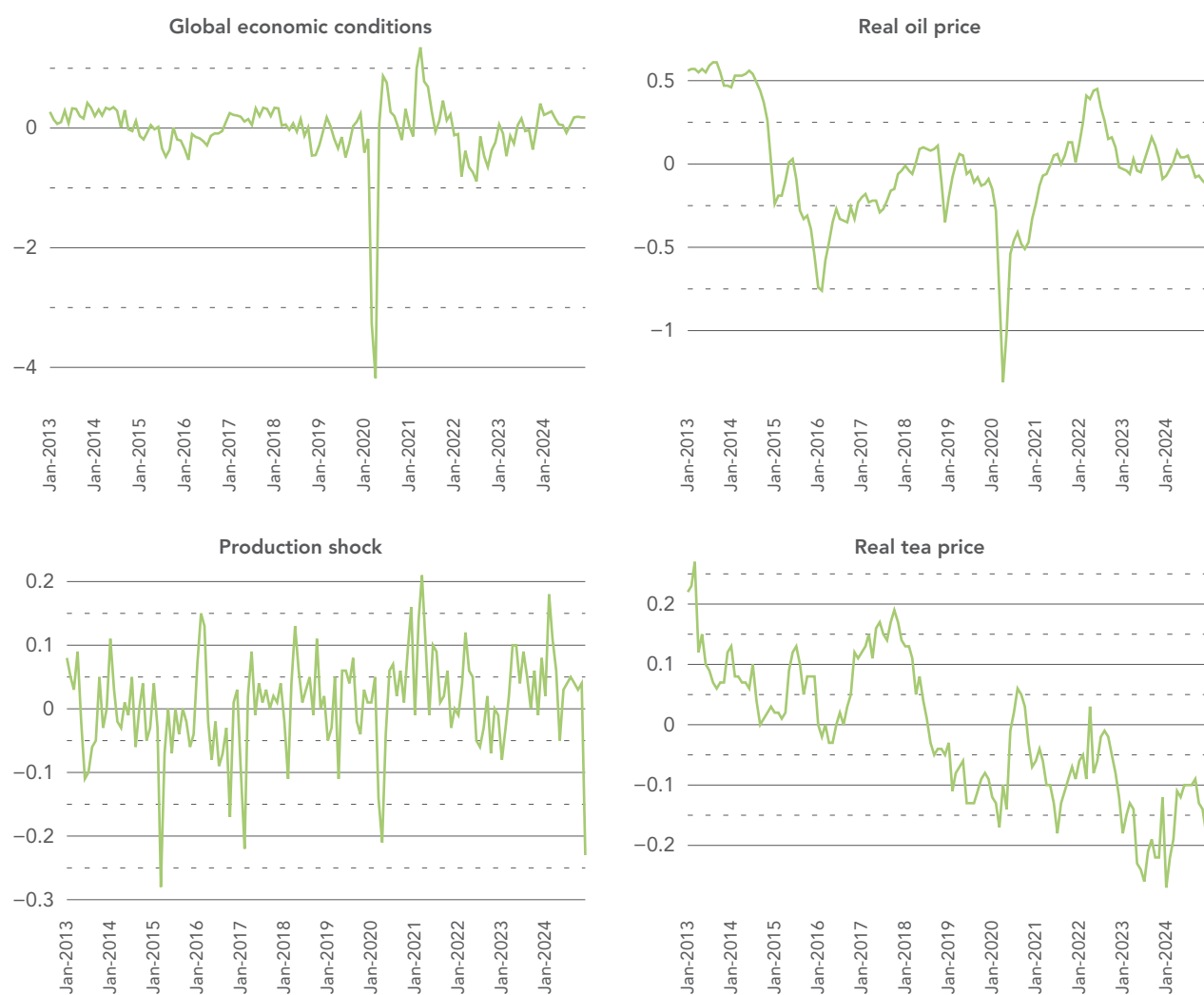
**Figure A3.1.** Transformed variables in the BSVAR model on global coffee market



Source: Authors' own elaboration.

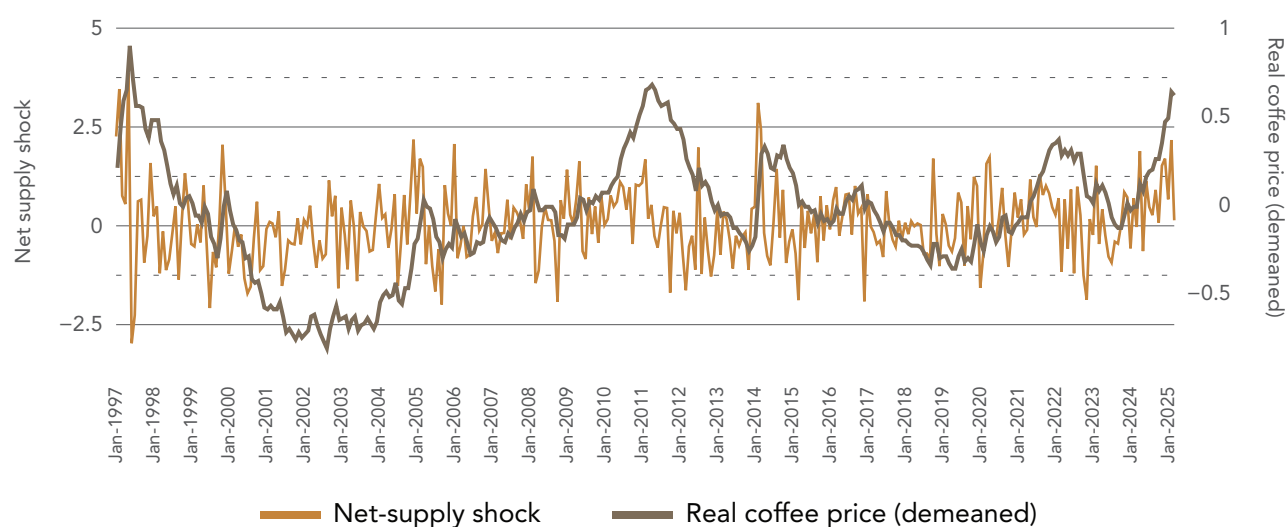
**Figure A3.2.** Transformed variables in the BSVAR model on global cocoa market

Source: Authors' own elaboration.

**Figure A3.3.** Transformed variables in the BSVAR model on global tea market

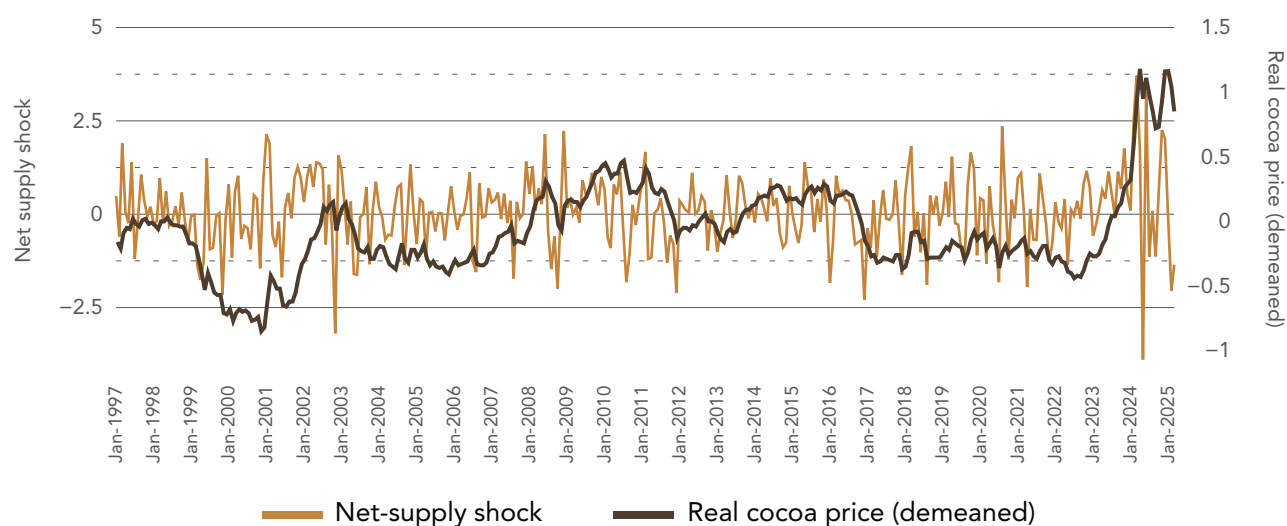
Source: Authors' own elaboration.



**Figure A3.4.** Net-supply shocks in the global coffee market

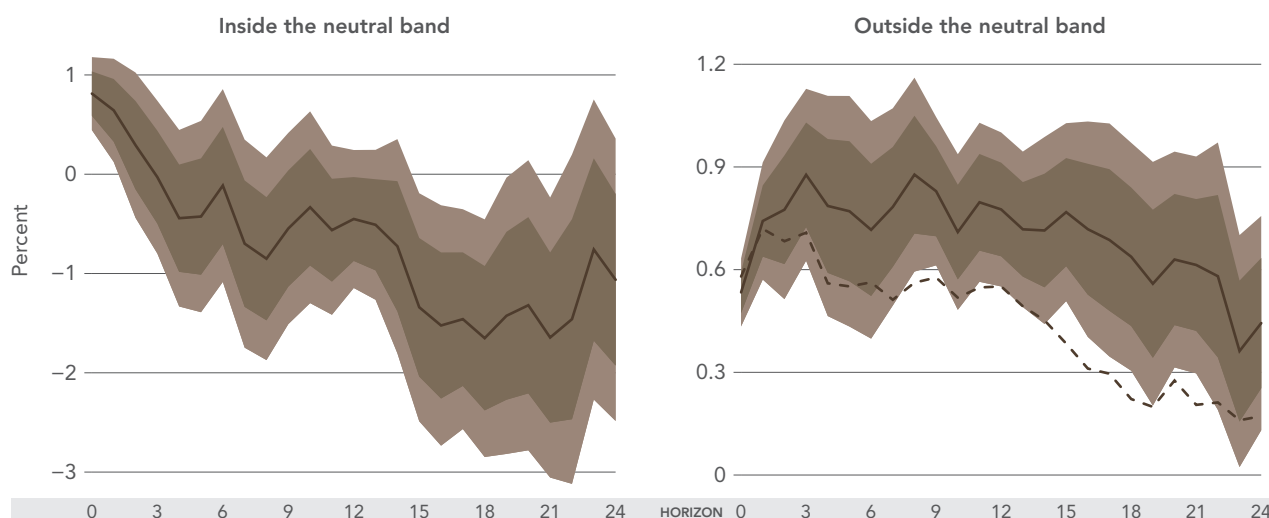
*Notes:* The red line reports the net-supply structural shocks over the period 1996M5-2025M3 based on the estimated BSVAR model that minimizes the expected absolute loss function over the set of admissible structural models.

*Source:* Authors' own elaboration.

**Figure A3.5.** Net-supply shocks in the global cocoa market

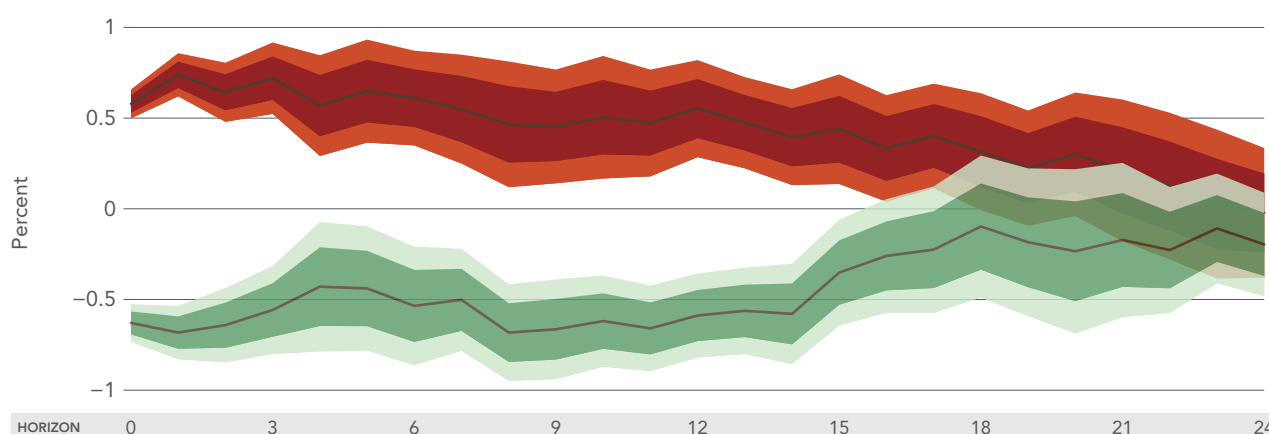
*Notes:* The red line reports the net-supply structural shocks over the period 1996M5-2025M3 based on the estimated BSVAR model that minimizes the expected absolute loss function over the set of admissible structural models.

*Source:* Authors' own elaboration.

**Figure A3.6.** The size-asymmetric impact of net-supply shocks on the real Arabica producer prices

*Notes:* The left panel reports the impact of the net-supply shocks when the shocks are included inside a neutral band, meaning they are smaller, in absolute value, than the first decile of the structural shocks' distribution. The right panel reports the impact of the net-supply shocks when the shocks are outside this neutral band. The dark and light shaded areas represent the 68 and 90 percent confidence interval, respectively, and are calculated using the Driscoll and Kraay standard errors.

*Source:* Authors' own elaboration.

**Figure A3.7.** The sign-asymmetric impact of net-supply shocks on the real Arabica producer prices

*Notes:* The figure reports the impact of the net-supply shocks differentiating by negative (red) and positive (green) shocks. Estimates are normalized such that a negative (positive) net-supply shock increases (decreases) the global Arabica coffee price by one percent on impact. The dark and light shaded areas represent the 68 and 90 percent confidence interval, respectively, and are calculated using the Driscoll and Kraay standard errors.

*Source:* Authors' own elaboration.





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