Facultad de Ciencias Económicas y Empresariales

ICADE

COFFEE AS A COMMODITY: MARKET STRUCTURE AND PRICE DRIVERS

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Declaración de Uso de Herramientas de Inteligencia Artificial Generativa en Trabajos Fin de Grado

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Fecha: 1 de junio de 2026

Firma: ______________________________

1. Introduction

Globally, more than 2.2 billion cups of coffee are consumed every single day, with over 400 million of those in the United States alone (Krishnan et al., 2021). These staggering figures illustrate that coffee is far more than a mere commodity: it constitutes a powerful social and economic force deeply embedded in the fabric of daily life across cultures.

Beyond its cultural significance, coffee also plays a fundamental role in the global economy. In countries such as Ethiopia, Uganda, and Honduras, coffee exports account for over 25% of total export earnings, which makes the crop a vital driver of national economies (Bunn et al., 2015). Worldwide, the sector sustains the livelihoods of more than 125 million people, ranging from farmers to traders and baristas, and is estimated to generate a market value surpassing $100 billion annually (Bunn et al., 2015). Major corporations such as Starbucks and Nestlé dominate this market, with valuations in the tens of billions, reinforcing coffee's dual identity as both a local lifeline and a global commodity central to international trade.

Despite its ubiquity, coffee is far from a simple commodity: behind its consumption lies a chain of complexities that span agriculture, logistics, and culture. Although more than 100 species exist, Arabica and Robusta dominate global production, each requiring distinct climates, altitudes, and cultivation techniques to thrive (Bunn et al., 2015). Coffee plants are highly sensitive to environmental conditions, which makes them particularly vulnerable to climate change, pests, and diseases capable of compromising both yields and quality. Once harvested, the beans undergo intricate processing, roasting, and distribution chains that connect smallholder farmers in tropical regions to consumers in urban cafés around the globe. This combination of biological fragility, economic dependence, and global interconnection illustrates the unique complexity of coffee, which is shaped by countless forces operating across continents.

The journey of coffee from the mountains of Colombia to supermarkets, cafeterias, and homes around the world would not be possible without the financial system that underpins it. From accounts-receivable management for farmers to futures trading, modern financial infrastructure has transformed coffee from a colonial luxury good into an everyday worldwide drink. This dual nature, simultaneously agricultural and financial, makes coffee pricing particularly complex: prices are grounded in physical production realities yet ultimately determined in forward-looking financial markets. Consequently, understanding coffee requires understanding how futures markets translate uncertainty into price signals that guide production, trade, and consumption decisions worldwide. The aim of this paper is precisely to unpack that mechanism by examining the financial structure behind coffee, the way in which it is traded, the factors that shape its supply and demand, and how those factors are translated into its price. To this end, the paper is organised into four main blocks. The first block introduces the basics of coffee, covering its botanical nature, its species, the geographic distribution of production, the environmental implications of cultivation, and the structure of the financial markets in which it is traded. The second block analyses the supply side, with particular attention to the harvesting, processing, and transportation stages and the indicators that capture each of them. The third block addresses the demand side, including the uses of coffee, the geographic distribution of consumption, and the macroeconomic and financial drivers that shape demand. The paper closes with a concluding section that consolidates the empirical findings and reflects on the broader dynamics of coffee as a global commodity.

2. The basics of coffee

Following the roadmap outlined in the introduction, the first of the four blocks of this paper begins by laying out the fundamentals of the product itself, since any analysis of coffee pricing must rest on a clear understanding of what is actually being traded. This section therefore reviews what coffee is from a botanical and consumer perspective, where and how it is grown, the two main species that dominate global production, the environmental implications associated with cultivation, and the basic functioning of the financial markets in which coffee is priced. Together, these elements provide the conceptual foundation on which the subsequent analysis of supply and demand is built.

2.1 What is coffee?

At its most basic level, coffee refers to the product obtained from the seeds of the Coffea plant, which are harvested, processed, roasted, and ultimately brewed into the beverage consumed around the world. A central feature of this beverage is its high content of caffeine, a natural stimulant present in coffee (Abu-Hashem et al., 2024) whose invigorating effect is one of the main reasons behind its popularity. An average cup of coffee contains approximately 85 mg of caffeine (Burdan, 2015), whereas specialty coffee, defined by the Specialty Coffee Association as high-quality, traceable, and distinctly flavoured coffee graded under standardised criteria, contains a substantially higher average of 188 mg (McCusker et al., 2003).

2.2 Where does coffee grow from?

Coffee beans grow inside the cherries produced by the Coffea plant, which is cultivated primarily in the tropical regions of Latin America, Africa, and Asia. Each tree can yield between less than one and approximately 2.5 kilograms of green beans per year, depending on species, soil fertility, and management practices. For instance, experimental work in Ethiopia found that well-managed Coffea arabica trees, subject to proper pruning and fertilisation, reached yields close to 2.5 kilograms annually (Worku, Astatkie, & Boeckx, 2022). This variability not only explains why productivity differs significantly across farms and countries but also highlights the potential of agronomic practices to improve harvests.

Beyond yields, the internal structure of the bean itself is a key determinant of coffee quality. As Figure 1 illustrates, coffee beans display a complex anatomy in which every element plays a specific role in the final product:

1. The centre cut is the line dividing the two halves of the seed.
2. The bean is the actual coffee seed, which after roasting and grinding becomes the powder we use to brew the drink.
3. The silver skin, which surrounds the bean, is a thin papery layer that often clings to the bean even after roasting.
4. The parchment (hull), which further protects the bean, is a tough outer shell removed during hulling.

5. The pectin layer, which is outside the parchment, acts as a sticky binder between the parchment and the pulp and plays a key role during fermentation.
6. The pulp covers all the elements mentioned before; it is a fleshy, sugary layer that supports fermentation and can also be used in cascara products.
7. Finally, the outer skin, or cascara, encloses the entire fruit, protecting the inner layers, and is often dried to produce teas or infusions. Taken together, these seven layers both protect the seed and contribute decisively to coffee processing and flavour development (Clarke & Macrae, 2012).

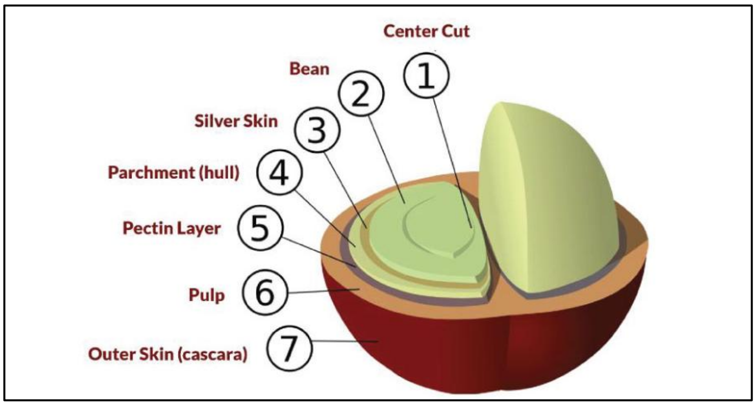

Figure 1: The anatomy of the coffee cherry (Arctos Coffee, n.d.)

2.3 Species of coffee

Coffee comprises two commercially dominant species: Arabica and Robusta. Together, they account for approximately 99% of global coffee production (Lashermes et al., 2023), and the differences between them shape both the geography of production and the dynamics of international markets.

Arabica coffee (Coffea arabica) is the most widely cultivated and commercially valued species, accounting for approximately 56–57% of global production (Lashermes et al., 2023). Originating in the highlands of Ethiopia, Arabica is typically grown at higher altitudes, where cooler temperatures and stable climatic conditions allow for the slower maturation of cherries and enhance the complexity of flavour profiles (Bunn et al., 2015). Compared with Robusta, Arabica beans contain lower levels of caffeine and exhibit a smoother, more aromatic, and less bitter taste, which makes them the preferred choice for specialty coffee markets and high-quality blends (Narváez & Curi, 2018). However, this superior quality comes at a cost: Arabica plants are more vulnerable to pests, diseases such as coffee leaf rust, and environmental stress, particularly temperature fluctuations and irregular rainfall (Bunn et al., 2015; Davis et al., 2006). As a result, Arabica production is especially sensitive to climate change and supply shocks, with important implications for price volatility in global markets. Despite these challenges, Arabica remains the dominant species in premium markets, particularly in Europe and North America, where consumer preferences favour higher-quality and differentiated products.

Robusta coffee (Coffea canephora), in turn, is the second major cultivated species worldwide and accounts for approximately 43–44% of global coffee production (Lashermes et al., 2023). Native to West and Central Africa, Robusta is known for its resilience to pests, diseases, and drought, which makes it the preferred crop in low-altitude and high-temperature regions (Aquino et al., 2018). Relative to Arabica, Robusta contains substantially more caffeine and has a stronger, more bitter taste, which explains its central role in instant coffee and espresso blends (Narváez & Curi, 2018). As Figure 2 shows, Robusta is particularly important for producing countries such as Vietnam, the world's leading exporter of this species, and it plays a crucial role in the economies of tropical regions where alternative crops would struggle to thrive (Garavito et al., 2016). Moreover, its genetic diversity and adaptability are increasingly viewed as essential for breeding programmes aimed at improving resilience to climate change (Depecker et al., 2022).

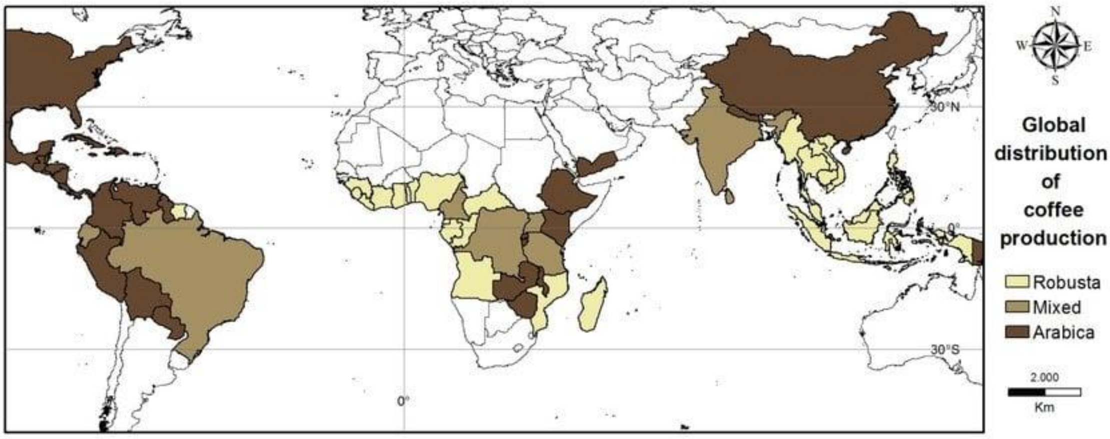

Figure 2: Global distribution of coffee production (Bunn et al., 2015)

To complement this qualitative description, it is useful to examine the geographic distribution of coffee production in terms of volume. As Figure 3 shows, the countries with the largest production coincide with those identified in Figure 2: Brazil accounts for over a third of the world's coffee production, while Vietnam and Colombia also stand out as large producers.

Market	% of Global Production	Total Production (2025/2026, 60 KG Bags)
Brazil	35%	63 million
Vietnam	17%	30.8 million
Colombia	8%	13.8 million
Indonesia	7%	12.45 million
Ethiopia	6%	11.56 million
Uganda	4%	6.88 million
India	3%	6.05 million
Honduras	3%	5.8 million
Peru	2%	4.2 million
Mexico	2%	3.9 million

Figure 3: Global distribution of coffee production 2025/2026 (USDA – Foreign Agricultural Service)

2.4 Environmental implications

Coffee production is closely tied to environmental conditions, particularly temperature, rainfall, and altitude, which jointly determine both where coffee can be cultivated and the quality of the final product. Arabica coffee is typically grown at higher altitudes and cooler climates, which allow for slower cherry development and more complex flavours but also make the species more vulnerable to climate variability and disease (Nugroho et al., 2020). Robusta, by contrast, is more resilient to heat, humidity, and pests, and is therefore better suited to lower-altitude tropical regions (Fachruddin et al., 2021). Despite advances in breeding, these environmental constraints continue to shape global production patterns.

The relationship between coffee and the environment, however, is not one-directional. The expansion of coffee cultivation, driven by sustained global demand, has led to farming practices that place significant pressure on natural systems. One of the main concerns is the intensive use of fertilisers and pesticides employed to maintain yields and control pests such as the coffee berry borer and coffee leaf rust. While effective in the short term, excessive use of these inputs can degrade soil quality, contaminate water sources, and reduce biodiversity (Harelimana et al., 2022). In some producing regions, high concentrations of agricultural chemicals have even been detected in groundwater, which highlights the environmental costs of intensive farming (Aronson et al., 2021).

Water use is another critical issue, particularly during post-harvest processing. Wet processing methods require large volumes of water and generate wastewater with high concentrations of organic pollutants. If this wastewater is not properly treated, it can deplete oxygen levels in nearby water bodies and damage aquatic ecosystems (Mburu, 2005). In addition, the expansion of coffee plantations has contributed to deforestation in several tropical regions, especially in biodiversity-rich areas, where forest clearing aimed at increasing production has caused habitat loss and rising carbon emissions (Gibson et al., 2011).

Coffee production also generates waste throughout its value chain. Processing coffee cherries produces organic residues such as pulp and husks, while consumption generates packaging waste, including disposable cups and coffee capsules (Takala, 2021). Alongside these residues, the overall carbon footprint of coffee is significant, as emissions are produced at every stage of the chain, from farming and processing to transportation and roasting. Estimates suggest that producing one kilogram of roasted coffee can generate between 11 and 15 kilograms of CO_2 equivalent, depending on production methods and logistics (Killian et al., 2013).

2.5 Financial markets and pricing

Once the agronomic and environmental dimensions of coffee have been outlined, it is necessary to turn to the financial dimension that ultimately determines its price. Unlike most consumer goods, coffee is not priced primarily through spot transactions, but through centralised financial markets that aggregate information, expectations, and risk. This structure reflects the fact that coffee production involves long biological cycles, high uncertainty, and geographically dispersed participants, all of which make forward pricing essential (Nguyễn et al., 2020).

At the core of this system lies the distinction between physical markets and financial (futures) markets. Whereas physical coffee is traded through exporters, importers, and roasters, the reference price used across the industry is determined in futures markets. Futures contracts are legal agreements to buy or sell a standardised quantity of coffee at a predetermined price and date, which allows market participants to manage price risk in a highly volatile environment (Nguyễn et al., 2020). Such volatility is largely driven by supply shocks, climate variability, and macroeconomic conditions, all of which continuously affect expectations about future availability.

In sum, modern financial markets have allowed the different parties involved in the coffee industry to gain flexibility and certainty in a sector in which, a century ago, uncertainty reigned. To understand how this pricing mechanism operates in practice, the next section examines the specific structure of coffee futures markets.

2.5.1 The structure of coffee futures markets

Coffee futures are traded in organised exchange markets rather than in over-the-counter (OTC) or dealer markets. The primary venue is the Intercontinental Exchange (ICE), where standardised Arabica coffee futures (Coffee "C") and Robusta coffee futures are listed.

ICE is an American financial services company that operates as the exchange venue for both Arabica and Robusta coffee futures and is backed by major financial institutions such as Goldman Sachs, Morgan Stanley, and Deutsche Bank, among others. The company operates several exchanges around the world: Arabica coffee futures (Coffee "C") are traded on the New York exchange (ICE NY), while Robusta coffee futures are traded on the London exchange (ICE Futures Europe).

ICE has also established a standard contract size for both species: 37,500 lbs of coffee per Arabica contract, and 10 metric tons (approximately 22,406 lbs) per Robusta contract, the latter priced in USD per metric ton.

Beyond contract size, ICE defines specifications regarding quality and delivery conditions, enabling participants worldwide to trade under uniform rules. Such standardisation is essential for liquidity and efficiency, since it allows a large number of buyers and sellers to interact in a single marketplace (Nguyễn et al., 2020).

Figures 4 and 5 illustrate how an investor would visualise coffee futures pricing in practice. The charts displayed on trading information platforms such as TradingView show the settlement-date contract closest to expiration on a continuous basis.

Figure 4: Arabica Coffee Futures 1D (Trading View, n.d.)

Figure 5: Robusta Coffee Futures 1D (Trading View, n.d.)

2.5.2 Coffee price evolution and volatility

Having outlined the structure of the markets in which coffee is traded, this section turns to the evolution of coffee prices and their volatility. As previously noted, coffee prices in financial markets are observed through futures contracts, which are quoted by the pound or by metric ton depending on the species and the exchange in which they trade.

To better understand the dynamics of coffee pricing and the magnitude of its volatility, the following analysis draws on data from relevant market sources.

An initial observation is that the correlation between Arabica and Robusta coffee futures prices is approximately 77.9% over the period for which comparable data are available (since February 2008, according to FactSet). While this correlation indicates a strong relationship, it is not sufficiently high to treat both markets as one. The differences in pricing dynamics and their underlying causes will be explored throughout the rest of the paper. Nevertheless, the analysis hereinafter focuses on Arabica futures. Despite some structural differences, both Arabica and Robusta exhibit similar long-term trends and are influenced by comparable macroeconomic drivers. More importantly, data availability for Arabica is significantly richer, with historical series dating back to 1972, whereas Robusta data are available only since 2008.

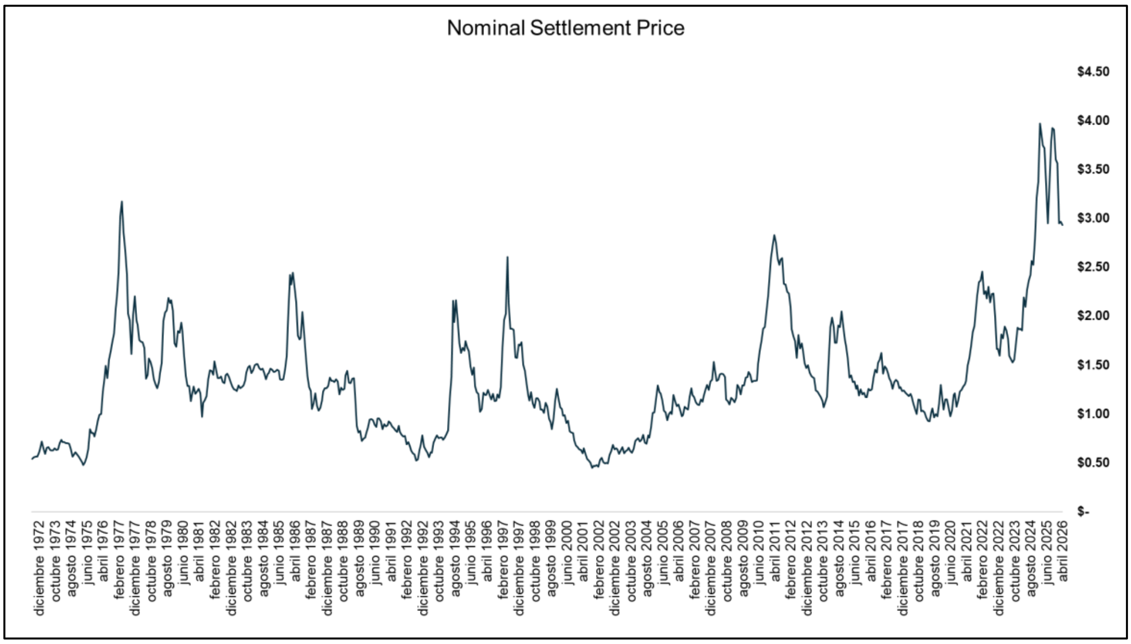

Figure 6: Nominal Price History: KC00-USA – Arabica Coffee.

Note. Own elaboration based on data from FactSet and Federal Reserve Economic Data (FRED).

Figure 6 shows how Arabica coffee has been priced per pound over the years in nominal terms. Although there are several spikes that will be discussed throughout this paper, nominal prices have generally remained between $0.50/lb and $4.00/lb, with the most recent years marking the all-time highs (FactSet, 2026).

Figure 7 complements this nominal picture by examining the price of Arabica coffee futures in real terms, which is essential to understand the price of coffee relative to the purchasing power of consumers.

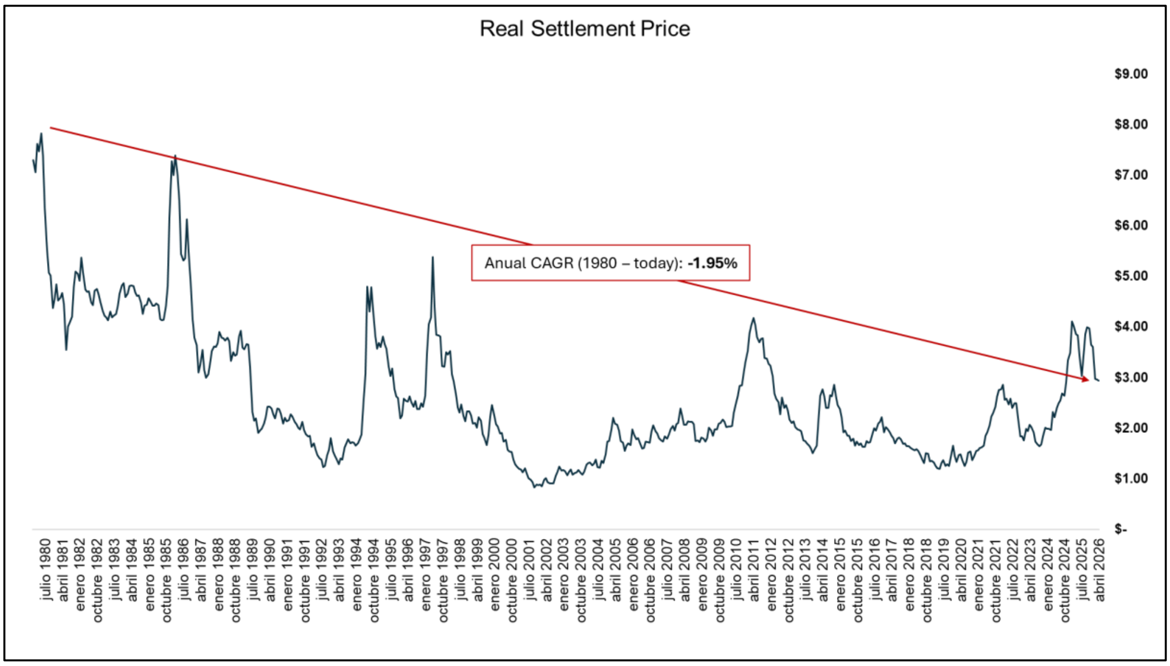

Figure 7: Real Price History: KC00-USA – Arabica Coffee (Factset, 2000 - 2026).

Note. Own elaboration based on data from FactSet and Federal Reserve Economic Data (FRED).

Figure 7 shows that, expressed in today's dollars, Arabica coffee used to cost around $7–$8 per pound, a figure that has decreased to $1–$3 in the 2020s. When this decline is compounded, the result is an annual decrease of close to 2% over the last 46 years, even taking into account the 2026 prices that have approached triple the pre-pandemic level. If March 2020 is used instead as the end point, the annual decrease rises to 3.91% (FactSet, 2026; Federal Reserve Bank of St. Louis, 2026). This real-term decrease illustrates how industrialisation and the development of financial markets have transformed coffee from a luxury good that not everyone could afford to consume on a daily basis into a beverage consumed more than 2.2 billion times per day (Krishnan et al., 2021).

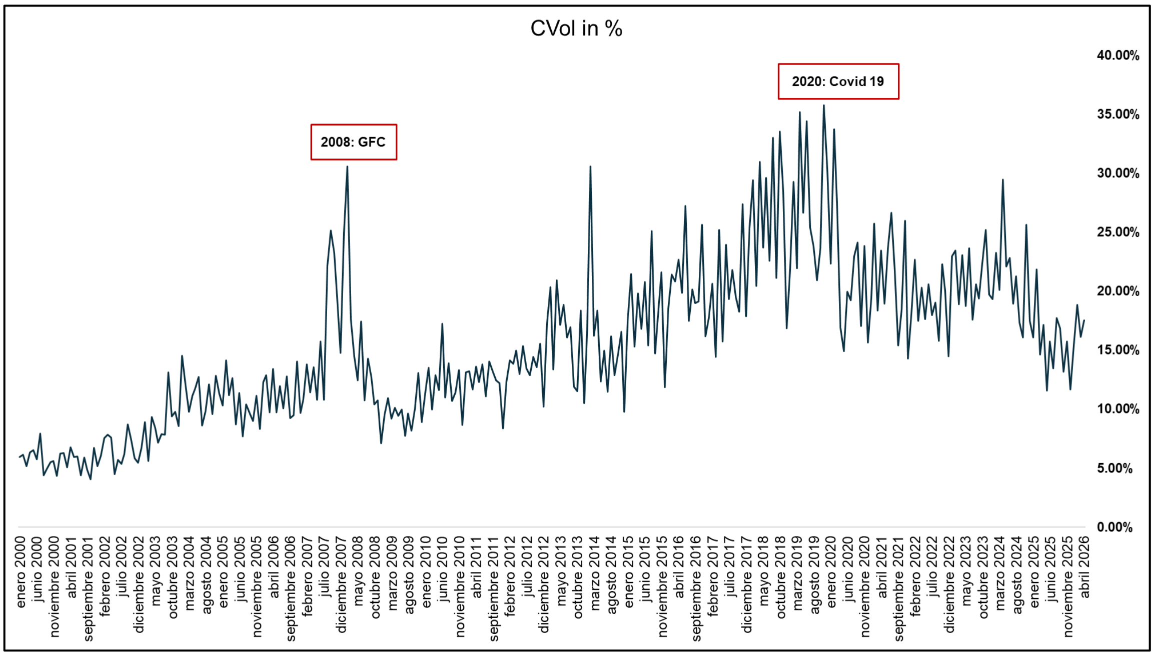

Figure 8: CVol History: KC00-USA – Arabica Coffee (Factset, 2000 - 2026)

Note. Own elaboration based on data from FactSet and Federal Reserve Economic Data (FRED).

Figure 8 presents the Commodity Volatility (CVol) for Arabica coffee futures. This measure reflects the market-implied volatility derived from options on futures contracts, typically based on contracts beyond the nearest maturity. The index expresses volatility on an annualised basis, providing an estimate of the magnitude of price fluctuations that market participants expect over the following year. Historically, CVol for Arabica coffee futures has ranged between 10% and 20%, with an average since 2000 of 15.47%, somewhat lower than that of the overall market, which has averaged 17.20% over the same period (VIX Price History, 2026). However, when the analysis is restricted to the most recent decade (2017–2026), the picture changes substantially: the average CVol for Arabica coffee futures rises to 21.28%, significantly higher than the 17.01% recorded for the overall market over the same period. The reasons behind this divergence will be analysed in detail throughout the remainder of the paper.

3. Supply of coffee

Having established the botanical, geographic, environmental, and financial fundamentals of coffee in the previous section, the analysis now turns to the first side of the market: supply. The supply side of coffee is shaped by a complex sequence of activities that span agriculture, processing, and global logistics, each of which translates the biological and environmental conditions described earlier into a tradable product. This section reviews the main stages of the coffee production chain, from the cultivation and harvesting of the cherries to the processing, transportation, and trade of green beans, and then identifies the key factors and quantitative indicators that shape supply at each stage. The objective is to establish, in a structured manner, which variables can be reasonably expected to affect coffee supply and, ultimately, its price.

3.1 Production process

The production of coffee is a long and multi-stage process that begins several years before the beans are harvested. A Coffea plant typically requires between 2.5 and 4 years to start producing cherries, which means that supply cannot quickly adjust to changes in demand or environmental conditions (Davis et al., 2006). During this pre-harvest period, farmers must manage a range of agronomic risks, particularly pests and diseases such as the coffee berry borer and coffee leaf rust, both of which can significantly reduce yields if left untreated. To mitigate these risks, producers often rely on pesticides and other crop-protection methods to maintain plant health and ensure consistent production (Harelimana et al., 2022; Staver et al., 2001). While these inputs are essential for sustaining yields, especially in regions with high pest pressure, their use must be carefully managed in order to avoid negative environmental and economic consequences.

Once the cherries are harvested, they must be processed promptly to prevent spoilage and preserve quality. The main objective of post-harvest processing is to remove the outer layers of the cherry and reduce the moisture content to approximately 11–12%, which ensures stability during storage and transport. This can be achieved through three main methods—washed (wet), natural (dry), and honey (semi-dry)—each of which exerts a distinct influence on the final flavour profile. The choice of method depends mainly on local climate and infrastructure (Fufa, 2019; Aswathi & Murthy, 2024). After processing, the beans must be dried carefully, either naturally under the sun or through mechanical methods, particularly in regions with high humidity. Proper drying is essential, since excessive moisture can lead to mould or fermentation defects, while drying too rapidly may damage the bean and reduce quality (Haile & Kang, 2019).

Once dried, the beans undergo hulling—the process of removing the outer dry layers—and milling, which involves cleaning, sorting, and grading according to size, density, and defects. This stage is crucial for standardising quality and determining market value, as defective beans are removed in order to maintain consistency (Hameed et al., 2018).

After grading, green coffee beans (so called because they no longer retain the outer brown layers) are prepared for export, typically packaged in jute or polypropylene bags and transported to ports. Given that coffee is produced primarily in tropical regions but consumed in developed markets, most production enters international trade networks before reaching roasters (Bunn et al., 2015). Quality inspections and certifications may also be conducted at this stage, particularly in the case of specialty coffee.

The final transformation occurs during roasting, in which heat induces chemical reactions such as Maillard reactions and caramelisation, generating the characteristic aroma, flavour, and colour of coffee (Seninde & Chambers, 2020; Obando & Figueroa, 2024). Roasting levels—light, medium, or dark—determine the balance between acidity, sweetness, and bitterness, as well as the preservation or degradation of specific compounds.

3.2 Transportation

Once coffee beans have been processed, dried, and graded, they enter the global transportation network that connects producing countries with consuming markets. Unlike many agricultural products that are consumed locally, coffee is overwhelmingly exported, since the majority of production takes place in tropical regions while the largest consumer markets are located in North America, Europe, and parts of Asia. As a result, transportation plays a crucial role in the global coffee supply chain, both in terms of logistics and cost structure (Bunn et al., 2015).

Green coffee beans are typically transported from farms to local collection centres, where they are consolidated and prepared for export. In many producing countries, especially those with mountainous terrain such as Colombia or Ethiopia, this first stage of transport involves trucks that must navigate difficult road conditions or limited rural infrastructure. Inefficient transportation systems can therefore increase costs, delay shipments, and compromise bean quality whenever storage conditions are inadequate (Hameed et al., 2018).

After reaching export facilities or ports, coffee beans are packaged and loaded into shipping containers for international transport. Maritime shipping is by far the most common method for moving coffee across continents, since it offers the most cost-effective solution for transporting large volumes of goods over long distances. Major exporting countries such as Brazil, Vietnam, and Colombia ship millions of bags of coffee annually to importing markets in the United States, Germany, Japan, and Italy (International Coffee Organization, 2023).

The cost and efficiency of maritime transportation can significantly affect the global supply of coffee. Freight rates fluctuate depending on factors such as fuel prices, shipping capacity, global trade conditions, and geopolitical disruptions. During periods of high shipping demand or logistical disruption, transportation costs can rise sharply, increasing the effective cost of delivering coffee to consumer markets. For commodities such as coffee, which rely heavily on global supply chains, these fluctuations can translate into higher market prices and increased volatility (Nguyễn et al., 2020).

Beyond cost considerations, transportation conditions also influence coffee quality. Green coffee beans are hygroscopic, which means that they absorb moisture from the surrounding environment. If containers are exposed to high humidity or temperature fluctuations during transit, the beans may develop mould or undesirable flavour characteristics. For this reason, exporters often resort to ventilated containers or specialised packaging in order to maintain stable conditions along long shipping routes (Hameed et al., 2018).

3.3 Factors that affect coffee supply and their indicators

Having described the coffee supply chain, this section now identifies the specific factors and indicators that affect supply at each stage of production. The discussion is organised in three blocks—harvesting, processing, and transportation—and, for each of them, the most relevant cost and climatic drivers are introduced, together with the empirical indicators selected to capture their impact on coffee futures prices.

3.3.1 Factors and indicators related to harvesting

As discussed in the previous section, coffee supply can be divided into three main stages: harvesting, processing, and transportation. Within the harvesting stage, two factors stand out as potential sources of supply disruption: input costs and climatic conditions. Regarding inputs, the most relevant variables are water availability and fertiliser prices. As a proxy for water availability, this study uses rainfall data for the five largest coffee-producing countries—Brazil, Vietnam, Colombia, Indonesia, and Ethiopia, as presented in Figure 3. Rainfall is an appropriate indicator in these regions, where coffee production depends largely on natural precipitation patterns. The rainfall data were obtained from the Humanitarian Data Exchange (Humanitarian Data Exchange, n.d.), originally reported in millimetres per day, and aggregated into monthly values by summing the daily observations.

An initial analysis comparing contemporaneous rainfall and coffee prices (sourced from FactSet and transformed into monthly averages from daily prices (FactSet, 2024)) revealed weak correlations, suggesting that climatic conditions do not translate immediately into price movements. For example, the correlation between rainfall and coffee prices within the same month was 6.41% for Brazil, 2.02% for Vietnam, and 8.2% for Colombia. This result is consistent with the biological nature of coffee production, since climatic shocks such as droughts primarily affect future harvests rather than current output.

To account for this lagged effect, a one-year lag was introduced, comparing coffee prices with rainfall from the previous year. This adjustment substantially strengthened the observed relationships for most countries: correlations rose to

40.72% for Vietnam, 33.26% for Ethiopia, 31.98% for Indonesia, and 21.60% for Colombia. These results are aligned with the existing literature, which shows that rainfall variability is a key determinant of coffee yields in regions where production depends heavily on seasonal precipitation for flowering and fruit development (DaMatta & Ramalho, 2006; Haile, 2018).

Brazil, however, represents a notable exception, since it exhibits a negligible correlation (0.10%) between lagged rainfall and coffee prices. This divergence can be explained by the distinct climatic and structural characteristics of Brazilian coffee production. Unlike other major producers, Brazil's coffee output depends less on rainfall variability and more on temperature-related shocks, particularly extreme events such as frost. Historical evidence shows that frost events in Brazil have caused severe and persistent reductions in coffee supply, which have in turn led to significant increases in global prices (Camargo, 2010; Bunn et al., 2015). Moreover, Brazil's relatively abundant water resources and more developed agricultural infrastructure reduce the impact of short-term rainfall fluctuations on production. Consequently, temperature anomalies provide a more appropriate proxy for supply shocks in Brazil, whereas rainfall remains a better indicator for the remaining producing countries.

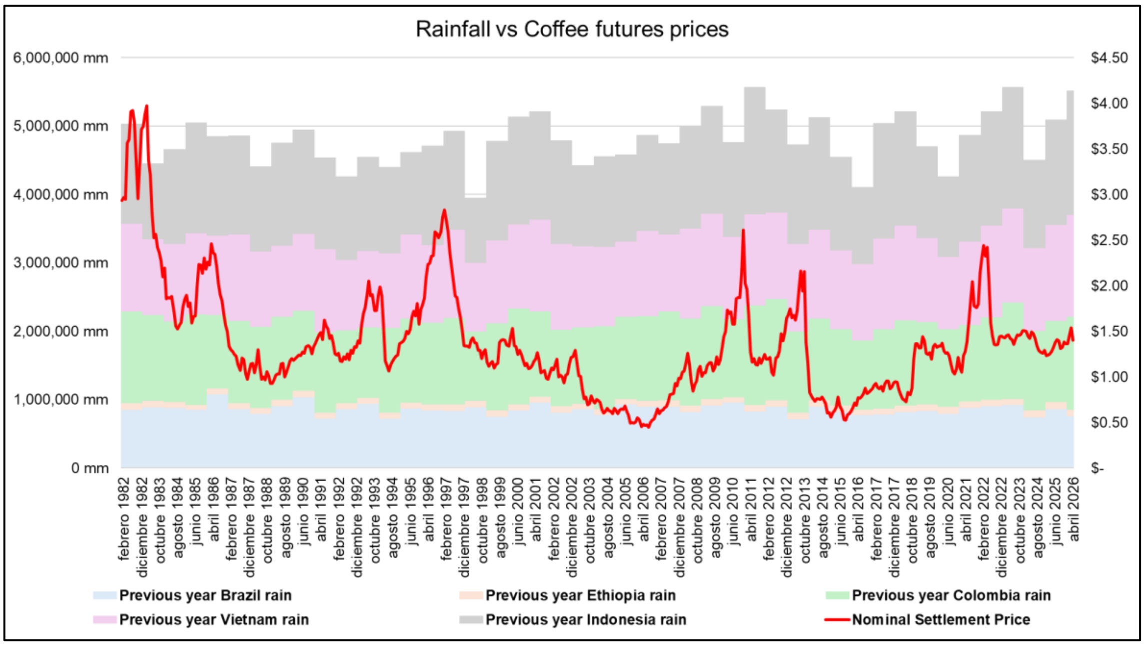

Figure 9: Rainfall vs Coffee futures prices (HumData, FactSet, 1982 - 2026)

Note. Own elaboration based on data from FactSet and HumData.

Figure 9 corroborates these findings: Brazil's rainfall remains more stable than that of other producers, and the figure shows how falls in Vietnam's or Indonesia's rainfall—such as those of 2010 and 1997, respectively—coincided with spikes in coffee prices.

In light of these findings, temperature was incorporated into the analysis for Brazil. Given that coffee production in the country is highly concentrated in a limited number of states—Minas Gerais, Espírito Santo, São Paulo, and Bahia—which together account for the majority of national output (Volsi et al., 2019; International Coffee Organization, 2023), the analysis focuses on average temperature data for these key regions, as shown in Figure 10 (Global Data Lab, n.d.).

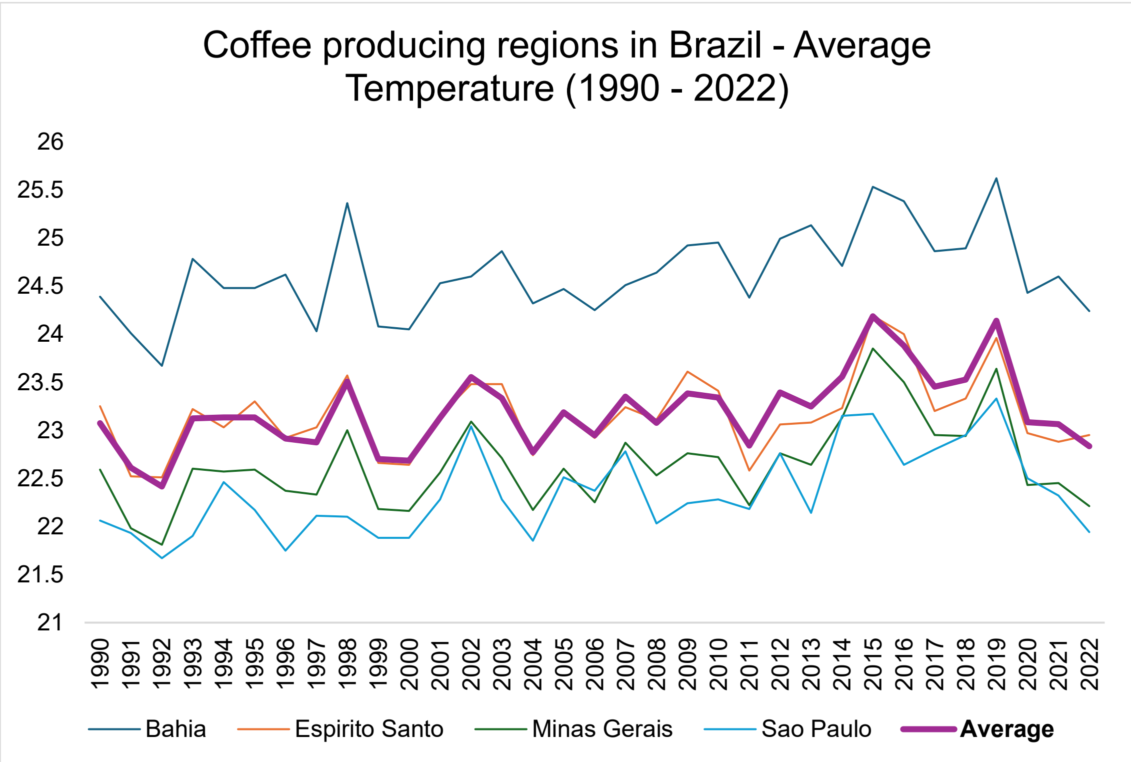

Figure 10: Coffee producing regions in Brazil - Average Temperature (GlobalDataLab, 1990 - 2022)

Note. Own elaboration based on data from GlobalDataLab.

The inclusion of temperature yields a correlation of 11.1% between Brazilian temperature and coffee futures prices. Although this relationship remains relatively weak, it is notably stronger than the negligible correlation observed with rainfall, which supports the hypothesis that temperature is a more relevant climatic driver of coffee production in Brazil. This finding is consistent with the literature, which emphasises the role of temperature-related shocks—particularly extreme events such as frost—in affecting Brazilian coffee yields (Camargo, 2010; Bunn et al., 2015).

At the same time, the relatively low magnitude of the correlation suggests that additional factors may mitigate the impact of temperature variability. Brazil's large-scale and relatively well-capitalised agricultural sector may be better equipped to adapt to climatic fluctuations through technological inputs, irrigation, and risk-management practices. Furthermore, the country's position as the world's largest coffee producer reflects generally favourable and stable growing conditions, which may reduce the sensitivity of output—and therefore prices—to moderate temperature variations. Taken together, these results indicate that, while temperature is a more appropriate proxy than rainfall for Brazil, its explanatory power remains limited unless extreme events or additional structural factors are explicitly considered.

In addition to country-level rainfall and temperature, the El Niño–Southern Oscillation (ENSO) phenomenon was also examined in relation to coffee price dynamics. ENSO is a large-scale climatic oscillation characterised by periodic warming (El Niño) and cooling (La Niña) of sea surface temperatures in the central and eastern Pacific Ocean, which in turn alters global atmospheric circulation patterns and weather conditions (Trenberth, 1997). These shifts can significantly affect temperature and precipitation across major agricultural regions, including key coffee-producing countries.

Data	Correlation
Correl. with ElNiño	**-2.81%**
Correl. with ElNiño (6 month lag)	**-4.18%**
Correl. with ElNiño (12 month lag)	**0.15%**
Correl. with ElNiño (18 month lag)	**5.31%**
Correl. with ElNiño (24 month lag)	**3.91%**

Figure 11: ElNiño and Coffee Futures correlation (ENSO, FactSet, 1972 - 2026)
Note. Own elaboration based on data from FactSet and ENSO.

Empirically, however, coffee prices are not strongly explained by ENSO indicators alone. As shown in Figure 11, the correlation between coffee futures prices and

El Niño indices remains below 10%, even when various temporal lags are incorporated. This relatively weak relationship can be attributed to the heterogeneous and region-specific impacts of ENSO. While El Niño events may cause drought conditions in Southeast Asia, with negative consequences for production in countries such as Vietnam and Indonesia, they can simultaneously bring increased rainfall to parts of South America, with mixed or even beneficial effects depending on timing and intensity (DaMatta & Ramalho, 2006; Bunn et al., 2015). Similarly, in Brazil, ENSO influences temperature and precipitation patterns in complex ways, but its impact on yields is often mediated by localised climatic conditions and extreme events such as frost, which are not fully captured by aggregate ENSO indices (Camargo, 2010).

As a result, the net global effect of ENSO on coffee supply, and therefore on prices, tends to be ambiguous and difficult to isolate. The opposing regional impacts may offset one another in aggregate market data, which reduces the overall statistical relationship between ENSO indicators and global coffee prices. This finding is consistent with the broader literature on agricultural commodities, which suggests that, although ENSO can influence production at the regional level, its effect on global prices is often indirect and conditional on additional factors such as timing, severity, and interaction with local climatic conditions (Bunn et al., 2015).

Beyond climate and water availability, the second factor analysed in the harvesting stage is input costs, more specifically fertiliser and pesticide prices. In order to capture these effects, this study uses the Producer Price Index by Commodity: Chemicals and Allied Products: Fertilizer Materials, together with the Producer Price Index by Industry: Pesticide and Other Agricultural Chemical Manufacturing, both obtained from the Federal Reserve Economic Data (FRED) database (Federal Reserve Bank of St. Louis, n.d.). These indices provide a consistent measure of the cost pressures faced by producers and allow for an evaluation of how input price fluctuations relate to coffee price dynamics.

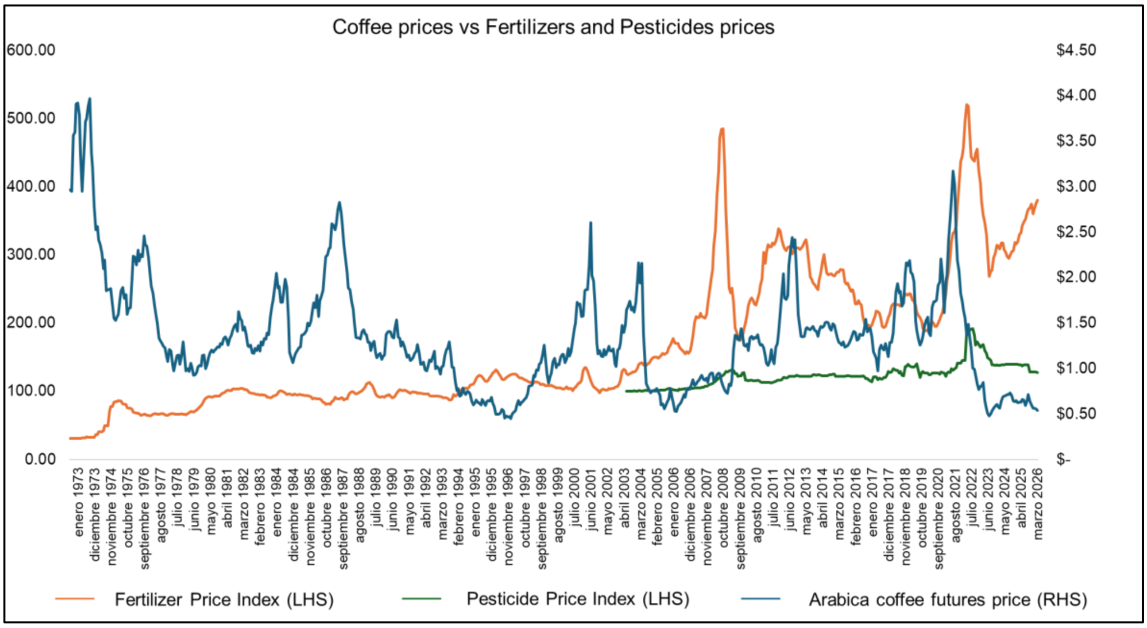

Figure 12: Coffee prices vs Fertilizers and Pesticides prices (FRED, FactSet, 1972 - 2026)
Note. Own elaboration based on data from FactSet and FRED.

As Figure 12 shows, there is a clear relationship between coffee prices and the prices of these agricultural inputs. The empirical analysis confirms this observation, revealing a correlation of 49.64% between coffee futures prices and fertiliser prices, and of 42.67% with pesticide prices. These relatively strong correlations suggest that input costs play a significant role in shaping coffee supply conditions and, consequently, market prices. Higher input prices increase production costs, which can lead to reduced input use, lower yields, and tighter supply, thereby exerting upward pressure on prices. This finding is consistent with the broader agricultural economics literature, which highlights input costs as a key determinant of commodity price dynamics (Gilbert, 2010).

The reliance on fertilisers and pesticides in coffee production can be explained by both agronomic and economic factors. First, producers often use fertilisers to accelerate plant growth and maximise yields, particularly in response to rising global demand and price incentives, since fertiliser application enhances soil nutrient availability and allows coffee plants to sustain higher productivity levels over time (DaMatta & Ramalho, 2006). Second, coffee is grown predominantly in tropical regions characterised by high humidity and temperatures, conditions that are highly conducive to pests, fungal diseases, and infestations such as the coffee berry borer and coffee leaf rust. As a result, the use of pesticides becomes essential in order to prevent yield losses and maintain crop quality (Avelino et al., 2015; Staver et al., 2001). These structural characteristics of coffee production systems explain why fluctuations in fertiliser and pesticide prices are closely linked to coffee supply and, ultimately, to price formation in global markets.

3.3.2 Factors and indicators related to processing

Once the harvesting stage has been analysed, attention turns to the processing stage of coffee production, in which two key cost drivers are likely to influence coffee prices: labour costs and energy costs. This section focuses on energy in a broad sense, while a more detailed analysis of oil prices is presented in the following section, given their direct relevance to transportation through fuel costs.

To assess the role of labour costs, minimum wages were analysed across four of the main coffee-producing countries—Brazil, Colombia, Vietnam, and Indonesia—excluding Ethiopia due to data limitations. As shown in Figure 13, minimum wages expressed in United States dollars, in order to control for exchange rate volatility, exhibit a strong relationship with coffee futures prices. This relationship is further supported by the correlation analysis, which yields coefficients of 52.05% for Brazil, 64.81% for Colombia, 51.39% for Vietnam, and 57.90% for Indonesia. These results suggest that labour costs constitute an important determinant of coffee price dynamics, reflecting the labour-intensive nature of coffee production.

Although this variable is introduced within the context of processing, labour costs are relevant across multiple stages of the coffee value chain, including harvesting and, to a lesser extent, transportation. Coffee production remains highly dependent on manual labour, particularly in harvesting and post-harvest handling. This relationship, however, may evolve over time: as producing countries gain access to improved technologies and as mechanisation becomes more widespread, especially in large-scale operations, the dependence on labour—and therefore the sensitivity of coffee prices to wage fluctuations—may decline (Countryeconomy.com, n.d.).

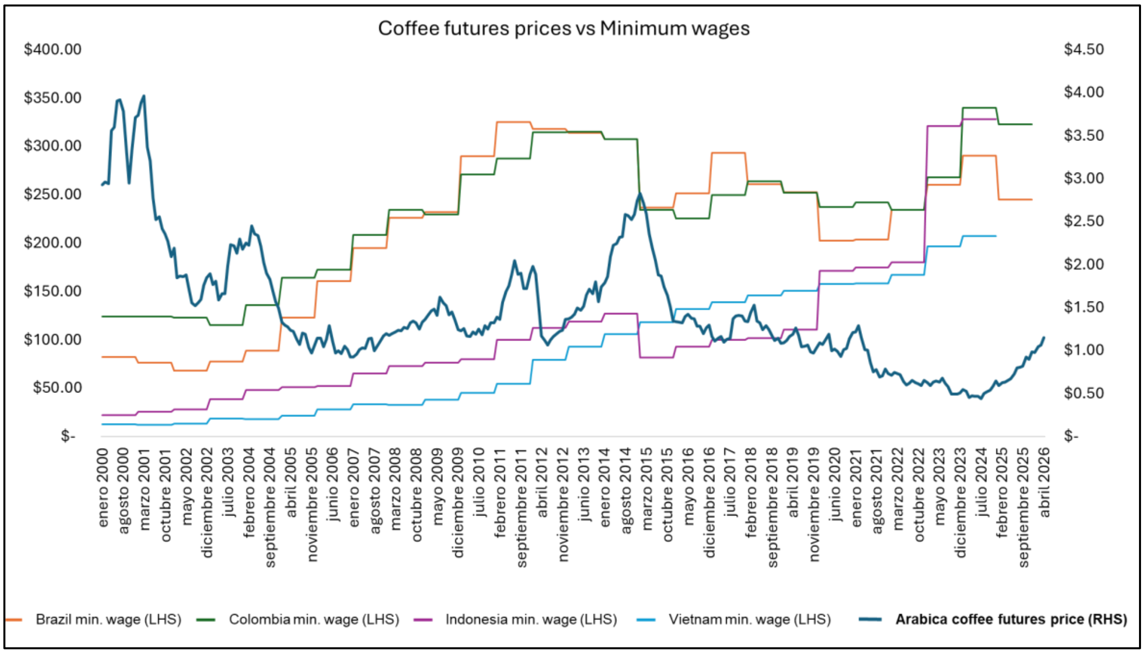

Figure 13: Coffee futures prices vs Minimum wages (Countryeconomy.com, FactSet, 2000 - 2026)
Note. Own elaboration based on data from FactSet and Countryeconomy.com.

The second key input factor in the processing stage is energy costs. To capture this effect, the Global Price of Energy Index from the Federal Reserve Economic Data database was used. The analysis reveals a strong relationship between energy prices and coffee futures, with a correlation of 50.69%. This finding suggests that fluctuations in energy costs play a significant role in shaping coffee price dynamics, since energy is required throughout processing, drying, and other stages of production.

A visual inspection of the data, presented in Figure 14, further supports this relationship. Periods of rising energy prices, such as those observed between 2002 and 2006, are associated with increases in coffee futures prices. Conversely, declines in energy costs, such as those following the market adjustments to the Russia–Ukraine conflict in early 2023, coincide with decreases in coffee prices. These patterns highlight the transmission of energy shocks into agricultural commodity markets and reinforce the importance of energy costs as a determinant of coffee price movements (Federal Reserve Bank of St. Louis, n.d.; FactSet, n.d.).

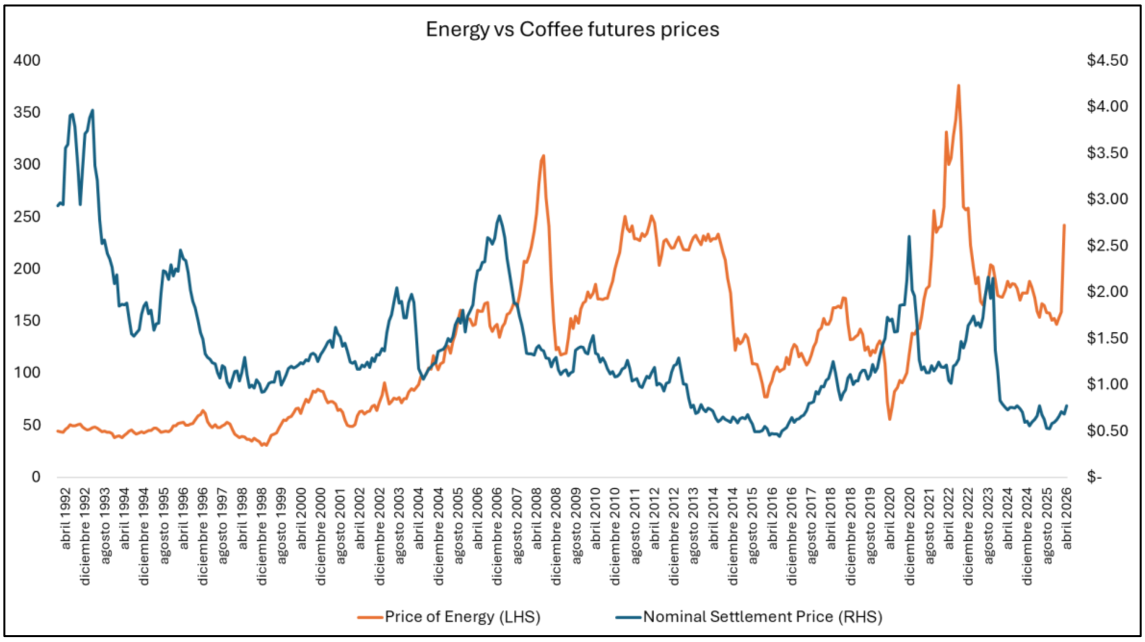

Figure 14: Energy vs Coffee futures prices (FRED, FactSet, 1982 - 2026)
Note. Own elaboration based on data from FactSet and FRED.

3.3.3 Factors and indicators related to transporting

As noted previously, the vast majority of coffee transportation takes place via maritime routes. "Global coffee trade, estimated at approximately 170–180 million 60 kg bags per year, corresponds to roughly 10–11 million metric tons. Given that a standard container carries around 18–20 tons of green coffee, this implies that on the order of 500,000 to 600,000 containers of coffee are transported annually by sea" (International Coffee Organization, 2023; International Trade Centre, 2021).

The nature of coffee transportation suggests that two key cost drivers should be considered: freight costs and fuel costs. In order to capture these effects, the Producer Price Index by Industry for Deep Sea Freight Transportation from the Federal Reserve Economic Data database was used as a proxy for shipping costs, while Brent crude oil spot prices were used to represent fuel costs.

At first sight, one might expect these two variables to be highly correlated, given the strong dependence of maritime transport on fuel prices. However, the empirical analysis reveals a correlation of 68.4% between Brent crude oil prices and freight costs. Although this indicates a substantial relationship, it is not sufficiently high to justify excluding either variable. Instead, the results suggest that freight costs are shaped not only by fuel prices but also by additional factors such as global shipping demand, capacity constraints, and logistical disruptions. Including both variables therefore allows for a more comprehensive representation of transportation costs within the coffee supply chain.

When the relationship of these two variables with coffee futures prices is analysed, the correlations also prove to be high: 57.28% with the freight cost index and 48.75% with the Brent crude oil price. This pattern aligns with prior expectations, since approximately 73% of coffee is produced in five countries and consumed worldwide, which explains the strong dependence of coffee on transportation.

This relationship is further illustrated in Figures 15 and 16, which highlight specific historical episodes in which sharp movements in Brent or freight prices were accompanied by corresponding movements in coffee prices. Two clear examples are the oil price shock that followed the Russia–Ukraine war in 2022, and the period between 2016 and 2019, during which both freight prices and coffee futures prices rose by approximately 1.5 to 2 times.

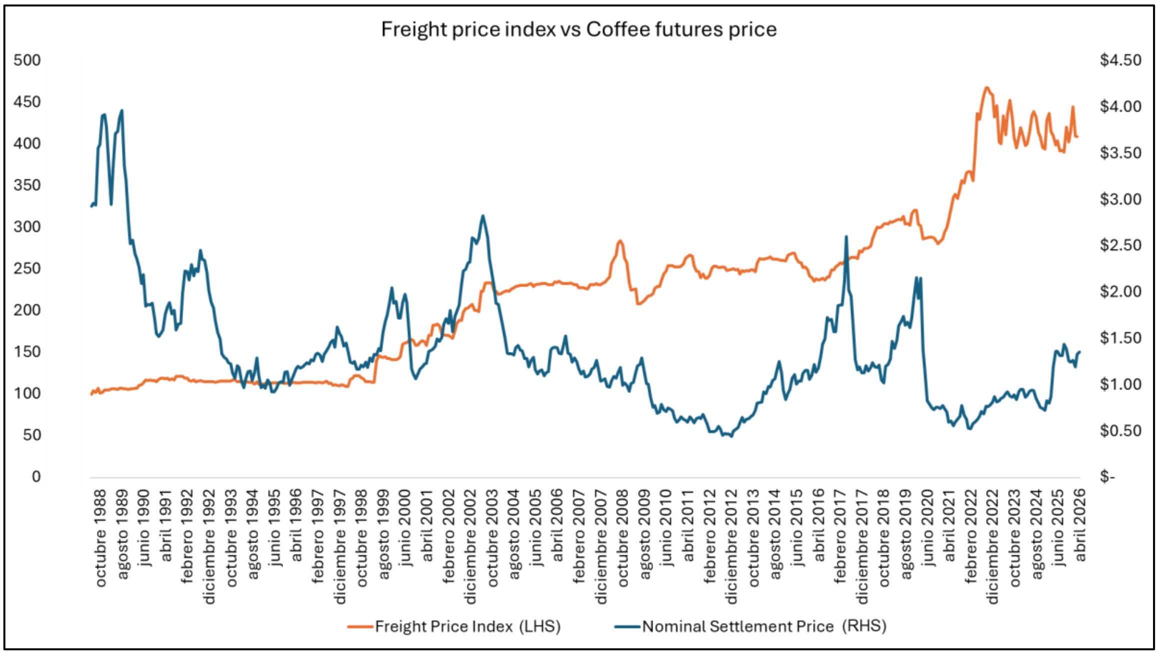

Figure 15: Freight price index vs Coffee futures price (FRED, FactSet, 1988 - 2026)
Note. Own elaboration based on data from FactSet and FRED.

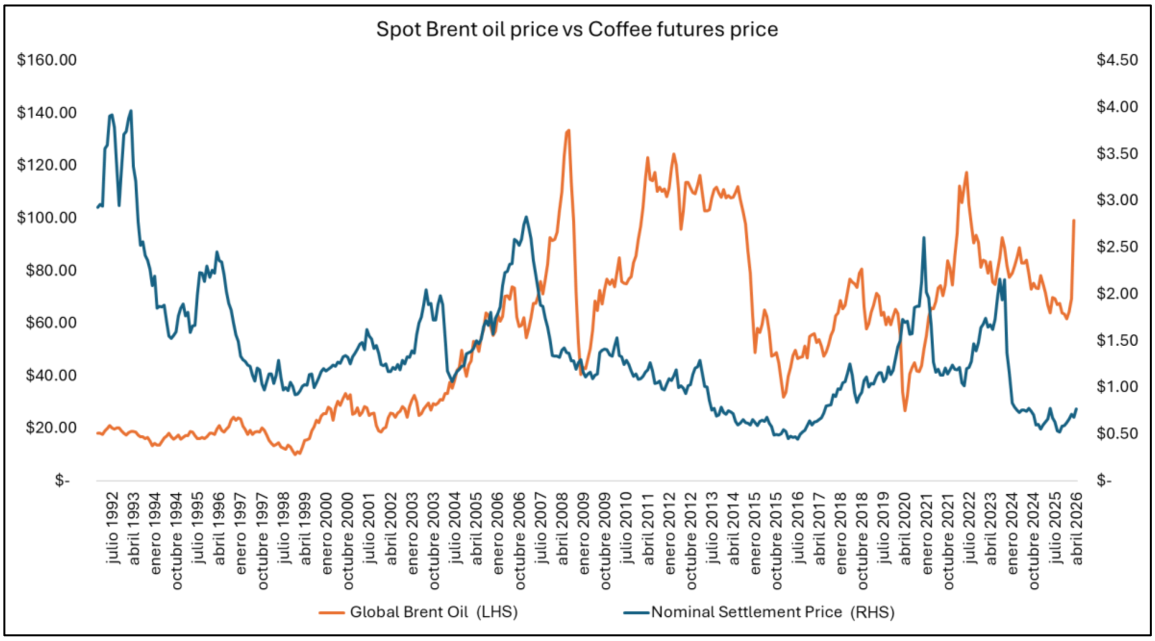

Figure 16: Spot Brent oil price vs Coffee futures price (FactSet, 1992 - 2026)
Note. Own elaboration based on data from FactSet.

4. Demand for coffee

Once the supply side has been characterised, with its production, processing, and logistics drivers identified, attention now shifts to the demand side of the coffee market, which closes the second pillar of price formation. This section first reviews the main uses of coffee, which extend well beyond its role as a beverage; it then examines the global distribution of coffee consumption; and, finally, it analyses the macroeconomic, financial, and behavioural factors that shape coffee demand and, through it, prices. Taken together with the previous section, it completes the empirical mapping of the variables that interact in the futures market analysed in the conclusion.

4.1 Uses of coffee

Having examined the supply side of the coffee market, attention now turns to the demand side. Coffee is a highly versatile agricultural commodity whose applications extend well beyond its primary role as a beverage, reaching the food industry, pharmaceuticals, cosmetics, and sustainable production systems. This diversity of uses contributes to its global economic relevance and helps sustain demand across multiple sectors.

Figure 17 shows the current and projected distribution of the coffee-as-beverage market, according to estimates by Grand View Research. A notable feature of this projection is the expected increase in the market share of ready-to-drink coffee which, together with instant coffee, is expected to drive the future expansion of the coffee market, whereas roasted coffee is projected to grow only modestly (Grand View Research, n.d.).

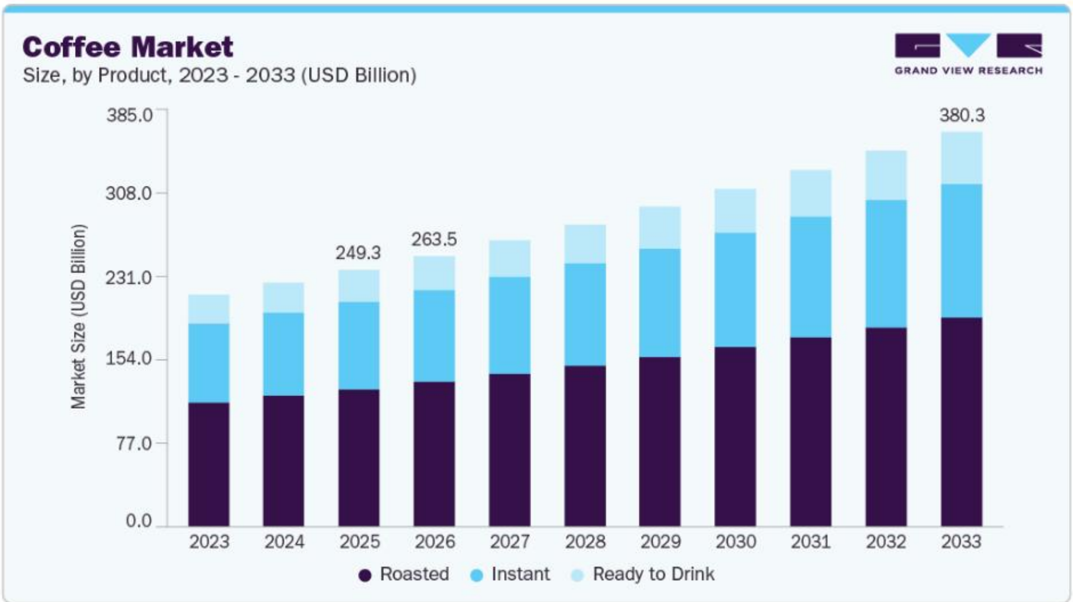

Figure 17: Coffee Market by format (Grand View Research, n.d.)

The expansion of specialty coffee markets has further diversified consumption by increasing demand for high-quality and differentiated products.

Coffee is also widely used in the food industry as a flavouring ingredient. It is incorporated into desserts, baked goods, and dairy products, where its aromatic and bitter characteristics enhance both sweet and savoury preparations. In addition, coffee contains bioactive compounds with antioxidant properties, which has led to its use in functional foods and nutraceutical products (Ascrizzi & Flamini, 2020).

In the pharmaceutical sector, caffeine is commonly used in medications, particularly in combination with analgesics in order to improve their effectiveness, and it is also present in treatments for migraines and other conditions. Moreover, moderate coffee consumption has been associated with certain health benefits, although the specific outcomes depend on individual consumption patterns (Poole et al., 2017).

Finally, coffee and its by-products are increasingly used in cosmetics and sustainable applications. Coffee grounds are used in exfoliating skincare products, while by-products such as pulp and husks can be repurposed as fertilisers or bioenergy sources, contributing to more sustainable production practices (Murthy & Naidu, 2012).

4.2 Global distribution of coffee consumption

Figure 18 illustrates how coffee demand is distributed across the world. The data, drawn from 2023, show that two countries dominate global coffee consumption: the United States and Brazil. Together, they account for 2,492,000 tons of coffee per year, which exceeds the combined consumption of the next six countries (Germany, the Philippines, Vietnam, France, Italy, and the United Kingdom) (World Population Review, n.d.).

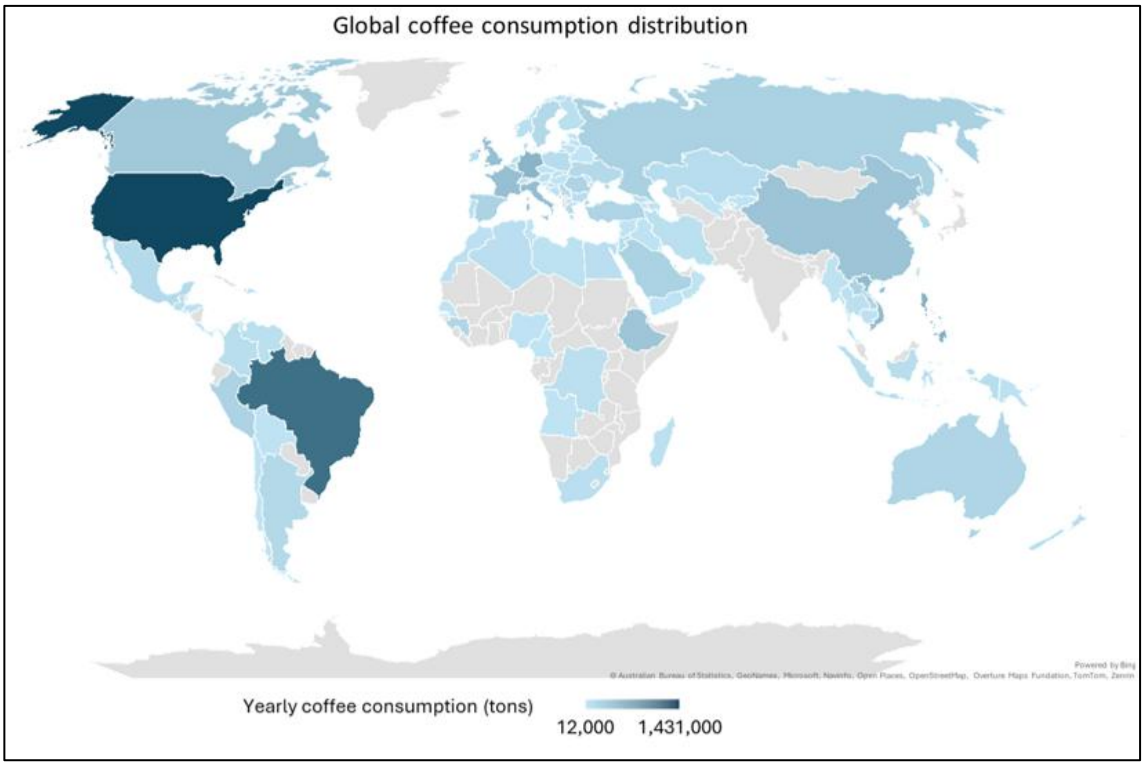

Figure 18: Global coffee consumption distribution (World Population Review, n.d.)
Note. Own elaboration based on data from World Population Review.

4.3 Factors that affect the demand for coffee

The demand for coffee is influenced by a combination of economic, demographic, and market-specific factors. Although coffee consumption may appear relatively stable due to its habitual nature, several external variables shape demand patterns across countries and over time. The remainder of this section therefore reviews the main demand-side indicators considered in the analysis, starting with measures of economic and political uncertainty and moving on to consumer-purchasing-power variables, exchange rates, and indicators of global economic activity.

One of the main drivers of coffee prices is uncertainty. Coffee futures are widely used as a hedging tool, either by farmers seeking to lock in a selling price or by food-and-beverage corporations seeking to secure a purchase price. The more uncertain the future is perceived to be, the more attractive—and therefore more expensive—such hedging tools become. Two types of uncertainty are analysed below: economic uncertainty and political uncertainty.

To capture economic uncertainty, the Economic Policy Uncertainty (EPU) Index for the United States is used. This choice is justified by the central role of the United States in the global coffee market, since the country represents the largest consuming region, the location where Arabica coffee futures are traded, and the economy in which transactions are denominated in US dollars. As a result, this indicator provides a relevant proxy for the broader financial and economic conditions that influence coffee markets.

The EPU Index for the United States shows a correlation of 46.58% with coffee futures prices, a clearly stronger relationship that is consistent with the hedging logic introduced earlier in this section. When economic uncertainty rises, the probability of disruptions along the coffee supply chain — from input costs to logistics and processing — increases, and both producers and corporate buyers seek to lock in prices through futures contracts. The resulting surge in hedging demand pushes futures prices upward, which explains why higher EPU readings tend to coincide with higher coffee futures prices. As shown in Figure 19, coffee prices react most strongly to energy-related crises and uncertainty episodes, such as the Russia–Ukraine conflict or the 1998 oil crisis. This pattern is consistent with the rest of the evidence, since energy prices (50.69%) and Brent oil (48.75%) are also among the indicators most correlated with coffee futures, reinforcing the view that economic uncertainty operates on coffee prices primarily through its impact on production and transportation costs along the supply chain.

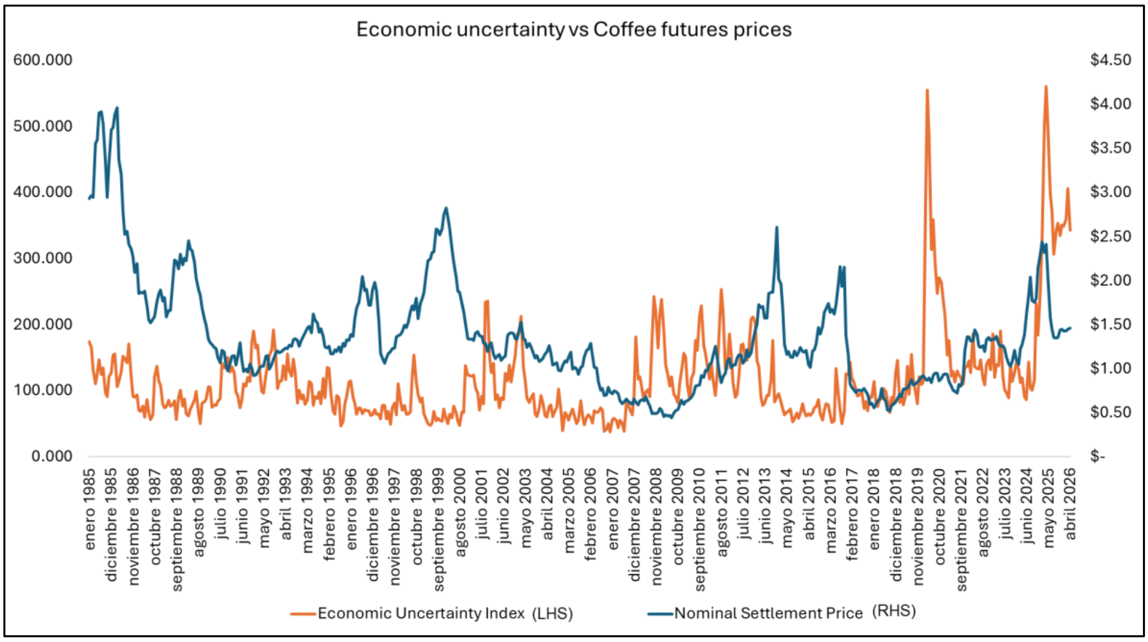

Figure 19: Economic Uncertainty vs Coffee futures prices (FRED, FactSet, 1985 - 2026)
Note. Own elaboration based on data from FRED and FactSet.

Political uncertainty was captured using data from the Global Economic Policy Uncertainty (GEPU) website, which aggregates policy-uncertainty indices across the major economies and therefore provides a global, rather than purely US-centric, view of the geopolitical environment. Comparing the monthly GEPU index from 1997 onwards with coffee futures prices yields a correlation of 54.95%, even higher than that of the US EPU. The interpretation mirrors that of economic uncertainty: because coffee is grown in a relatively small number of tropical countries and shipped through long international routes, geopolitical tensions and global policy shocks raise the perceived probability of disruption along the supply chain, which in turn pushes farmers and corporate buyers to lock in coffee prices through futures. The resulting increase in hedging demand is reflected in higher futures prices, and Figure 20 illustrates how the GEPU index and coffee futures tend to move in tandem.

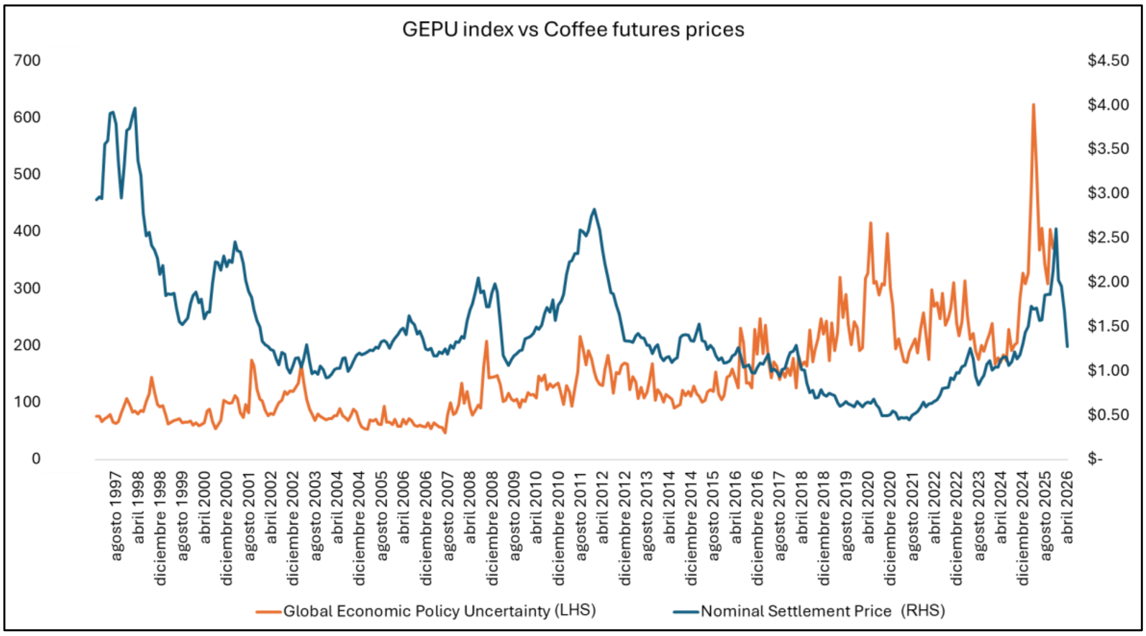

Figure 20: GEPU Index vs Coffee futures prices (GEPU Website, FactSet, 1997 - 2025)
Note. Own elaboration based on data from GEPU Website and FactSet.

Household disposable income and wealth also constitute a relevant factor, since higher income levels enable consumers to consume more coffee. To measure this effect, world GDP per capita in current dollars was used. The correlation between this indicator and coffee futures prices stands at 29.06% (World Bank, n.d.).

Currency exchange rates represent a further relevant variable. As noted earlier, most coffee is harvested in local economies such as Brazil, Colombia, and Vietnam, while it is consumed predominantly in the United States and Arabica coffee futures are traded in New York. Consequently, every year millions of dollars are exchanged into local currencies in order to carry out these transactions. To analyse this relationship, the currencies of the two main Arabica producers—Brazil and Colombia—were considered. The correlation between BRL/USD and coffee futures prices is 41.66% since the year 2000, while the equivalent figure for COP/USD is 36.42%. As Figure 21 shows, the Brazilian real and coffee futures prices moved very closely together between 2001 and 2016, with some divergence appearing thereafter.

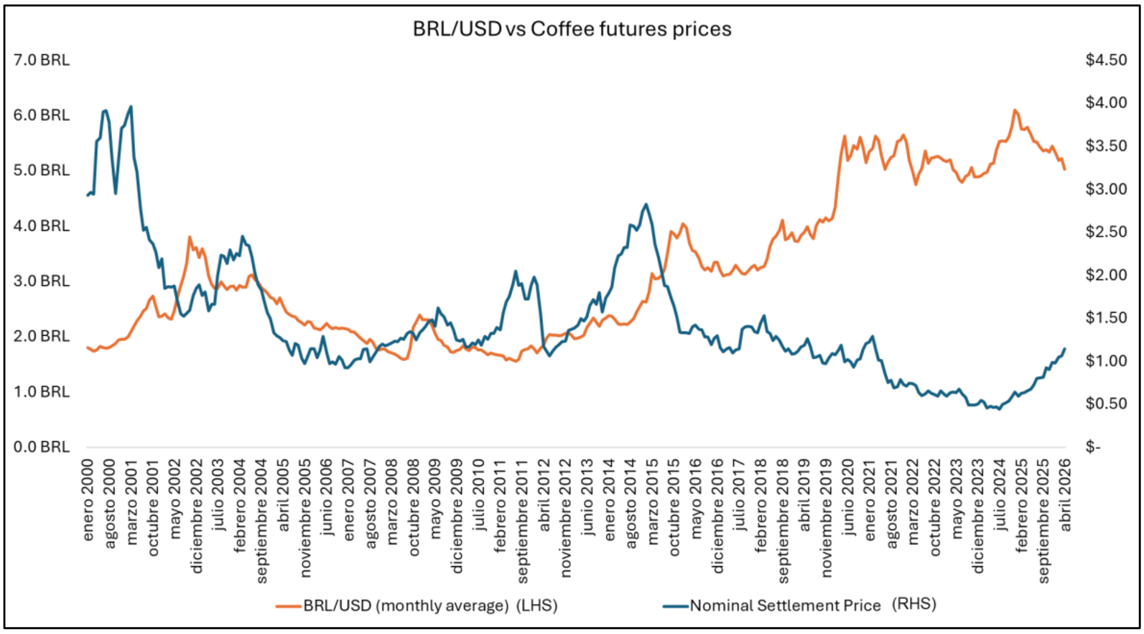

Figure 21: BRL/USD vs Coffee futures prices (FactSet, 2000 - 2026)
Note. Own elaboration based on data from FactSet.

Lastly, a close proxy of global demand is the Industrial Production Index. Christiane Baumeister's website compiles this index on a monthly basis for the OECD countries plus six major non-OECD economies (China, India, Indonesia, Russia, Brazil, and South Africa). When the year-over-year change in this index is compared with the year-over-year change in coffee futures prices, a correlation of 34.42% emerges between the World Production Index (WPI) and coffee futures prices. The relationship between these two series is illustrated in Figure 22. Baumeister, C. and J.D. Hamilton (2019)

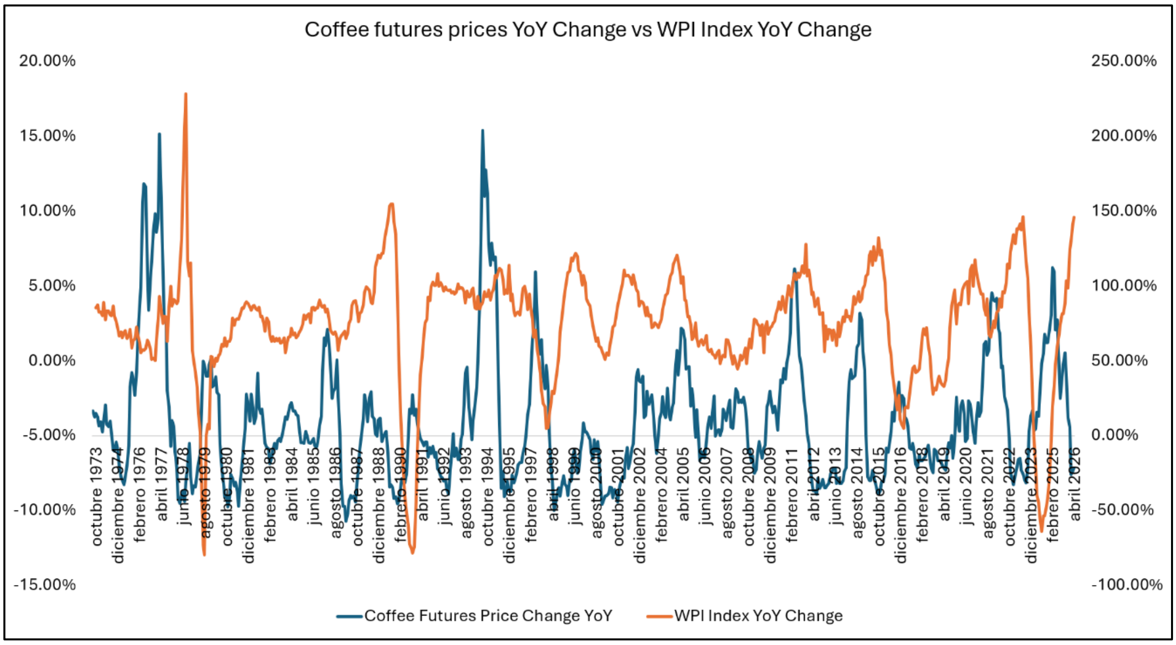

Figure 22: Coffee Prices YoY Change vs WPI YoY Change
(Baumeister, C. and J.D. Hamilton (2019), FactSet, 1972 - 2026)
Note. Own elaboration based on data from Baumeister, C. and J.D. Hamilton (2019) and FactSet.

5. Conclusion

This paper has shown that coffee is not simply an agricultural product, but a global commodity whose price is shaped by the interaction of production conditions, logistics, macroeconomic forces, and financial markets. The analysis confirms that the coffee futures price is not explained by any single factor, but rather by a layered structure in which supply shocks, cost pressures, and market expectations all play a role. What emerges most clearly from the evidence is that the price of coffee responds most strongly to variables that affect the cost of producing and moving coffee, while demand-side indicators tend to play a more moderate role. This pattern is consistent with the broader argument developed throughout the paper, in which coffee was presented as a commodity whose pricing reflects the full value chain rather than only farm output or consumer demand.

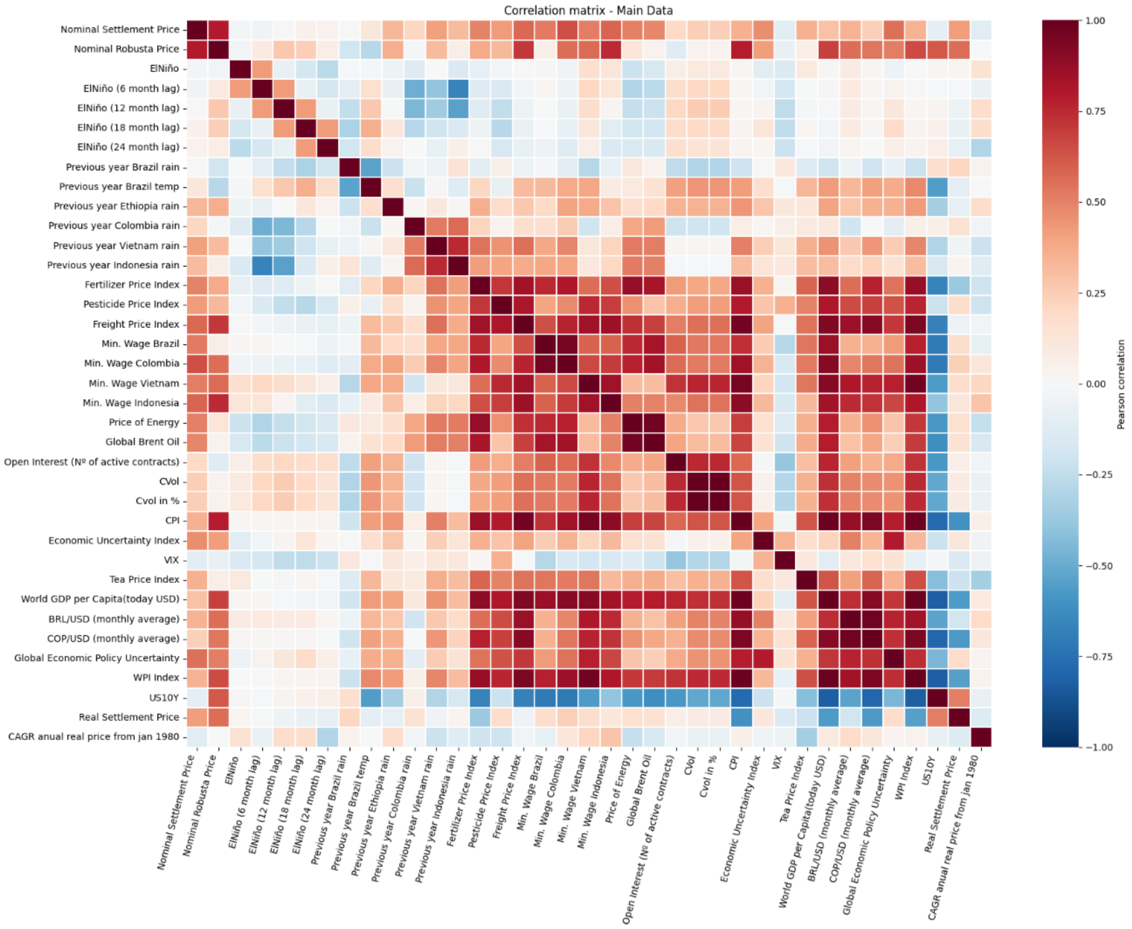

Figure 23: Final correlation matrix
Note. Own elaboration based on data used throughout the paper.

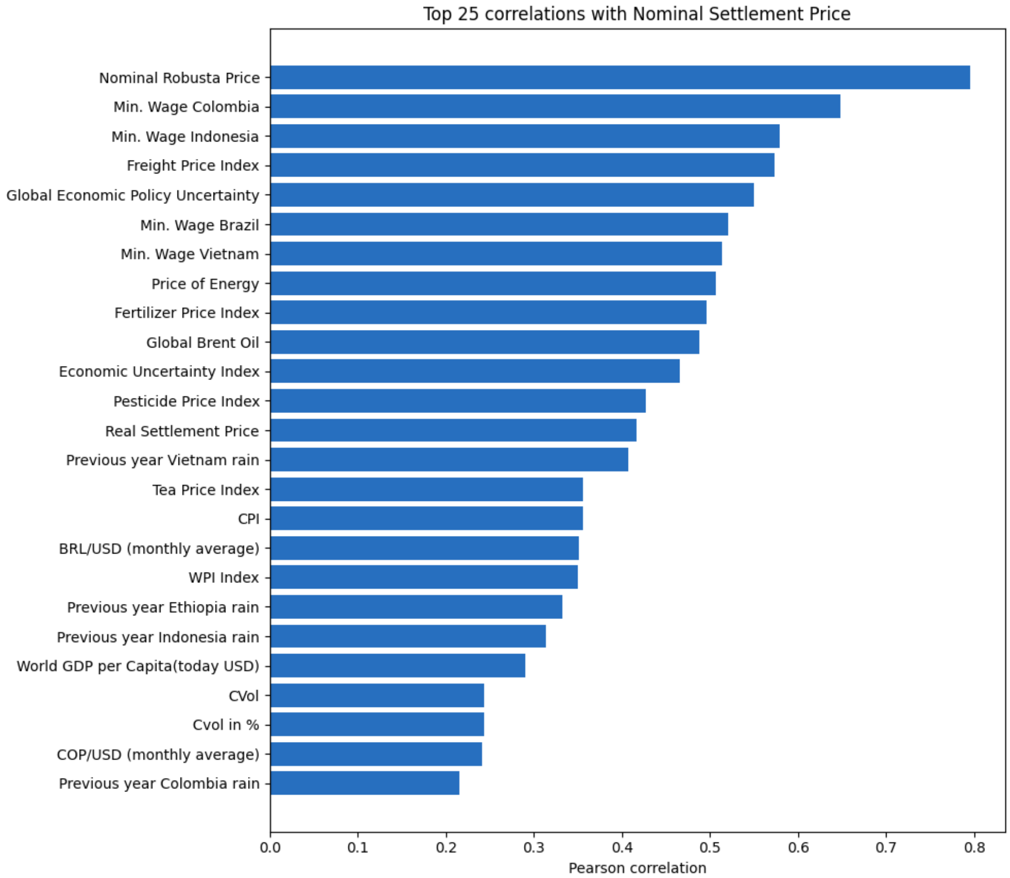

Figure 24: Top 25 correlations with coffee futures price
Note. Own elaboration based on data used throughout the paper.

The correlation matrix in Figure 23 shows that the strongest relationships are concentrated in a relatively small group of variables, and that these relationships are not random but rather clustered around supply-side and cost-related indicators. The most striking result is the very high correlation between nominal coffee futures and nominal Robusta prices, which suggests that Arabica pricing is strongly connected to the broader coffee market and to shared global shocks affecting both varieties. The next most relevant indicators are minimum wages in producing countries, freight costs, energy prices, fertiliser prices, pesticide prices, and economic uncertainty measures. In other words, the main drivers are not isolated demand variables, but the costs and frictions that directly affect production, processing, and transportation. Figure 24 reinforces this point by ranking the highest correlations with the nominal settlement price, making the hierarchy of influences considerably easier to visualise.

Climate variables are also relevant, but their importance is more nuanced. Coffee prices respond more clearly to direct and delayed production stress than to global climate oscillations considered in isolation.

Demand-side indicators, in turn, are relevant but exhibit lower explanatory power than supply and cost variables. This pattern is consistent with the notion that coffee demand is relatively inelastic: consumption does not adjust dramatically in the short run, so that price changes are driven more by supply constraints and cost shocks than by changes in consumption alone.

Overall, the main conclusion of this analysis is that coffee futures are best understood as a market in which supply-side pressures dominate, demand-side forces reinforce the trend, and futures pricing integrates both dimensions into a single benchmark. The empirical evidence suggests that the most important indicators are those related to labour, freight, energy, fertilisers, pesticides, and country-specific climate stress, whereas the least important are broad financial or climatic measures that are too indirect to capture coffee-specific dynamics. Coffee is, therefore, a commodity whose price reflects not only consumption, but also the cost of producing, moving, and hedging the product across a highly globalised chain. This makes coffee a particularly clear example of how futures markets transform scattered information into a single price signal capable of summarising the condition of an entire market.

6. References

Abu-Hashem, A. A. (2024). [Título del artículo sobre cafeína como estimulante natural]. [Revista], vol., [páginas]. https://doi.org/[...]

Anders, S., & Fedoseeva, S. (2017). Quality, sourcing, and asymmetric exchange-rate pass-through into U.S. coffee imports. Journal of Agricultural and Resource Economics, 42(3), 372–385.

Aquino, S. de O., Carneiro, F. de A., Rêgo, E. C. S., Alves, G. S. C., Andrade, A. C., & Marraccini, P. (2018). Functional analysis of the Coffea arabica PR-10a gene in response to abiotic and biotic stresses. Plant Physiology and Biochemistry, 130, 596–607. https://doi.org/10.1016/j.plaphy.2018.08.005

Arctos Coffee. (n.d.). The anatomy of a coffee cherry [Image]. https://arctoscoffee.com/the-anatomy-of-a-coffee-cherry/

Aronson, I. S., Rodriguez, M. M., & Hall, J. S. (2021). Land-use intensity and environmental drivers structure the microbiome of coffee agroecosystems. Ecology and Evolution. https://doi.org/10.1002/ece3.XXXX

Ascrizzi, R., & Flamini, G. (2020). Wild Harenna coffee: Flavour profiling from the bean to the cup. European Food Research and Technology, 246, 1333–1344. https://doi.org/10.1007/s00217-020-03479-4

Aswathi, M. K., & Murthy, P. S. (2024). Coffee processing methods and their influence on quality: A review. Journal of Food Science and Technology.

Avelino, J., Cristancho, M., Georgiou, S., Imbach, P., Aguilar, L., Bornemann, G., & Morales, C. (2015). The coffee rust crises in Colombia and Central America (2008–2013): Impacts, plausible causes and proposed solutions. Food Security, 7, 303–321.

Baumeister, C., & Hamilton, J. D. (2019). Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. American Economic Review, 109(5), 1873–1910. https://doi.org/10.1257/aer.20151569

Bekele, W. T., & Mersha, F. (2019). A dynamic panel gravity model application on the determinant factors of Ethiopia's coffee export performance. Annals of Data Science, 6, 787–806. https://doi.org/10.1007/s40745-019-00222-6

Bunn, C., Läderach, P., Rivera, O. O., & Kirschke, D. (2015). A bitter cup: Climate change profile of global production of Arabica and Robusta coffee. Climatic Change, 129(1–2), 89–101. https://doi.org/10.1007/s10584-014-1306-x

Burdan, F. (2015). Caffeine in coffee. In V. R. Preedy (Ed.), Coffee in health and disease prevention (pp. 201–207). Academic Press. https://doi.org/10.1016/B978-0-12-409517-5.00022-7

Camargo, M. B. P. (2010). The impact of climatic variability and climate change on Arabica coffee crop in Brazil. Bragantia, 69(1), 239–247. https://doi.org/10.1590/S0006-87052010000100030

Cao, X., Wu, H., Gonzalez Viejo, C., Dunshea, F., & Suleria, H. (2022). Effects of postharvest processing on aroma formation in roasted coffee: A review. International Journal of Food Science & Technology, 57(3), 1232–1245. https://doi.org/10.1111/ijfs.15562

Capps, O., Cheng, M., Kee, J., & Priestley, S. L. (2022). A cross-sectional analysis of the demand for coffee in the United States. Agribusiness, 8(3), 689–704. https://doi.org/10.1002/agr.21744

Cboe Global Markets. (2026). Cboe Volatility Index (VIX) historical data [Data set]. Cboe. https://www.cboe.com/tradable_products/vix/vix_historical_data/

Chen, C. T., & Sun, H. N. (2023). Effects of involvement on the loyalty of specialty coffee consumers. International Journal of Business and Management Studies.

Clarke, R. J., & Macrae, R. (2012). Coffee: Volume 2: Technology. Springer.

Countryeconomy.com. (n.d.). Minimum wage data.

DaMatta, F. M., & Ramalho, J. D. C. (2006). Impacts of drought and temperature stress on coffee physiology and production. Brazilian Journal of Plant Physiology, 18(1), 55–81.

Davis, A. P., Gole, T. W., Baena, S., & Moat, J. (2006). Coffee: Botany, biogeography, and conservation of genetic resources. Plant Genetic Resources, 4(1), 1–17. https://doi.org/10.1079/PGR2006105

Depecker, J., Asimonyio, J. A., Verleysen, L., Hatangi, Y., Kambale, J.-L., Mwanga Mwanga, I., Stoffelen, P., Ruttink, T., Dhed'a, B., & Honnay, O. (2022). The genetic diversity and structure of Coffea canephora in the Yangambi forest reserve. Plant Genetic Resources, 20(2), 138–146. https://doi.org/10.1017/S147926212200016X

Durevall, D. (2018). How do coffee prices pass through to consumers? Applied Economics Letters, 25(13), 887–890. https://doi.org/10.1080/13504851.2017.1380281

European Coffee Federation. (2024). European coffee report 2023/2024.

Fachruddin, F., Sumardi, S., & Mahdi, M. (2021). The growth and productivity of Robusta coffee (Coffea canephora) in lowland tropical regions. IOP Conference Series: Earth and Environmental Science, 715, 012038. https://doi.org/10.1088/1755-1315/715/1/012038

FactSet. (2024). Coffee futures prices data. FactSet Research Systems.

FactSet. (2026). Arabica coffee futures prices (KC00-USA) [Data set]. FactSet.

Federal Reserve Bank of St. Louis. (2026). Consumer Price Index for All Urban Consumers (CPIAUCSL) [Data set]. Federal Reserve Economic Data (FRED). https://fred.stlouisfed.org/series/CPIAUCSL

Federal Reserve Bank of St. Louis. (n.d.). Producer Price Index by commodity: Fertilizer materials. Federal Reserve Economic Data (FRED).

Federal Reserve Bank of St. Louis. (n.d.). Producer Price Index by industry: Pesticide and other agricultural chemical manufacturing. Federal Reserve Economic Data (FRED).

Fufa, F. (2019). The effect of coffee processing methods on coffee quality. Journal of Food Quality. https://doi.org/10.1155/2019/XXXX

Ganes, J. (2024, April 4). The "other" certified coffee: Understanding recent rule changes to the Intercontinental Exchange. Specialty Coffee Association. https://sca.coffee

Garavito, A., Montagnon, C., Guyot, R., & Bertrand, B. (2016). Identification by the DArTseq method of the genetic origin of the Coffea canephora cultivated in Vietnam and Mexico. BMC Plant Biology, 16(1), 242. https://doi.org/10.1186/s12870-016-0933-y

Gibson, L., Ware, C., & Laurance, W. F. (2011). Deforestation threatens biodiversity hotspots. Nature, 478, 17–18. https://doi.org/10.1038/478017a

Gilbert, C. L. (2010). How to understand high food prices. Journal of Agricultural Economics, 61(2), 398–425.

Global Data Lab. (n.d.). Subnational climate data.

Grand View Research. (n.d.). Coffee market size, share & trends industry report.

Haile, M. (2018). Impacts of climate variability on Arabica coffee production systems.

Haile, M., & Kang, W. (2019). Post-harvest management practices and coffee quality.

Hameed, A., Hussain, S. A., Ijaz, M. U., Ullah, S., Pasha, I., & Suleria, H. (2018). Farm to consumer: Factors affecting coffee characteristics. Comprehensive Reviews in Food Science and Food Safety, 17(5), 1184–1237. https://doi.org/10.1111/1541-4337.12345

Harelimana, A., Rukazambuga, D., & Hance, T. (2022). Pests and diseases regulation in coffee agroecosystems. Journal of Plant Diseases and Protection, 129(5), 1041–1052. https://doi.org/10.1007/s41348-022-00655-2

Humanitarian Data Exchange. (n.d.). Rainfall dataset. https://data.humdata.org

Intercontinental Exchange. (n.d.). About ICE. https://www.ice.com/about

Intercontinental Exchange. (n.d.). Coffee "C" futures contract specifications. https://www.theice.com

International Coffee Organization. (2023). Coffee market report and global consumption data.

International Coffee Organization. (n.d.). ICO composite indicator prices. https://www.ico.org

International Trade Centre. (2021). The coffee guide (4th ed.).

Kaye, A. S. (1986). The etymology of "coffee". Journal of the American Oriental Society, 106(1), 95–98.

Killian, B., Perez, J., & Dietsch, T. (2013). Coffee carbon footprint. Journal of Sustainable Agriculture, 37(1), 15–29. https://doi.org/10.1080/10440046.2013.789958

Krishnan, S., Matsumoto, T., Nagai, C., Falconer, J., Shriner, S., Long, J., Medrano, J., & Vega, F. (2021). Vulnerability of coffee genetic resources. Genetic Resources and Crop Evolution, 68, 2691–2710.

Lashermes, P., Denoeud, F., & Combes, M. C. (2023). Coffee genomics and breeding. Current Opinion in Plant Biology, 72, 102342. https://doi.org/10.1016/j.pbi.2023.102342

Mburu, J. (2005). Coffee processing waste management.

McCusker, R. R., Goldberger, B. A., & Cone, E. J. (2003). Caffeine content of specialty coffees. Journal of Analytical Toxicology, 27(7), 520–522.

Murthy, P. S., & Madhava Naidu, M. (2012). Sustainable management of coffee industry by-products and value addition—A review. Resources, Conservation and Recycling, 66, 45–58. https://doi.org/10.1016/j.resconrec.2012.06.005

Narváez, C. A., & Curi, P. N. (2018). Sensory and chemical differentiation of Arabica and Robusta coffee species: A review. [Revista — completar], vol., [páginas].

Nguyễn, T. N., Ngan, N. N., Hong, T. T., & Cuong, N. D. (2020). Hedging with commodity futures: Evidence from the coffee market. Investment Management and Financial Innovations, 17(4). https://doi.org/10.21511/imfi.17(4).2020.01

Nugroho, D., Wibowo, A. A., Suhartanto, M. R., & Sumirat, U. (2020). The effect of altitude on the physical and chemical characteristics of Arabica coffee (Coffea arabica L.). IOP Conference Series: Earth and Environmental Science, 466, 012006. https://doi.org/10.1088/1755-1315/466/1/012006

Obando, A. M., & Figueroa, J. G. (2024). Roasting and aroma compounds. Molecules, 29. https://doi.org/10.3390/molecules29000000

Poole, R., et al. (2017). Coffee consumption and health: Umbrella review. BMJ.

Seninde, D. R., & Chambers, E. (2020). Coffee flavor: A review. Beverages, 6(3), 44. https://doi.org/10.3390/beverages6030044

Staver, C., Guharay, F., Monterroso, D., & Muschler, R. G. (2001). Designing pest-suppressive multistrata perennial crop systems. Agroforestry Systems, 53(2), 151–170.

Takala, B. (2021). Coffee waste utilization. Journal of Natural Sciences Research.

TradingView. (n.d.). Coffee futures charts. https://www.tradingview.com

Trenberth, K. (1997). The definition of El Niño. Bulletin of the American Meteorological Society.

Volsi, B., Telles, T. S., Caldarelli, C. E., & Câmara, M. R. G. (2019). The dynamics of coffee production in Brazil. PLoS ONE, 14(7), e0219742. https://doi.org/10.1371/journal.pone.0219742

World Bank. (n.d.). GDP per capita data.

World Population Review. (n.d.). Global coffee consumption statistics.

Worku, M., Astatkie, T., & Boeckx, P. (2022). Effects of separate and combined applications of mineral fertilizer and farmyard manure on yield and yield components of Arabica coffee (Coffea arabica L.) in Ethiopia. Experimental Agriculture, 58, e1. https://doi.org/10.1017/S0014479721000326