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RESEARCH ARTICLE OPEN ACCESS

Climbing the Coffee Global Value Chain—Three Decades of Trade and Upgrading

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ABSTRACT

Developing countries frequently struggle to generate wealth from trade in agri-commodities such as coffee, where the end price of a cup of coffee sold in Berlin or New York returns only a fraction of the value to the actual coffee grower. With this in mind, we investigate this phenomenon using unique cross-border data for 28 years (1991–2018), where coffee is represented in its various formats, from unprocessed ‘green’ coffee beans to the roasted and soluble products. In so doing, we derive a measure of functional upgrading. Analogously, we report the extent to which countries upgrade their coffee production, adding value to their raw coffee exports (product upgrading). Our data reveal that many coffee cultivating countries are unable to capitalize on the boom in roasted coffee exports—losing out on the upswing in high-end consumption. Conversely, we find that Asian countries are more likely to climb the coffee GVC, while many African countries remain exporting green coffee. Interestingly, coffee cultivating countries with higher levels of industrialization and reduced distance to processing hubs, all things equal, are associated with higher value added. The coffee variety cultivated also plays a crucial role as does the trade policy pursued.

JEL Classification: F14, O13, O30

1 | Introduction

The global coffee industry is an important sector for many countries, providing employment and income for millions of people. While the production of green coffee is dominated by smallholders along the coffee belt close to the equator, industrial countries in the Global North dominate the world market for processed coffee. This is especially observable for roasted coffee, where the biggest exporters are high-income countries such as Germany, Italy or the United States. While the revenue from global retail sales of coffee is around \$200 billion, coffee-growing countries only capture 10% of this revenue (ICO 2019a). In 2015, the United Nations prioritized fair treatment of trading partners from poorer countries through the Sustainability Development Goals (SDGs). This has prompted industries such as the coffee

industry to examine their global value chains (GVCs) and identify ways to improve the economies of coffee-growing countries. Moving up the value chain or improving the quality of the raw product can lead to substantial economic gains, making it important to understand the determinants of GVC participation and upgrading. Such an understanding can also inform policy and the private sector to develop investment strategies for sustainable economic development.

While coffee-growing countries like Ecuador, Vietnam, Indonesia or India to some extent successfully climbed the coffee value chain, for example, by exporting soluble coffee, other countries fail for different reasons. Such reasons include challenges such as supply and demand overruns, product perishability, price competition and marketing dominance of global

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brands. These challenges increase uncertainty and vulnerability to external conditions and make it difficult for remote coffee-growing countries to enter the market for processed coffee, as they lack sufficient knowledge, institutions, business networks and funding.

With this paper, we contribute to the understanding of country-level determinants explaining countries' success in climbing the coffee value chain. To this end, we empirically identify factors that correlate with a country's participation in coffee GVCs and upgrading based on a detailed dataset, which includes 28 years (1991–2018) of country-specific information on import and export volumes and values of coffee at various stages of coffee processing. The dataset is unique in its quality and coverage of global trade flows in green and processed coffee. It was made available to us for research by the International Coffee Organization, an intergovernmental organization in the coffee sector established in 1963 under the auspices of the United Nations.¹ First, we isolate the correlates of coffee exports in various stages of processing: green bean (largely unprocessed), soluble coffee and roasted coffee. Second, exploiting the sequential nature of coffee production (green coffee processed to roasted or soluble coffee), we examine functional upgrading: the factors related to increases in the share of processed coffee (soluble or roasted). Third, we focus on product upgrading: the correlates of receiving higher revenues for unprocessed (green) coffee exports. Among the factors explaining GVC participation and upgrading that we explore are factor endowments, geography, trade policy, institutions and macroeconomic factors. Notably, this is the first time a comprehensive empirical study for the coffee sector has been able to shed light on GVC participation. Accordingly, our analysis broadly compares to other studies investigating value-added for agricultural products (e.g., Macchiavello and Morjaria 2015; Hansman et al. 2020). Our choice of variables used in the empirical analysis builds on Fernandes et al. (2022). However, we align our study with the coffee sector, adding variables specific to the sector (e.g., a measure of coffee specialization).

There are several advantages to our focus on the coffee sector, in contrast to more aggregate approaches. First, coffee is one of the most widely traded commodities; its value chain is well understood and rather simple. Second, coffee is an agricultural commodity, and any results may therefore be informative for other agricultural commodities. Third, as coffee grows predominantly in developing countries, the coffee trade is strongly connected to economic development. Fourth, country-specific studies have shed some light on the sector, guiding the choice of variables for empirical work (e.g., Macchiavello and Morjaria 2021). Fifth, features of our data allow for the direct empirical implementation of the participation and upgrading concepts.

Our headline findings can be summarized as follows. Europe (non-EU), the EU and North America dominate export markets for roasted coffee, which is relatively high in value added. While countries in other regions, mostly developing countries, are still responsible for a rather small share of the higher value-added segments of the coffee value chain, these countries have made progress—though to different degrees—over time. Among coffee-growing countries, Asian countries have been relatively more successful than African countries at shifting towards exports of processed coffee.²

In our econometric analysis, we find that distance to processing hubs correlates negatively with exports of processed coffee, while it is *not* associated with the export of green coffee. Furthermore, domestic industrial capacity is helping countries to add higher value to their coffee by processing. We also find that countries endowed with more suitable land and coffee-growing countries that are specialized in the Robusta variety are more likely to pursue functional upgrading. Robusta coffee is mostly processed into soluble formats, and the manufacturing, as well as transportation and distribution of soluble coffee is relatively straightforward, enabling the sector to maintain product quality across seasons and countries of origin.

Moreover, we reveal that agricultural import tariffs negatively relate to functional upgrading. First, it becomes more expensive for firms to source inputs such as fertilizers and insecticides, but also processing equipment on international markets. Second, high agricultural import tariffs might be suggestive of a generally higher tariff regime faced by exporters.

Countries with a higher industrial capacity are positively associated with functional upgrading but negatively associated with product upgrading. Less developed countries, which cannot build upon a strong industrial base, can still go the route of quality improvements (product upgrading), thereby raising the price they can ask for their coffee. We also observe a negative connection between the availability of land suitable for coffee cultivation and product upgrading. This suggests that countries with reduced endowments of suitable land may be specialized in higher quality coffee, extracting increased value from their green coffee exports. Countries closer to processing hubs, which are also major consumption regions, are found to functional upgrade, while there is no significant relationship for product upgrading.

Our study identifies several factors that policymakers and businesses in both developing and developed countries can configure to allow coffee-growing countries to participate and upgrade in global value chains. Our recommendations are targeted towards achieving the Sustainable Development Goals by reducing the exclusivity of the coffee value chain and pointing out a more beneficial development trajectory for low- and middle-income countries.

The remainder of the paper is organized as follows. In Section 2 we provide a summary of the related literature. In Section 3 we introduce our empirical model as well as the GVC indicators and potential GVC determinants considered in the regressions. Results are presented in Section 4. We highlight the main findings and provide policy suggestions in Section 5.

2 | Literature Background

2.1 | Framing the Debate on Value Added for Suppliers in the Global South

Empirical studies such as ours, written by researchers from entities in the West, can be biased by geocentricism: failing to take a fair and balanced perspective when investigating the value chain for coffee. For example, Touboulic et al. (2020) caution

against implicit biases in research that may favour Global North actors when exploring profit allocation. They advocate for a critical, multi-stakeholder approach that addresses the following questions: (1) Who benefits and who loses? (2) Which voices are included or excluded? (3) What mechanisms of power underpin these dynamics?

This reflective framing is vital. For this reason, this section looks critically at the structure and dynamics of the coffee value chain, endeavouring to consider the structural realities faced by weaker value chain participants such as Global South growers.

Small-scale growers, typically from the Global South, supply raw commodities to large-scale buyers. These buyers, often multinational corporations (MNCs), are frequently associated with popular coffee brands, expertise in catering to sophisticated consumers, multiple products (e.g., a comprehensive range of coffee preparations), and impressive logistical networks. All these advantages create disparities between buyers and smaller-scale sellers, leading to significant asymmetries in bargaining power along the value chain. Unfortunately, for weaker Global South suppliers, it is difficult to negotiate contracts that fairly reflect their contributions to the creation of the coffee end product. This difficulty is compounded by the dynamics of global value chains (GVCs), where lead firms—primarily from the Global North—often dictate pricing, quality standards and market access. However, this market power dynamic is not set in stone: economic, political and technological shifts can cause the locus of market power to rebalance (Benito et al. 2019). Nevertheless, recent events (e.g., COVID lockdowns and heightened geopolitical tensions) do not appear to have significantly diluted the power of lead firms from the Global North.

There are three main determinants of the power relations: (1) the over-dependence of coffee growers, (2) the achievement of Corporate Social Responsibility (CSR) initiatives employed by multinationals, and (3) the role of technology transfer in helping growers and suppliers capture increased value from their coffee exports.

A growing body of research underscores the need to examine mechanisms for creating value for farmers in the Global South, including coffee growers whose livelihoods often depend on a single crop (Kano 2018). This over-dependence tends to reinforce the concentration of profits at the buyer's end. Dallas et al. (2019) indeed find that buyers—often multinationals—act as 'lead firms' with disproportionate influence over network dynamics. Historically, producers in niche markets such as the wine industry wielded greater bargaining power, but the consolidation of retail power has diminished these advantages, even in higher-quality segments (Ponte 2009; Ponte 2019). Grabs and Ponte (2019) show that despite decades of change, power inequities persist, leaving coffee producers in an even more vulnerable position. Identifying ways to empower small-scale growers—through enhanced economic stability and resilience—should be a focus of research agendas.

In recent years, corporate social responsibility (CSR) has emerged as an initiative portrayed by multinational lead firms as a means of increasing fairness and profit-sharing with Global South growers. However, the results achieved by CSR initiatives

have often proven disappointing. CSR initiatives frequently serve to enhance MNCs' public image without addressing underlying inequalities. Several well-cited studies highlight how CSR narratives invariably depict farmers as thriving under the benevolent guidance of MNCs while masking challenges such as dependency and financial vulnerability (Levy et al. 2016; Touboulic et al. 2020). For this reason, authentic efforts must go beyond superficial sustainability claims to enable genuine empowerment and value redistribution.

Where CSR initiatives have failed, technological advances by Global South growers and suppliers may offer a more promising path. In the coffee industry, technological advancement can be exemplified by the conversion of raw coffee into instant coffee through processes like freeze-drying and advanced packaging. These innovations require significant technological inputs, enabling suppliers to sell directly to local or international markets and enhancing their bargaining power (MacCarthy et al. 2016). However, these benefits are tempered by barriers such as limited market access, branding challenges and the small scale of operations. Lessons from industries like Ghanaian cocoa suggest that cooperative initiatives can help smallholders achieve the scale and visibility necessary to benefit from technological advancements and to compete against larger players (Ponte 2009).

The coffee value chain, like that of many other agricultural commodities, is characterized by strong power asymmetries, making it difficult for coffee growers from the Global South to capture value. While these asymmetries persist, researchers should not be deterred from examining value flows in GVCs, provided they acknowledge these structural imbalances. Where possible, research should endeavour to examine the role of technological advances, as they are pinpointed in the literature as a factor that may help smooth out these asymmetries. By applying longitudinal, cross-country data, a study like ours can build on earlier empirical work by Antràs and Chor (2013) and Johnson and Noguera (2012), shedding light on how technology moderates the buyer–supplier relationship. Accordingly, our analysis aims to provide a sound empirical basis for debates on value creation and distribution.

2.2 | Studies From the Global South—Capturing Value Added

Understanding the coffee market requires an examination of existing studies on how farmers and suppliers in the Global South have historically created value within agricultural commodity chains. There is an abundance of case studies (though fewer quantitative studies) that shed light on this question (see Kano et al. 2020, for a comprehensive discussion).

Pipkin and Fuentes (2017) analyse 45 of these case studies examining how Global South suppliers in primary and manufacturing industries capture value added. Their evidence shows that the push to upgrade production and capture higher value added is typically initiated by these Global South suppliers, notably supported by local agencies and business associations, rather than by Global North multinationals, despite the latter's control over supply chains. This suggests that, even with Global North firms claiming to support their Global South

partners in capturing more value, meaningful value-added improvements for Global South players are unlikely without strong backing from local representative groups in the suppliers' home countries.

Similarly, Foster et al. (2018) investigate how countries in the Global South, such as Kenya and Rwanda, can expand the technological capacity of their native enterprises in sectors such as the cultivation and processing of tea. The move to implement digital platforms could narrow the gap between suppliers in these countries and technologically advanced buyers in the Global North. However, the results of introducing such improvements are rather disappointing for capturing value in GVCs, except for firms being able to develop niche and novel markets for their products.

In addition to niche markets, regional markets or technology hubs can provide a viable pathway for developing countries to access neighbouring economies, increase production, expand sales, refine expertise, further specialize and move up the quality ladder (Amendolagine et al. 2019; Brown et al. 2010; Morris et al. 2011; Godfrey 2015; Barrientos et al. 2016). By leveraging regional markets and production hubs, suppliers in the Global South are better positioned to cultivate enterprise champions. Some of these champions may eventually assume leadership roles in GVCs, becoming lead firms. Even if they do not attain such leadership, Global South firms can still benefit significantly through strategic partnerships with their Global North counterparts, facilitating a more equitable distribution of profits across supply chain participants (Horner and Nadvi 2018).

While research on production hubs and regional markets suggests potential benefits for Global South firms, Zoo et al. (2017) analysing 63 studies on innovation and standardization in Global South countries find that benefits from regional markets are not guaranteed. Serving or sourcing from local and regional markets also presents unique challenges, as each market imposes its own regulatory requirements (e.g., country-specific adjustments to the product to accommodate local tastes, in the case of coffee). The traditional assumption of stricter quality standards in the Global North that make Global North markets more challenging to serve is increasingly questioned. Schouten and Bitzer (2015) reveal that quality standards in the Global South can be equally demanding.

In summary, research on value capture in the Global South highlights three key factors: (1) production upgrading, often facilitated by local governments and NGOs; (2) the role of cities as production hubs that enhance specialization and efficiency; and (3) the potential of regional markets to support expansion and value capture—though empirical evidence on their effectiveness remains mixed.

2.3 | Exports of Agricultural Commodities

In this section, we examine the physical characteristics of agricultural commodities like coffee and the volatility of markets, both of which shape how these perishable foodstuffs are bought and sold globally. Countries exporting agricultural commodities face huge challenges in optimizing the value of these exports.

Adding value to the raw commodity and, hence, increasing the revenues from exports requires further processing of the raw commodity. This is not always possible, for several reasons. Commodities are relatively generic crops, the quality of which is hard to observe and control for buyers—even more so when the final market is remote (Hansman et al. 2020). This hard-to-observe quality of agricultural commodities gives rise to substantial asymmetries between suppliers and buyers. As a result, transactions become riskier. A further risk factor is high product perishability and quality uncertainty. Accordingly, the buyer and supplier must negotiate which of the partners is liable for the cost of unwanted or unsold inventory. Only over repeated transactions can the reliability of both partners be established (Macchiavello 2010; Macchiavello and Morjaria 2015).

Demand and supply frictions in international markets introduce an additional complexity which coffee farmers face. On the supply side, coffee farmers face long investment horizons (up to 30 years). This may lead to underinvestment or failure to plant crops which can be exported more profitably (Krishna and Sheveleva 2017). These long time horizons are coupled with a familiar nightmare for growers—unpredictable weather events. Finally, the perishable nature makes coffee hard to transport at a profit. On the demand side, exogenous shocks (e.g., the COVID-19 pandemic, leading to the closure of cafes and restaurants) can lead to sudden changes in demand (ICO 2020a). A sudden spike in the price creates incentives for growers to sell their crops on the spot market, abandoning their regular buyers (Blouin and Macchiavello 2019). In this way, the market for coffee is undermined by hold-up problems.

Several studies analyse these market frictions and explore how transaction costs between suppliers and buyers can be mitigated. Because the legal institutions in many countries that export agricultural commodities are sometimes too weak to enforce contracts (Atkin and Khandelwal 2020), greater emphasis is placed on self-enforcing contracts, relying on relationships and reputations, even those established on an informal basis (Macchiavello and Miquel-Florensa 2017). Consistent with this intuition, McMillan and Woodruff (1999) find that Vietnamese firms are more willing to extend trade credit to buyers with a payment incentive, who are less likely to switch suppliers and have a good purchasing history. It is easy to grasp why coffee growers might favour binding contracts with coffee processors, buffering them from demand shocks. Studies provide additional evidence why such long-term contracts are beneficial. Contractual commitments between different agents in a production chain are often, but not necessarily, accompanied by knowledge transfers between the agents (Alfaro and Charlton 2009; Görg et al. 2018).

2.4 | Drivers of Global Value Chain Participation

Reflecting on the evidence so far, we notice that the global value chain of the coffee industry has been highlighted in a few previous country-specific studies (e.g., Neilson 2008; Neilson et al. 2018). These studies reveal some country-specific patterns in this sector. For instance, big brand multinationals have increased their efforts to control coffee cultivation, exacting higher CSR standards from growers without adequately compensating them for these costly actions. Despite these

insights, the literature could be expanded by a study examining coffee growing countries collectively, together with coffee recipient countries, from where many of these multinationals originate. In this way, we could build up an understanding of the value chain transcending the particularities of any individual country. For this purpose, we turn to Fernandes et al. (2022), a study which greatly contributed to a high-impact analysis on GVCs and development (see IBRD and World Bank 2020). The approach used in the latter can help inform such an analysis of the coffee sector. They investigate the factors determining the participation of countries in GVCs and consider four broad sectoral groups (agriculture, mining, manufacturing and services) in the analysis. One main implication of Fernandes et al. (2022) is that a whole range of correlates come into play in helping to explain how countries participate in GVCs, maximizing the value of their exports. These correlates include factor endowments, geography, political stability, liberal trade policies, foreign direct investment (FDI) inflows, and domestic industrial capacity. Moreover, these factors correlate more with a country's GVC participation than with its traditional exports. Based on these findings, Fernandes et al. (2022) shed light on why some countries like Vietnam have integrated successfully into GVCs while other countries (such as many in the African region) have failed to unlock the full potential of their downstream exports. Building on the aggregate analysis of Fernandes et al. (2022), we investigate the factors that determine the participation of countries in the global coffee sector.

3 | Empirical Methodology

3.1 | Measures of GVC Participation

The sequence of the coffee production chain is relatively simple. Coffee is cultivated on plantations. After the raw coffee cherries are picked, the coffee cherries are washed and dried at washing stations. The dried product is then combined or 'blended' to optimize flavour. Thereafter, the beans are transformed into soluble coffee or roasted coffee before being further packaged, shipped and sold to final consumers. The steps along this chain are often distributed globally. It can be profitable for coffee-growing countries to capture some of the higher value-added segments of the value chain.

Along the GVC, there are several possible ways for coffee-growing countries (and those not growing coffee) to benefit from the coffee trade. A coffee-growing country can expand its market reach and export its coffee products to overseas customers. In addition, countries already involved in the coffee GVC can further add value to their coffee products through product upgrading or functional upgrading. In coffee, product upgrading can be achieved by using science to identify more promising strains of coffee, selectively handpicking coffee or introducing post-harvest processing and following sustainability and/or fair-trade standards. Functional upgrading, which involves additional processing of the commodity into final products, can be achieved by producing roasted or soluble coffee.³

Both product and functional upgrading can be done on the initiative of the coffee growers, but upgrading can also be conducted

at the behest of coffee traders and multinational enterprises. The latter is to ensure, for example, more reliable access to consistently high-quality coffee beans or to increase domestic processing work for local markets (e.g., ICO 2021; International Trade Centre (ITC) 2021). In environments with market power, as in coffee, buyer–supplier relationships are essential for the success of developing countries in capturing market share and upgrading (see, e.g., Boudreau et al. 2023).

Using the data from the International Coffee Organization, we derive three measures of GVC participation. We consider exports of different coffee forms as a first natural GVC integration measure in our analysis. As our second GVC measure, we use the share of exports in soluble and roasted coffee. We can interpret a higher share of exports in soluble and roasted coffee as indicative of functional upgrading. In a supplementary analysis, we confine the analysis to the subset of coffee-growing countries. In this way, we allow for a different export emphasis of these countries—their higher focus on green coffee exports and reduced potential for functional upgrading, compared to values observed for non-coffee-growing countries. Thirdly, we use average per-unit export values of green coffee to proxy the improvement made in the quality of green coffee. We interpret such a quality improvement as a kind of product upgrading, another avenue for GVC integration and one open, almost exclusively, to coffee-growing countries.

3.2 | Regression Model

Our general specification can be formulated as:

$$Y_{it} = \alpha + X'_{it}\beta + \delta_t + u_{it} \quad (1)$$

with Y_{it} as the dependent variable measuring GVC integration of country i at time t . This includes individual specifications for coffee exports and GVC upgrading (functional and product upgrading). We take the natural logarithm of coffee exports (total, green, soluble and roasted) and of GVC product upgrading proxied by per-unit value of green coffee exports. OLS is used in our models for coffee exports and for product upgrading. PPML is, instead, used in our model for functional upgrading since it does not require any transformation of the dependent variable (such as taking the natural logarithm) so that we can include observations where the dependent variable equals zero (Santos Silva and Tenreyro 2006). The vector X_{it} comprises potential determinants of GVC participation, δ_t denotes year fixed effects, and u_{it} is an independent and identically distributed error term clustered at the country-year level.⁴

While the full coffee trade dataset for 1991–2018 is used for the descriptive analysis of the development of the coffee trade, our econometric analysis focuses on the period between 1996 and 2017, due to limited coverage of the variables for the periods 1991–1995 and 2018.⁵ Notably, Fernandes et al. (2022) calculate the decadal averages of the variables captured in the data and include decadal fixed effects in their regression. Missing year-by-year variation of GVC-related variables is stated as a key reason for adopting this approach. The strong development of the coffee trade over time and the integration of ever more countries

in the coffee GVC—in one form or another—suggest that global participation in coffee GVCs varies more substantially over time. Our estimation thus considers year-by-year variation and year fixed effects. However, we face a similar constraint to that documented by Fernandes et al. (2022, 338) who argue that within-country variation over time is insufficient for precisely measuring a panel regression.

3.3 | Potential Determinants of GVC Participation

To finalize a list of potential determinants of GVC participation for the analysis, we use a similar taxonomy to the pioneering Fernandes et al. (2022) study. We cover all domains considered there: factor endowments, geography, FDI, trade policy (tariffs), domestic industrial capacity, institutional quality and macro-economic factors. Additionally, we consider some coffee-specific covariates. These are summarized in Table 1 and discussed in the part that follows.

3.3.1 | Factor Endowments

We cover three different aspects of factor endowments, namely, (1) natural resources, (2) capital and (3) suitable land for coffee cultivation. Natural resources are denoted by the natural logarithm of rents from resources scaled by gross domestic product (GDP). An abundance of natural resources (e.g., petroleum or copper) is closely linked to forward GVC integration because agricultural products and commodities are used in a variety of downstream products (Fernandes et al. 2022). However, in interpreting the connection between natural resource endowments and upgrading, we need to exercise caution. Although there exists—in theory—a negative connection between the two (resource curse aka Dutch Disease), the empirical evidence appears to reject the existence of a dampening effect from natural resources on other parts of the economy (Brunnschweiler and Bulte 2008; Haseeb et al. 2021). In practice, the elasticity of labour between workers employed in the natural resource sector and elsewhere in

TABLE 1 | Overview about the independent variables for our analysis and the respective sources.

Variable name	Description	Source
(ln) resource rents/Gross domestic product (GDP)	Total natural resources rents (% of GDP) (NY.GDP.TOTL.RT.ZS)	World Bank (2020a)
(ln) capital/GDP	Capital stock at constant 2011 national prices (in mil. 2011USD) in relation to GDP (constant 2010 USD)	University of California, Davis and University of Groningen (2019) and World Bank (2020a)
(ln) coffee suitability	Very suitable or suitable land for coffee cultivation (in km ²)	FAO and IIASA (2022)
(ln) distance to processing hubs	Average distance of the capital of Germany, United States and Italy	CEPII (2020)
(ln) domestic industrial capacity	Manufacturing, value-added (% of GDP) (NV.IND.MANF.ZS)	World Bank (2020a)
Tariffs rate (primary)	Tariff rate, applied, weighted mean, primary products (%) (TM.TAX.TCOM.WM.AR.ZS)	World Bank (2020a)
(ln) FDI inflows	Foreign direct investment: Inward flows	UNCTAD (2020b)
Political Stability Index	Political Stability and Absence of Violence/Terrorism: Estimate (PV.EST)	World Bank (2020b)
Depreciation	Official exchange rate (LCU per USD, period average)	World Bank (2020a)
(ln) GDP p.c.	GDP (constant 2010 USD) and Population, total (SP.POP.TOTL) - UNIT	World Bank (2020a)
(ln) Population	Population, total (SP.POP.TOTL) - UNIT	World Bank (2020a)
(ln) consumption p.c. in kg	Consumption per capita based on ICO statistics	ICO (2020b)
Coffee-growing country: Arabica dominates (dummy)	A dummy if the country reported any production of coffee and Arabica dominates	ICO (2020b)
Coffee-growing country: Robusta dominates (dummy)	A dummy if the country reported any production of coffee and Robusta dominates	ICO (2020b)
Geographic region	Region of a country: Africa, Asia, Europe (non-EU), European Union, MEX, Central America & Caribbean, Middle East & Arab States, North America, Oceania and South America	ICO (2020b)

the economy is low and there is little evidence of currency hikes because of a strong trade in natural resources. In fact, some countries have managed to conduct a parallel trade in coffee and minerals, for example, Rwanda.

Secondly, we measure capital endowments, using the natural logarithm of capital over GDP. Capital endowments are especially important for the sections of the processing industry located further downstream in the value chain (Fernandes et al. 2022). In line with this intuition, we expect that our specifications for processed coffee are driven by capital endowments. The relevance of this variable is less predominant for exports of green coffee, which are still mainly harvested by smallholder farmers. However, we also investigate the drivers of product upgrading in the green coffee value chain where we similarly expect a positive effect. Specifically, countries with a higher capital endowment are better able to engage themselves in quality-improving measures and in applying for high-quality certifications.

Thirdly, the land endowments are measured by the natural logarithm of suitable (or very suitable) land for coffee cultivation in square kilometres (FAO and IIASA 2022).⁶ However, our expectations for the direction and magnitude of this effect are not clear-cut. On the one hand, the larger endowments of land suitable for coffee cultivation might relate to higher production volume, which can be used by the coffee processing industry. On the other hand, countries with reduced land endowments can also export more coffee if they, for example, have a higher cultivation intensity, are more productive or are specialized in specific types of popular coffee strains. In addition, more knowledgeable and better-equipped smallholders might self-select onto the scarce land, resulting in higher yields and average prices.

3.3.2 | Geography

With geography we mean, as in the GVC literature, the geographic proximity of growers to processors and of processors to distributors and retailers.

Growers and processors within the same ‘neighbourhood’, separated by only a short distance, are more likely to exchange ideas and work more closely towards streamlining production (Ellison et al. 2010). The overall effect of geography on GVC integration is positive, where growers are located closer to processors. We follow the intuition of Fernandes et al. (2022) who introduce the average distance to main manufacturing hubs but align the approach to the coffee industry. We thus include the natural logarithm of the average distance to the capitals of Germany, the United States and Italy, which are major hubs for coffee processing and consumption. We expect that with distance to these hubs, GVC integration decreases.

In addition, we include regional fixed effects to control for general differences between regions, for example, comparing Asian countries that have been successful in participating in GVCs over the last decades and African countries that still lag behind in many industries. In general, we expect that our regional dummies illustrate quantitatively how different world regions have different success rates in GVC participation and upgrading, with

African countries having probably achieved less success than Asian countries and members of the EU in becoming major exporters of roasted coffee.

3.3.3 | FDI and Tariffs (Trade Policy)

In our introduction section, we have touched on the recurring problem of commodification, lack of market power and oversupply. The latter problem of oversupply has kept prices at such a low level that many growers find it difficult to cover operating costs and invest in upgrading their technologies and equipment. The result is a shortfall in productivity. This is where we expect FDI may play a compensating role. As such, we would expect the domestic content of exports to rise, with increases in FDI inflows (Stiglitz 2000; Bickenbach et al. 2018).

However, FDI may also deter coffee growers’ motivation to move towards higher value-added processing work if the inflowing FDI aims at maintaining and deepening coffee buyers’ relations with coffee growers, thus ensuring more direct access to potentially better green coffee. It can, for example, be observed that increased FDI flows to coffee-growing countries (e.g., Vietnam and Uganda) have increased the share of land dedicated to coffee-growing by over 30% in the period 2000–2018 (Tchibo 2020). In other words, we expect a positive connection of FDI to coffee trade in general and to product upgrading in particular. But whether FDI may be linked to more processed trade is uncertain. To measure the connection to FDI inflows, we include the natural logarithm of the latter.

Tariffs are a highly controversial component of any trade talk or study. Yeats (1998) describes how basic commodities such as iron ore mining in Mauritania are typically shipped to industrial nations for further processing. Afterwards, a fraction of the processed product gets re-exported back to Mauritania. The iron ore example, very much in the mode of traditional trade flows, is somewhat analogous to today’s coffee industry. Low-income coffee-growing countries and industrialized coffee-importing countries exhibit a certain degree of path dependency, each specializing in its comparative advantage (coffee-growing vs. processing).

Since we do not have data on tariffs directly related to coffee, we included import tariffs for agricultural products as a proxy. On the one hand, lower tariffs may strengthen the specialization of the respective countries in the tasks where they possess a comparative advantage. This implies that the existing division of labour in harvesting and processing may be intensified, enhancing the exports of all kinds of coffee products, but lowering the unit price of exported green coffee and keeping coffee-growing countries from taking over more processing work. On the other hand, countries with lower tariffs are considered to be more open to the world economy. This openness implies they may import inputs (green coffee, machines and equipment) for future processing work at a lower cost. This would lead to more functional upgrading in coffee-growing countries. In other words, we expect negative correlations between tariffs and coffee trade, but not necessarily between tariffs and GVC upgrading.

3.3.4 | Industrial Capacity

Countries with a higher domestic industrial capacity have a more established tradition in trade (Fernandes et al. 2022). Moreover, the coffee industry can build on the knowledge stock of other industries or of the workforce. In the context of the coffee GVC, we expect a country's domestic industry capacity to drive exports of processed coffee. Accordingly, industrial capacity is also expected to co-determine the extent to which countries engage in GVC upgrading. We proxy domestic industrial capacity with the natural logarithm of manufacturing value-added as a percentage of GDP.

3.3.5 | Institutional Quality

Institutional quality, as often proxied by a country's political stability, is an important factor, enabling firms to invest in production techniques and to work with longer time horizons. We use the Political Stability Index, part of the World Bank Worldwide Governance Indicators, for the analysis (World Bank 2020b). The index measures the perception of the likelihood of political instability and/or politically motivated violence, including terrorism. On the one hand, lower political stability demotivates long-term costly investments—from home or abroad—in processing work. This leads to fewer exports of processed coffee. On the other hand, lower political stability may not necessarily reduce the willingness of coffee traders to buy coffee beans from the coffee-growing countries concerned. In this case, more efforts will probably be invested by coffee buyers to develop and maintain their long-term direct relationships with coffee growers and the local authorities, ensuring stable and more reliable access to green coffee. Lower political stability thus does not necessarily hinder green coffee exports.

3.3.6 | Macroeconomic Factors

Macroeconomic factors shed light on the importance of the overall economic environment. Exchange rates can represent a source of comparative (dis-)advantage. We capture exchange rate changes using a variable linked to depreciation. On the one hand, an unexpected depreciation makes exports cheaper and may thus help to boost exports. On the other hand, depreciation makes imports costlier, which in turn increases production costs. It also drives up international transportation costs, for example, fuel costs. When we consider the industry-specific features of coffee, we expect a rather negative correlation between depreciation and green coffee exports. For the planting of coffee plants and the cultivation of coffee beans, coffee growers often rely on imports such as fertilizers, insecticides and pesticides. Additionally, the bulk of green coffee needs to be transported within countries and continents to ports and to be exported over a long distance to overseas roasteries located (mainly) in the Global North.

3.3.7 | Other Coffee-Related Variables

We include a set of coffee-specific variables, designed to capture integration into the coffee GVC. First, we consider a dummy

for being a coffee-growing country, where Arabica dominates, and a dummy to characterize a coffee-growing country, where Robusta dominates. We expect that those specializing in Robusta coffees may well conduct proportionately more coffee processing than those specializing in Arabica coffees since the former is usually used for producing lower-priced soluble coffee that is easier to transport over long distances.

An additional control variable is the natural logarithm of coffee consumption per capita. Strong domestic demand for coffee might further incentivize domestic production and processing capabilities. Accordingly, we would expect a positive correlation between coffee consumption and exports.

3.3.8 | Supplementary Variables

Finally, we control for some country-specific factors. One of these supplementary variables is the natural logarithm of GDP per capita. This denotes the relative wealth of countries. Smallholder farmers in relatively less wealthy countries are likely to harvest coffee but may fail to upgrade their production towards higher quality or processed coffee. Accordingly, these poorer coffee-growing countries may fail to capture any gains in value added. Moreover, we also use the natural logarithm of a country's population to control for size effects. A larger population might enable larger-sized coffee cultivation and higher coffee trade, irrespective of any differences in (domestic) market demand (Table 1).

4 | Results

4.1 | Stylized Facts

Before presenting our estimation results, we analyse in this section how the different forms of coffee exports have been evolving over the past three decades. We examine the changing patterns of regional concentration and market dominance in the sector and show the evolution of different country groups in realizing functional and product upgrading over time.

In our introduction, we emphasized the importance of coffee in the global economy. Figure 1 illustrates how this importance evolved from 1991 to 2018 (Figure 1). Although coffee exports

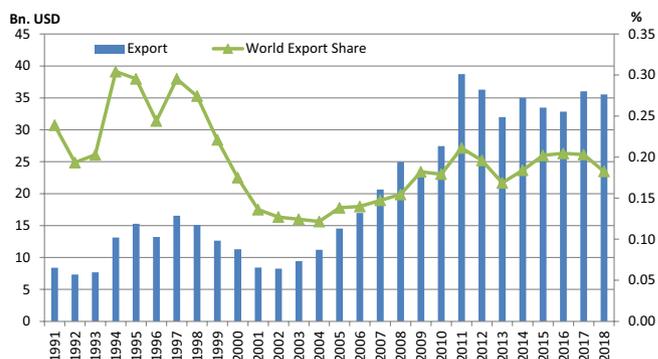


FIGURE 1 | Development of coffee exports over time. Note: Export in current value. Source: ICO (2020b) and UNCTAD (2020a).

represent merely circa 0.20% of global exports in 2018, this value belies the growing value of traded coffee, with export revenues hovering around the \$30–\$40 billion mark for the most recent years of the research period.⁷

The overall growth in coffee exports is, however, not reflected in proportionate export growth for coffee, in all its various forms. Table 2 shows that the growth rates of roasted coffee

TABLE 2 | Growth rates of coffee exports in % (2015–2018 vs. 1991–1994).

	Constant value (price of 2015)	Volume
Green coffee export	65.98	57.19
Roasted coffee export	577.43	397.06
Soluble coffee export	132.56	221.83

Note: The growth rate is calculated as follows:

$$\left(\frac{\sum_{t=2015}^{2018} X_t - \sum_{t=1991}^{1994} X_t / \sum_{t=1991}^{1994} X_t}{\sum_{t=1991}^{1994} X_t} \right) * 100\%$$
 where X refers to the respective export activity considered.
 Source: ICO (2020b).

exports from 1991–1994 to 2015–2018—both at constant prices and in volumes—were the highest among the three forms of coffee traded, followed by the growth rates for soluble coffee and those for green coffee. Roasted coffee exports increased by an almost six-fold multiple (in value terms) and a four-fold multiple (in volume terms), while green coffee exports only increased by 66% and 57%, respectively. Figure 2 additionally shows that roasted coffee exports enjoyed a much higher growth rate in per-unit value than both the soluble and green coffee forms. These developments suggest an increasing premium for roasted coffee production and exports.

Dividing the world into its familiar trading blocs, we can illustrate how the processing of coffee tends to be highly specialized, concentrated in the coffee-consuming wealthier nations (Figures 3 and 4). In 2018, Europe (non-EU), the EU and North America together accounted for more than 96% of roasted coffee exports. Their dominance in soluble coffee was somewhat weaker.

This, however, does not necessarily mean that countries in regions beyond Europe (non-EU), the EU and North America refrained from the more profitable export trade in processed coffee

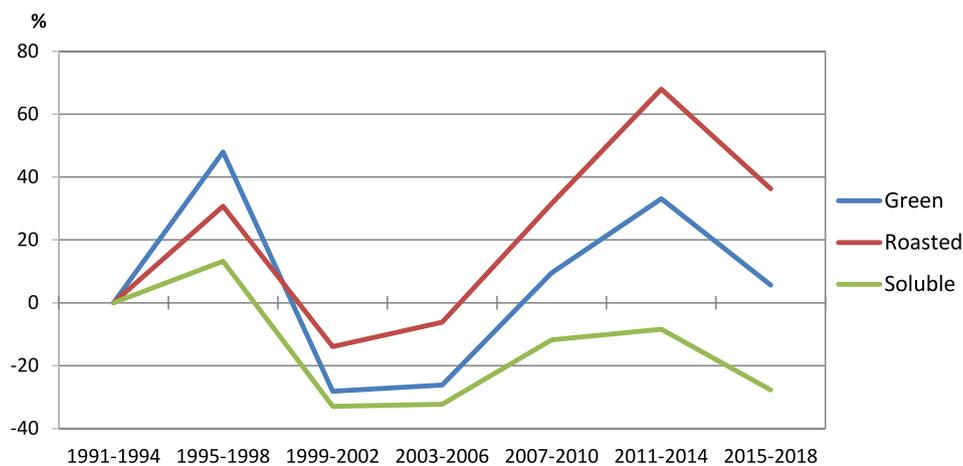


FIGURE 2 | Growth rate of per unit value (product-specific price). Note: The growth rate of price is calculated in the same way as in Table 1, that is, the per unit export value in the first period (1991–1994) are used as base prices. The per unit export value is calculated by dividing the inflation-adjusted export value by export volume. Source: ICO (2020b).

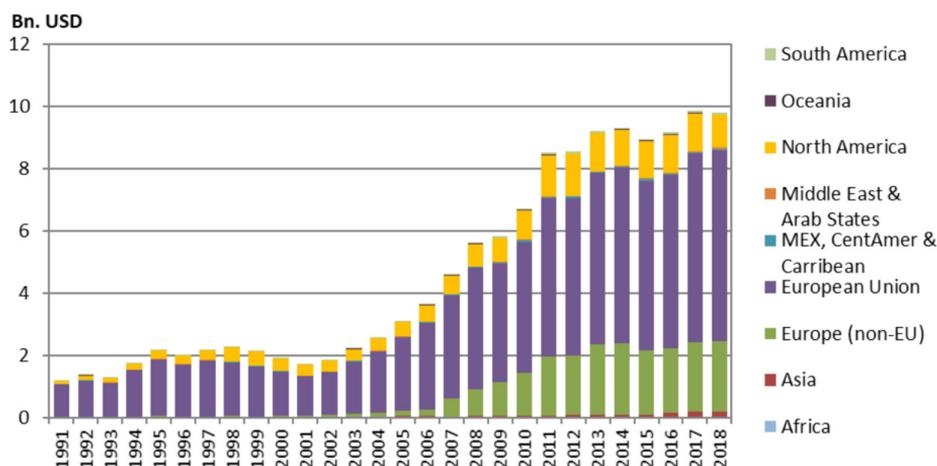


FIGURE 3 | Regional distribution of the roasted coffee trade over time. Note: Export in constant value. Source: ICO (2020b).

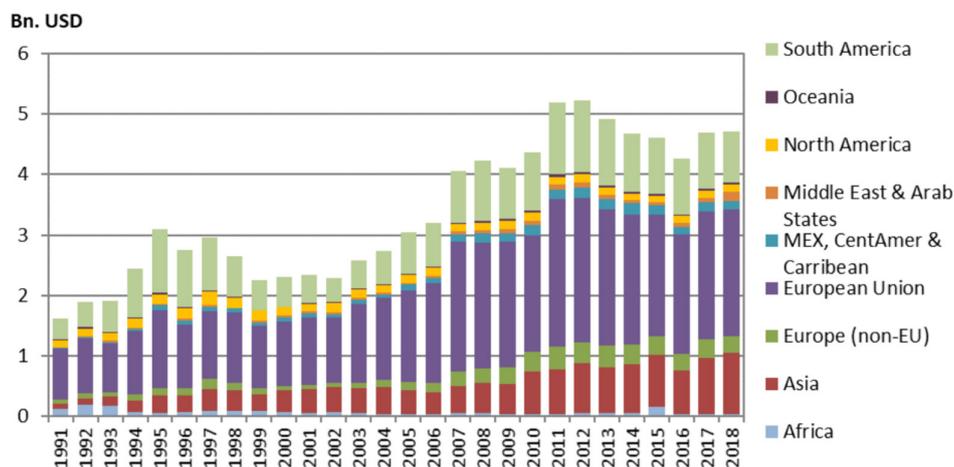
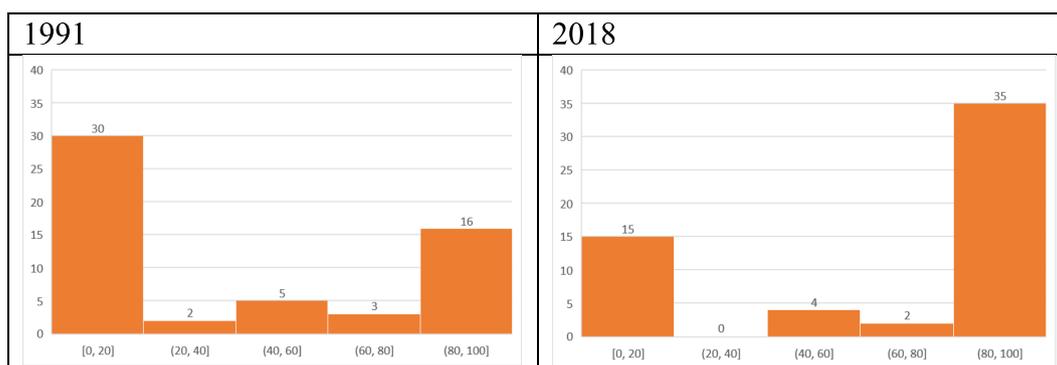


FIGURE 4 | Regional distribution of the soluble coffee trade over time. *Note:* Export in constant value. *Source:* ICO (2020b).

(a) Countries in North America, Europe (non-EU) and the EU (#56)



(b) Countries in other regions (#184)

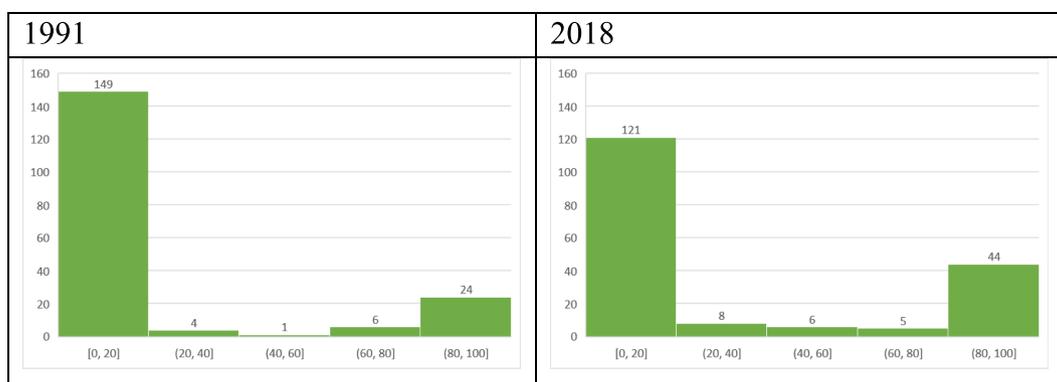


FIGURE 5 | Number of countries by share of processed coffee exports in relation to their total coffee exports (%)—1991 vs. 2018. *Note:* For countries without coffee export activity in the years concerned, their share is assumed to be zero for the figure here. *Source:* ICO (2020b).

in 2018, as decades before. Figure 5 reveals that more countries in these regions enhanced their processed coffee exports in relation to their total exports over time.⁸ However, the relative number of countries with higher shares of processed coffee exports in the regions was much smaller than that in Europe (non-EU), the EU and North America.

In summary, higher value-added processing is dominated by the wealthier coffee-consuming nations, mainly in Europe (non-EU), the EU and North America. Countries in other

regions did make some—rather limited progress—in functional upgrading, that is, moving towards exporting more processed coffee, particularly soluble coffee.

4.2 | Estimation Results

As described above, we capture different forms of a country's integration into the coffee GVC: exports and upgrading (functional and product). We now examine each of these in turn.

4.2.1 | Determinants of Coffee Exports

Table 3 depicts the empirical results for the correlates of a country's coffee exports. The first column includes the export value of all forms of coffee, while each of the columns (2) to (4) focuses on a specific coffee form (green, soluble or roasted). Statistically, a high R-squared reveals that our specifications explain much of the between-country variation.

The results illustrated in Table 3 show that the sign of the coefficient of many of the variables is as expected. There is only a weak negative relationship between resource endowments and exports of green and soluble coffee. Accordingly, resource endowments and the resulting competition for inputs such as labour do not appear to hinder the establishment of a soluble coffee industry as successfully initiated by India, Indonesia, Vietnam and Ecuador. For roasted coffee, in contrast, the data suggest a stronger negative relationship with exports.

Concerning capital endowments, there is, as expected, a significant and positive connection between capital endowments for exports of soluble and roasted coffee. Bringing out processed coffee products necessitates a higher injection of capital.

Countries with larger land acreage where coffee can be cultivated as defined by the 'coffee suitability' measure are exporting less coffee, irrespective of the form of coffee, than others. A likely reason for this finding is that the land can also be assigned for alternative usage. Moreover, countries with smaller areas of suitable land can also account for relatively more coffee exports with higher cultivation intensity.

The variable distance to processing hubs picks up the correlation with geographic agglomerations (e.g., Ellison and Glaeser 1997; Ellison et al. 2010). The existence of a longer distance deters remotely located countries from taking over the processing work and thus discourages them from being more intensively engaged in soluble and roasted coffee exports.

Green coffee exports are, however, not impeded by longer distances between countries and the processing hubs. This finding is not surprising, considering the low degree of processing required for green coffee immediately following harvesting, and the fact that green coffee is inevitably required for the follow-up processing work for other coffee products, irrespective of where the processing work takes place.

The existence of domestic industrial capacity favours exports of soluble coffee. This result is also in line with expectations and with Fernandes et al. (2022) that show that 'larger domestic industrial capacity is associated with higher forward GVC participation' (Fernandes et al. 2022: p.355).

As to FDI, the findings are in line with our expectation of a positive FDI and coffee export nexus only for soluble coffee. However, we refer to the relatively broad measure applied because we cannot limit the FDI inflows to the coffee sector. Results relating to the connection between tariffs and the coffee trade are, however, contrary to expectations. Simply lowering tariffs seems not to be spontaneously linked to the increased coffee trade.

Another highly interesting finding is the role played by political stability. Political stability is found to be positively and significantly related to coffee exports. It is even so for exports in green coffee, suggesting that although political instability may not be a reason hindering coffee buyers from ensuring green coffee supply via direct relationships and arrangements, a politically more stable environment is preferred.

Depreciation, as expected, is positively linked to exports of processed coffee and negatively connected to green coffee exports. While depreciation improves the comparative advantage of exporters in terms of the exporting price, it also increases the price of inputs necessary for the cultivation and harvesting of coffee. Additionally, transportation becomes more expensive. In line with this, we observe a negative relationship between currency depreciation and green coffee exports. The positive coefficient for exports of processed coffee supports the competitiveness argument.

Unsurprisingly, per capita wealth is positively associated with exports of higher value-added soluble and roasted coffee, as is a larger population size and higher per capita coffee consumption. The latter two variables are connected to increased exports for all coffee varieties. This indicates that a domestic preference for coffee, a large population and high-level wealth appear to build a base for supporting a thriving domestic coffee industry that can also serve the global market.

Finally, when controlling for the dominant coffee variety in coffee-growing countries, results suggest that growing coffee is a plus for the coffee trade, irrespective of the forms of coffee exported. The positive linkage is, however, strongest for unprocessed green coffee exports. Findings related to our control for regional fixed effects suggest that countries in Africa, Central America and the Middle East, where many coffee growers originate, are those exporting more green coffee compared to Asian countries (reference group). Countries in Europe (non-EU), the EU and North America export, instead, more roasted coffee than Asian countries—unsurprising considering the dominance of coffee roasteries in the former regions. What is interesting, however, is the finding showing that these countries export no more or even less soluble coffee than Asian countries, hinting at the steady achievement of Asian countries in taking over this specific coffee segment. Noteworthy, Caribbean, Central and South American countries even show a significantly higher export of soluble coffee than Asian countries.

4.2.2 | Determinants of Functional Upgrading and Product Upgrading

In Table 4, we summarize the results from our regression analysis. The first two columns cover functional upgrading, the third one is for product upgrading. While Column (1) includes all countries of the sample, Column (2) and (3) consider only coffee-growing countries.

Regarding functional upgrading, we find that Asian countries are more successful in climbing the coffee GVC than countries in Africa, Central America or the Caribbean. Interestingly, at

TABLE 3 | Determinants of countries' exports in coffee.

VARIABLES	(1)	(2)	(3)	(4)
	All forms	Green	Soluble	Roasted
	ln (Tot. exp.)	ln (Gr. exp.)	ln (Sol. exp.)	ln (Roa. exp.)
	OLS	OLS	OLS	OLS
(ln) resources rents/GDP	-0.0576* (0.0303)	-0.0668* (0.0374)	-0.0365 (0.0381)	-0.1115*** (0.0403)
(ln) capital/GDP	0.2756 (0.1927)	-0.1667 (0.2124)	1.3900*** (0.2670)	0.4371** (0.2198)
(ln) coffee suitability	-0.3584*** (0.0471)	-0.2272*** (0.0533)	-0.2769*** (0.0507)	-0.0466 (0.0481)
(ln) distance to processing hubs	0.1855 (0.3772)	0.0746 (0.4803)	-1.3629*** (0.4304)	-1.1956*** (0.3769)
(ln) domestic industrial capacity	-0.1203 (0.1781)	-0.7244*** (0.1709)	0.4274* (0.2360)	0.1155 (0.2239)
Tariffs rate (primary)	0.0202* (0.0122)	0.0165 (0.0152)	-0.0128 (0.0186)	0.0070 (0.0132)
(ln) FDI inflows	0.1206** (0.0520)	0.0721 (0.0627)	0.3256*** (0.0666)	0.0876 (0.0614)
Political stability index	0.6279*** (0.1166)	0.6884*** (0.1417)	0.2798* (0.1488)	0.4647*** (0.1304)
Depreciation	0.0032*** (0.0011)	-0.0041** (0.0021)	0.0050*** (0.0018)	0.0052*** (0.0013)
(ln) GDP p.c.	-0.0070 (0.1045)	-0.0310 (0.1284)	0.5406*** (0.1420)	0.6838*** (0.1310)
(ln) population	1.2121*** (0.0629)	1.1088*** (0.0836)	1.2716*** (0.0752)	0.8221*** (0.0734)
(ln) consumption p.c. in kg	0.8381*** (0.0575)	0.8745*** (0.0686)	0.6631*** (0.0901)	0.4550*** (0.0703)
Robusta dominates = 1	6.7175*** (0.4260)	7.9942*** (0.4747)	4.0344*** (0.6128)	1.1395** (0.5564)
Arabica dominates = 1	7.9720*** (0.3937)	9.8166*** (0.4274)	3.0799*** (0.4640)	2.5452*** (0.4618)
Africa	2.2989*** (0.3474)	2.9004*** (0.3906)	1.2730*** (0.4854)	0.5960 (0.4631)
Europe (non-EU)	1.1056*** (0.3937)	-0.0531 (0.5567)	-1.4681*** (0.4612)	1.1715** (0.4731)
European Union	2.8564*** (0.4214)	2.6784*** (0.5178)	-0.1132 (0.4935)	2.6423*** (0.4967)

(Continues)

TABLE 3 | (Continued)

VARIABLES	(1)	(2)	(3)	(4)
	All forms	Green	Soluble	Roasted
	ln (Tot. exp.)	ln (Gr. exp.)	ln (Sol. exp.)	ln (Roa. exp.)
	OLS	OLS	OLS	OLS
Mexico, Central America and Caribbean	0.8653** (0.3597)	1.0973** (0.4410)	1.4953*** (0.4739)	0.4305 (0.4675)
Middle East and Arab States	0.7661*** (0.2949)	1.9572*** (0.3696)	-0.5379* (0.3265)	0.0591 (0.3853)
North America	-0.5603 (0.6363)	-0.4763 (0.8636)	-1.5704*** (0.4319)	2.2996*** (0.4545)
Oceania	3.5645*** (0.4833)	3.3038*** (0.5816)	4.8533*** (0.5532)	2.4791*** (0.5206)
South America	0.5624* (0.3281)	-0.1557 (0.4357)	2.3844*** (0.3907)	-0.3283 (0.4243)
Observations	1814	1596	1459	1461
R-squared	0.6881	0.6649	0.6137	0.6814
Year dummy	Yes	Yes	Yes	Yes
p-value for model test	0.00	0.00	0.00	0.00

Note: Robust standard errors in parentheses (clustered at the country-year level); Asian countries are determined as the reference group for the regional dummies.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

the global scale, Asian countries are also more likely to pursue functional upgrading than European countries (EU and non-EU). Beyond this, the key factors that facilitate functional upgrading are several: capital endowments, availability of land suitable for coffee cultivation, domestic industrial capacity, currency depreciation and being mainly Robusta growers.⁹

The positive result for capital endowments is intuitive. Without (public) spending on infrastructure (e.g., paved roads and shipping ports), it is difficult to integrate into the GVC, including transporting green coffee from the plantation to the processing location, and thereafter transporting the processed coffee to overseas buyers. What is interesting is that the positive connection of capital to functional upgrading is significant for the all-countries sample, but not for the restricted sample of coffee-growing countries. For the latter, the linkage is positive but not significant. This indicates that among coffee growers, their success in functional upgrading is much less dependent on their financial capability. Instead, industrial capacity seems to matter more in this regard. The industrial capacity variable reveals that the presence of this capability supports the establishment of downstream coffee industries. This result applies to both groups of countries considered, but the positive linkage between domestic industrial capacity and functional upgrading is more pronounced for the group of coffee growers than for all. This suggests that a strong domestic manufacturing base, which goes hand-in-hand with accumulated industrial knowledge, general industrial infrastructures and facilities as well as a qualified

workforce, is beneficial for coffee-growing countries to pursue functional upgrading.

The positive correlation between suitable land and functional upgrading suggests that suitable land endowment supports countries to move up the value chain, for example, by using their own production of green coffee to produce soluble coffee.

As to the relevance of currency depreciation for functional upgrading, a positive relationship is only observable when considering the full sample in Column (1). This finding is plausible when recalling the findings above that a currency depreciation is negatively linked to green coffee exports but positively linked to processed coffee exports. The positive competitive advantage through currency depreciation reflected in a reduced export price may help non-coffee-growing countries to further expand their market share in processed coffee exports. For coffee growers, such an advantage might be much less pronounced, considering on the one hand the negative impact of depreciation for their green coffee exports and on the other hand the possibly higher investment costs for the purchase of machines and facilities from abroad, which are needed for taking over more complicated coffee processing work.

Our analysis also shows that different coffee varieties make a difference for coffee growers in terms of permitting functional upgrading. We find a higher functional upgrading activity of

TABLE 4 | Determinants of countries' coffee GVC upgrading.

VARIABLES	(1)	(2)	(3)
	Functional upgrading PPML	Functional upgrading PPML	Product upgrading OLS
(ln) resources rents/GDP	-0.0328*** (0.0046)	-0.0249 (0.0448)	-0.0357** (0.0176)
(ln) capital/GDP	0.2466*** (0.0352)	0.2912 (0.2640)	0.1220* (0.0660)
(ln) coffee suitability	0.0269*** (0.0054)	0.4957*** (0.1171)	-0.0924*** (0.0334)
(ln) distance to processing hubs	-0.3140*** (0.0611)	-4.3166*** (0.7770)	0.1608 (0.1694)
(ln) domestic industrial capacity	0.1484*** (0.0279)	1.3589*** (0.2130)	-0.2171*** (0.0562)
Tariffs rate (primary)	-0.0112*** (0.0030)	-0.0687*** (0.0167)	-0.0021 (0.0035)
(ln) FDI inflows	-0.0013 (0.0106)	-0.2401*** (0.0708)	0.0426** (0.0176)
Political stability index	-0.0529** (0.0216)	-0.3545*** (0.1065)	-0.1928*** (0.0372)
Depreciation	0.0013*** (0.0002)	0.2139 (0.7443)	0.0040 (0.1565)
(ln) GDP p.c.	0.1520*** (0.0230)	0.8870*** (0.1127)	0.1417*** (0.0331)
(ln) population	-0.0304*** (0.0103)	-0.2985** (0.1360)	-0.0492 (0.0321)
(ln) consumption p.c. in kg	-0.0381*** (0.0145)	-0.3260*** (0.0578)	-0.0445*** (0.0141)
Robusta dominates = 1	-1.1280*** (0.0880)	1.8843*** (0.4153)	-0.6389*** (0.0722)
Arabica dominates = 1	-1.6252*** (0.0872)		
Africa	-0.6248*** (0.0609)	-3.1004*** (0.5723)	-0.3281*** (0.1241)
Europe (non-EU)	-0.2043*** (0.0557)		
European Union	-0.4248*** (0.0652)		
Mexico, Central America and Caribbean	-0.6416*** (0.1112)	-0.5413 (0.6297)	-0.2054 (0.1288)

(Continues)

TABLE 4 | (Continued)

VARIABLES	(1)	(2)	(3)
	Functional upgrading PPML	Functional upgrading PPML	Product upgrading OLS
Middle East and Arab States	-0.3474*** (0.0471)		
North America	0.2921*** (0.1108)	1.3787* (0.8040)	-0.5582*** (0.2050)
Oceania	0.1314** (0.0667)		
South America	0.1978*** (0.0507)	0.5907 (0.5686)	-0.5588*** (0.1300)
Observations	1814	603	598
(Pseudo) R-squared	0.134	0.269	0.5898
Year dummy	Yes	Yes	Yes
Sample	All countries	Only coffee growing	Only coffee growing
p-value for model test	0.00	0.00	0.00

Note: Robust standard errors in parentheses (clustered at the country-year level). Asian countries are determined as the reference group for the regional dummies.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Robusta growing countries vs. Arabica growing countries. This is in line with a more stringent entry barrier for firms aiming to export roasted vs. soluble coffee, where Robusta serves as the main input for the latter.

Several factors are found to hamper a country from climbing the coffee GVC via functional upgrading: distance to processing hubs, tariffs, FDI (for coffee-growing countries) and political stability. Coffee-growing countries, in particular, remote from countries where processing gets carried out, are, as expected, more likely to stay with exporting coffee in the green form. This is in line with the finding above of a negative linkage between geographic distance and processed coffee exports. When we include tariffs for primary goods, these are seen to punish the industrial coffee sector, reducing the profitability of any processed product and thus reducing the shares in the countries' total coffee exports. This result is most striking, suggesting the crippling effect of tariffs. FDI is found to be negatively linked to functional upgrading for coffee growers. Jointly with the positive relevance of FDI for coffee trade as found above, this suggests that FDI inflows may, driven by the motivations of coffee buyers, help to expand the existing coffee trade, irrespective of coffee forms. However, FDI is not used to help develop local processing work for the global market. In other words, FDI rather aims at further deepening the existing comparative advantage of the FDI host countries, ensuring that the investment is likely to benefit the investing firms instead of aiming at creating future competitors. The finding of a negative connection between political stability and functional upgrading is, however, surprising. It might

be explained by the importance of direct relations between buyers and sellers within the coffee sector and the reduced importance of the state. This also seems to be valid for upgrading along the value chain. Overall, we interpret this finding with caution and should emphasize that the coefficients for functional upgrading turn insignificant once we exclude two major actors in the coffee GVC, namely Vietnam and Brazil.¹⁰

In terms of resource endowments, we find that higher endowments are negatively correlated with functional upgrading in the full sample. Focusing on coffee-growing countries, such a relation is not observable. The latter matches our previous finding on soluble coffee exports, which are not related to resource endowments. However, the establishment of a roasted coffee industry is less likely to be observed in the case of resource-rich countries.

In line with expectations, a country's economic development, measured by per capita GDP, positively correlates with functional upgrading. This result is evidenced in both columns. Generally, wealthier countries are equipped with better opportunities to climb the coffee GVC. Although countries with a larger population size were found to export more coffee irrespective of coffee forms (Table 3), they are not found more likely to conduct functional upgrading. This suggests that a wealthy country with a relatively small population can also succeed in functional upgrading to enhance its processed coffee share in exports over time. Similarly, reduced local consumption seems to present no barrier for countries in conducting functional upgrading for a higher share of processed coffee exports.

Column (3) in Table 4 reports the results of product upgrading. What matters in the same way for both functional and product upgrading are resource endowments, capital endowments, political stability, country wealth (GDP p.c.) and domestic coffee consumption. While the financial capability of a country is positively connected to countries' GVC upgrading, resource endowments and political stability are not. Wealthier countries, even with reduced consumption, are more likely to step into a higher-quality green coffee market.

There are, however, some interesting differences between the determinants of functional upgrading and product upgrading. Firstly, countries with a larger industrial capacity are positively associated with functional upgrading but negatively with product upgrading. Less developed countries, which cannot build upon a strong industrial base, can still go the route of quality improvements (product upgrading), thereby raising the price they can ask for their green coffee. Quality improvements can be achieved through the application of low-cost innovations such as washing stations or labour-intensive selective picking. Secondly, there is a negative linkage between the availability of land suitable for coffee cultivation and product upgrading. This suggests that countries with reduced endowments of suitable land may be specialized in higher quality coffee, extracting further value from their green coffee exports. Thirdly, a longer distance to processing hubs is negatively linked to functional upgrading but not related to product upgrading. This indicates that countries with a longer distance to processing hubs, which are also major consumption regions, tend to work more on improving the quality of coffee beans than on producing processed coffee products to serve these markets.

Moreover, inflowing FDI is more advantageous for coffee-growing countries to carry out product upgrading, where the investors can benefit from better access to high-quality green coffee. Due to generally higher quality and thus higher prices required for the Arabica coffee variety than for Robusta, it is thus no surprise to observe that countries that dominate in growing Robusta coffee tend to have lower average export revenues for their exported green coffee. Robusta growers' willingness to conduct product upgrading is also more limited than Arabica growers. Interestingly, no significant correlation is found between product upgrading and tariffs and currency depreciation. All findings on product upgrading are robust against excluding Vietnam and Brazil from the sample (Table A2).

5 | Conclusions

Developing countries frequently struggle to generate wealth from trade in agri-commodities such as coffee. In this paper, we analysed the factors relevant for countries' participation in the global coffee value chain, using unique cross-border data for 28 years (1991–2018).

Our empirical analysis reveals a striking pattern: while green (unprocessed) coffee exports have increased, the highest value-added has been captured through sales of roasted coffee. The roasted coffee market remains overwhelmingly dominated by high-income countries in the Global North. This indicates that lead firms in the Global North have consolidated

their dominance over the most lucrative segments of the coffee trade. Several factors contribute to this pattern. Roasted coffee is primarily processed and sold in high-income countries, largely due to concerns about perishability and the logistical challenges of long-distance transport. However, another crucial factor is that Global North multinationals may have a vested interest in maintaining control over roasting, packaging and branding—activities that yield the highest profits. This persistent concentration of economic gains aligns with existing studies on lead firms, power asymmetries and the limitations of Corporate Social Responsibility (CSR) as a tool for redistributing value added more equitably (Levy et al. 2016; Grabs and Ponte 2019; Touboulic et al. 2020). While this trend presents clear disadvantages for Global South producers, our findings also highlight a more nuanced picture. Examining the two primary coffee varieties—Arabica and Robusta—reveals an important distinction. Some Global South countries, particularly those with stronger industrial capabilities, have managed to capture a larger share of value added from Robusta coffee. Vietnam, in particular, stands out as a success story, leveraging its domestic technology base to process Robusta into soluble coffee, which is less sensitive to perishability concerns. This case illustrates how technology acquisition and industrial capacity can enable Global South actors to partially subvert the dominance of the Global North, as suggested in previous studies (MacCarthy et al. 2016). Despite such a success story, we find no evidence of a Global South lead firm emerging to challenge Global North dominance on a global scale. This raises an important question: given the empirical realities we have identified, what strategies can governments, international organizations and NGOs pursue to counteract these persistent power asymmetries and foster more equitable participation in the coffee GVC?

As always, our study is not free of limitations. While our cross-country analysis captures broad structural patterns, it does not fully reflect the lived experiences of smallholder farmers who form the backbone of global coffee production. Nonetheless, we believe our findings provide valuable insights for policymakers and practitioners aiming to foster greater value creation in developing and emerging economies along the coffee value chain. Our policy recommendations depend on the agricultural and industrial capabilities of each country.

5.1 | Product Upgrading for Countries Growing Arabica Coffee

In countries where Arabica dominates cultivation, one viable strategy is product upgrading—improving coffee quality through practices such as washing stations and selective picking (a labour-intensive but value-enhancing approach) but also through utilizing new digital technologies to better deal with, for example, weather conditions. Our analysis shows that foreign direct investment (FDI) can facilitate this upgrading process, enabling producers to capture increased value added. However, product upgrading alone is unlikely to yield transformative economic gains, as the highest value remains concentrated in downstream processing. The success of this strategy, therefore, depends on securing higher prices through quality differentiation and certification schemes.

5.2 | Functional Upgrading for Countries Growing Robusta Coffee

Countries with a strong industrial base have greater potential for functional upgrading—expanding into processing activities such as soluble coffee production. Our findings indicate that domestic industrial capacity is a key determinant of success in this area, underscoring the importance of infrastructure investment and knowledge transfer. For Global South producers to serve beyond regional markets at a larger scale, greater access to international distribution networks and targeted support for technology acquisition will be necessary.

5.3 | Leveraging Geographic and Structural Advantages

Interestingly, our analysis also finds that Global South countries with less suitable land for coffee cultivation tend to extract proportionally more value from smaller coffee volumes. This suggests that some suppliers are strategically maximizing returns on limited production through quality differentiation. Similarly, countries located farther from major processing hubs appear to compensate by investing in higher-quality green coffee exports. These findings reinforce the notion that suppliers tend to play to their comparative advantages, but targeted interventions—such as investment in certification schemes and marketing strategies—could help them further enhance their position in the value chain.

5.4 | Strengthening Sustainable and Niche Market Strategies

One promising avenue for Global South producers is positioning themselves within niche markets for sustainable and specialty coffee. For instance, London's Kew Gardens is actively researching wild coffee strains with lower environmental footprints, for which farmers can command price premiums. However, while sustainability certification schemes have worked well in industries such as cocoa, their effectiveness in coffee remains limited. Unlike cocoa, which is cultivated in a small number of countries, coffee production is geographically dispersed, weakening the bargaining power of individual producing countries. Addressing this challenge requires coordinated efforts among producing countries to strengthen their collective influence in global markets.

5.5 | Holding Lead Firms Accountable for Equitable Value Distribution

Ultimately, the role of multinational corporations is pivotal in shaping a fairer distribution of profits along the coffee supply chain. Unfortunately, evidence suggests that major brands often fail to meaningfully engage with the needs of supplier countries in the Global South (Bager and Lambin 2020). A study by McCarthy et al. (2018) found that at least one major multinational firm had significantly overstated its sustainability commitments in its advertising narratives. This case underscores the broader limitations of CSR in addressing

power imbalances in global supply chains. Developing more substantive mechanisms for technology transfer and engaging more supplier participation in multi-tiered production processes are essential for more positive prospects for coffee-growing countries.

In sum, our analysis highlights the entrenched power asymmetries in the coffee GVC but also points to potential pathways for Global South producers to capture more value. While functional upgrading offers opportunities for Robusta growing countries with industrial capacity, product upgrading can enable Arabica producers to command price premiums—though neither strategy alone is a silver bullet. Sustainable niche markets and improved producer coordination may help, but the most significant structural barriers remain tied to the dominance of multinational lead firms. Meaningful change will require policy interventions that facilitate industrial development, reduce trade barriers, and, crucially, hold major brands accountable for their role in shaping the distribution of value added in the coffee industry.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Stata is used for running the analysis. All results are reproducible. Do-files are available on request. The data used for the analysis was provided by the International Coffee Organization (www.ico.org). Due to copyright issues, we would not be able to share the data directly; however, interested readers could contact ICO for data enquiry.

Endnotes

¹ Our analysis of the ICO dataset with evidence-based research insights made contributions to the ICO annual flagship report 'Coffee Development Report 2020' (ICO 2021). ICO with (major) coffee exporting and importing countries as its members represent more than 90% of the global coffee production (ICO 2024). The quality and the comprehensiveness of the ICO dataset are supported not only by the neutrality of ICO being an intergovernmental organization in the sector but also by its continuously strong engagement in improving the quality of and transparency on its data collection and in improving the consistency of the data when data provided by ICO members being demonstrably inconsistent or incomplete. Such engagement also includes regular statistics roundtables and on-site knowledge exchanges and trainings in coffee-growing countries in less developed countries in the Global South (e.g., ICO 2017; ICO 2019b).

² This underperformance of African producers in climbing the coffee GVC mirrors the somewhat worrying findings of Foster-McGregor et al. (2015) that African participation in GVCs is mainly in upstream production and there are only limited possibilities for upgrading along GVCs.

³ Besides these forms, value added can also be achieved by increased productivity improvements and decreasing overall costs. Such cost reduction is, however, not possible to monitor, while using trade statistics for the analysis.

⁴ Stata is used for running the analysis. All results are reproducible. Unfortunately, we are not allowed to share the underlying data. However, do-files are available upon request.

⁵ In addition, the years 1997, 1999 and 2001 do not enter the estimation because there is no information on political stability, which we include as an independent variable. The list of countries considered in the analysis and country-specific statistics can be obtained upon request.

⁶ We downloaded country-data of the GAEZ V4 Project provided under crop summary. We use CRUTS32 climate data based on the period 1981–2010. In addition, we use rainfed irrigation, with a low input level. For the land cover classes, protection/exclusion classes and AEZ classes, we use total land. Using historical data matches a large span of our period under investigation. Since coffee smallholders play a major role in coffee cultivation and do not necessarily have good access to inputs, we use rainfed irrigation and low input level. Total land is used because we are interested in the general land endowments related to coffee cultivation.

⁷ According to ICO (2019a), the sector is worth an annual \$200 billion globally. Export revenues represent a non-neglectable fraction of this annual sales.

⁸ Focusing on the six largest green coffee exporting countries, functional upgrading proxied by increasing processed coffee shares is rather observed for Colombia, Indonesia and Vietnam (Figure A1 in the Appendix).

⁹ We should recall, these results are pooled across both forms of functional upgrading—conversion to soluble coffee and roasting.

¹⁰ The tables are part of the Appendix (Tables A1 and A2). The results are very robust against the exclusion, however, some slight differences are observable, e.g., for political stability, resource endowments and regional dummies.

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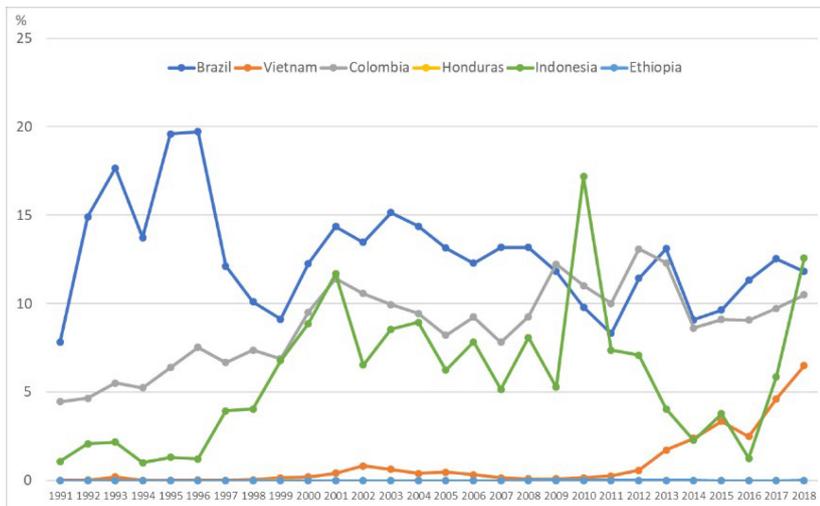
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(a) Functional upgrading (proxied by the share of processed coffee exports in relation to their total coffee exports)



(b) Product upgrading (proxied by the price of exported green coffee in USD per 60 kg bag)

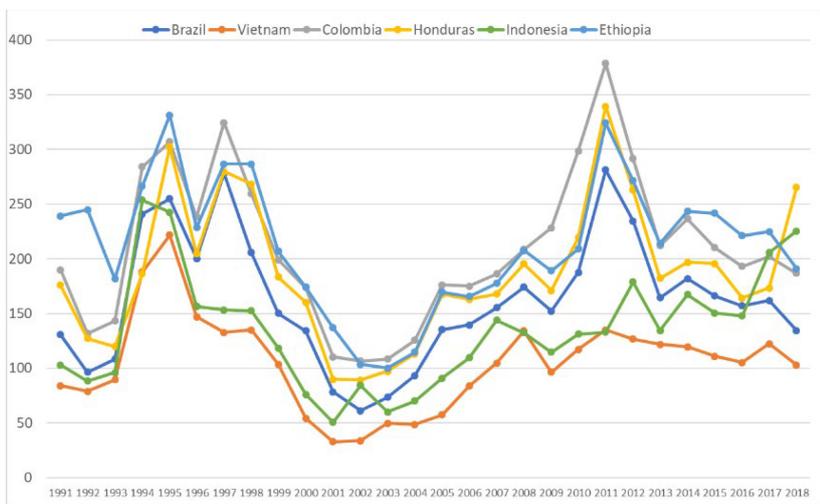


FIGURE A1 | Functional and product upgrading for the six developing countries that exported most green coffee exporters. *Note:* Data for 2015 to 2018 is used for determining the top six countries. *Source:* ICO (2020b).

TABLE A1 | Determinants of countries' exports in coffee—excluding Brazil and Vietnam.

Variables	(1)	(2)	(3)	(4)
	ln (Tot. exp.) OLS	ln (Gr. exp.) OLS	ln (Sol. exp.) OLS	ln (Roa. exp.) OLS
(ln) resources rents/GDP	−0.0582* (0.0302)	−0.0683* (0.0371)	−0.0349 (0.0383)	−0.1108*** (0.0406)
(ln) capital/GDP	0.3022 (0.1908)	−0.1267 (0.2088)	1.3940*** (0.2696)	0.4449** (0.2205)
(ln) coffee suitability	−0.3635*** (0.0485)	−0.2467*** (0.0546)	−0.2807*** (0.0524)	−0.0475 (0.0498)
(ln) distance to processing hubs	0.1304 (0.3882)	0.0556 (0.4885)	−1.3523*** (0.4396)	−1.1976*** (0.3810)
(ln) domestic industrial capacity	−0.0809 (0.1809)	−0.6516*** (0.1729)	0.4467* (0.2415)	0.1202 (0.2273)
Tariffs rate (primary)	0.0195 (0.0122)	0.0128 (0.0151)	−0.0120 (0.0187)	0.0082 (0.0132)
(ln) FDI inflows	0.1076** (0.0515)	0.0506 (0.0612)	0.3210*** (0.0672)	0.0835 (0.0621)
Political stability index	0.5147*** (0.1231)	0.4484*** (0.1447)	0.2554 (0.1607)	0.4448*** (0.1385)
Depreciation	0.0033*** (0.0011)	−0.0040** (0.0021)	0.0050*** (0.0018)	0.0052*** (0.0013)
(ln) GDP p.c.	0.0888 (0.1093)	0.1441 (0.1319)	0.5619*** (0.1541)	0.7033*** (0.1396)
(ln) population	1.1992*** (0.0631)	1.0767*** (0.0836)	1.2679*** (0.0759)	0.8219*** (0.0738)
(ln) consumption p.c. in kg	0.8013*** (0.0591)	0.7978*** (0.0706)	0.6505*** (0.0952)	0.4463*** (0.0745)
Robusta dominates = 1	6.5551*** (0.4261)	7.7898*** (0.4706)	4.0145*** (0.6197)	1.0943* (0.5589)
Arabica dominates = 1	7.9322*** (0.3913)	9.7745*** (0.4217)	3.0683*** (0.4643)	2.5297*** (0.4620)
Africa	2.4877*** (0.3583)	3.2507*** (0.4025)	1.3076*** (0.5017)	0.6195 (0.4725)
Europe (non-EU)	1.1434*** (0.3947)	0.0488 (0.5564)	−1.4522*** (0.4667)	1.1820** (0.4739)
European Union	2.9086*** (0.4264)	2.8394*** (0.5200)	−0.0828 (0.5045)	2.6616*** (0.5000)
Mexico, Central America and Caribbean	1.0430*** (0.3725)	1.4665*** (0.4502)	1.5443*** (0.5013)	0.4660 (0.4885)
Middle East and Arab States	0.7416** (0.2943)	1.9108*** (0.3693)	−0.5505* (0.3260)	0.0539 (0.3868)

(Continues)

TABLE A1 | (Continued)

	(1)	(2)	(3)	(4)
	ln (Tot. exp.)	ln (Gr. exp.)	ln (Sol. exp.)	ln (Roa. exp.)
Variables	OLS	OLS	OLS	OLS
North America	-0.4146 (0.6424)	-0.1357 (0.8618)	-1.5113*** (0.4627)	2.3348*** (0.4699)
Oceania	3.7348*** (0.4852)	3.6140*** (0.5849)	4.8771*** (0.5601)	2.5035*** (0.5260)
South America	0.6372* (0.3365)	-0.1129 (0.4491)	2.3712*** (0.3981)	-0.3207 (0.4319)
	-0.0582*	-0.0683*	-0.0349	-0.1108***
Observations	1780	1562	1425	1430
R-squared	0.6778	0.6522	0.6008	0.6810
Year dummy	Yes	Yes	Yes	Yes
p-value for model test	0.00	0.00	0.00	0.00

Note: Robust standard errors in parentheses (clustered at the country-year level); Asian countries are determined as the reference group for the regional dummies.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

TABLE A2 | Determinants of countries' GVC upgrading—excluding Brazil and Vietnam.

Variables	(1)	(2)	(3)
	Functional upgrading PPML	Functional upgrading PPML	Product upgrading OLS
(ln) resources rents/GDP	−0.0334*** (0.0047)	−0.1653*** (0.0526)	−0.0224 (0.0198)
(ln) capital/GDP	0.2424*** (0.0350)	0.3479 (0.2630)	0.1236* (0.0705)
(ln) coffee suitability	0.0304*** (0.0056)	0.8823*** (0.1532)	−0.1562*** (0.0535)
(ln) distance to processing hubs	−0.3220*** (0.0610)	−5.1778*** (0.7739)	0.3002* (0.1770)
(ln) domestic industrial capacity	0.1332*** (0.0278)	0.9700*** (0.2253)	−0.1957*** (0.0540)
Tariffs rate (primary)	−0.0114*** (0.0030)	−0.0573*** (0.0166)	−0.0022 (0.0037)
(ln) FDI inflows	0.0025 (0.0105)	−0.1910*** (0.0735)	0.0518*** (0.0194)
Political stability index	−0.0247 (0.0214)	−0.1002 (0.1316)	−0.2015*** (0.0498)
Depreciation	0.0012*** (0.0002)	0.1074 (0.7356)	0.0420 (0.1596)
(ln) GDP p.c.	0.1273*** (0.0230)	0.8375*** (0.1237)	0.1169*** (0.0338)
(ln) population	−0.0262** (0.0103)	−0.4229*** (0.1439)	−0.0310 (0.0337)
(ln) consumption p.c. in kg	−0.0247* (0.0146)	−0.2397*** (0.0654)	−0.0414*** (0.0154)
Robusta dominates = 1	−1.0731*** (0.0857)	1.5277*** (0.3923)	−0.6102*** (0.0694)
Arabica dominates = 1	−1.5862*** (0.0882)		
Africa	−0.6689*** (0.0615)	−3.3193*** (0.5577)	−0.3059** (0.1267)
Europe (non-EU)	−0.2256*** (0.0552)		
European Union	−0.4540*** (0.0649)		
Mexico, Central America and Caribbean	−0.7007*** (0.1141)	−1.3051** (0.6212)	−0.1823 (0.1298)
Middle East and Arab States	−0.3378*** (0.0465)		

(Continues)

TABLE A2 | (Continued)

Variables	(1)	(2)	(3)
	Functional upgrading PPML	Functional upgrading PPML	Product upgrading OLS
North America	0.2398** (0.1076)	0.8083 (0.8132)	-0.5850*** (0.2028)
Oceania	0.1025 (0.0671)		
South America	0.1995*** (0.0508)	0.3959 (0.5691)	-0.5874*** (0.1339)
Observations	1780	569	564
(Pseudo) R-squared	0.129	0.281	0.5795
Year dummy	Yes	Yes	Yes
Sample	All countries	Only coffee growing	Only coffee growing
p-value for model test	0.00	0.00	0.00

Note: Robust standard errors in parentheses (clustered at the country-year level). Asian countries are determined as the reference group for the regional dummies.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.