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Pass-through of cocoa prices along the supply chain: What's left for farmers in Côte D'Ivoire?

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Pass-Through of Cocoa Prices Along the Supply Chain: What's Left for Farmers in Côte D'Ivoire?

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Gunther Bensch, Kathrin Kaestner, and Colin Vance¹

Pass-Through of Cocoa Prices Along the Supply Chain: What's Left for Farmers in Côte D'Ivoire?

Abstract

Cocoa farmers in Côte d'Ivoire face precarious livelihoods. Low farm-gate prices that are a fraction of the world market price compel land-extensive farming practices that perpetuate a cycle of poverty and environmental degradation. This paper seeks to understand the drivers of the low pass-through of cocoa prices in the world's largest cocoa-producing country and to identify potential inefficiencies and remedies. The analysis comprehensively covers price formation along all segments of the in-country supply chain. Our approach couples econometric analyses using secondary cocoa price data and primary farm household survey data with qualitative assessments of institutional factors specific to the cocoa value chain in Côte d'Ivoire. Notwithstanding the country's highly regulated system of setting cocoa prices, we do not find evidence for inefficiencies that would explain persistently low farm-gate prices. Nor do we find that the recently introduced "Living Income Differential", a price premium on internationally traded cocoa, has benefited farmers. We conclude by advocating for the international cocoa industry to strengthen its development programmes in cocoa-growing communities, complemented by government provision of infrastructure and other public goods. Such efforts can ultimately serve to increase the opportunity cost of cocoa production, drawing farmers into other employment sectors while improving the resilience and livelihoods of those who remain.

JEL-Codes: O12, O13, Q11

Keywords: Cocoa; pass-through; price; policy impact; value chain

August 2023

¹ Gunther Bensch, RWI; Kathrin Kaestner, RWI; and Colin Vance, RWI and Constructor University. - This work was financially supported by the German Federal Ministry of Food and Agriculture (BMEL) based on a decision of the Parliament of the Federal Republic of Germany, granted by the Federal Office for Agriculture and Food (BLE; grant number 2817HS010 / 2818HS010). We would like to thank Pascal Tillie for the valuable exchange that helped us develop our sample design for the field survey. We are also thankful for feedback by participants of the 2022 Merian Institute for Advanced Studies in Africa (MIASA) conference on "Policies for a sustainable rural transformation in Africa" in Accra, Ghana. Special thanks go to Arouna Kouassi and the enumerator team from the Brainland Consulting Group who led the farm household data collection in Côte d'Ivoire. - All correspondence to: Gunther Bensch, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: gunther.bensch@rwi-essen.de

1 Introduction

Cocoa is the main cash crop of smallholder farmers in Côte d'Ivoire, the world's largest cocoa producer. More than a third of the population lives off its production, but most farmers face precarious livelihoods that keep them trapped below the poverty line. Low farm-gate prices compel agricultural practices that perpetuate a cycle of poverty and environmental degradation. The prevalence of child labor, along with land extensive cultivation that results in high rates of deforestation, are among the manifestations ([van Vliet et al., 2021](#); [Busquet et al., 2021](#); [Lambin and Furumo, 2023](#)).

As a global commodity that is consumed predominantly in industrialized countries, the conditions surrounding cocoa production have attracted the attention of both producing and consuming countries to identify the causes of the persistently low incomes of cocoa farmers. Several structural features have been highlighted, most of which defy straightforward policy remedies. Low farm productivity is seen as one culprit ([FAO, 2022](#)), partly a consequence of shallow markets for credit ([Suh and Molua, 2022](#)). The highly skewed distribution of value-added in the global supply chain is another, reflected in the concentration of higher-earning processing activities outside of origin countries ([Fountain and Hütz-Adams, 2022](#)). A third, if oft neglected, determinant of cocoa farmers' income is the pass-through of world market prices to the farm gate, that is, the extent to which world price signals are transmitted into domestic prices received by the farmer.

This paper focuses on the latter aspect, analysing the price formation and pass-through along the cocoa supply chain in Côte d'Ivoire to identify reasons why Ivorian farmers receive among the lowest farm-gate prices for cocoa in the world. We undertake a comprehensive analysis of potential factors at different segments of the supply chain, including regulatory mechanisms, fiscal policies, and producer-buyer relationships. To this end, we combine econometric and institutional analyses using secondary quantitative and qualitative data, as well as primary data elicited in a representative nationwide survey of farm households in 2021.

Our study thereby addresses a gap between two strands of the literature. The first strand supplies important macro-level insights on the pass-through in agricultural commodity markets. Following the seminal work by [Mundlak and Larson \(1992\)](#), studies from this strand of the literature pool across various agricultural commodities, mostly to assess variations in the degree of market deregulation and trade liberalisation. [Baffes and Gardner \(2003\)](#) study nine agricultural commodities in eight countries and find that results strongly depend on the level of liberalisation. [Arnade et al. \(2017\)](#) assess the over-time development of pass-through for various agricultural commodities in the Chinese market and observe wide variation across commodities, which may partly be explained by commodity-specific differences in import barriers set by the government.

The second strand furthers our understanding of micro-economic mechanisms underlying pass-through rates in – mostly deregulated – agricultural commodity markets. While some use

short-term pass-through rates as proxy measures of competition and market power (Casaburi and Reed, 2022; Bergquist and Dinerstein, 2020; Hofman and Malan, 2022), others investigate producer-buyer pass-through more directly. Fafchamps and Hill (2008) and Kopp and Sexton (2021) observe that international price increases are transmitted slowly and incompletely to producer prices compared to price decreases for coffee in Uganda and rubber in Indonesia, respectively. This is mainly explained by traders being more aware of downstream price changes than producers, and producers often lacking bargaining power in setting prices vis-à-vis traders, processors and exporters (see also Lambert (2014)). Emran et al.'s (2021) study of the edible oil market in Bangladesh concludes that banning one layer of intermediaries is ineffective in increasing pass-through rates, possibly because intermediaries provide efficiency-enhancing services to downstream traders, not least in the form of credit.

We add to this literature by comprehensively examining the various mechanisms underlying the price pass-through of one specific agricultural commodity, cocoa. We do so for Côte d'Ivoire as the largest cocoa producer with a highly regulated cocoa market, where prices are seasonally fixed for all national market participants. This brings about regulatory mechanisms that are distinct from those in deregulated markets.

In addition, we are, to our knowledge, the first using post-intervention data to analyze the impact of the Living Income Differential (LID), which is a large-scale price intervention introduced in 2019 by Côte d'Ivoire and neighbouring Ghana, the world's second-largest cocoa producer. Boysen et al. (2023) provide ex-ante simulations on the likely impact of the LID and adjustments to it (see also van Vliet et al., 2021 and Waarts et al., 2021). Their main insight is that the potential welfare benefits from the LID vary widely, from zero to sizable, depending on how the policy is implemented and the behavioral response of chocolate manufacturers. Through interviews with industry experts, Staritz et al. (2023) document challenges in the implementation of the LID, with buyers pushing through reductions in other components of the cocoa price to offset the LID.

Following an overview of the institutional background and our data sources, we undertake a systematic assessment of the key links in the cocoa supply chain in Côte d'Ivoire. Among our main findings, we estimate the transmission elasticity of the world market price to local producer prices in Côte d'Ivoire to be close to unity, reflecting nearly perfect pass-through at this juncture. We subsequently provide new insights into the different segments of the pass-through from the world market price to the farm-gate price. We identify some inefficiencies at the interface between the physical and futures cocoa market, whose correction could lead to somewhat higher farm-gate prices. Beyond this, however, we find few indications for price-based interventions that would substantially improve farmer incomes, the LID being the most recent case in point. Absent obvious policy interventions that would increase farm-gate prices or rectify market inefficiencies, we argue that a more promising route is through building on the existing efforts of the international cocoa industry to support community development. Such efforts, when implemented in

coordination with government policies that invest in human capital and infrastructure, can increase the opportunity cost of cocoa production, ultimately drawing farmers out of the sector while improving the livelihoods of those who remain.

2 Institutional background

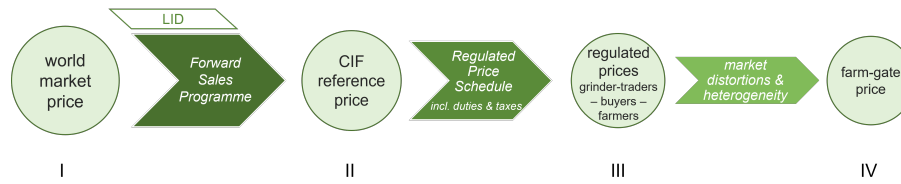
In [Figure 1](#), we identify three links that connect four segments along the cocoa value chain that are key to cocoa price formation and the pass-through of the global price to the farm-gate price in Côte d'Ivoire. Taking the world market price as the point of departure¹, a key subsequent component is a regulatory mechanism called "Forward Sales Programme", or PVAM by the French abbreviation. After a more liberalised period that started in the late 1990s, the Ivorian cocoa sector was re-regulated in 2012. The *Coffee and Cocoa Council* was established as the public institution that has the leading role in carrying out sector regulation, stabilization and development. The main objective of the Forward Sales Programme is to define the regulated prices for all actors of the national value chain for cocoa harvested in the upcoming crop year, which spans from October to September. To this end, the *Council* fixes a reference budget at the beginning of a crop year based on forward and expected spot sales. This reference budget forms the sum of the regulated prices and can be expressed in terms of the per-kg price in local currency that covers all costs to the port of destination, defined as CIF (cost, insurance, and freight price). It is therefore referred to as the "CIF reference price", represented in segment II of [Figure 1](#).

The challenge for the *Council* is to fix this CIF reference price at the beginning of a crop year to eliminate intra-seasonal price risks, especially for producers. To do so, over the course of the six months before a new crop year, the *Council* sells 70 to 80% of next year's crops to exporters via forward sales, with the remaining 20-30% sold through spot contracts during the season. For the forward sales, exporters acquire permits from the *Council* to source a specified quantity of cocoa beans on the domestic market at harvest time for delivery in an agreed month. The forward sales price reached in these transactions fluctuates over the six months, and is the sum of two components. One is the current quotation for cocoa at the London futures exchange, the ICE Futures Europe, which is the exchange for cocoa from West Africa. The second price component is an "origin differential," a price premium that reflects country-level differences in expected cocoa bean quality and supplier dependability. This premium is negotiated in a live fashion by the *Council* and exporters ([Aidenvironment and SFL, 2018](#)).²

¹The literature studying international spot and futures cocoa exchanges suggests that there is little scope for interventions that would substantially improve efficiency – and by extension the pass-through to the farm-gate price. [Ohemeng et al. \(2016\)](#) fail to reject market efficiency based on an analysis of cocoa cash and futures exchanges over the period 1981 to 2009. [Oomes et al. \(2016\)](#) similarly find that, notwithstanding an increase in market concentration among cocoa processors, there is no evidence that market power is exploited to keep prices artificially low. More recently, [Bensch et al. \(2022\)](#) apply multivariate time-series models and machine learning approaches to identify the price determinants for cocoa price trends and daily cocoa returns, concluding that market efficiency at the cash and futures markets cannot be rejected.

²For the 2019/20 season, Côte d'Ivoire's premiums reported at the London futures exchange averaged 12% of average future prices.

Figure 1: Stylized chain of pass-through from global to farm-gate prices



Note: LID abbreviates the Living Income Differential and CIF stands for *Cost, Insurance, and Freight*.

The CIF reference price is the basis to calculate regulated prices for all actors in the national cocoa value chain, represented in segment III of Figure 1. The cocoa value chain in Côte d’Ivoire starts at the farm gate, where predominantly smallholder farmers with plantation sizes below 5 hectares sell dried and fermented, unprocessed cocoa beans to buyers. Three types of buyers exist: cooperatives, local intermediaries (*pisteurs*), and regional intermediaries (*traitants*). *Traitants* are typically located in marketing centers closer to the ports in the south of the country. Like cooperatives, they often have a warehouse to store the beans before delivering them to the final set of actors in the in-country value chain, the companies that handle the export. The majority of these trade companies export the cocoa unprocessed (70% of cocoa beans), with the remainder being processed before shipping into nibs or semi-finished cocoa products, namely liquor, butter, or powder. Given this dual nature of the companies, Staritz et al. (2023) call them “grinder-traders”. A total of around 120 such companies exist in Côte d’Ivoire, with ten companies handling two-thirds of all exports (Ermgassen, 2021). They typically also provide intermediaries with pre-financing and equipment, such as vehicles and weighing equipment.

The regulated prices received by farmers, buyers, and exporters are summarized in a price schedule called *barème* (scale), a system established in the 1950s in Côte d’Ivoire to allocate parts of the export price to different actors along the value chain. All regulated prices are fixed at least for the entire main harvest season; sometimes revised prices are set in April for the side harvest. In the 2019/20 season, for example, around 61% of the CIF reference price accrued to the farmers, which is in alignment with the government’s goal that the producer price not fall below 60% of the CIF reference price.

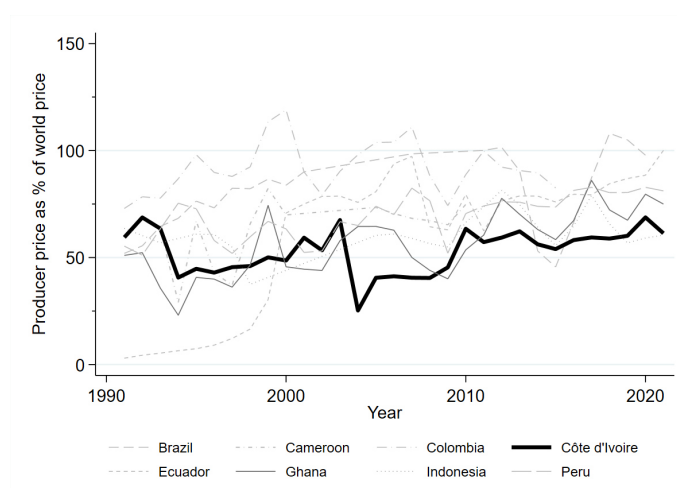
The actual farm-gate price, represented by segment IV in Figure 1, may deviate from the regulated price due to idiosyncratic factors at the site of the transaction, including bargaining outcomes that may reflect market distortions and differences in quality and transport costs.

A strong decline in the world cocoa price in 2016-2017 prompted Côte d’Ivoire and neighbouring Ghana to cooperate on further price regulations. The main intervention is the Living Income Differential (LID), designed as a price premium on top of the world market price for cocoa. With the LID, the two countries aim to leverage their strong market position, which accounts for over 60% of global cocoa production, to ultimately increase the farm-gate price. In Côte d’Ivoire, the LID forms part of the Forward Sales Programme, at the link between segment I and II of Fig-

ure 1. The premium was first incorporated in the regulated price schedule for the cocoa season of 2020/21 and amounts to 400 US dollars per metric tonne of cocoa beans on top of the Free on Board price (FoB) determined in cocoa forward contracts. Being based on a voluntary commitment, however, the LID is crucially dependent on the willingness of international buyers to pay the premium, and its long-term success remains unclear.

One thing is clear: producer prices for cocoa in Côte d’Ivoire remain low. Figure 2 presents producer prices in real US dollars as a percentage of the global cocoa price for the major cocoa producers. Ivorian cocoa farmers are seen to receive among the lowest cocoa prices in the world. The producer price share fell below 50% in the mid-2000’s at the time of a civil war, and then edged slightly above 50% as of 2010. Aside from a brief LID-induced blip in 2020, the share maintained at roughly the same level for the past ten years.

Figure 2: Cocoa producer prices as a percent of the world price



Note: Producer prices and world price in real US dollars as annual averages, based on data from [FAO, 2023](#) and [IMF, 2022](#).

3 Data

To trace price formation along the stylized chain in Figure 1, we draw on data from a mix of primary and secondary sources.

First, we assess the extent to which variations in world prices are transmitted to domestic farm-gate prices, i.e. we link segment I and IV of the figure. This requires data on country-level producer prices, world prices, and exchange rates to convert all prices into dollars. We do this analysis for Côte d’Ivoire and other large cocoa-producing countries, as defined by a production of at least 100,000 tons in 2019 ([FAO, 2022](#)). Nigeria meets this criterion but is excluded due to the unreliability of official exchange rates to the Nigerian Naira. This leaves us with eight countries for this analysis. The Food and Agricultural Organization provides annual data on producer prices for cocoa in the local currency ([FAO, 2023](#)). For years in which the regulated farm-gate

price differed between main and side harvest in Côte d'Ivoire, we weighted prices of the two seasons by the respective cocoa production levels in order to arrive at an effective farm-gate price for the entire season. The world price is recorded by the International Cocoa Organization (ICCO) and measured in US dollars per metric ton, obtainable from the International Monetary Fund (IMF, 2022). It represents the annual average of CIF quotations of the nearest three active futures trading months at the Europe and US cocoa futures markets at the time of London close. Data on exchange rates is obtained from the Federal Reserve Bank of St. Louis (FRED, 2022). Temporal coverage of the data varies by country but generally spans from the mid-1990s to nearly 2021. For Côte d'Ivoire, we have 31 data points spanning 1991 to 2021.

In a second analysis, we assess the functioning of the Forward Sales Programme as link between segments I and II in Figure 1. Here, we rely on commodity exchange data and documents from the public regulating body in the cocoa sector of Côte d'Ivoire, the *Coffee and Cocoa Council*. In terms of commodity exchange data, we use more granular weekly data on cocoa prices and country-specific origin differentials from the London future exchange for the years 2015 to 2021 for Côte d'Ivoire and neighbouring countries in West Africa. In line with the procedures of the *Coffee and Cocoa Council*, we convert all price and origin differential data from British pound to the local currency, Francs CFA (FCFA), according to the daily exchange rate. The *Coffee and Cocoa Council* provided us with regulated price schedules for the past years, from which we retrieve the CIF reference price for the years 2015 to 2021.

Third, we conduct an institutional assessment of how the *Coffee and Cocoa Council* distributes the CIF reference price across in-country value chain actors via regulated prices in Côte d'Ivoire. This is to assess the effect of the regulated price schedule as the link between segments II and III of Figure 1.

Fourth, we use primary data from a survey of farm households in Côte d'Ivoire to assess variations in the prices that farmers actually fetch from local buyers, segments III and IV of Figure 1. The sample is representative for all cocoa-growing regions in Côte d'Ivoire, namely the cocoa belt of Côte d'Ivoire, using a sampling plan and enumeration areas prepared for a previous survey by the Joint Research Centre (JRC) conducted in 2019. Our data was collected towards the end of the 2020/21 cocoa season in August and September 2021. The sample includes 1,052 farming households, of which 972 (92%) identify as cocoa farmers and 80 (8%) as other farming households (see Bensch et al., 2022 for further details).

Fifth and finally, we shed light on the impact of the Living Income Differential (LID) as an intervention targeted at cocoa price formation, returning to the link between segment I and IV of Figure 1. Our key measure here is the ratio of producer prices to world market prices. We adopt a descriptive event-study design to analyze the evolution of this ratio before and after the implementation of the LID. For comparison, our analysis also covers Ghana as the second country that implemented the LID and Cameroon as a liberalized cocoa market in western Africa. For this

more granular analysis, we use monthly world market prices and monthly (or annual) producer prices. For the latter, we again use the FAO (2023) data and season-specific data for Côte d’Ivoire from the *Coffee and Cocoa Council*, complemented by monthly data from the *National Cocoa and Coffee Board* in Cameroon (ONCC, 2022).

4 Results

This section presents the results of the five analyses outlined in Section 3, each indicated by the number of the segments from Figure 1 that the analysis addresses.

4.1 Global to local cocoa price pass-through (I to IV)

Our analysis of global to local pass-through draws on a simple approach employed by Mundlak and Larson (1992). Their point of departure references the law of one price, according to which the domestic price of the commodity at time t , P_t , equals the product of the world price, W_t , the exchange rate, E_t , and tax policy, S_t :

$$P_t = W_t * E_t * S_t. \quad (1)$$

Writing the natural log of the variables in the above equation in lower case letters, we estimate the following regression for the countries in our sample individually:

$$p_t = \beta_0 + \beta_w w_t + \beta_e e_t + \beta_{year} year_t + \varepsilon_t. \quad (2)$$

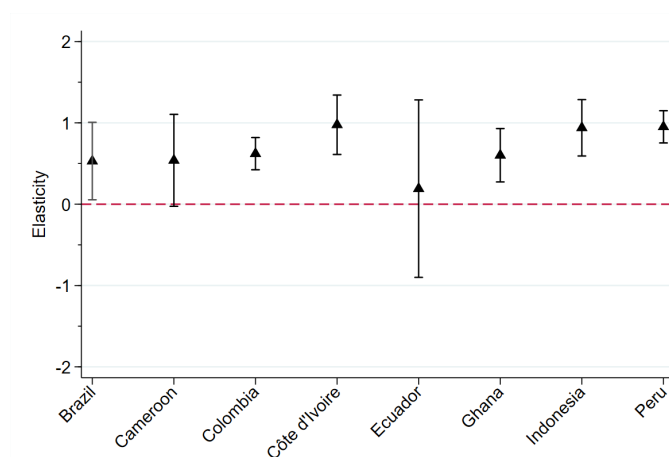
where $year_t$ is a yearly time trend that controls for tax policy and ε_t is a normally distributed disturbance that accommodates other determinants of price differences across countries, like transport costs. β_w is the parameter estimate of interest, which we refer to as “transmission elasticity”, borrowing from Mundlak and Larson (1992).

Figure 3 presents estimates of these transmission elasticities. The point of reference is a transmission elasticity of one, as this implies that variation in the world price is fully transmitted to the domestic price. All of the transmission elasticities are well above zero with the exception of Brazil and Ecuador, where the null value for these two countries implies no transmission of world prices for cocoa. Otherwise, the 95% confidence intervals of most of the remaining estimates contain the value one. In the case of Côte d’Ivoire, the point estimate is almost exactly the reference of one (= 0.98). Although we would expect such proportional variation with world prices in the absence of price-distorting government interventions, this near spot-landing may seem curious in light of the heavy role of the state in the regulation and taxation of Côte d’Ivoire’s cocoa markets. One might rather expect a lower transmission elasticity like in neighboring Ghana, which

has a similarly regulated cocoa market. Two explanations offer themselves. First, while these interventions will affect the local *level* of cocoa prices, this does not necessarily preclude domestic prices from moving in tandem with world prices (Mundlak and Larson, 1992). This seems plausible given that taxation as well as price regulation for the regulated sub-periods remained very stable over the observation period. Second, as the world’s largest cocoa producing country, we cannot fully rule out simultaneity, whereby market conditions in Côte d’Ivoire also affect world prices, a possibility that prevents us from ascribing a causal interpretation to the estimates of β_w . However, we deem simultaneity unlikely given that both Côte d’Ivoire and Ghana are considered as price-takers in a consolidated market of grinders and traders on the demand side, despite their large share in global cocoa production and despite their regulatory systems (Ohemeng et al., 2016; Staritz et al., 2023).

Another potential source of bias in the estimates of transmission elasticities is quality differences that vary over time. In the cocoa market, country-specific quality differences are reflected in the origin differentials, which are added to the world market price and are thus not reflected in the above analysis. Yet, one would not expect quality difference to distort the picture from the figure, since Côte d’Ivoire has rather average origin differentials (see, for example, Gaia Cacao B.V., 2021). Hence, the results for Côte d’Ivoire suggest that price transmission from global to local prices works well and that government regulation leads to virtually no efficiency losses in the pass-through of price signals from the world market.

Figure 3: Transmission elasticities in Côte d’Ivoire and other main cocoa-producing countries



4.2 The effect of the price-setting mechanism on pass-through (I to II)

The Forward Sales Programme that determines the CIF reference price and fixes in-country prices at the beginning of a crop year is the first link at which the pass-through from global to farm-gate prices may be affected. The ambition of the *Coffee and Cocoa Council* to guarantee prices over the entire season is an enormous challenge. Several risks must be managed, including uncertainties

related to realized cocoa bean volumes, as well as exchange rate and spot price developments. Moreover, the *Council* must reach agreements with exporters via forward contracts, exposing it to risk from non-delivery and default that may result from factors such as crop failures, smuggling and speculation (Tröster et al., 2019). This requires skills in both anticipating market fluctuations and negotiating, all the while operating beyond the reach of possible attempts by influential stakeholders to procure export licenses at below-market prices (Oomes et al., 2016).

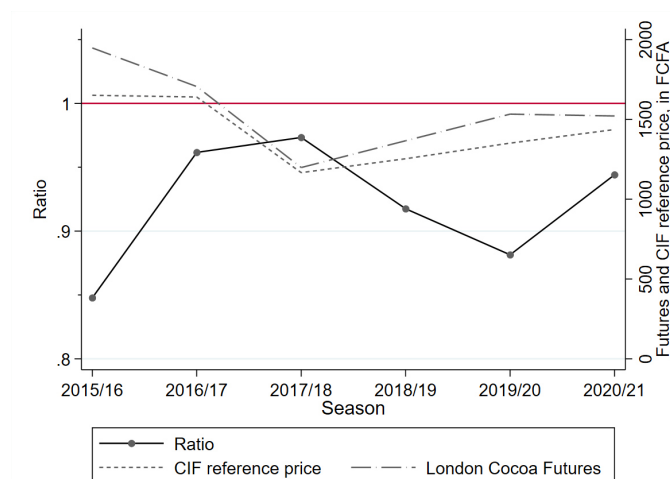
The *Council's* performance in managing these challenges is difficult to assess directly³, but some insight can be gleaned by tracking the CIF reference price, which is the *Council's* target measure that ultimately bears on the price received by farmers. Figure 4 compares CIF reference prices for the six seasons up to 2021 with the average price of cocoa – including the origin differential – from Côte d'Ivoire six months ahead on the London Cocoa Futures, measured on the right axis in FCFA. This average price can be regarded as a benchmark for the CIF reference price that could be fetched if cocoa were sold evenly over the marketing season.⁴ Under frictionless exchange, we would expect that the ratio of the CIF reference price to this benchmark is close to one, also considering that stock exchange fees are negligible. In fact, the ratio averages substantially below at 0.92 over the six seasons, measured on the left axis of Figure 4. To provide an idea of the potential increase in the farm-gate price through a tighter alignment of the CIF reference price with the benchmark, we take the example of the 2019/20 season. The ratio in that season was 0.88, which corresponds to a difference of 182 FCFA/kg. In a thought experiment that distributes this money among value-chain actors in accordance to the regulated price schedule, with 61% going to farmers, the farm-gate price could have been increased by 17%.⁵ One has to acknowledge that the benchmark can only imperfectly represent the counterfactual of frictionless exchange, and that at least part of the difference is likely to be actual transaction costs. Nevertheless, these figures suggest at least some scope for leveraging meaningful efficiency improvements through optimization of the *Council's* transactions on the forward market.

³While international auditing firms detected governance issues in 2014 and 2017 relating to the management of contracts with exporters and modalities of the PVAM, the World Bank later concluded that the firms' recommendations were implemented, which it had set as a prerequisite for a financing agreement with the *Council* in 2018.

⁴These sales include both forward sales and spot sales. Since we lack spot price data, we assume that spot sales occur periodically upon the dates of maturity of forward contracts. This allows us to take forward sales prices for spot sales as well, considering the convergence of forward and spot prices at maturity of the forward contracts.

⁵If the difference would be entirely allocated to the farmers in analogy to the initial announcements of the LID, this increase would even amount to 22%.

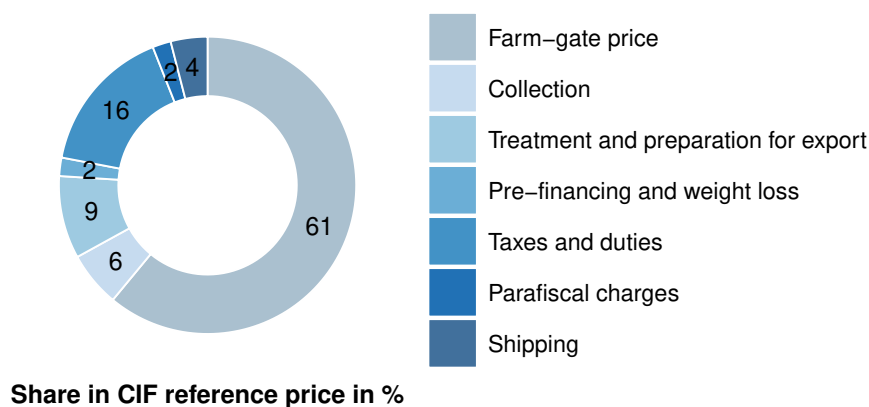
Figure 4: Ratio of CIF reference prices to average London prices of cocoa futures including origin differential, by season



4.3 Pass-through in the in-country cocoa value chain (II to III)

The CIF reference price defines the total added value that can be distributed among all actors of the in-country cocoa value chain, the second link in our analysis of pass-through. This distribution, which is effectively determined by regulatory fiat via the regulated price schedule rather than by market forces, is perhaps the most consequential determinant of pass-through to the farm gate. Figure 5 shows the effective distribution from the individual farmer up to the port of destination for the season 2019/20, during which the structure of the regulated price schedule did not change in the side season. In this season, 61% of the CIF reference price accrued to the farmer, who should in principle receive this payment instantly at the time of selling the unprocessed beans to intermediaries. Since these buyers are not paid for the cocoa until it is shipped by the exporters, they must be pre-financed, as shown in Figure 5.

Figure 5: Regulated prices across in-country cocoa value chain, as percentage of CIF reference price



Beside small variations in the share of taxes and duties, Figure 5 roughly represents the relative distribution of the regulated prices for all cocoa seasons starting from 2012/13, when regulation

was re-introduced in Côte d'Ivoire to maintain the share for farmers at 60% (or at least at a minimum of 50% in times of falling global prices). A key lever for the government to maintain these shares has been the registration tax paid by exporters, which varies between 0 and 5% and was 3% in the 2021/22 season. In the main season of 2020/21, the share of the farm-gate price was exceptionally high at 65%, a temporary effect of the Living Income Differential (LID) that will be further discussed in [subsection 4.5](#).

The question arises as to whether the prices specified by the regulated price schedule result in lower farm-gate prices than would otherwise emerge under a less regulated system. For example, it is conceivable that the regulated price schedule shields low-efficiency enterprises and services from competitive market pressures, resulting in excessive margins that eat into the farm-gate price. Overall, we find little evidence in support of this possibility. It is difficult to judge how financially attractive individual tasks along the national value chain are, partly because most activities are licensed by the *Coffee and Cocoa Council* such that the number of parties willing to enter the respective businesses is not observable. Nevertheless, a deeper look does not suggest obviously high margins for any of the activities, and sector actors such as exporters instead report weak margins (KPMG, 2018, see also [Aka Zebra Sas, 2021](#)). Moreover, many individual regulated prices, such as for collection, treatment, and shipping, developed proportionately to the CIF reference price in recent years, such that price rigidity has formed somewhat of a bulwark against inefficiencies.

Another possible source of excessive margins are the parafiscal charges on cocoa, which partially cover services provided to farmers such as input provision and training. A recurrent critique is that such parastatal services are vulnerable to corruption or patronage, and tend to be rendered less efficiently ([Kolavalli and Vigneri, 2017](#); [Bymolt et al., 2018](#)). Although cocoa farm productivity has remained relatively static, giving some credence to these concerns, it also bears noting that the physical quality of cocoa beans has significantly improved over the last years. This is not only acknowledged by grinders and traders ([Maile, 2020](#)), it is also reflected in price comparisons with less regulated neighbouring markets. For example, the difference in the price including the origin differential paid for cocoa beans from Côte d'Ivoire and Nigeria at the London exchange increased from 0.7 to 4.6% in the period 2015 to 2019 (before implementation of the LID).⁶ A similar increase in the gap of origin differentials can be observed when comparing Côte d'Ivoire with Cameroon. Thus, the parastatal services appear to add real value to Ivorian cocoa beans, which would justify the parafiscal charges.

A final concern is that regulation may impose an excessive tax burden on the sector and thereby on the farmers. Distinguished from other cocoa-producing countries like Ecuador or Cameroon, Côte d'Ivoire relies heavily on cocoa as a taxable export product. Taxes and duties are relatively high compared to other countries and totalled 16% in the 2019/20 season ([Figure 5](#)).

⁶Similarly, the price difference increased to 4.8% when considering the period from 2015 to 2021, including the LID.

With a contribution of more than 10% to total national tax revenues, they are an important source of government revenue. As such, the taxes and duties make cocoa farming the most heavily taxed income-generating activity in the country (World Bank, 2019). For the time being, though, this source of government revenue seems indispensable to fund public goods in the country.

4.4 Pass-through of the regulated farm-gate price (III to IV)

Regulated farm-gate prices mean that farmers have little to no room to negotiate or differentiate prices (e.g. by quality), making an assessment of local price variation seemingly moot. However, the possibility of non-compliance with this regulated price cannot be ruled out. For example, there may be some scope for cocoa buyers to bargain down the price in regions where the absence of competitors confers them with market power. Our farmer survey indeed revealed that average farm-gate prices remain below the regulated price.

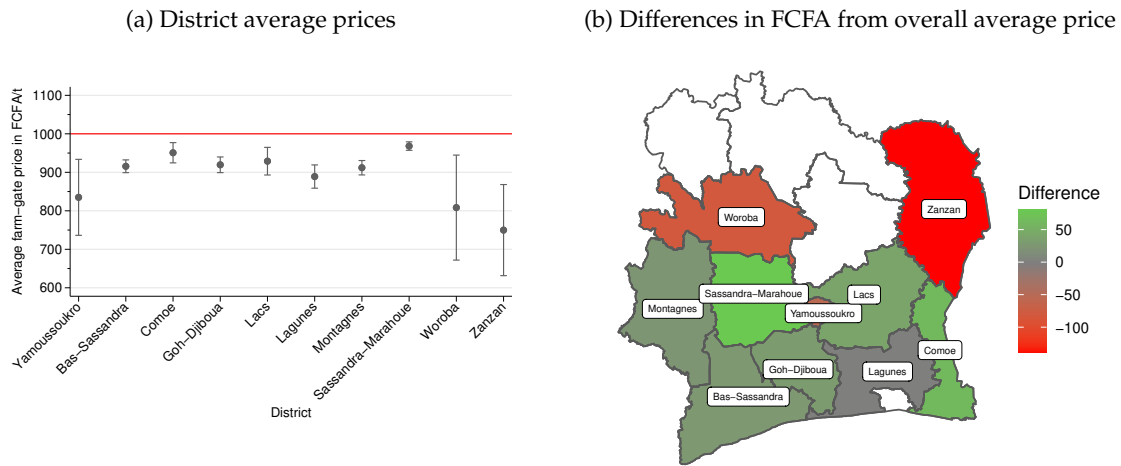
For the main cocoa harvest of 2020/21, the year of the farm household survey, the *Coffee and Cocoa Council* had set a regulated producer price of 1,000 FCFA/kg for the main harvest and 750 FCFA/kg for the side season, equivalent to 1.8 and 1.3 US dollars/kg, respectively. Some 32% of farmers reported a per-kg price below 1,000 FCFA, with a low of 500, while 4.6% of farmers reported a price higher than 1,000, with a high of 1,100. The average price is 922 FCFA during the main harvest, and 637 FCFA during the side harvest, thus 8 and 15% below the guaranteed price, respectively.

Panel (a) of Figure 6 presents the average main harvest price level for all districts in Côte d'Ivoire, while panel (b) cartographically displays the difference from the overall average price. The districts of Comoé and Sassandra-Marahoué register the highest price levels, translating to a difference of 7 to 10% above the overall mean price. Conversely, Woroba and Zanzan have the lowest price levels. Consistent with the law of one price, transportation costs may play some role in these differences (von Cramon-Taubadel and Goodwin, 2021), also considering that the regulated price schedule involves a flat price for the collection of the raw cocoa from the farmers. The road network extending into rural areas of the country is relatively sparse and poorly maintained, making transportation from more remote regions in the north costly in terms of fuel expenses, vehicle maintenance, and travel time. To the extent that there are differences in cocoa quality across locations, buyers furthermore treat the goods as imperfect substitutes, which could compel sellers to accept different prices depending on location.

Other factors, not all of which are readily observable, likely also play a role in the observed farm-gate price variability. We attempt to account for as many of these factors as possible in an Ordinary Least Squares regression of the determinants of the cocoa price received by the farmer. The explanatory variables include socio-demographics, location, cocoa quality, and access to price information via different channels of communication.⁷ We also include controls for the degree of

⁷Arbitrage is predicated on an awareness of price differences across regions, allowing traders on both sides of the

Figure 6: Price variation at district level for the main harvest 2020/21



local competition and the degree of income diversification from crop sales, the latter variable being measured by a Shannon diversity index (Sibhatu and Qaim, 2018; Tesfaye, 2022). Higher values of the index indicate a higher degree of diversification.

Turning first to the district dummy variables, the results presented in Table 1 confirm the unconditional means from Figure 6 (a). As the model suppresses the constant term, the coefficients can be interpreted as the mean price level for cocoa in a district conditional on the other explanatory variables. It bears noting that while the estimates are all statistically significant, they are not statistically different from each other, as evidenced by the overlap of the 95% confidence levels in the figure.

Overall, the coefficients on the remaining variables are mostly small and imprecisely estimated, which likely owes to the regulated structure of the Ivorian cocoa market, leaving little room for negotiation. Beyond the district dummies, five of the estimated coefficients reach the level of statistical significance. The two demographic variables measuring the age of the household head and being native to the place of residence are negatively associated with prices. Moreover, with a negative and statistically significant coefficient on the Shannon Diversity Index, our results do not confirm a downward pressure on farm-gate prices due to a higher dependency on cocoa, as discussed by Oomes et al. (2016). Statistically significant – and in this case positive – effects are observed for cocoa certified by a voluntary sustainability standard such as *Fairtrade* and for a cooperative being the buyer of the cocoa.⁸ All four estimates are in an absolute-value range of 16 to 18 FCFA, i.e. about 2% of the average per-kg cocoa farm-gate price.

In contrast to these moderately influential factors, it is of interest to note that none of the variables indicating access to agricultural price information is found statistically significant. This holds equally for technological measures like access to a phone as well as measures of human

market to pursue riskless profit opportunities. Several studies have pointed to the importance of radio, television, telephone and the internet as channels through which price information is conveyed, (Jensen, 2007; Donner, 2008; Muto and Yamano, 2009).

⁸In our sample, as many as 31% of cocoa farmers sell at least some certified cocoa. Sellare et al. (2020) stress the interaction of certification and cooperatives for agricultural yields.

Table 1: Econometric results on determinants of prices

	Price	
	Coefficient	Std. Err.
Amount of cocoa sold during main harvst, in kg	-0.001	(0.001)
Some cocoa certified	18.529**	(9.250)
Shannon	-24.880*	(13.332)
Elderly household head	-16.322*	(9.577)
Distance to plots	-0.111	(1.033)
No formal education	8.133	(8.599)
Born in village	-18.020*	(9.543)
Born outside Côte d'Ivoire	1.676	(10.617)
Wealthy	6.023	(10.635)
Cooperative as buyer	15.537*	(8.558)
Traitant as buyer	-11.218	(21.226)
Awareness of LID	13.495	(9.782)
Main source about agricultural markets: phone	-18.120	(25.281)
Main source about agricultural markets: TV	6.201	(15.273)
Main source about agricultural markets: Radio	16.807	(12.964)
Main source about agricultural markets: Village chief	29.335	(20.463)
Main source about agricultural markets: Cooperative	28.895	(20.288)
Number of buyers in village during main season	-0.279	(0.207)
district = Yamoussoukro	822.603***	(52.975)
Bas-Sassandra	900.154***	(16.699)
Comoé	931.055***	(23.184)
Gôh-Djiboua	910.198***	(18.624)
Lacs	920.649***	(25.546)
Lagunes	875.576***	(22.086)
Montagnes	910.761***	(18.152)
Sassandra-Marahoué	966.720***	(18.508)
Woroba	829.942***	(69.907)
Zanzan	708.228***	(52.921)
Number of observations	914	
R-Squared	.984	

Note: Robust standard errors are in parentheses. ***, ** and * denote statistical significance of a two-sided *t*-test at the 1 %, 5 % and 10 % level, respectively.

contact, as when information on prices is obtained from the village chief. The number of cocoa buyers reported to visit the village, which can be viewed both as a source of information and as capturing monopsony power, is likewise statistically insignificant.

4.5 Living Income Differential and pass-through (I to IV)

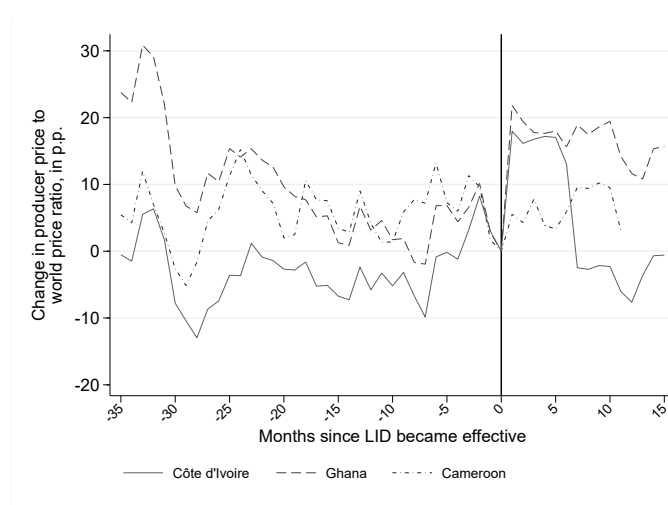
The final part of our analysis returns to the link between segment I and IV of [Figure 1](#) and the role of the Living Income Differential (LID). The motivation behind the LID was to increase farmers' shares in cocoa world market prices, the evolution of which is tracked in [Figure 7](#) covering the period before and after the implementation of the LID. The vertical axis measures the percentage point change in the ratio of farm-gate prices to world market prices relative to September 2020, that is, the month right before its implementation, when it is set at zero. In addition to Côte d'Ivoire, the figure presents the trajectory for two other countries: Ghana, which introduced the LID contemporaneously, and Cameroon, a liberalised West African cocoa exporter that serves as a benchmark. Although not evident from the figure, note that at $t=0$, the ratio itself was nearly identical between Côte d'Ivoire and Ghana at 60%, but considerably higher at almost 70% in Cameroon.

In the period following implementation of the LID, the world market price was fairly stable,

implying that changes in the ratio were mainly due to changes in farm-gate prices measured in nominal US dollars. In accordance with announcements, Côte d'Ivoire and Ghana converted the LID price premium of 400 US dollars per tonne of cocoa to their local currencies in the first main cocoa season. This led to a significant increase of about 20 percentage points in the farmgate-to-world price ratio in both Côte d'Ivoire and Ghana, corresponding to an absolute increase in the ratio from 60 to 80% in both countries.

Following this initial spike, however, Côte d'Ivoire could not maintain the premium and had to reduce the regulated farm-gate price at the beginning of the side season in March 2021, leading to a drop in the ratio even below the initial level in September 2020. This primarily owed to the *Coffee and Cocoa Council's* inability to push the LID through in their price negotiations with international buyers. Market uncertainties and a slump in demand due to the Covid-19 pandemic likely exacerbated the situation, even if the development of the ratio in Ghana and Cameroon suggests that the farm-gate price in these countries escaped this source of pressure. In the second year following implementation, the 2021/22 season, an LID was not even specified in the regulated price schedule set by the *Coffee and Cocoa Council*. Thereafter, the absolute ratio in Côte d'Ivoire dipped even further, recovering to a level of 60% only at the end of our observation period in 2021.

Figure 7: Evolution of the ratio of farm-gate prices to world market prices around the implementation of the LID



Note: All prices are expressed nominally in US dollars. The LID became effective with the beginning of the cocoa season 2020/21 in October 2020. $t = 0$ therefore denotes September 2020. At that point in time, the ratio amounted to 60.4% in Côte d'Ivoire, 59.0% in Ghana and 69.3% in Cameroon, while the world market price was 2460 US dollars.

Côte d'Ivoire's medium-term experience with the LID is thus sobering, as the desired effect of increasing the pass-through to the farm gate could not be sustained. Figure 7 suggests that Ghana was more successful in this endeavour. Here, the ratio is still more than 10 percentage points higher than it was when the LID was implemented one and a half years hence. As higher revenues from sales to the world market in Ghana vis-à-vis Côte d'Ivoire are unlikely, the increase seems to be funded by national public sources. A key difference between Ghana's national regulatory institution, *COCOBOD*, and the *Coffee and Cocoa Council* in Côte d'Ivoire, is that *COCOBOD*

and its subsidiaries are also engaged in the physical handling and export of cocoa beans. This provides leeway to inject public funds into the national value chain and thereby change the net tax/ subsidy burden imposed on the sector. In fact, *COCOBOD* claimed in 2022 that it subsidises the sector with 400 million US dollars a year, which would correspond to around 400 US dollars a ton, but sufficiently recent audit data is not available to assess such financial flows.⁹ It is therefore unclear whether *COCOBOD* can maintain the farm-gate prices in the future. Instead, the price trend prior to the LID in [Figure 7](#) provides indications why the Ghanaian government likely felt more domestic pressure to increase farm-gate prices. Three years before implementation of the LID, the ratio between farm-gate and world market prices in Ghana was almost 25 percentage points higher, whereas it was at roughly the same level in Côte d'Ivoire.¹⁰ Farm-gate prices subsequently decreased in Ghana by 500 international dollars (or 12%), while they increased in Côte d'Ivoire by 600 international dollars (or 20%).

5 Policy Implications and Conclusions

Côte d'Ivoire recently responded to persistently low farm-gate prices by introducing the Living Income Differential (LID), jointly implemented with neighbouring Ghana. This measure has so far proved ineffective. The two countries' expectation was that they could push through a price premium beyond the quality-differentiated origin premium, which at current world prices would be equivalent to a 15% surcharge. The motivation was to increase the money available for distribution across the actors in the national cocoa value chain – first and foremost the cocoa farmers. Preliminary experience with the LID, however, suggests that even a market share of global cocoa production of over 60% between Côte d'Ivoire and Ghana does not appear to provide sufficient leverage in the cocoa market to dictate prices. The desire to establish a cocoa cartel – sometimes nicknamed “COPEC” ([Boysen et al., 2023](#)) – along the lines of OPEC seems to be doomed to failure, in particular by the fact that raw cocoa – unlike crude oil – is a perishable commodity whose production cannot be quickly ramped up and down. As such, regulatory measures that prop up prices will unlikely prevent the covariation of domestic cocoa prices and world prices in the long run, as was demonstrated in the foregoing analysis of the transmission of world cocoa prices. Conversely, ensuring exposure to market signals is critical to affording farmers with the information needed to make optimizing decisions with respect to crop choice and diversification.

The decisive question is how to maintain such market signals while providing cocoa farmers with a living income. As it is, current estimates say that below 10% of cocoa farmers in Côte d'Ivoire earn a living income and less than 25% earn above the poverty line ([True Price, 2018](#); [Tys-](#)

⁹State Ownership Reports by the Ministry of Finance and Annual Reports by *COCOBOD* provide indications for net losses and increasing debt burdens already before implementation of the LID, but no reports are available for the time since LID implementation.

¹⁰[Figure A.1](#) in [Appendix A](#), which expresses farm-gate prices in current international dollars using Purchasing Power Parity (PPP) conversion factors to make them more comparable from the farmers' perspective, confirms these different trends before LID implementation.

zler et al., 2019; Fountain and Hütz-Adams, 2022). Our analysis shows that government regulators may leverage moderate price increases by tightening some of the identified inefficiencies that remain in the pricing mechanisms underpinning the cocoa value chain. For example, a deeper analysis of the forward sales price-setting mechanism adopted by Côte d'Ivoire may expose ways to improve the Forward Sales Programme. However, overcoming these inefficiencies seems insufficient to lift farm-gate prices to a level at which living incomes are guaranteed. Similarly, as suggested by the econometric analysis of farm survey data, certification has so far led to only very modest increases in farm-gate prices. Finally, the assessment of the LID exemplifies the challenge of unilateral efforts to encourage cocoa consumers – be these downstream processors or end consumers – to pay a price premium on cocoa.

It may instead be constructive to consider the ways in which the local cocoa sector is – contrary to the vision of “COPEC” – characterized by the features of a perfectly competitive market. To wit, the sector contains a large number of price-taking producers selling a homogeneous product, essentially with free entry and exit. The long run equilibrium in such a market is one of zero economic profit, measured as total revenue minus the sum of explicit costs and opportunity costs. Viewed in this light, interventions that either increase revenue or decrease explicit costs – including improvements in terms of quality and production volumes – may yield positive economic profit in the short run. However, over the long run, they will draw more farmers into the sector, increasing supply and depressing world market prices to a point at which economic profit returns towards zero. A more viable strategy necessitates policies that are instead targeted at increasing the opportunity costs of cocoa cultivation, which would draw farmers to employment outside the sector while increasing the long run equilibrium price for those that remain. This is a tall order, requiring public investments in human capital, infrastructure, and structural changes to the economy that encourage exit from cocoa production.

These investments would simultaneously improve the livelihoods and resilience of farmers who stay in the cocoa business without distorting their cocoa production decisions. Greater complementary involvement of the international cocoa industry appears essential to achieve these ends. All major cocoa processors and chocolate manufacturers indeed seek to take more responsibility through corporate sustainable sourcing programmes such as “Forever Chocolate” by Barry Callebaut or the “Cocoa Life Programme” by Mondelez, but these efforts need to be ramped up in order to create tangible impacts on farmers (Thorlakson, 2018). Thus, the combination of government policies that create opportunities for cocoa farmers to exit the sector, and community development supported by the international cocoa industry, can lead to the structural change needed to improve the livelihoods in communities in which cocoa farming households reside.

References

- Aidenvironment and Sustainable Food Lab (2018). *Pricing mechanisms in the cocoa sector: options to reduce price volatility and promote farmer value capture*. Aidenvironment, Amsterdam, Netherlands.
- Aka Zebra Sas (2021). *Passage à l'exportation pour une coopérative de cacao de Côte d'Ivoire implications et étapes*. Trade for Development Centre of Enabel, Brussels, Belgium.
- Arnade, C., Cooke, B., and Gale, F. (2017). Agricultural price transmission: China relationships with world commodity markets. *Journal of Commodity Markets*, 7:28–40.
- Baffes, J. and Gardner, B. (2003). The transmission of world commodity prices to domestic markets under policy reforms in developing countries. *Policy Reform*, 6(3):159–180.
- Bensch, G., Kaestner, K., Schmid, L., Vance, C., and Wilhelm, A. (2022). Price formation on the futures market and the physical market for cocoa. Technical report, RWI – Leibniz Institute for Economic Research, Essen, Germany.
- Bergquist, L. F. and Dinerstein, M. (2020). Competition and entry in agricultural markets: Experimental evidence from Kenya. *American Economic Review*, 110(12):3705–3747.
- Boysen, O., Ferrari, E., Nechifor, V., and Tillie, P. (2023). Earn a living? What the Côte d'Ivoire–Ghana cocoa living income differential might deliver on its promise. *Food Policy*, 114:102389.
- Busquet, M., Bosma, N., and Hummels, H. (2021). A multidimensional perspective on child labor in the value chain: The case of the cocoa value chain in West Africa. *World Development*, 146:105601.
- Bymolt, R., Laven, A., and Tyzler, M. (2018). *Demystifying the cocoa sector in Ghana and Côte d'Ivoire*. The Royal Tropical Institute (KIT), Amsterdam, The Netherlands.
- Casaburi, L. and Reed, T. (2022). Using individual-level randomized treatment to learn about market structure. *American Economic Journal: Applied Economics*, 14(4):58–90.
- Donner, J. (2008). Research approaches to mobile use in the developing world: A review of the literature. *The Information Society*, 24(3):140–159.
- Emran, M. S., Mookherjee, D., Shilpi, F., and Uddin, M. H. (2021). Credit rationing and pass-through in supply chains: Theory and evidence from Bangladesh. *American Economic Journal: Applied Economics*, 13(3):202–236.
- Ermgassen, E. z. (2021). Mapping cocoa exports from Côte d'Ivoire and Ghana. Trase. Retrieved may 23, 2023 from: <https://doi.org/10.48650/KFTH-GP94>.
- Fafchamps, M. and Hill, R. V. (2008). Price transmission and trader entry in domestic commodity markets. *Economic Development and Cultural Change*, 56(4):729–766.
- FAO, Food and Agriculture Organization (2022). FAOSTAT, crops and livestock products. Retrieved May 31, 2022 from: <https://www.fao.org/faostat/en/#data/QCL>.
- FAO, Food and Agriculture Organization (2023). FAOSTAT, commodity prices. Retrieved March 20, 2023 from: <https://www.fao.org/faostat/en/#data/PP>.
- Fountain, A. C. and Hütz-Adams, F. (2022). *Cocoa Barometer 2022*. VOICE Network, Ede, the Netherlands.

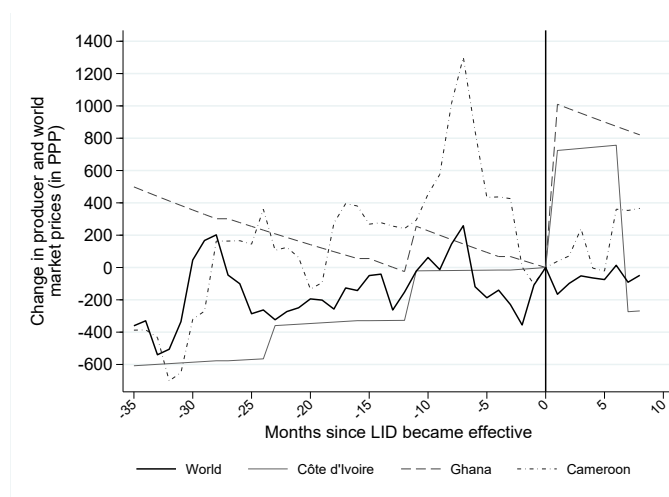
- FRED, Federal Reserve Economic Data (2022). Federal Reserve Bank of St. Louis, Exchange rates. Retrieved November 24, 2022 from: <https://fred.stlouisfed.org/tags/>.
- Gaia Cacao B.V. (2021). *Global Cocoa Market Study*. Gaia Cacao B.V., Amsterdam, the Netherlands.
- Hofman, P. and Malan, M. (2022). Testing for market power in a concentrated agricultural market in Sierra Leone. *mimeo*.
- IMF, International Monetary Fund (2022). International Monetary Fund, Primary Commodity Prices. Retrieved September 23, 2022 from: <https://www.imf.org/en/Research/commodity-prices>.
- Jensen, R. (2007). The digital divide: Information (technology), market performance, and welfare in the South Indian fisheries sector. *The Quarterly Journal of Economics*, 122(3):879–924.
- Kolavalli, S. and Vigneri, M. (2017). *The cocoa coast: The board-managed cocoa sector in Ghana*. International Food Policy Research Institute (IFPRI), Washington, United States.
- Kopp, T. and Sexton, R. J. (2021). Farmers, traders, and processors: buyer market power and double marginalization in Indonesia. *American Journal of Agricultural Economics*, 103(2):543–568.
- KPMG (2018). *Audit du système de commercialisation du cacao. Rapport pour Ministère de l'Agriculture et du Développement Rural*. KPMG, Abidjan, Côte d'Ivoire.
- Lambert, A. (2014). *The fairness gap: Farmer incomes & solutions to child labor in cocoa*. International Labor Rights Forum (ILRF), Washington, United States.
- Lambin, E. F. and Furumo, P. R. (2023). Deforestation-free commodity supply chains: Myth or reality? *Annual Review of Environment and Resources*, 48.
- Maile, F. (2020). *Cooperation or confrontation? Public and private governance and smallholders' incomes in the cocoa sector in Ghana and in Côte d'Ivoire*. Master Thesis. University of Vienna, Austria.
- Mundlak, Y. and Larson, D. F. (1992). On the transmission of world agricultural prices. *The World Bank Economic Review*, 6(3):399–422.
- Muto, M. and Yamano, T. (2009). The impact of mobile phone coverage expansion on market participation: Panel data evidence from Uganda. *World Development*, 37(12):1887–1896.
- Ohemeng, W., Sjo, B., and Danquah, M. (2016). Market efficiency and price discovery in cocoa markets. *Journal of African Business*, 17(2):209–224.
- ONCC, National Cocoa and Coffee Board (2022). Statistiques cacao. Retrieved October 23, 2022 from: <https://oncc.cm/cocoa-statistics>.
- Oomes, N., Tieben, B., Laven, A., Ammerlaan, T., Appelman, R., Biesenbeek, C., and Buunk, E. (2016). Market concentration and price formation in the global cocoa value chain. *SEO-rapport*, 2016-79.
- Sellare, J., Meemken, E.-M., Kouamé, C., and Qaim, M. (2020). Do sustainability standards benefit smallholder farmers also when accounting for cooperative effects? Evidence from Côte d'Ivoire. *American Journal of Agricultural Economics*, 102(2):681–695.
- Sibhatu, K. T. and Qaim, M. (2018). Meta-analysis of the association between production diversity, diets, and nutrition in smallholder farm households. *Food Policy*, 77:1–18.

- Staritz, C., Tröster, B., Grumiller, J., and Maile, F. (2023). Price-setting power in global value chains: The cases of price stabilisation in the cocoa sectors in Côte d'Ivoire and Ghana. *European Journal of Development Research*, 35:840–868.
- Suh, N. N. and Molua, E. L. (2022). Cocoa production under climate variability and farm management challenges: Some farmers' perspective. *Journal of Agriculture and Food Research*, 8:100282.
- Tesfaye, W. (2022). Crop diversification and child malnutrition in rural ethiopia: Impacts and pathways. *Food Policy*, 113:102336.
- Thorlakson, T. (2018). A move beyond sustainability certification: The evolution of the chocolate industry's sustainable sourcing practices. *Business Strategy and the Environment*, 27(8):1653–1665.
- Tröster, B., Staritz, C., Grumiller, J., and Maile, F. (2019). Commodity dependence, global commodity chains, price volatility and financialisation: Price-setting and stabilisation in the cocoa sectors in Côte d'Ivoire and Ghana. *ÖFSE Working Paper*, 62.
- True Price (2018). *Cocoa Farmer Income. The household income of cocoa farmers in Côte d'Ivoire and strategies for improvement*. True Price, Amsterdam, the Netherlands.
- Tyszler, M., Bymolt, R., and Laven, A. (2019). *Analysis of the income gap of cocoa producing households in Côte d'Ivoire. Comparison of actual incomes with the Living Income Benchmark*. The Royal Tropical Institute (KIT), Amsterdam, The Netherlands.
- van Vliet, J. A., Slingerland, M. A., Waarts, Y. R., and Giller, K. E. (2021). A living income for cocoa producers in Côte d'Ivoire and Ghana? *Frontiers in Sustainable Food Systems*, 5:732831.
- von Cramon-Taubadel, S. and Goodwin, B. K. (2021). Price transmission in agricultural markets. *Annual Review of Resource Economics*, 13:65–84.
- Waarts, Y., Janssen, V., Aryeetey, R., Onduru, D., Heriyanto, D., Aprillya, S. T., N'Guessan, A., Courbois, L., Bakker, D., and Ingram, V. (2021). Multiple pathways towards achieving a living income for different types of smallholder tree-crop commodity farmers. *Food Security*, 13(6):1467–1496.
- World Bank (2019). *Au Pays du cacao. Comment transformer la Côte d'Ivoire*. World Bank, Abidjan, Côte d'Ivoire.
- World Bank (2022). PPP conversion factor, GDP (LCU per international \$). Retrieved October 31, 2022 from: <https://data.worldbank.org/indicator/PA.NUS.PPP>.

Appendices

A Living Income Differential and the evolution of farm-gate prices in PPP

Figure A.1: Evolution of farm-gate and world market prices measured in current international dollars around the implementation of the LID



Note: Annual Purchasing Power Parity (PPP) conversion factors are taken from [World Bank \(2022\)](#) and converted to monthly data by intra-year interpolation. Since conversion factors are only available until 2021, interpolation can only be computed until the middle of 2021 and the graph ends after May 2021. The LID became effective with the beginning of the cocoa season 2020/21 in October 2020. $t = 0$ therefore denotes September 2020. At that point in time, farm-gate prices in current international dollars were 3384 in Côte d'Ivoire, 3688 in Ghana and 4153 in Cameroon, while the US world market price was 2458.