



## Coffee cooperatives and cross-border side-sales in the Eastern Democratic Republic of Congo: two sides of the same coin

### RESEARCH ARTICLE

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### Abstract

In the Eastern DRC, coffee farmers combine the different sales outlets available to them. Cooperative members sell coffee to the cooperatives they belong to as well as to informal markets, which include a channel of illegal cross-border smuggling. In this conflict affected region, the informal cross-border markets persist irrespective of the presence of cooperatives. This paper seeks to understand the motivating factors of the side-selling behavior of coffee cooperative members. We study the coffee production and sales of 339 cooperative members in the region and use a double hurdle model to understand which farm characteristics relate to the side-selling behavior. The omnipresence of side-selling in the cooperatives suggest that the unstable political and economic environment is conducive to this co-existence of informal trade and cooperative membership. Side-selling seems a deliberate strategy by the farmers that is tolerated by the cooperatives. The results suggest that farmers who are in a more precarious situation are more inclined to engage with informal markets. This is further underscored by the effect of food insecurity and lack of credit. Hence, the informal market is a safety net that allows immediate payment of coffee in contrast to cooperatives that are more formally organized.

**Keywords:** informal trade, side-selling, coffee cooperatives, gpn 2.0, double hurdle model, Eastern Democratic Republic of the Congo

**JEL-code:** C34, O13, O17, Q12, Q13

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## 1. Introduction

‘Article quinze: débrouillez-vous’ has become an unofficial motto for the people of the Democratic Republic of the Congo (DRC) to build their livelihoods. As the fictional fifteenth article of the constitution of the secessionist state of South-Kasai during the Congo Crisis (1960-1965), the expression ‘débrouillez-vous’ (‘fend for yourselves’) became popularized as a reaction to the rapid economic decline and the gradual informalization of the economy under president Mobutu in the 1970’s and 1980’s (Schatzberg, 1988). Years later, it is the motto of many Congolese in their attempt to make a decent living. In the eastern provinces of Ituri, and North- and South-Kivu (the Eastern DRC), Arabica coffee farmers apply the said article and *se débrouille* in marketing their produce, combining the different sales channels available. Likewise, the cooperatives of which these farmers are member, cope with the fluctuating supply of coffee and the difficulties to reach international markets.

In this region, the lines between the official and non-official economies are blurry (MacGaffey, 1991). Since the African World Wars (1996-2003), of which the Eastern DRC was the main battleground, the region is plagued by a continuous threat of violence (Verweijen *et al.*, 2021; Vlassenroot and Huggins, 2005). Lingering conflict and the continuing informalization of the economy resulted in structural market and institutional constraints that limit the possibilities for the rural population in the region to gain a living. A lack of institutional organization, infrastructure, and available market outlets following several periods of diminishing state authority, leaves the rural population isolated and relying on commercial middlemen (Raeymaekers, 2007). In these areas, informal economies thrive (Raeymaekers, 2007; Titeca and Kimanuka, 2012).

Cooperatives provide coffee farmers with an additional sales channel and an extra way out of poverty. Producer organizations such as cooperatives are found to increase members’ bargaining position, product quality, productivity, and prices and incomes received around the world (Fischer and Qaim, 2010; Shumeta and D’Haese, 2016). Yet, the lingering conflict in the Eastern DRC challenges and even impedes the optimal functioning of the cooperatives (Ragasa and Golan, 2014), both at the supply side (i.e. coffee to be handled by the cooperative) as in the integration in the international coffee markets.

Side-selling is when members sell part of the produce to the cooperative, and part to other, often informal, sales channels (Shumeta *et al.*, 2018). The higher price offered by the cooperatives does not seem to sufficiently convince farmers to fully patronize them (Shumeta *et al.*, 2018). Given the high level of informality in the economy of the Eastern DRC and the general strategy of people to create a way to make a living and *se débrouiller*, side-selling by cooperative members is common. In the study area, members sell coffee to nonregistered traders most often involved in non-official cross-border trade. These informal traders cross borders despite the high amount of import and export taxes they are asked to pay to varying degrees of informality in dealing with the region’s state and non-state authorities. The traders involved in the cross-border market usually offer lower prices compared to the cooperatives (Titeca, 2009; Titeca and Kimanuka, 2012). Yet, they secure a direct payment and other services to the farmers. As such, cooperatives and side-sales co-exist.

Extant research on side-selling in coffee-producing countries in Africa shows that farmers often side-sell to establish a close relationship with the trader-buyer as they are involved in other dealings or contracts as well. Moreover, farmers may need cash and hence, immediate payment. Also, trust in the cooperative may be low (Gerard *et al.*, 2020, 2022; Mujawamariya *et al.*, 2013; Shumeta *et al.*, 2018; Wollni and Fischer, 2015). Many of the studies see side-sales as a threat to the functioning of the cooperatives (Gerard *et al.*, 2020), and the EU even considers prevention of side-selling to be a statutory requirement for institutional support of recognized producer organizations (Benos *et al.*, 2023; Eastham, 2014). As a result, cooperatives are recommended to find ways to limit the side-sales (Shumeta *et al.*, 2018). In the case of the Eastern Congo, side-sales seems also a part of the daily survival strategies. Yet, as the region and the coffee production in particular are understudied, we are unsure how important side-selling is for the members of the cooperatives nor do we know what characterizes those coffee producers who side-sell more than others. We use an analytical framework based on the Global Production Network (GPN) approach to explain how the informalized and conflict-affected institutional environment is conducive to the co-existence of both cooperative and informal

cross-border market channels. The argument we put forward is that the cooperatives are the preferred choice of the farmers, who are stakeholders of the cooperative. Side-selling functions as a safety net that protects farmers against the risk of falling into poverty. Hence, our research questions are threefold; can we assume that cooperative members and cross-border side-selling are co-existing as a result of the informalized and conflict-affected institutional environment? What characterizes the coffee producers who engage in side-selling? And, who are the coffee producers who side-sell more than others?

Arguably, the results of our study have importance that extends beyond the case study area in the Eastern DRC. We intend to describe the functioning of coffee markets in a conflict-affected area where informal trade thrives in the institutional voids. This situation may apply to other regions of the world that take up a similar peripheral place within their Global Production Network. Moreover, we take a different stance on side-selling compared to previous research. Unlike prior research that views side-selling as a threat to the cooperative system, we argue that it can co-exist with cooperative membership and serve as a safety net for farmers who operate in challenging environments. We contend that side-selling behavior may even benefit cooperatives by maintaining members' attachment to the organization. By using a GPN framework, we shed light on the realities of the coffee sector in the Eastern DRC and contribute to the expanding literature on GPNs. Specifically, this paper aims to address the gap in the literature regarding the role of cooperatives within GPNs. Furthermore, our study area, the Eastern DRC, has received limited attention in the literature, making this research a valuable contribution to the field.

In what follows, we start by providing our conceptual framework of GPNs and how it fits the institutional context on the coffee sector in the Eastern DRC, its informal market, and how cooperatives are involved. Next, we discuss the data and the methods used to analyze them. After providing the results, we discuss our findings and provide some concluding remarks and shortcomings.

## 2. Conceptual framework and background

### 2.1 A GPN approach to study side-selling of cooperatives

The Global Production Network (GPN) approach emerged as a heuristic framework to comprehend the intricate and dynamic nature of global economies as a network of relationships and structures (Coe *et al.*, 2008b). Unlike Global Value Chain (GVC) analysis, the GPN approach considers not only inter-firm relationships but also includes all relevant actors as network actors. These actors comprise the lead firm, its suppliers and buyers, other firms, and non-firm actors such as states, workers, and civil society organizations (Yeung, 2016). The aim of the GPN approach is to understand the interdependent actions among these agents and place them in the broader institutional structures that shape global economies (Coe *et al.*, 2008a,b). As such, a GPN approach associates the features of lead firms in a network with other actors and their strategies regarding network actors, including themselves. These strategies coalesce into trajectories that promote value creation, enhancement, and retention (Yeung, 2016). The GPN approach adopts a wider lens than that of the GVC analysis to understand how a production network impacts those involved in the production areas where the value chains 'touch down' (Behuria, 2020).

GPN analyses emerged around the 2000s in the economic geography literature as a response to the limitations of earlier analytical models with a narrower scope (Coe *et al.*, 2008a). This led Coe, Yeung, and their colleagues to reconsider the frameworks that explain a firm's strategies in relation to its internal organization as well as to other actors in the network (Coe *et al.*, 2008a,b). In the book they published in 2015 (Coe and Yeung, 2015), Coe and Yeung proposed GPN 2.0 as an updated lens for analysis, which we draw upon in this paper. GPN 2.0 relies on the assumption that competitive dynamics and actor-specific strategies are determined by firm characteristics. To explain these dynamics, the approach identifies four explanatory (i.e. input) variables: cost capability, market imperative, financial discipline, and risk environment (Table 1) (Coe and Yeung, 2015). These variables contribute to the explanation of four dependent (i.e. output) variables: intra-firm coordination, inter-firm control, inter-firm partnership, and extra-firm bargaining (Table 1) (Coe and Yeung, 2015). We operationalize the approach to our study in Section 2.2.

**Table 1.** Analytical anchors in the GPN 2.0 (based on Coe and Yeung, 2015: 266).

Variable	Definition (Coe and Yeung 2015: 266)	Operational definition in this paper
Explanatory variables		
Cost capability ratio	'Ratio between costs and a firm's capability'	Farm and farmer characteristics that determine coffee versus food production (land dedicated to coffee; food outcome). Location and other cooperative specific characteristics that determine transaction costs
Market imperative	'Maximize the value capture through the access to and even dominance on the market'	Household income from coffee versus food production
Financial discipline	'In the form of pressures to create value for shareholders through synergy and developing new products/markets'	Value for farmers (credit access through the cooperative; participation in the cooperative)
Risk environment		Production area
Dependent variables		
Intra-firm coordination	'Internalize and consolidate the value creation activities'	Not considered in the paper; cooperative management
Inter-firm control	'Maintaining control over the production processes and the quality of the products/services'	Decision to sell coffee informal
Inter-firm practices	'In various forms, from collaboration, co-evolution to joint development with strategic partners, specialized or key suppliers'	Volume of informal sales
Extra-firm bargaining	'A contested two-way process of negotiation and accommodation with extra-firm actors (Coe and Yeung, 2015: 151)'	Not considered in the paper; Coffee sales by the cooperative to foreign buyers
Key actors of interest		
Lead firm		Cooperative and its members-cum-shareholders
Farmers		Suppliers to the cooperative at the same time shareholder and workers
Informal traders		Competitor of the cooperative for buying coffee
International coffee market traders		Buyers of coffee from cooperative and informal trade
Civil society		NGO supporting the cooperative
State agents DR Congo		Exerting control over coffee trade and border control
State agents neighbouring countries		Control over coffee trade Rwanda and Uganda

The Global Production Network (GPN) approach, with its emphasis on examining the interrelated actions and institutional structures that shape global economies, offers a valuable lens for studying firm strategies in a development context, such as the case studied in this paper, in ways that exceed the scope of traditional value chain analyses (Coe and Yeung, 2019). Specifically, the GPN approach's broad view of network actors and their relationships can contribute to a deeper understanding of the dynamics of side-selling in cooperatives through at least three key analytical features.

First, the GPN framework provides a valuable lens for comprehending the position of illegal traders in coffee trade networks. In institutional contexts, rules and regulations are typically determined and enforced by state actors. However, the peripheral regions of GPNs – which refer to the production areas in the global south – may experience institutional and economic breakdowns that result in the emergence of market formations beyond the state's full effective control (Hough, 2019; Raeymaekers, 2007). Such institutional constraints can arise from conflict and isolation, leading to processes of 'politics of disinvestment, devaluation, place-making, and subject-making' that primarily impact the producing peripheries of agricultural GPNs (Bair and Werner, 2011; Hough, 2019). In the Eastern DRC, a power vacuum following the 1990s wars facilitated the development of informal cross-border trade in coffee and other commodities, as local commercial elites allied themselves with state or non-state military actors for protection and to maintain their positions in the trade networks (Raeymaekers, 2006, 2007; Titeca and Kimanuka, 2012). These commercial elites extract rents from the local traders, sellers, and buyers in the form of informal taxes or protection money, which are partly reinvested in public goods to legitimize their positions (De la Sierra, 2020; WorldBank, 2010). As a result, the rural population gradually lost bargaining power to these commercial elites, and became increasingly reliant on informal economic systems if they wished to remain connected to the GPN and earn income (Raeymaekers, 2006, 2007). By incorporating these actors and institutional structures, the GPN approach provides a comprehensive view of the dynamics and complexities of the coffee trade networks, allowing for a deeper understanding of the position of illegal traders in these networks.

Second, the GPN approach offers a more comprehensive understanding of the wider implications of market strategies, including the potential for local development beyond mere (regional) economic growth (Hough, 2019; McGrath, 2017), and encompassing inclusive social and environmental upgrading (Barrientos *et al.*, 2011; McGrath, 2017). In this regard, Vicol *et al.* (2019) integrate a livelihoods perspective in their GPN analysis to assess the impact of GPNs on farmers in the global south. As primary actors in the production process, farmers in these regions are more likely to experience the consequences of the uneven territorial development resulting from GPNs (Vicol *et al.*, 2019), which can lead to low prices and limited livelihood resources. Consequently, farmers' production and marketing decisions are not solely guided by price, but also influenced by other factors such as food security, which is critical for their survival.

Third, the GPN approach offers a nuanced understanding of the local implications of global value chains, while also providing flexibility in defining network actors. Although cooperatives are crucial nodes in value chains, they are often not considered as lead firms, even though they may be the primary buying actor within their local community in the global south (Ragasa and Golan, 2014). Furthermore, cooperatives are typically owned and governed by their members (Kolk and Lenfant, 2015; Ragasa and Golan, 2014), who are also the suppliers and workers of the cooperatives. Consequently, any strategy pursued by the cooperative has direct implications for its member farmers, and vice versa. In the context of the coffee cooperatives examined in this study, farmers make simultaneous decisions as both sellers of coffee and shareholders of the cooperative. Hence, a GPN approach can aid in understanding the complex interactions and dynamics between these interdependent actors and their collective influence on market strategies and outcomes.

## 2.2 GPN anchors for the coffee farmers, cooperatives and traders in the Eastern DRC

Confronted with the need for an income and food and faced with the institutional and market constraints to achieve this, farmers in the Eastern DRC have limited choice in sales outlets. Hence, farmers *se débrouillent* (i.e. cope) by acting as a member of cooperatives at the same time as using informal channels to side-sell.

Seen through a GPN lens, the side-selling channels are legitimized by their use. Hence, the side-selling becomes a strategy that is both part of and shaped by the GPN to which these farmers must connect to sell their coffee (Grabs and Ponte, 2019). Despite the potential loss for the cooperative, side-selling is tolerated and institutionalized under the watchful eye of government officials.

As mentioned above, we consider cooperatives as the lead firm of which the members are the shareholders and decision makers (Table 1). At the same time, the members are suppliers of coffee to the cooperatives. By side-selling, the members reduce the coffee supply to the cooperative. This seems to be accepted by the cooperative. Given that members are the cooperatives' stakeholders, allowing others and themselves to side-sell is arguably part of the strategy of cooperatives as well as of the suppliers. Applying the GPN 2.0, we consider both the side-sales by members and the volume they sell as dependent/outcome variables reflecting the lead firm's (in our case the cooperative and its members') strategy.<sup>1</sup> We see the decision of members to side-sell as an expression of augmenting or giving up *inter-firm control*. The extent of side-sales in terms of volumes of informal sales is considered as an *inter-firm practice* adopted by the members.

Following the GPN approach, we intend to explain the expression of inter-firm control and practices by members vis-à-vis the network actors by sets of explanatory variables (Table 1). A first set of variables relate to the *cost capability ratio* (Yeung, 2016). We assume that higher coffee production and lower transport and transaction costs increase patronage to the cooperative as it allows to balance capabilities and costs. Variables affecting coffee production and hence supply to the cooperative include farm characteristics such as land size dedicated to coffee and farmer characteristics as age, education and gender. Location and cooperative-specific characteristics affect transaction and transportation costs farmers face when selling either to the cooperative or to traders. With zero to little domestic consumption, all Congolese coffee needs to find a way to cross the border and is subject to transaction costs during this route (WorldBank, 2010). Poor state performance, safety issues, and the dire state of the infrastructure isolate the region. The absence of accessible roads increases transportation costs, while remoteness increases the cost of information. Additionally, taxes are levied. Official export taxes are topped with informal levies by state officials and non-state actors like militias (De la Sierra, 2020; Raeymaekers, 2013; WorldBank, 2010). The region's security situation has a negative impact on trust, aggravating this issue (Ragasa and Golan, 2014). Moreover, in the informal trade channel, coffee passes multiple hands before reaching the Congolese border (Titeca and Kimanuka, 2012). The number of hands arguably increases with distance. Hence, both transaction and transport costs are influenced by the distance between the coffee farmers and the Ugandan and Rwandan border.

A second set of explanatory variables relates to the *market imperative* (Yeung, 2016), which we operationalize as the potential value created through coffee marketing and is proxied by the contribution of coffee to family income and food. We use the share of coffee to income and the share of days during which the family experienced a lack of food in a year as explanatory variables. The latter is inspired by the livelihood approach introduced in GPN literature by Vicol *et al.* (2019) arguing that also non-monetary livelihood aspects need to be accounted for.

The third set of explanatory variables reflects *financial discipline* (Yeung, 2016). In the context studied, this refers to how members engage with the cooperative in alternative dealings than sales rather than the pressures exerted to create value from new products or markets. Members engage with cooperatives at different levels in their supply for credit and engage with cooperative management.

<sup>1</sup> Note that we do not consider the intra-firm coordination in this paper nor do we try to explain extra-firm bargaining. Given our focus on side-selling, we did not detail internal control mechanisms in the cooperatives nor study its negotiation strategies.

### 2.3 Coffee cooperatives in the Eastern DRC

The true volume of total coffee production and the exact number of active coffee members in the region is unknown due to the absence of reliable statistics. Nevertheless, a growing number of farmers are united in coffee cooperatives. Since the 2010s, four coffee cooperatives were founded in the region with the support of the international NGO Rikolto: Kawa Kabuya (North-Kivu, region Lubero-Beni), Kawa Kanzururu (North-Kivu, Ugandan border), Kawa Maber (Ituri, Ugandan border), and CPNCK (Société des Coopératives des Planteurs du Café et innovateurs du Kivu; Idjwi Island, South-Kivu, Rwandan border) (Figure 1). At the time of study, these four were the only ones operating in the region with export capacities, and united 7,343 individual smallholder coffee farmers. Other producer organizations were small community-based associations or loosely organized groups selling to middlemen who then sell the coffee to one of the big local exporters.

Rikolto's missions are to support smallholder farmers in combatting rural poverty and to contribute to discover how to feed the growing world population. The four cooperatives receive similar external support from the NGO and have the same membership system and managerial structure. Rikolto promotes cooperatives as the most appropriate business model for the inclusion of smallholder coffee farmers in international export markets. In the Eastern DRC, Arabica coffee farmers pay a one-time 50 USD in cash or kind to become a shareholder of a coffee washing station with a maximum of 100 farmers per station. This payment can be made in credit and paid back in instalments. These stations are owned by the cooperative, who pay the



**Figure 1.** Location of the coffee cooperatives. Each dot is a washing station, each shade of grey is a different cooperative.

farmers for the coffee delivered to the washing station and cover operating costs by its coffee sales. The NGO provides help in the formation of cooperatives and the organization of farmers. It helps to introduce good agricultural practices, provides training, and is active in lobbying with government actors and negotiating contracts with potential buyers.

With support of the NGO, the cooperatives are filling part of the ‘governance void’ (Kolk and Lenfant, 2015) in the region. Yet, despite generally offering higher prices at the washing stations, cooperatives find that part of their stakeholder-members side-sell some of their produce. Confronted with the need for an income and food and faced with the institutional and market constraints to achieve this, farmers in the Eastern DRC have limited choice in sales outlets. Hence, farmers *se débrouillent* (‘fend for themselves’) by acting as a member of cooperatives at the same time as using informal channels to side-sell (Grabs and Ponte, 2019). However, by side-selling, they reduce the coffee supply to the cooperative. Nevertheless, this seems to be accepted by the cooperatives. Given that members are the stakeholders of the cooperative, allowing the other members and themselves to side-sell is arguably a cooperative’s strategy induced by its own stakeholders.

### 3. Methodology

#### 3.1 Data

Data used in this paper come from four NGO-supported cooperatives in the Eastern DRC: Kawa Kabuya, Kawa Kanzururu, Kawa Maber, and CPNCK (Figure 1). As mentioned above, all four cooperatives are rather recent and founded in the 2010s. At the time of data collection, they were the only smallholder cooperatives with export capacities active in the region. Data was collected from 339 coffee-producing households with cooperative membership between January and August 2018. The sample covered 4.6% of the total of 7,343 registered members in the four cooperatives at that time. The surveys were held by trained enumerators from Rikolto DRC as part of a general impact evaluation program of the NGO. The impact evaluation was the prime reason for the survey. The analysis presented in this paper is a derivative but part of the impact evaluation.

Households were chosen randomly to participate, irrespective of their remoteness to the cooperative offices. From the membership list of the four cooperatives, 350 interviewees were selected at random into a sample from a membership list guided by the following conditions:

the final list had to have (1) a minimum of 50 observations per cooperative; (2) at least 30 female and at least 30 young farmers (defined as <35 years old by the NGO following their specific impact targets for young farmers); and (3) active members only. If a farmer dropped out or did not want to participate, the next name on the list was considered. In total, 339 households were interviewed.

#### 3.2 Dependent and explanatory variables

The main variable of interest for this research is the informal coffee sales by the cooperative members. The survey captured both the weight of the coffee sold informally and the share this represents from total sales in the last year. The two dependent variables are therefore: (1) a dummy variable that indicates if the farmer indicated to side-sell part of the coffee harvest; and (2) the share of the coffee sold informally.

As mentioned above, we distinguish different sets of explanatory variables (Table 1) in our search to understand side-selling behavior. To reflect the *cost capability ratio*, we include farm and farmer characteristics as well as cooperative-specific effects. The former regards variables that characterize the farmers and their households: the farmer is older than 35 years old, a gender component reflected by a woman in the household included in the household’s spending decisions, the highest attained diploma, and the size of land dedicated to coffee and its squared term to capture non-linearities in the relationship with side-sales. The cooperative-specific effects are captured by including a cooperative dummy. The second set reflects the *market imperative* and is proxied by the share of coffee in the total household income and a self-reported share of days in the

last month during which the household lacked sufficient food. Third, we consider *financial discipline* by controlling for the services the members receive from the cooperative and the relationship between member and cooperative. This includes the number of years the farmers had been member of the cooperative, a dummy if the farmers indicate they can receive credit from the cooperative, and a categorical variable where farmers reported to what extent their opinion is taken into account in cooperative decision making. Finally, location and cooperative-specific characteristics are captured by including a cooperative dummy.

Some of the variables may induce biased results as they could create endogeneity problems due to possible reverse causality. We acknowledge the risk of biases for each of the exploratory variables in the last column of Table 2. The standard methods to deal with endogeneity, like instrumental variable approaches, were considered but not adopted in this study. The search for instrumental variables was inconclusive. Instead, we present robustness checks of the models that show the consistency in our findings.

### 3.3 Analytical methods

Following Shumeta *et al.* (2018), we use a double hurdle model to explain the members' side-selling behavior. Other studies on market participation used either Tobit or Heckman sample selection models (Alene *et al.*, 2008; Gong *et al.*, 2006; Holloway *et al.*, 2004) to deal with the zero answers. Tobit models assume that the decision to participate in side-selling and the extent to which a farmer does, are impacted by the same independent factors simultaneously. Our data shows that a relatively large group of farmers did not side-sell (Figure 2; Table 3). This suggests that the decision not to participate in informal sales is an independent choice. The Heckman models consider a two-step procedure in which a first decision to participate is followed by an estimation of the positive values once a decision to participate is made. The models allow to overcome endogeneity problems, but do not accommodate for zero-answers in the second stage estimation (Amankwah *et al.*, 2016; Holloway *et al.*, 2005; Shumeta *et al.*, 2018).

A double hurdle model helps us to solve these issues. Formulated first by Cragg (1971) and further elaborated by Mullahy (1986), a double hurdle is a two-component model assuming individuals need to pass two hurdles: first, they have to decide if they will side-sell, and thus pass the hurdle of zero side-sales. In the second hurdle, these individuals who surpassed the first hurdle decide on the size of their informal sales. To do so, the double hurdle model contains a binomial model to estimate the zero-hurdle, and a truncated count data model (in this case truncated at 100%) for the positive counts (Zeileis *et al.*, 2008). The estimated equation is as follows:

$$f_{hurdle}(\gamma; x, z, \beta, \gamma) = \begin{cases} f_{zero}(0; z, \gamma) & \text{if } y = 0 \\ 1 - f_{zero}(0; z, \gamma) \cdot \frac{f_{count}(\gamma; x, \beta)}{1 - f_{count}(0; x, \beta)} & \text{if } y > 0 \end{cases} \quad (1)$$

$f_{zero}(0; z, \gamma)$  and  $f_{count}(\gamma; x, \beta)$  are, respectively, a Logit model for passing the zero-hurdle and a Poisson count data model (Zeileis *et al.*, 2008). They are used to estimate the observed value  $y$  of informal sales.  $x$  and  $z$  are sets of explanatory variables, with in our case  $x = z$ . Their corresponding parameters  $\beta$  and  $\gamma$  are estimated by Maximum Likelihood. For interpretation purposes, the exponential values of both parameters are provided in the results-section too. For the zero-hurdle part, these present the changes in odds for a positive value of  $y_i$ . For the positive counts, these present the percentage increases or decreases in expected  $y$  given a unit increase in  $x_i$  when  $y > 0$ .

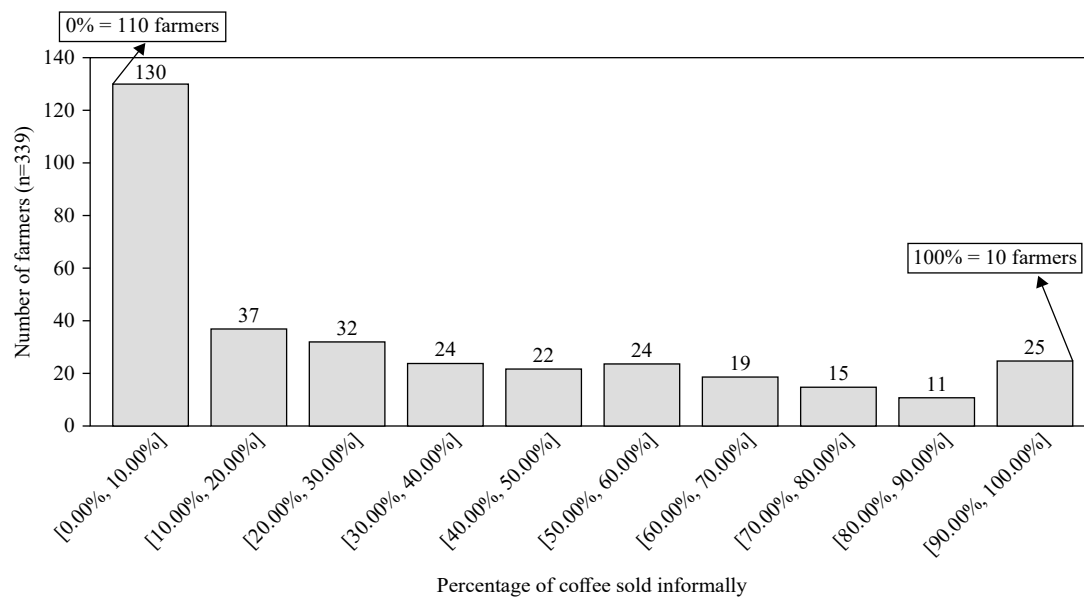
## 4. Results

### 4.1 Descriptive statistics

Figure 2 presents the shares of coffee sold informally by the cooperative members. 229 (67.55%) of the cooperative members interviewed sold coffee to informal traders. Ten respondents (2.95%) reported to sell all their coffee via informal channels. The level of informal sales differed considerably between cooperatives; Kawa Kabuya stands out as having less side-selling members compared to the other cooperatives (Table 3).

**Table 2.** Overview of explanatory variables included in the analysis.

	<b>Definition</b>	<b>Reason to include</b>	<b>Potential reason for endogeneity to side-selling behavior</b>
<b>Member characteristics</b>			
Older farmer	1: +35 years old	We assume that older farmers are better able to make an informed choice, while younger farmers may struggle	No
Gender	1: a woman is involved in household spending decisions	A woman taking part in family decision may be more concerned with feeding the family and hence in search of direct money from side-sellers	No
Highest diploma	scale ranging from 0: none to 6: University/Master's – redefined in dummies	Educated farmers may try to have better deals with traders and more inclined to diverse sales outlets	No
<b>Coffee livelihoods</b>			
Share coffee in household income	% income from coffee over total household income	The higher the importance of coffee in the income, the higher the loyalty of the farmers to the cooperatives to which it wants to contribute	Yes, if the coffee price received from either sales outlets influences the coffee income relative to the household income
Land size coffee	hectare	The more coffee the farmer has, the higher the importance of the services from the cooperative; hence, the higher the loyalty to it	No, as the time for the coffee trees to bear fruits is probably longer than the decision-making process to change sales outlets
Lack of food	% of days the household says to have experienced a lack of food	The farmers facing more difficulties in securing daily food may turn to side-selling as direct payments are needed to pay for the food	Yes, if the coffee price received from either sales outlet is insufficient to feed the family
<b>Cooperative characteristics</b>			
Cooperative membership	number of years	The longer the farmer is member, the higher the loyalty	No
Credit from cooperative	(1: yes)	Farmers receiving credit may value the relationship with the cooperative and side-sell less	Yes, if the patronage to the cooperative affects the cooperative's decision procedure in allocating credit
Participation in cooperative	scale ranging from 0 (no participation) to 4 (actively engaged in decision making, opinion taken into account) – redefined as dummies	Farmers that participate in the cooperative are less likely to side-sell	Yes, if the patronage to the cooperative affects the willingness of the cooperative to account for the farmer's opinions



**Figure 2.** Shares of coffee sold informally by cooperative members.

Table 2 shows the side-seller group differs from fully loyal farmers in terms of the perceived lack of sufficient food for the household and the share of households where a woman is involved in the decision-making on spending. The side-selling group counts relatively more farmers older than 35 years old, who, on average, have been cooperative members for about three years and gather 56-59% of their income from coffee sales. Farmers in both groups farm on less than a hectare, and only a small part of the sample reports being able to receive credit from their cooperative.

#### 4.2 Modeling side-selling behavior

The Likelihood ratio test (Table 4) indicates that the double hurdle model is a better fit to the data than a standard Poisson count model. An additional dispersion test confirms that the Poisson count model has a large over-dispersion. Furthermore, a Wald test checking for pairwise equality between all coefficients of the model's two components (hurdle test) confirms the validity of the double hurdle model. For details on the statistical properties of the tests, we refer to Cameron and Trivedi (1998). Based on these tests, we are confident that the double hurdle model fits our data.

Supplementary Table S1 shows the results of the double hurdle regression model. In the first step, few significant variables are found to explain the likelihood to side-sell. Membership of the cooperative Kawa Kabuya is by the far the most important explanatory factor: members of Kawa Kabuya are significantly less likely to engage in informal side-selling. This corroborates the findings of the descriptive analysis. Additionally, a longer cooperative membership and the second participation variable (i.e. answers to the question: 'My input is asked and taken into account') both increase the probability of side-selling, while a larger coffee land size decreases it.

The second model that searches to understand the share of coffee sold informally (i.e. the count model) produces more significant relations. Among the farmers who decide to sell part of their coffee outside of the cooperative, younger farmers appear to side-sell less. Side-selling volumes first decrease with higher education levels, to increase again for the most highly educated. Households where women are involved in decision making on spending and those who have been a member for longer sell more on the informal market. Regarding (coffee) livelihoods, households with a larger share of income out of coffee activities report less side-selling, though the coefficient is small and not highly significant. A higher reported number

**Table 3.** Descriptive statistics of fully loyal and side-selling cooperative members.<sup>1</sup>

	Fully loyal farmers	Side-sellers		
	n	n		
CPNCK	8	73	47.70 (32.07)	
Kawa Kabuya	98	49	11.71 (24.54)	
Kawa Kanzururu	3	55	33.28 (24.57)	
Kawa Maber	1	52	55.28 (23.09)	
<i>Total</i>	110	229	30.81 (31.77)	
	Mean (st.dev)	Mean (st.dev)	t-value (mean difference)	Chi-squared value
<b>Member characteristics</b>				
Older farmer (1: +35 years old)	0.31 (0.46)	0.23 (0.42)		2.22
Highest diploma (scale ranging from 0: none to 6: university/master's)	2.26 (1.43)	2.39 (1.39)	-0.76 (0.13)	
Gender (1: a woman is involved in household spending decisions)	0.16 (0.37)	0.27 (0.45)		4.15**
<b>Coffee livelihoods</b>				
Share coffee in household income (%)	56.47 (23.16)	58.95 (19.26)	-0.97 (2.48)	
Land size coffee (ha)	0.84 (0.94)	0.68 (0.83)	1.56 (-0.16)	
Lack of food (% days)	10.36 (0.23)	24.51 (0.25)	-4.79*** (14.15)	
<b>Cooperative characteristics</b>				
Cooperative membership (years)	3.20 (2.29)	3.10 (2.67)	0.35 (-0.10)	
Credit from cooperative (1: yes)	0.13 (0.33)	0.14 (0.34)		0.0
Participation in the cooperative (scale ranging from 0 (no participation) to 4 (actively engage in decision making, opinion taken into account))	3.21 (1.70)	3.22 (1.25)	-0.05 (0.01)	

<sup>1</sup> \*\*\* $P < 0.01$ , \*\* $P < 0.05$ , \* $P < 0.1$ ; st.dev = standard deviation; CPNCK = Société des Coopératives des Planteurs du Café et innovateurs du Kivu.

**Table 4.** Model test statistics.<sup>1</sup>

	Standard Poisson model	Double hurdle model
Dispersion test		
Null hypothesis	Equi-dispersion $E[y] = \mu$ and $\text{Var}[y] = \mu$	
Dispersion	$\text{Var}[y] = 26.57\mu$	
z-statistic	6.24***	
Decision	Over-dispersion	
Wald test		
Null hypothesis		No zero hurdle required
Chi-squared statistic		1,457***
Decision		Zero hurdle required
Likelihood ratio test		
Null hypothesis	Equal loglik's	
LogLik	-4,565.8	-2,397.8
Degrees of freedom	22	44
Chi-squared statistic	4,348.1***	
Decision	Double hurdle is the better fit	

<sup>1</sup> \*\*\* $P < 0.01$ , \*\* $P < 0.05$ , \* $P < 0.1$

of days without sufficient food for the household increases the size of informal sales. Regarding coffee land size, we find a U-shaped relation with informal sales, as these start the decrease with increasing land size, and increase for those with the largest coffee plots. At cooperative level, as opposed to CPNCK, members of Kawa Kabuya and Kawa Kanzururu side-sell less, and those of Kawa Maber more. Farmers who report being able to receive credit from their cooperative, and who feel their opinion is considered in cooperative decision making, engage less in informal side-selling.

As listed in Table 2, we suspect several exploratory variables are prone to induce errors in the coefficients due to reverse causality (Table 1). In Supplementary Table S2, we present three robustness checks of the double hurdle model whereby we leave out the explanatory variables which are potentially endogenous. Supplementary Table S2 gives the exponential values of the estimated coefficients for (1) a model without the four potentially endogenous variables, (2) a model without the cooperative credit and participation variables as these might mainly induce endogeneity in the first hurdle part, and (3) a model without the variables concerning the share of coffee in the household income and the reported lack of food, which mainly relate to the second hurdle. For all three models, little differences regarding the main model (Supplementary Table S1) were found. For endogeneity checks (1) and (2), the land dedicated to coffee production becomes insignificant in the first hurdle part, as does the older farmer-dummy in the second hurdle part. For endogeneity check (3), membership of the cooperative Kawa Maber becomes significant in the first hurdle part and insignificant in the second hurdle part.

## 5. Discussion

### 5.1 Widespread side-selling

The descriptive results show that side-selling is widespread amongst the coffee farmers in the Eastern DRC. In all four cooperatives studied, a significant share of the members says that they side-sell part of their coffee. By side-selling, the members arguably decrease their patronage to the cooperative they belong to and are shareholder of. Hence, the cooperative is seemingly losing control over its suppliers-cum-owners, and it seems to accept.

The most important determinant in explaining participation in informal side-selling is by far membership of other cooperatives than Kawa Kabuya, which counts the highest share of fully loyal members. This may be explained by its location. Figure 1 shows that Kawa Kabuya is the only cooperative not located directly at the Congolese border.

Coffee needs to cross the Congolese border in order to get into the GPN, a function taken on by the cooperative and traders. Informal trade exists by virtue of a conducive institutional and logistics environment. A more conducive environment closer to the border lowers transaction and transport costs to such an extent that informal trade starts to thrive. In the informal trade chain, coffee passes through the hands of many middlemen (Titeca and Kimanuka, 2012). Once the coffee is across the border, roads get better and roadblocks, where informal taxes are charged, disappear (Schouten *et al.*, 2017). As a result, transaction costs increase fast if the coffee needs to move around longer in the DRC. While trading middlemen allow farmers to get access to the GPN via immediate payment, this is translated into a price reduction (Lecoutere *et al.*, 2009) which one can consider as an interest payment for transaction costs. Cooperatives try to bypass the middlemen to achieve higher prices for their members (Kolk and Lenfant, 2015; Mujawamariya *et al.*, 2013). Rikolto DRC confirms that because of the distance to the border, there are fewer informal traders present in the region of Kawa Kabuya. Cross-border traders might also be less institutionalized the further away from the border.

Also personal characteristics of the coffee farmers seem to influence their likelihood to engage in side-selling. The probability of side-selling decreases with increasing land size, but increases for members that have been part of the cooperative for a longer time. We will come back to these explanatory variables in the next section when reflecting on the level of side-sales. Yet, it is worth mentioning here that we think cooperatives act differently vis-à-vis farmers of smaller volumes of coffee and long-term members. They may be given more leeway to side-sell from the cooperative.

## 5.2 Side-sales as a safety net

As mentioned throughout the paper so far, the cooperatives seem to accept that their members side-sell. The second hurdle component on the model informs on the relative level of side-sales compared to the farmers' total production. We find that vulnerable farmers side-sell a relatively higher share of their coffee production. These farmers are more vulnerable in terms of costs and capabilities, but also for market imperative parameters such as income and food availability, as well as regarding the services they demand from the cooperative.

Side-selling farmers where females are involved in decision-making on spending report larger informal shares. A remark often given at the end of the surveys was that the production of coffee is generally a man's business. If women are included in decision-making, this is often a sign of vulnerability, for instance as she might be a widow or as her husband may have migrated in search of work (Gerard *et al.*, 2020). Female-led households in Central and Eastern Africa are generally found to be more vulnerable (Ansoms and McKay, 2010), which in combination with the male-dominated views on coffee production results in different and fewer marketing options for the household to connect to the GPN (Alinyo and Leahy, 2012; Hill and Vigneri, 2014).

Additionally, younger farmers and more recent members side-sell less. Here, we see an impact of the conflict-affected institutions on trust and cooperation (Ragasa and Golan, 2014), as is the emergence of informalized economies in such environments (Hough, 2019). Members that worked in this weak institutional environment for a longer time (and '*se débrouille*'), get to know the informal alternatives better and engage in repeated transactions between farmers and traders (Mujawamariya *et al.*, 2013).

We find side-selling first decreases with increasing levels of education, to become insignificant and even increase at the highest levels of education. The former trend of increasing side-sales with education corroborates other side-selling literature as those with better education may recognize the benefits of cooperative sales and collective action (Shumeta *et al.*, 2018; Wollni and Fischer, 2015). We speculate that the larger side-selling

by the best educated farmers in our sample is explained by their inclination to use bargaining power in the side-selling relation with the traders. The higher levels of side-sales amongst the least educated farmers in the sample point again to the higher side-sales amongst the most vulnerable members.

The results of the model suggest that the probability of informal sales and its size decrease with an increasing land size dedicated to coffee. The share of side-selling also decreases as the share of the household's income coming from coffee sales increases. Farmers with more coffee and relatively more income from coffee are less vulnerable, and less inclined to accept the lower informal prices. The coffee income relaxes their liquidity constraints, and it is easier for them to sit out the payment period of the cooperative. Interestingly, we find that the size of informal sales starts to increase again with larger coffee land sizes. We thus find a U-shaped relation, but inverse to the one Wollni and Fischer (2015) found in Costa Rica. This, we attribute to the political economy of the region, and the constraints it imposes upon the actors in the GPN including the cooperatives who suffer from finding sufficient buyers for the coffee they collect from the members. The largest farmers may face the cooperative's limitations in finding sufficient buyers while they also need to secure enough liquidity to keep their farm going. For instance, external wage laborers are hired to help during harvest, especially by producers with larger plantations for whom the household labor does not suffice. Because cash is not readily available, these laborers are usually paid in the coffee they help harvest. Second, as with the older farmers maintaining long-standing relations with traders, informal sales for the largest farmers is a way of diversifying coffee income and maintaining similar relations in an insecure setting.

The advantage of the informal side-selling for the farmers is that payment happens immediately and that traders tie farmers to them with pre-financing, as opposed to multiple months of waiting at the cooperative. Members of the cooperatives report having to wait for six up to nine months before the cooperatives pay them. Faced with a dire lack of food, they often are not able to sit out this wait. The cooperatives told us the informal traders often tie coffee farmers to them by giving them pre-financing. Though prices are lower, this can partially solve the farmer's liquidity constraints. This also explains why we find that farmers who did not receive credit from the cooperatives side-sell more.

Other literature proposes improvements in the timeliness of cooperative payments to increase farmers' patronage (Saitone *et al.*, 2018). However, the cooperatives face liquidity constraints too and are not able to simply increase their timeliness. By allowing their members to connect to the GPN via side-selling for part of their coffee, members can enjoy the liquidity benefits of informal sales as a safety net. This co-existence allows the more vulnerable farmers to remain attached to the cooperatives.

While, as mentioned, farmers with a longer cooperative membership side-sell more as they get to know the alternatives, we find that when their opinions are taken into account in cooperative decision making they side-sell less (Mujawamariya *et al.*, 2013). Together with our results on the provision of credit, this shows that a more efficient functioning of the cooperatives could increase cooperative sales even in this weak institutional framework (Shumeta and D'Haese, 2016).

When basic needs are met and members can sit out the wait, they can then turn to the more remunerative cooperatives to market coffee. Additionally, informal sales provides a way to generate an income from coffee that does not fulfil the cooperatives' quality standards by getting it access to the market informally. The lower quality coffee is diverted to another channel, opening up to the cooperatives' limited capacities to coffee which is up to their standards.

## 6. Conclusions and policy implications

Using the case of Arabica coffee smallholder in the Eastern DRC, we explained how in unstable regions cooperatives and informal side-selling can co-exist. Coffee farmers resort to informal channels, involving cross-border smuggling, which functions as a safety net. In the region, transaction costs are high, buyers are difficult to find, and cooperatives lack the liquidity for immediate payment to the member farmers.

Cooperatives allow this co-existence, to mediate for the institutional issues they experience themselves. By making use of the different options available to them, most farmers stay connected to the international markets via the preferred cooperative channel albeit alongside the informal sales channels. The informal sales channels in the study region are illegal cross-border trade which thrive by virtue of the institutional void.

Especially the more vulnerable farmers need to rely on the safety nets provided by the informal traders, as they need immediate cash to cover subsistence needs of their households. They have the weakest bargaining positions when exchanging with the informal traders. While they benefit from collaborating via their cooperatives, delayed payments and quality requirements push them into the informal market. This is shown by the increased levels of informal sales amongst members with small coffee plots, and those that lack of food and credit. Older farmers with more years of cooperative membership are also found to side-sell more, as they diversify their coffee sales channels by maintaining long-lasting relations with the cross-border traders.

However, also farmers with the largest coffee plots are involved more in informal sales. They face the limits of the cooperatives in assuring sufficient interesting contracts with buyers, paying external laborers in coffee due to liquidity constraints, and diversifying their coffee income. Finally, we find that farmers with higher education side-sell more. Information might not only strengthen the farmers' position in bargaining with informal traders but could also learn them combining cooperative sales with informal sales is indeed a viable livelihood strategy given the imposed constraints and regulatory order in the region.

Changing the dynamics of value capture within the GPN to the benefit of the farmers requires institutional change to take place in the Eastern DRC. This is difficult and should be viewed as future – long run – options by the different actors involved. We give some proposals in the following sections. These might apply to other unstable peripheral production regions within their respective GPNs as well, and do not have to be seen as confined to coffee and the Eastern DRC.

*Formalization of the informal trade channels* can be a step forward in strengthening the bargaining position of the coffee farmers. Government officials realize the possibilities of the cross-border trade and gather part of their living by levying informal taxes on the exported coffee. In recent years, state officials have become more involved in the organization and taxing of the (informal) coffee exports which could be a start of a formalization process. The money raised through these informal taxes are partly reinvested in local social and economic development initiatives. While this entails extra costs for coffee farmers, it also allows a fragile functioning of the Congolese state in its periphery. Lifting the trade out of illegality could not only strengthen the position of the farmers by providing them with legal back-up, but would also keep a DRC label on the coffee instead of 'changing' to Ugandan or Rwandan coffee once abroad. This contributes to state-building in the DRC and increases traceability for other nodes in the global value chain such as roasters, lead firms, retailers, and consumers. While power relations are skewed, recognizing where the coffee is coming from is a first step in ameliorating the farmers' position.

However, the Congolese state is fragile, and formalizing informal trade is a lot easier said than done. Alternatively, *enhancing the capacities of the cooperatives* is a way forward in the shorter run. They provide the highest prices and strongest bargaining positions to members. Yet, the cooperatives' challenges in finding well-paid contracts with buyers result in the coffee farmers treating less coffee up to the cooperatives' quality standards and consequently selling less via this more remunerative channel. Finding more and better-paying buyers increases buying capacity and liquidity at the cooperative-level, and in turn, decreases the prolonged payments and gives the cooperative more capacity to provide credit to their members. Quicker payment by the cooperative in its turn decreases dependency upon the lower but immediate payments by informal traders. Regarding cooperative management, higher member participation within the cooperatives is also shown to increase sales to the cooperative. NGO-support could be a way forward in solving this issue. In this study, the support by Rikolto not only generated additional buyers for the cooperatives but also contributed to decreasing informal sales by targeting the more vulnerable farmers and promoting participatory ways of

management. Furthermore, the NGO has negotiated multi-year contracts including pre-financing with buyers who previously were hesitant to buy coffee from the region due to its instability.

Some limitations of this study include the fact that this study has only examined (NGO-supported) cooperative members. As inclusion into international markets would usually involve the exclusion of others, enhancing the capacities of cooperatives might have important implications for non-cooperative members whom we have not yet looked at. Furthermore, becoming a member requires a membership fee, which might exclude the most vulnerable in the region who are not able to pay this initial sum. Further research should acquire data from non-cooperative farmers to solve these issues.

Related to this, attention should be paid to the informal traders too. They are economic agents trying to sustain certain livelihoods. If cooperatives push them aside, the increase of cooperative capacities might also result in exclusion at their side. In the future, the GPN perspective should be extended to these nodes in the network as well, to examine the impact of dynamics on their ways of life.

## Supplementary material

Supplementary material can be found online at <https://doi.org/10.6084/m9.figshare.23508264>.

**Table S1.** Main model: double hurdle model estimating cooperative members' participation in and size of side-sales.

**Table S2.** Robustness checks with dropped variables: double hurdle models estimating cooperative members' participation in and size of side-sales.

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