Participation of Farmers in Market Value Chains: A Tailored Antràs and Chor Positioning Indicator

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Abstract

This study presents a micro-level indicator of farmers' positioning in the market chain, based on the conceptual framework outlined by Antràs and Chor (2013, 2018). The indicator considers the selling location of a farming household and its crop buyers. Using panel data from the World Bank's 'Living Standards Measurement Study: Integrated Surveys on Agriculture' for Ethiopia and Nigeria, this paper applies the proposed indicator empirically and showcases its superior performance in comparison to existing alternatives at the micro-level. Furthermore, by analyzing the dynamics of farmers' food and total consumption over time and controlling for various household and production characteristics, as well as potential confounding factors, this study shows that moving towards a downstream position in the market chain has a positive impact on farmers' food and total consumption levels. The results are validated through sensitivity analysis and robustness checks.

Keywords: value chains, economic development, market chain, farming households

JEL-Codes: *Q12; O12; O13; C23*

Introduction

The discourse on the effects of farmers' participation in global markets remains nuanced. One segment of the literature highlights that smallholder farmers' engagement in traditional markets catalyzes pro-poor outcomes through a cycle of enhanced household income, increased consumption, greater food security, and improved nutrition (Bellemare, 2010; Montalbano et al., 2018). Conversely, another segment postulates that market participation might not significantly benefit those unable to leverage increased market orientation's advantages (von Braun, 1995; Carletto et al., 2017).

Market chain participation encompasses essential activities for food production delivery to consumers, including trading (Kaplinsky & Morris, 2001). In development scenarios, farmers often find themselves limited to lower-value activities, positioning them at the backward stages of the market value chain, which contrasts with increased employment, better jobs, resources, governance, and food security associated with downstream positioning (African Development Bank et al., 2014; Minten et al., 2009; Cattaneo & Miroudot, 2013; Swinnen, 2014; Swinnen & Vandeplas, 2014). Antràs and Chor (2013) offer a foundational model on positioning, illustrating a dependency of downstream stages on upstream activities, yet discussions on the structuring of the most upstream sectors within value chains remain limited.

This research merges insights from trade and development literature on value chain positioning, focusing on supplier positioning in global chains as per Antràs and Chor (2013; 2018), and the commercialization decisions of rural farmers as detailed by Migose et al. (2018), Minten et al. (2018), and Montalbano et al. (2018). It introduces a novel downstreamness measure for rural farmers in market value chains, inspired by Antràs and Chor's framework. This study tests the new positioning indicator using the LSMS-ISA dataset for Ethiopian households, selected for its detailed commodity exchange market data, and conducts parallel testing with Nigerian

LSMS-ISA data and analyses related to food quantity and market positioning. The indicator outperforms traditional measures in empirical tests.

The study examines how farmers' market positioning affects their consumption levels. Findings show that improved positioning significantly boosts farmers' food and total consumption, supporting existing literature on agricultural commercialization's impact, validated through extensive sensitivity and robustness checks. The paper is organized as follows: Section 2 reviews the literature and theoretical framework. Section 3 introduces the market positioning indicator. Section 4 details crop value chain structure and methodology. Section 5 describes the data and statistics. Section 6 discusses the empirical strategy and results. Section 7 concludes the study, summarizing key findings and implications.

2. Literature Review

Agricultural commercialization is widely regarded as a key mechanism for poverty alleviation in rural settings, underpinned by literature suggesting its positive impact on rural households' development (de Janvry & Sadoulet, 2006; von Braun & Kennedy, 1994). This transition allows smallholder farmers to shift from subsistence farming practices to the cultivation of market-specific crops, facilitating specialization, the adoption of modern agricultural technologies, and ultimately, higher productivity (van Asselt & Useche, 2022). Studies like those of Jensen (2010), Key et al. (2000), and Svensson & Yanagizawa (2009) have documented that market participation and positioning are affected by access costs and risk preferences, affirming the benefits of effective market positioning. However, agricultural trade may yield several effects on production constraints, land use, and environmental sustainability (Minten et al., 2007), with smallholder farmers facing barriers such as low productivity, stringent standards compliance, and elevated transaction costs that limit market entry (Montalbano et al., 2015).

Vertical market integration turns out to be critically relevant in these contexts characterized by fragmented markets, weak contract enforcement, and political instability (Fackler & Goodwin, 2001). The nature of the crop buyer significantly influences market positioning, with farmers navigating interactions with intermediaries, large processing firms, and state-managed markets. Despite the perception of intermediaries as monopolistic rent-seekers (Montalbano et al., 2018), empirical evidence suggests that farmers' involvement in contract schemes and export chains generally yields positive outcomes for smallholders (Barrett et al., 2012; Bellemare, 2010; Bellemare & Novak, 2017; Minten et al., 2009; Subervie & Vagneron, 2013).

The interaction between global and local value chains raises questions about the impact of global market participation on local agricultural systems and food consumption. While some argue that global value chains can undermine traditional local markets (Ríos Guayasamín et al., 2016), others point to the competition for resources that such integration entails (Feyaerts et al., 2020). The debate extends to the efficacy of local versus global value chains, with some evidence suggesting local markets may offer better performance or serve as gateways to global chains (Wegerif & Martucci, 2019; D'Souza & Jolliffe, 2014). The importance of market positioning within these distribution networks cannot be overstated, yet the lack of comprehensive data and theoretical frameworks for micro-level analysis underscores the complexity of drawing definitive conclusions (Feyaerts et al., 2020). Selling to immediate social circles is often seen as a strategy of last resort for farmers constrained by high transaction costs or market access issues, highlighting the challenges faced by rural farmers in developing economies (Timmer, 1997; Key et al., 2000; Fackler & Goodwin, 2001; Fafchamps & Hill, 2005).

Given the disparate nature of existing studies, often limited to specific case studies, this paper aims to bridge the gap by proposing a micro-level measure of market positioning. This contribution seeks to enrich the ongoing discussion on the nuanced relationship between market participation and food consumption, providing a new analytical lens to examine the intricate dynamics at play in agricultural commercialization and its broader socioeconomic impacts.

3. The Proposed Positioning Measure

Value chain downstream positioning, which denotes the proximity of production to final demand, integrates development and trade concepts, highlighting the importance of geographical distance and market access on agricultural decision-making (Montalbano & Nenci, 2022; von Thünen, 1966; Chamberlin & Jayne, 2013; Oosting et al., 2014). This approach reveals the profound effect of location on farming strategies, extending beyond mere physical distance to include factors like travel costs (Nanyeenya et al., 2007; Duncan et al., 2013).

Kaplinsky and Morris (2001) outline three value chain elements: key buyers, transaction dynamics, and critical factors. Montalbano et al. (2018) further refine this by introducing a "Positioning Dummy", based on the identity of market outlets, for distinguishing between upstream and downstream positions, highlighting the significance of broader market access. However, the challenge remains in developing a theoretical model that accurately captures value chain participation, especially the volume of sales, a crucial aspect in Global Value Chains (GVCs) discussions (Nenci, 2020). Traditional Input-Output (I-O) tables, despite their utility, fall short in detailing the entire value chain network (Montalbano & Nenci, 2022).

Antràs and Chor (2018; 2022) expand on this by incorporating the sequence of production stages into the analysis, defining upstreamness (U) as the weighted average distance of a stage from final demand, and downstreamness from the proximity to primary production factors. The formula for upstreamness is given by:

$$U_i^r = 1 \times \frac{F_i^r}{Y_i^r} + 2 \times \frac{\sum_{s=1}^{S}\sum_{j=1}^{J} a_{ij}^{rs} F_j^s}{Y_i^r} + \cdots. \quad [1]$$

where a_{ij}^{rs} represents the dollar amount of each country's sector needed to produce one dollar's worth of industry output in another country (i.e., $a_{ij}^{rs} = \frac{Z_{ij}^{rs}}{Y_j^s}$). Downstreamness is similarly defined, focusing on the distance from primary factors, emphasizing the role of value addition in determining chain positioning.

Applying theoretical models to agricultural value chains reveals challenges, notably with data limitations and the non-linear structure of these chains, which often resemble "flatter" or "spider" configurations, complicating the application of Antràs and Chor's (2018) framework. Antràs & Chor (2019) distill market positioning into the share of output sold directly to consumers, creating a micro-level downstreamness indicator. However, this indicator faces limitations in capturing the intricacies of market chains due to data scarcity. Building on the insights from Veugelers et al. (2013), Giunta et al. (2022), and Nenci et al. (2022), who examine value chain participation through the share of imported intermediates, this study proposes a refined indicator for agricultural value chain positioning that accounts for the sequence of intermediaries from farmers to final retailers, emphasizing the critical role of selling positions within the chain. It accounts for the intermediary sequence from farmers to end retailers, highlighting the critical role of selling positions within the chain. This is quantitatively represented as:

$$D_i^r = \text{Selling Position n.1} \times \frac{C_i^r}{Y} + \text{Selling Position n.2} \times \frac{C_i^r}{Y} + \cdots; \quad [2]$$

where the first integer term indicates the Selling Position number (i.e., the chain positioning of acquiring intermediaries), C_i^r equals the quantity of crop sold by each household, and Y is the total quantity of that crop sold along the crop-selling chain.

The current literature reveals numerous shortcomings: the absence of a comprehensive, standalone indicator; incomplete data that lead to partial interpretations; and a neglect of the impact of vertical integration on positioning. These deficiencies underscore the necessity for a refined micro-level downstreamness indicator. This improved indicator should account for the selling position, incorporate the geographical selling location, and consider the multiplicity of buyers. Furthermore, it should integrate the welfare effects of positioning, net of geographical distance, and the impact of trade costs on positioning (Mancini et al., 2023; Fafchamps & Hill, 2005). To address these concerns, an enhanced formula is proposed**:**

$$D_i^r = p_i^r \times \frac{C_i^r}{Y} \times l_i^{r\,1/(1-\rho)}; \qquad [3]$$

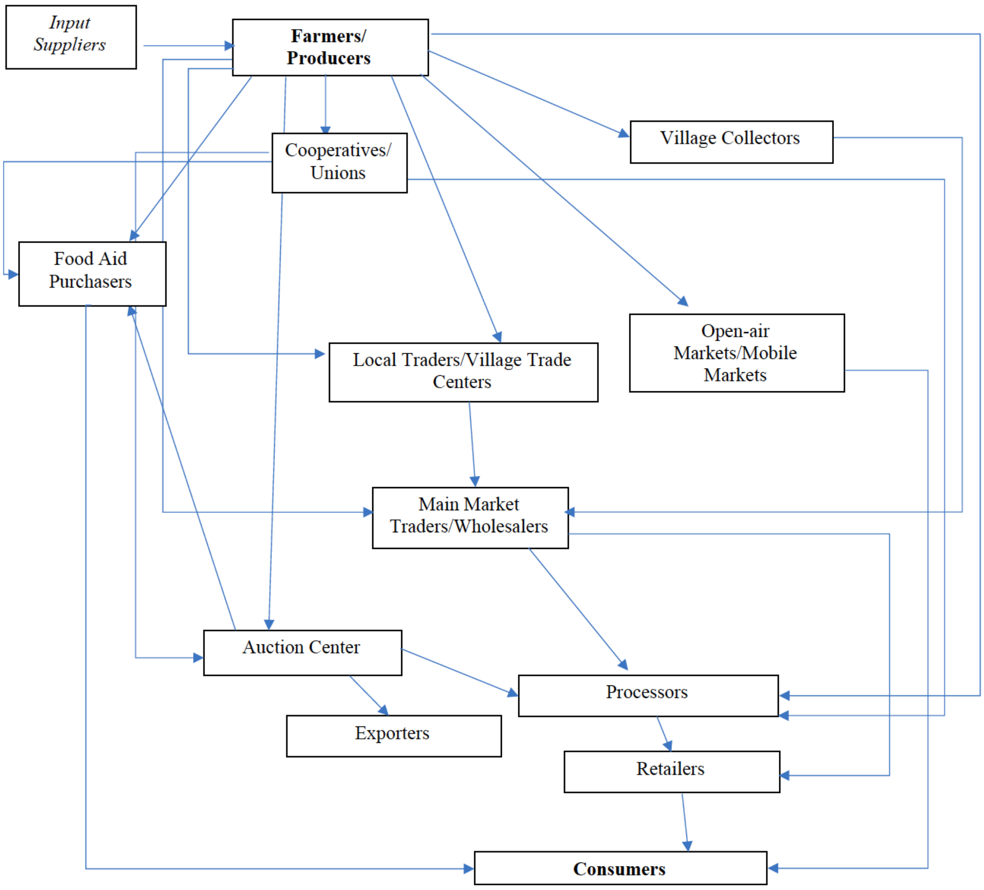
where p_{ij}^{rs} equals $\frac{Selling\ Position\ Number}{Total\ Number\ of\ Selling\ Positions}$, l_{ij}^{rs} equals $\frac{Selling\ Location\ Number}{Total\ Number\ of\ Selling\ Locations}$, C_i^r equals the quantity of crop sold, and Y equals the total quantity of that crop sold along the crop market selling chain. It is important to note that farming households are commonly involved in multiple crop value chains. Hence, the resulting positioning value attached to them will be the average of their positioning score in each single crop selling chain. The proposed indicator, following the theory of Antràs and Chor (2013), incorporates crop demand elasticities as a tuning parameter, suggesting that lower elasticity values (ρ) increase the likelihood of vertical integration in the value chain. This tuning parameter, formulated as 1/(1- ρ), reflects the observation that own-price elasticities are negative for most commodities, as indicated by Deaton & Muellbauer (1980), and particularly low for crops like maize and sorghum, which exhibit among the lowest values (Tafere et al., 2010). Finally, the proposed indicator facilitates comparability across different types of value chains and fields by being structured as an index ranging from 0 to 1.

The adaptation of Antràs and Chor's framework assumes farmers as a type of firm, with the analysis specifically targeted at a singular stage of the chain. The investigation is confined to the dynamics of selling chains, under the premise that scrutinizing solely the farmers' roles does not encompass the evaluation of added value. Additionally, it is assumed that farmers have the capability to engage in multiple crop value chains simultaneously, illustrating a diversified strategy to market participation. The proposed approach integrates elements from development and trade literature, such as "selling position," "selling location," and "crop ratio," while updating the model to reflect non-sequential production stages and the diverse nature of agricultural sales, as suggested by recent insights (Antràs & Chor, 2022; Davis et al., 2018).

4. Empirical framework

In the establishment of the empirical framework for this analysis, Figure 1 systematically delineates the array of market outlets available to smallholder farmers. By illustrating the comprehensive network through which agricultural products transition from production to the end consumer, Figure 1 methodically outlines the agricultural value chain, beginning with input suppliers—such as seeds, fertilizers, pesticides, and herbicides—primarily provided by either agricultural development agencies or private entities (Audet-Bélanger et al., 2013; Ugonna et al., 2015; Ayele et al., 2021).

Figure 1: A Standard Crop Value Chain in Ethiopia and Nigeria



Source: Author's adaptation from Gabre-Madhin & Goggin (2006); Ayele et al. (2021); Rashid & Negassa (2013), Gashaw & Kibret (2018); FAO (2020); Babama'aji et al. (2022).

Notably, village collectors often constitute the initial market entry point in countries such as Nigeria and Ethiopia (Babama'aji et al., 2022; Ayele et al., 2021), leading to further engagement with agricultural cooperatives and processors. These entities are instrumental in vertical integration, offering essential services like free storage and facilitating transactions with exporters, or local food agencies (USAID, 2017; Gabre-Madhin & Goggin, 2006). Additionally, the figure highlights the role of wholesale markets situated in main districts, which acquire crops either directly from farmers or via intermediaries, thereby augmenting access to storage and communication channels (Ayele et al., 2021).

The significance of private companies in providing downstream positioning benefits is also emphasized, noting their contribution to higher income levels and the facilitation of technology spillovers, which in turn enhance income stability and food security (Case, 1992; Bandiera & Rasul, 2006; Matuschke & Qaim, 2009; Barrett et al., 2017). The analysis further acknowledges the importance of mobile markets and commodity exchange markets as additional, critical conduits connecting smallholders with formal market segments (FAO, 2020). The variability in the length of value chains necessitates that farmers engage at various stages, with their positioning influenced by external contingencies such as natural disasters (Biggeri et al., 2018).

Leveraging insights from Montalbano et al. (2018), this research assumes that direct sales to primary markets or private entities potentially yield higher profitability, indicative of sophisticated management expertise. Consequently, market outlets are classified into seven distinct groups, spanning from upstream positions, characterized by lesser reward, to downstream positions, associated with greater economic benefit. Specifically,

- Outlet n.1: Roadside → Selling Position n.1
- Outlet n.2: Agricultural Cooperatives → Selling Position n.2
- Outlet n.3: Farm-Based Association → Selling Position n.2
- Outlet n.4: Government Agencies → Selling Position n.3
- Outlet n.5: Political Leader → Selling Position n.3
- Outlet n.6: Private Trader in Local Market → Selling Position n.4
- Outlet n.7: Local Merchant/Grocery → Selling Position n.4
- Outlet n.8: Local Market → Selling Position n.5
- Outlet n.9: Mobile Market → Selling Position n.5
- Outlet n.10: Private Trader in Main Market → Selling Position n.6
- Outlet n.11: Main Market → Selling Position n.6

- Outlet n.12: Private Company
- Outlet n.13: Auction Market

→ Selling Position n.7

Also, a final note must be made for selling locations, whose score scale of 3 is defined, due to limited observations, as follows[1]:

- Selling Location n.1: Selling within the village or near the village
- Selling Location n.2: Selling near the town or near the district
- Selling Location n.3: Selling outside the district or outside the region

5. Data and Descriptive Statistics

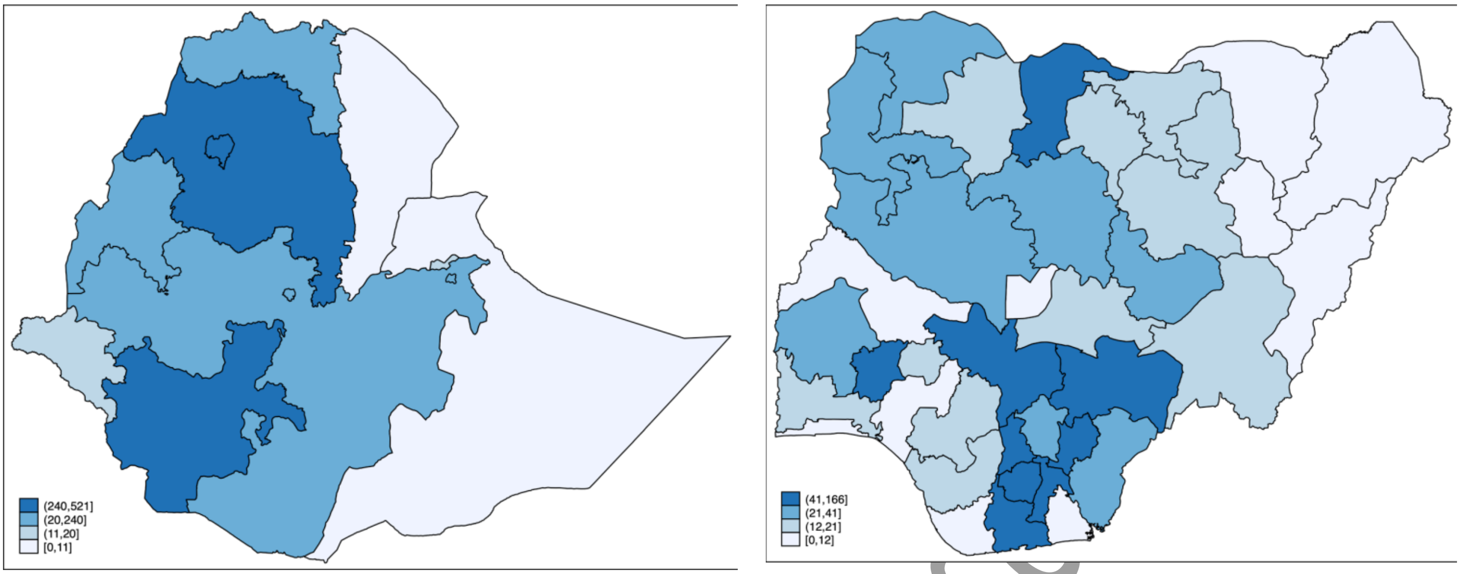
This study utilizes the LSMS-ISA dataset from Ethiopia and Nigeria, gathered by the Ethiopian Central Statistics Agency, the National Bureau of Statistics of Nigeria, and the World Bank across three survey waves from 2010 to 2016. The final dataset, nationally representative, comprises approximately 1460 and 1178 observations for Ethiopian and Nigerian farmers, respectively, commercializing their crops.

The analysis draws from household and agricultural data within the LSMS-ISA dataset, focusing on farmers' responses about their main crop buyers, encapsulated in a network roster of over 30 actors, allowing identification of primary and secondary commercial partners. Descriptive statistics for household variables are detailed in Tables A.1, A.2 (Ethiopia), and A.3 (Nigeria) in the Appendix, noting omissions in the Nigerian dataset due to missing data. Geographical analysis reveals that households are generally located far from main markets, with Figure 2 depicting the regional distribution of households in Ethiopia and Nigeria.

[1] If households resides in the main market, this measure can be bypassed.

Figure 2: Household Density per Region/State

ETHIOPIA NIGERIA

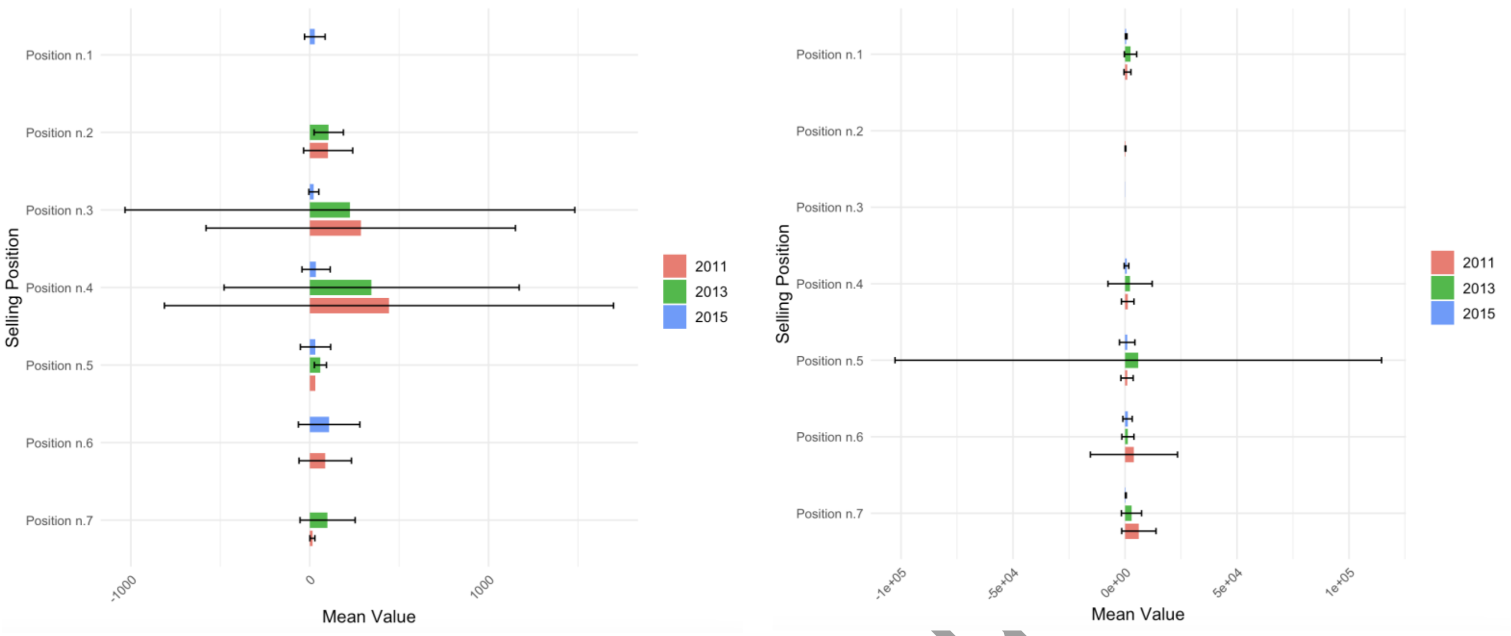


Source: Author's own elaboration from LSMS-ISA data.

Selling patterns, as shown in Figure A.1 in the Appendix, indicate a preference for selling large crop amounts outside formal markets, particularly with relatives, friends, and neighbors. Notably, events like the 2011 floods in Ethiopia significantly influenced these trends, with a marked shift in the selling outlets used by farmers.

Figure 3 and 4 categorize crop sales quantities from Figure A.1 by selling position and location, respectively. Specifically, as shown in Figure 3, Ethiopian farmers tend to sell upstream, mainly to agricultural cooperatives and farm-based associations, while Nigerian farmers predominantly sell downstream but also through local markets.

Figure 3: Quantity of Crop Sold (in Kilos) per Position



The distribution of sales by location (see Figure 4) shows a majority within or near villages, with a notable portion of Nigerian crops sold outside the region before 2012.

Figure 4: Ethiopia – Quantity of Crop Sold (in Kilos) per Selling Location

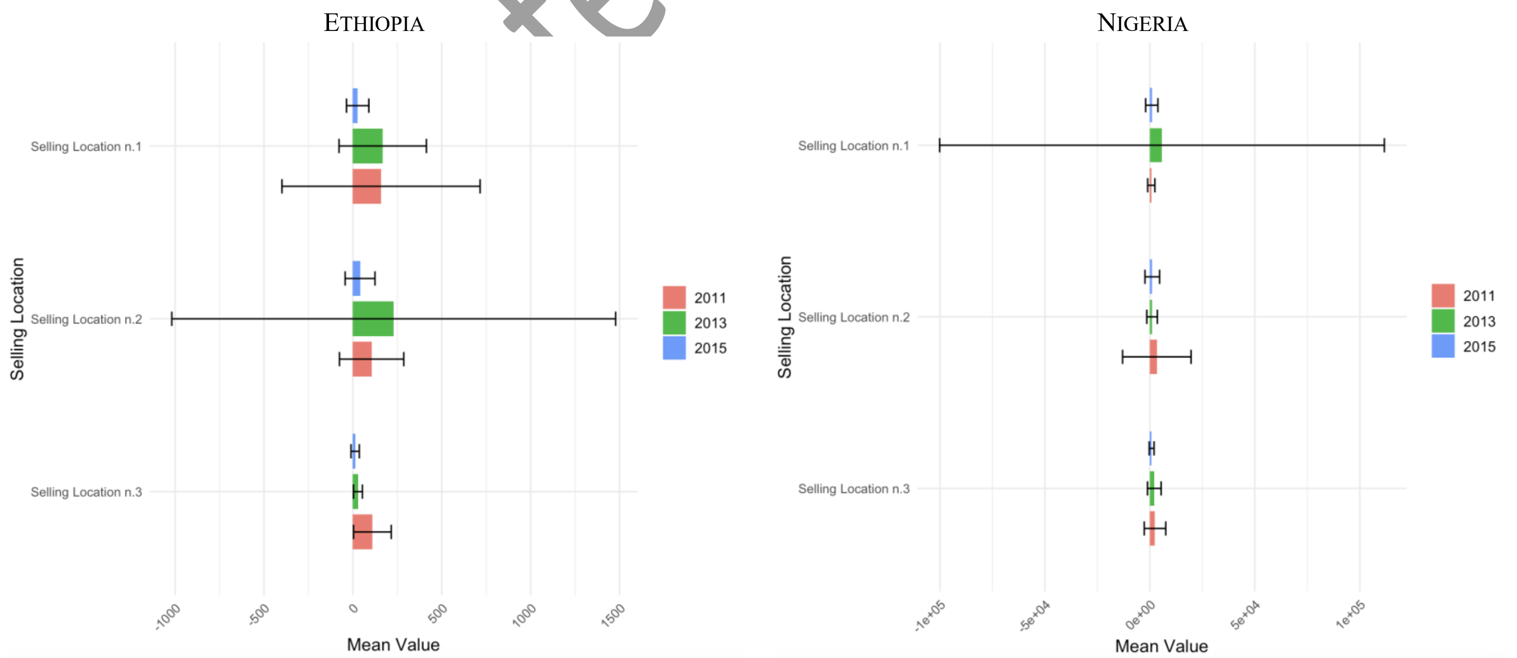


Table 1 presents summary statistics for food and total consumption[2,3], alongside food quantity for sensitivity analysis.

Table 1: Dependent Variables Summary Statistics

			N. of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
ETHIOPIA		Food Consumption *(decimals, ETB)*	1,394	1,666.08	1891.68	156.24	41,616.74
		Total Consumption (decimals, ETB)	1,394	2,021.67	1986.22	188.59	42,073.02
	Sens. Test	Food Quantity *(decimals, Kg)*	1,459	7.15	37.77	0.07	1,004.40
NIGERIA		Food Consumption *(decimals, NGN)*	1,178	56,075.51	74,259.26	4,751.17	1,672,537
		Total Consumption (decimals, NGN))	1,178	78,349.05	88,541.40	9,334.46	1,699,927
	Sens. Test	Food Quantity *(decimals, Kg)*	1,175	32.9454	156.1	0.04	3268.39

Consumption data in nominal values, adjusted for inflation using the 2010 CPI,[4] shows that food consumption constitutes over 70% of total expenditure for households in both Ethiopia and Nigeria.

Table 2 shows the downstreamness indicator results, indicating that Ethiopian rural households have an average downstreamness score of 0.02, suggesting a predominant upstream positioning within market chains, a trend also observed in Nigeria but with more variability.

[2] Following the LSMS-ISA documentation on the Ethiopia Socioeconomic Survey, consumption total expenditures include three sources: food, non-food and education expenses for each household.
[3] As specified in the "Basic Information Document" for the LSMS-ISA Nigeria General Household Survey, total consumption is calculated as the sum of all food, education, non-food, and imputed rent expenditures. Expenditures were calculated and aggregated to household level and converted to per capita terms.

[4] Available at http://data.worldbank.org/indicator/FP.CPI.TOTL.

Table 2: Downstreamness Indicator Results

		N. of Obserbations	Mean	Standard Deviation	Minimum Value	Maximum Value
ETHIOPIA	Downstreamness in 2011 *(decimals)*	521	0.02	0.07	0.00	0.70
	Downstreamness in 2013 *(decimals)*	1,026	0.02	0.07	0.00	0.70
	Downstreamness in 2015 *(decimals)*	883	0.02	0.07	0.00	0.70
NIGERIA	Downstreamness in 2011 *(decimals)*	346	0.05	0.12	0.00	1.00
	Downstreamness in 2013 *(decimals)*	757	0.00	0.03	0.00	0.45
	Downstreamness in 2015 *(decimals)*	515	0.03	0.09	0.00	0.86

These figures indicate that in the Ethiopian sample, the positioning indicator for crop-specific value chains ranges from 0 to 0.7, with rural households having an average downstreamness value of approximately 0.02. In Nigeria, there is greater heterogeneity in downstreamness values, with a maximum of 1 in 2011 and a decrease to 0.45 in 2013. These findings support the transition of food supply chains from local and fragmented to longer and geographically connected ones (IFAD, 2016). Farmers in the market chain predominantly position themselves upstream (Montalbano et al., 2018), and the crops they sell exhibit low price elasticity of demand, as demonstrated by studies from which crop elasticities are taken: Tafere et al. (2010), World Bank Group (1982), Akinleye & Rahji (2007), Pan et al. (2009), Ashagidigbi (2019), Obayelu et al. (2019), and Adeniji (2019). Moreover, analyzing the data while excluding outliers reveals micro-trends in market positioning dynamics over the years (Figure A.2, A.3 and A.4 in the Appendix).

6. Identification Strategy, Results, and Sensitivity

This section details the identification strategy and results of this study, including analyses of alternative positioning indicators, primary findings for the amended indicator, and subsequent sensitivity and robustness assessments (Subsections 6.1 to 6.3).

6.1 Identification Strategy

The empirical strategy tests the correlation between the amended value-chain positioning indicator and the natural log of food and total household consumption, utilizing a semi-logarithmic econometric model. This approach incorporates household and production characteristics to control for heterogeneity, following Dercon (2004), Chaudhuri (2003), and Montalbano et al. (2018). The specification employed is:

$$C_{h,t} = \alpha_h + \beta_t + \phi_1 Down_{h,t} + \delta X_{h,t} + \varepsilon_{h,t}; \qquad [4]$$

where $C_{h,t}$ is alternatively the natural log of household per capita[5] of food consumption and total consumption, $Down_{h,t}$ represents the value of the proposed downstreamness indicator, and $X_{h,t}$, is the vector of control variables for household heterogeneity and includes observable household and production characteristic. A non-zero ϕ_1 coefficient suggests a significant relationship between market positioning and consumption. The model also accounts for unobserved heterogeneity, time, and location effects, with fixed effects to mitigate time-variant unobserved biases.

[5] LSMS-ISA household surveys for Nigeria do not provide per adult equivalencies in consumption aggregates. Considering the current debate around the likelihood of incurring in mistakes when self-calculating equivalencies (see, Deaton & Margaret, 1998) and to make estimates across the two samples comparable, the consumption levels for Ethiopia are reported in terms of per capita in line with those for Nigeria.

The study exclusively considers households engaged in value chains to focus on the impact of market chain positioning.[6] Possible reverse causality between food/total consumption and market positioning is not expected to impact the estimates because proxies for food consumption and commercialization are measured in different time periods. Robustness checks in the Appendix include the Heckman correction for selection bias and the control function method to address self-selection bias, as suggested by Wooldridge (2015).

6.2 Main Empirics

Table 3 contrasts the proposed adjusted "à la Antràs and Chor" (AC) indicator from Equation [3] with common downstreamness indicators like the crop share ratio, the geographical distance to the main market and Montalbano et al. (2018)'s positioning in terms of crop market outlets.

Table 3: Downstreamness Indicators Comparison – Main Results for Ethiopia

	Food Consumption				Total Consumption			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Proposed Indicator	(ln) Crop Share	(ln) Distance to Market	Market Outlets	Adjusted Down.	(ln) Crop Share	(ln) Distance to Market	Market Outlets
Downstreamness	42.01***	0.12*	-0.20	0.07	35.96***	0.08	-0.06	0.04
	(12.91)	(0.07)	(1.64)	(0.10)	(11.01)	(0.05)	(1.44)	(0.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.04***	6.73***	9.25	6.28***	6.66***	7.20***	8.84+	6.86***
	(0.99)	(1.09)	(6.58)	(1.03)	(0.85)	(0.94)	(5.82)	(0.89)
N. of Observations	1,387	1,387	1,381	1,387	1,387	1,387	1,381	1,387
N. of HH_id	1,097	1,097	1,093	1,097	1,097	1,097	1,093	1,097
R-squared Adj.	0.72	0.71	0.64	0.71	0.73	0.72	0.69	0.75
AIC	-1316.97	-1266.77	-1013.52	-1251.08	-1697.19	-1644.86	-1371.93	-1633.08
BIC	-615.49	-565.29	-375.39	-549.61	-995.71	-943.38	-733.80	-931.60

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.

Model comparison using adjusted R-squared, AIC, and BIC coefficients reveals the superior performance of the proposed indicator with respect to traditional market positioning proxies. This finding challenges the commonly used proxies for marketing factors, orientation, and

[6] Households selling their crop in non-market outlets account for around 7-8% of the final sample for Ethiopia.

positioning that have been traditionally employed in empirical studies (e.g., *inter alia*, Montalbano et al., 2018; Migose et al., 2018; Mkuna & Wale, 2022).

Table 4 reports the positive impact of downstream positioning on consumption levels in Ethiopia. All estimates were adjusted for household production characteristics to account for additional latent variables that could explain variations in market positioning, effectively reducing potential endogeneity resulting from selectivity bias (Fafchamps & Hill, 2005).

Table 4: Main Results for Ethiopia – Panel Fixed Effects Clustered by Household ID

	Food Consumption			Total Consumption		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	31.04**	43.11***	42.01***	27.17*	36.13***	35.96***
	(15.03)	(12.74)	(12.91)	(14.31)	(11.03)	(11.01)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
Constant	7.65***	5.95***	6.04***	7.99***	6.55***	6.66***
	(0.63)	(0.99)	(0.99)	(0.58)	(0.85)	(0.85)
N. of Observations	1,387	1,387	1,387	1,387	1,387	1,387
N. of HH_id	1,097	1,097	1,097	1,097	1,097	1,097
R-squared Adjusted	0.31	0.72	0.72	0.31	0.73	0.73

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.

By accounting for time- and geography-related factors, it is observed that Ethiopian farmers positioned downstream in the market experience significantly higher per-capita consumption levels compared to farming households with similar characteristics but lower positioning scores. Specifically, a 0.01 increase in their market positioning boosts per-capita food consumption by over 50% and total consumption by more than 40%, challenging the view that consumption patterns solely depend on food price shifts. Ignoring household and geographic specifics leads to underestimating the "market positioning effect." The impact is consistent across food and total consumption, with accuracy improving when location controls are included. Despite the size of the hypothesized change in positioning score is observed in less than 2% of cases, its significant effect highlights the importance in driving consumption changes among households with varying initial downstream positions.

Similarly, Table 5 presents the Nigerian results, mirroring the Ethiopian findings. A 0.01 enhancement in positioning indicator value corresponds to approximately 40% and 37% increases in per-capita food and total consumption, respectively.

Table 5: Main Results for Nigeria – Panel Fixed Effects Clustered by Household ID

	Food Consumption			Total Consumption		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	31.50***	33.39***	33.85***	26.79**	31.56**	31.46**
	(11.94)	(12.16)	(12.50)	(10.75)	(13.97)	(14.19)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
Constant	10.75***	11.45***	10.93***	11.08***	11.49***	11.03***
	(0.236)	(0.277)	(0.512)	(0.276)	(0.244)	(0.576)
N. of Observations	1,178	1,178	1,178	1,178	1,178	1,178
N. of HH_id	979	979	979	979	979	979
R-squared Adjusted	0.41	0.82	0.82	0.32	0.74	0.74

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.

In Nigeria, like Ethiopia, farmers sell through various channels including local markets, cooperatives, and directly to processors, with a crop range extending to non-food items like cotton. The empirical strategy to Nigerian data[7] yields results mirroring Ethiopia's: a 0.01 improvement in market positioning leads to roughly a 40% increase in per-capita food consumption and a 37% increase in total consumption. This confirms that better market positioning, after accounting for variables like district characteristics and time trends, significantly enhances consumption levels for farmers in both countries.

[7] The variable "crop code" is not controlled for in the case of Nigeria, given the few changes in labeling across the years that may have altered the panel dataset combined "crop code" variable. Also, interview month is omitted due to several missing observations. Consumption data rely on the postharvest surveying visit. Data on fertilizer use are from the post-planting questionnaire.

6.3 *Sensitivity and Robustness Checks*

Table 6 shows the result of the sensitivity analysis for food quantity in both samples. Food quantity is also measured in logarithmic form, just like consumption.

Table 6: Sensitivity Testing with Food Quantity

	Food Quantity (ETHIOPIA)			Food Quantity (NIGERIA)		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	61.86**	70.51*	81.38**	61.07**	82.03***	78.18***
	(26.55)	(36.81)	(36.54)	(25.31)	(26.60)	(28.09)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
Constant	-1.09	7.68***	7.76***	2.07***	2.08***	2.89***
	(1.05)	(1.97)	(1.92)	(0.43)	(0.38)	(0.77)
N. of Observations	1,452	1,452	1,452	1,175	1,175	1,175
N. of HH_id	1,121	1,121	1,121	977	977	977
R-squared Adjusted	0.13	0.53	0.54	0.59	0.88	0.88

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.

Results in both countries are very similar. Food quantity is positively affected by higher positioning scores for all the specifications provided for both samples. If rural households are able to increase their positioning indicator value by 0.01, on average, and *ceteris paribus*, they are able to more than double their food quantity level both in Ethiopia and Nigeria. Therefore, impact of increased positioning in value chains on food quantity per household is greater, in terms of magnitude, than the impact on food and total consumption levels per capita.

Robustness checks are reported in Table 7 above for Ethiopia and Table 9 for Nigeria.

Table 7: Main Results with Population Sampling Weights for Ethiopia

	Food Consumption			Total Consumption		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	22.68+	21.85+	21.47+	20.08+	21.81*	22.39*
	(15.07)	(14.50)	(14.61)	(13.58)	(13.00)	(12.97)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
Constant	7.24***	6.91***	7.05***	7.61***	7.56***	7.68***
	(0.62)	(1.23)	(1.22)	(0.58)	(1.07)	(1.05)
N. of Observations	1,387	1,387	1,387	1,387	1,387	1,387
N. of HH_id	1,097	1,097	1,097	1,097	1,097	1,097
R-squared Adjusted	0.33	0.72	0.73	0.34	0.70	0.71

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.

Table 7 shows the results of Table 4 replicated with population sampling weights.[8] Results are robust and consistent with what was previously obtained. As in Table 4, results for both food and total consumption show the same dynamics: lower significance for the baseline specification and a downward bias if district dummies are not in the control group but only the wave dummies are considered.

Table 8: Main Results with Population Sampling Weights for Nigeria

	Food Consumption			Total Consumption		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	15.96	20.52*	21.58**	11.98	18.26	18.56+
	(12.26)	(10.46)	(10.79)	(10.89)	(13.01)	(13.02)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
Constant	10.90***	11.27***	10.38***	11.29***	11.38***	10.52***
	(0.27)	(0.23)	(0.51)	(0.38)	(0.23)	(0.65)
N. of Observations	1,172	1,172	1,172	1,172	1,172	1,172
N. of HH_id	973	973	973	973	973	973
R-squared Adjusted	0.33	0.83	0.83	0.23	0.76	0.77

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15

[8] Conversely to Nigeria, combined population weights are not reported in the LSMS-ISA Ethiopia Rural Socioeconomic Surveys. To avoid mistakenly corrections, population weights were adjusted across the years by attaching the latest weight to the household's highest surveying wave.

Similarly, in Table 8 above, the results for Nigeria (shown in Table 5) are replicated with the provided population sampling weights. Coefficient estimates for the proposed amended positioning indicator in Table 7 and 8 are significant for almost all the specifications provided in both samples. Controlling for factors such as time and district fixed effects, including region, district, and village dummies, as well as trends, Ethiopian and Nigerian households who participate and have a better position in the market chain register, on average and *ceteris paribus*, have a per-capita equivalent food and total consumption level around 20% times higher than those farming households with the same characteristics and who have a position-indicator score lower than 0.01 unit.

To address potential selection bias from excluding about 100 households not commercializing their crops within value chains, this study utilizes the *xtheckmanfe* Stata module by Rios-Avila (2021) to account for endogeneity and sample selection. The results, adjusted for time effects and Heckman correction, are in Appendix Table A.4. Moreover, the issue whether households' participation and positioning in markets could be influenced by characteristics affecting both consumption and market position, is addressed using a control function approach. This approach involves adding the residual of a first-stage regression, which predicts the "Downstreamness Positioning" binary variable, to the main regression as an exclusion restriction. This residual, denoted as ρ, is designed to be uncorrelated with the endogenous variable, thereby providing unbiased estimators in the main equation and mitigating self-selection bias (Wooldridge, 2015). Table A.5 in the Appendix reports the results, showing very consistent outcomes with the previous regressions.

7. Discussion and conclusions

To summarize, the empirical outcomes indicated that changes in market positioning significantly and consistently matters to increasing the consumption levels of Ethiopian farmers selling crops in the market chain. From this perspective, the findings of Montalbano et al. (2018) extend to Ethiopia and Nigeria regarding the positive role of farmers' market participation in Uganda. However, the results contradict the conclusion of Montalbano et al. (2018), arguing instead for the significance of market intermediaries.

Finally, a concern should be sounded concerning the external validity of these findings. Since the focus is on investigating market positioning, the overwhelming majority of farmers who produce crops only for home consumption are excluded from the analysis. This gap hampers the ability of the analysis to derive consistent estimates for the entire population of a crop producer. Nevertheless, results of the parallel test conducted for Nigeria are highly reassuring regarding the proposed amended indicator's external validity.

Historically, the examination of farmers' market decisions traces back to the early 1990s, with seminal works by Fafchamps (1992), von Braun (1995), and Key et al. (2000). Yet, a comprehensive analysis of market structure from the farmers' perspective remains elusive. The motivation behind this work lies on the idea that farmers selling to wholesalers/producers are better off than farmers that sell to the most proximate markets. This work adjusts Antràs and Chor's downstreamness indicator to farming households' selling locations and buyer-market chains. It contributes to the literature by creating a conceptual framework for farmers' market positioning and a replicable setting for assessing the effects of market positioning on both food security and welfare levels.

Utilizing national, representative household surveys from Ethiopia and Nigeria, this paper investigates the relationship between market positioning scores and consumption levels, revealing that farmers positioned further downstream in the value chain experience enhanced food and overall consumption. This study evidences the significant impact of micro-variations in market positioning on rural development and establishes the superiority of the Antràs and

Chor-informed indicator over other alternatives for assessing market positioning's welfare effects. The findings, robust across various empirical models and further supported by sensitivity analyses focusing on food quantity, underscore the reliability of the research question addressed.

This work fills a critical void in existing literature by offering a nuanced, well-validated indicator that assesses farmers' value chain positioning with a novel emphasis on market outlet identities and selling locations. By incorporating demand elasticity as a pivotal parameter for vertical integration, as suggested by Antràs and Chor (2013), the indicator not only adheres to but also expands upon the theoretical underpinnings of value chain analysis. Empirical validation from Ethiopia and Nigeria illustrates that slight enhancements in market positioning lead substantial increases in consumption, with 0.01 rise in positioning yielding over a 40% uplift in per-capita consumption levels.

The study also acknowledges the challenges in comparing across countries due to incomplete data in existing datasets, especially regarding the network roster for inputs acquisition. It advocates for a broader data collection strategy encompassing trade flows for all actors in the agricultural chain, aiming to elucidate the value added along a farmer's selling line. This approach promises a more holistic understanding of the agricultural value chain's dynamics and its implications for farmer welfare.

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Appendix

Table A.1: Variable Definitions and Other Basic Information

Variable name	Definition	Time period	Source
Gender of the Household Head	Gender of the household head *(binary, 1=female)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Age of the Household Head *(decimals)*	Age years of the household head *(decimals)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Number of Household Members in the Labor Force *(decimals)*	Number of household members (*binary, 1=female)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Household Size *(decimals)*	Number of people in the household *(decimals)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Average Years of Education for Household Adults *(decimals, years of schooling)*	Average education level attained by the household adult members *(values from 0 to 8)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Average Years of Education for Household Head *(decimals, years of schooling)*	Average education level attained by the household head *(values from 0 to 8)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Number of Household Infants *(decimals)*	Number of household members in the infant age range *(decimals)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Number of Household Children *(decimals)*	Number of household members in the children age range *(decimals)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Household Years of Education *(decimals, years of schooling)*	Average education level attained by all household members *(values from 0 to 8)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Harvest Crop *(decimals, Kg)*	Quantity of crop harvest in the surveying period *(decimals, Kg)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Field Size *(decimals, Ha)*	Average field size in the surveying period *(decimals, Ha)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Free Seed	Event of receiving free seed *(binary, 1=no and 2=Yes)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Seed Purchase	Necessity of purchasing seed *(binary, 1=no and 2=Yes)*	2011-2015	World Bank LSMS-ISA Ethiopia only
Fertilizer Use	Use of fertilizers *(binary, 1=no and 2=Yes)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Fertilizer Purchase	Purchase of fertilizers *(binary, 0=no and 1=Yes)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Leftover Fertilizer	Presence of leftover fertilizers *(binary, 0=no and 1=Yes)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria
Free Fertilizer	Event of receiving free fertilizers *(binary, 0=no and 1=Yes)*	2010-2016	World Bank LSMS-ISA Ethiopia and Nigeria

Table A.2: Households Summary Statistics for Ethiopia

	N. of observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Gender of the Household Head *(binary, 1=female)*	1,460	0.18	0.39	0	1
Age of the Household Head *(decimals)*	1,460	45.72	14.21	18	97
Number of Household Members in the Labor Force *(decimals)*	1,460	2.69	1.38	0	10
Household Size *(decimals)*	1,460	5.77	2.19	1	14
Average Years of Education for Household Adults *(decimals, years of schooling)*	1,460	1.70	1.83	0	8
Number of Household Infants *(decimals)*	1,460	0.58	0.80	0	5
Number of Household Children *(decimals)*	1,460	2.39	1.68	0	10
Household Years of Education *(decimals, years of schooling)*	1,460	1.70	1.83	0	8
Harvest Crop *(decimals, Kg)*	1,460	914.13	752.98	0	3,249.61
Field Size *(decimals, m^2)*	1,460	9030.31	9370.73	0	38,917.46
Free Seed *(binary, 2=Yes)*	1,459	1.99	0.12	1	2
Seed Purchase *(binary, 2=Yes)*	1,462	1.94	0.24	1	2
Fertilizer Use *(binary, 2=Yes)*	1,462	1.81	0.40	1	2

Table A.3: Households Summary Statistics for Nigeria

	N. of Observations	Mean	Standard Deviation	Minimum Value	Maximum Value
Gender of the Household Head *(binary, 1=female)*	1,178	0.20	0.40	0	1
Number of Household Members in the Labor Force *(decimals)*	1,178	2.48	2.13	0	13
Household Size *(decimals)*	1,178	6.41	3.27	1	28
Number of Household Infants *(decimals)*	1,178	0.55	0.92	0	6
Number of Household Children *(decimals)*	1,178	1.90	2.22	0	14
Fertilizer Purchase *(binary, 1=Yes))*	1,178	0.33	0.47	0	1
Letfover Fertilizer *(binary, 1=Yes)*	1,178	0.03	0.17	0	1
Free Fertilizer *(binary, 1=Yes)*	1,178	0.01	0.10	0	1
Fertilizer Use *(binary, 1=organic)*	1,178	1.69	0.46	1	2

Figure A.1: Quantity of Crop Sold (in Kilos) Mean Values per Selling Outlet

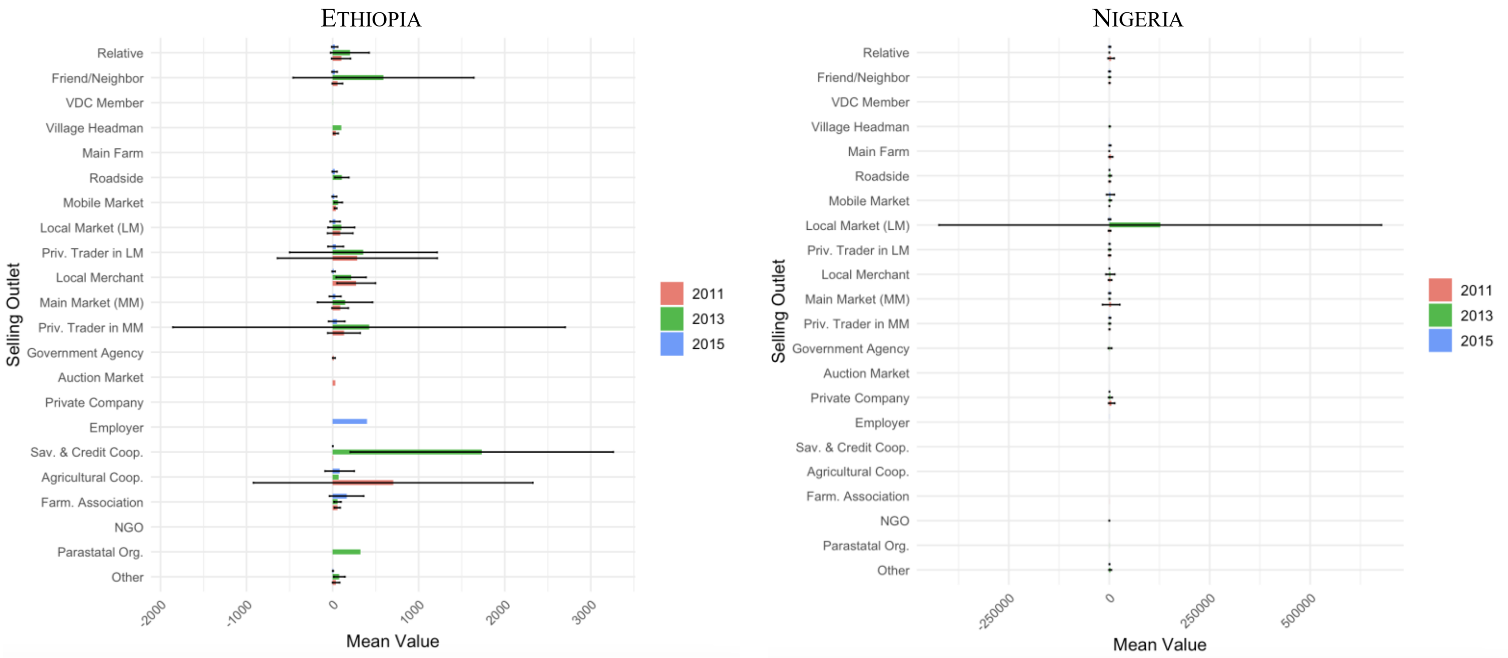

Figure A.2: Kernel Density Downstreamness Positioning Indicator Ethiopia 2011

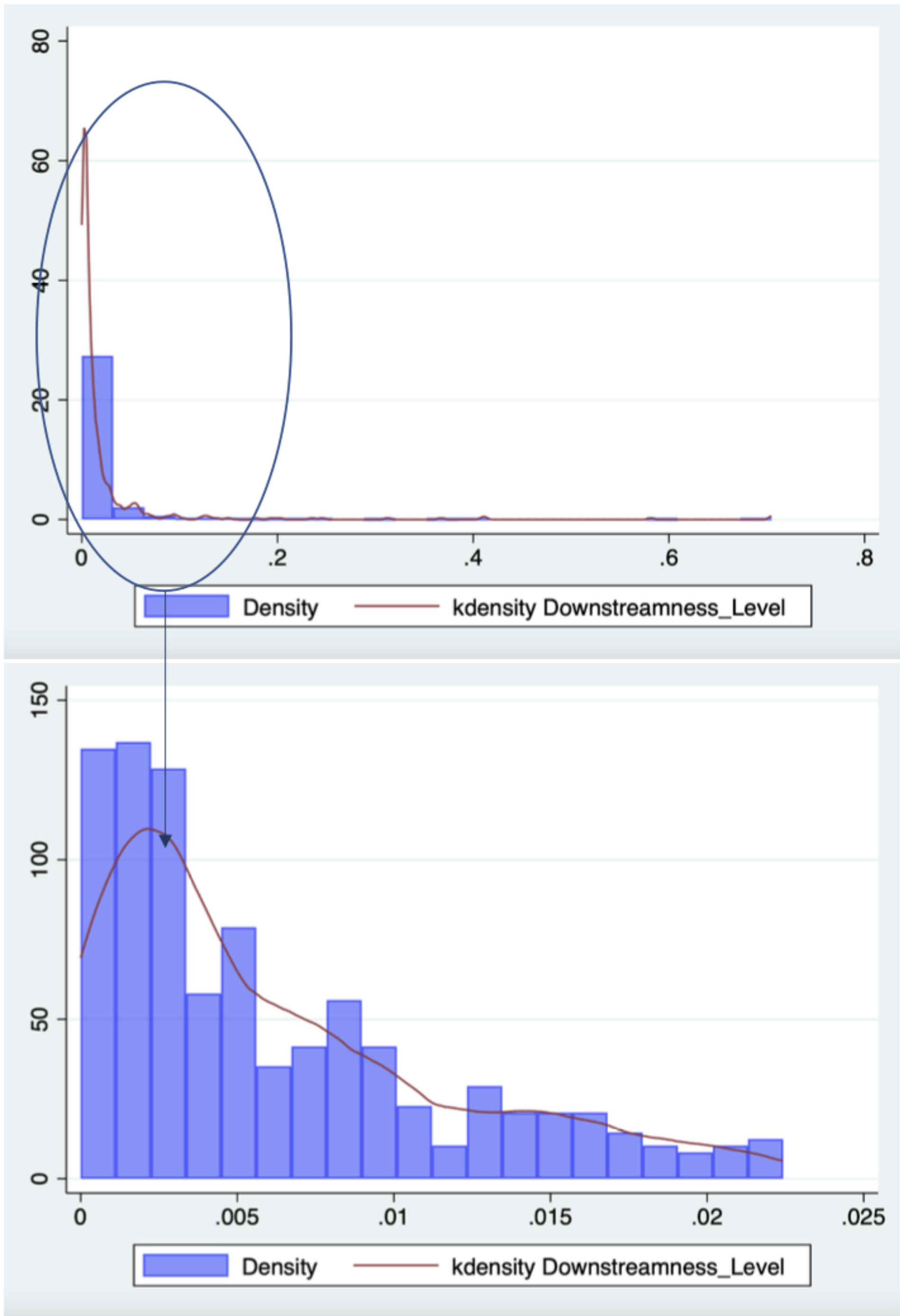

Figure A.2: Kernel Density Downstreamness Positioning Indicator Ethiopia 2013

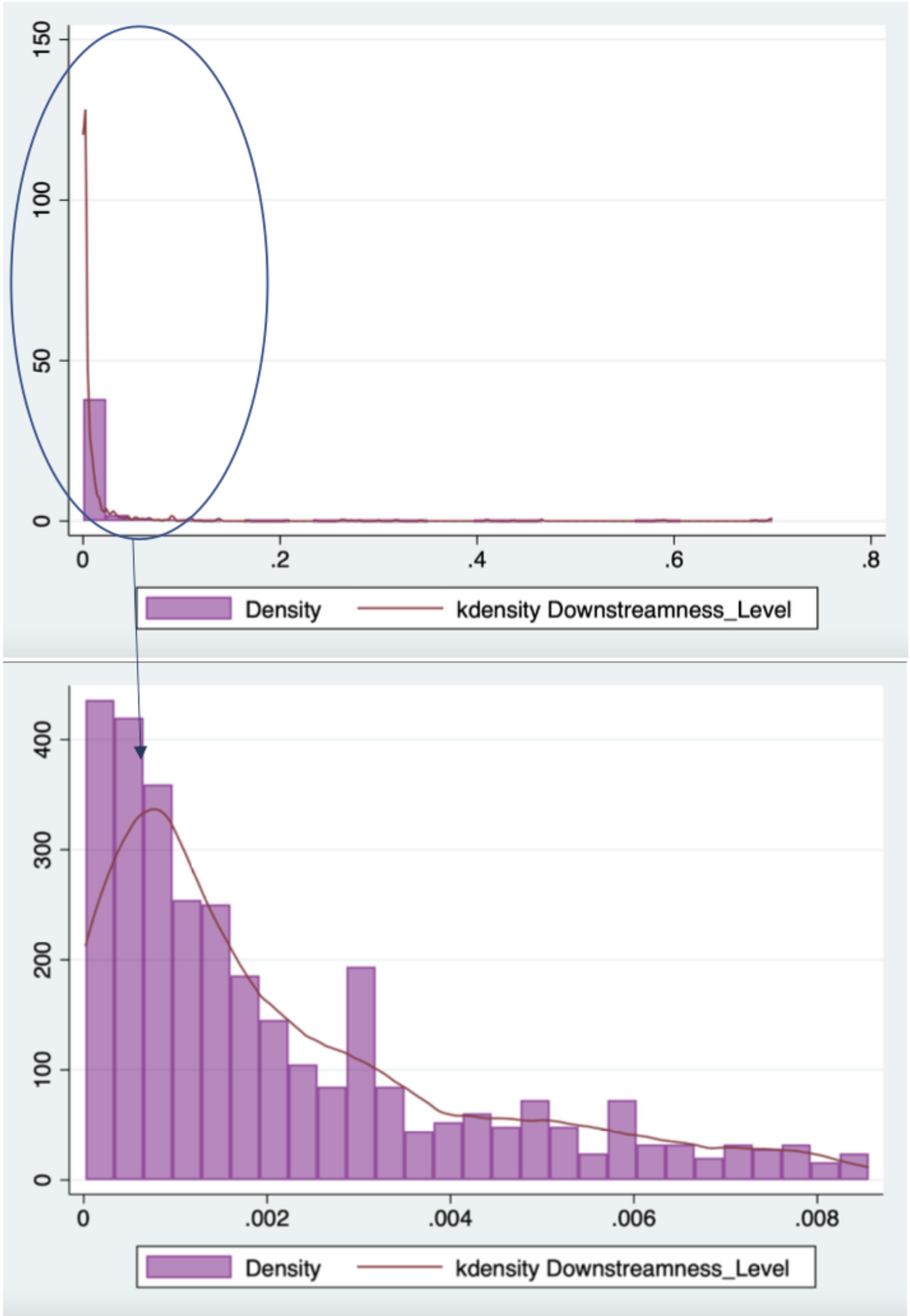

Figure A.3: Kernel Density Downstreamness Positioning Indicator Ethiopia 2015

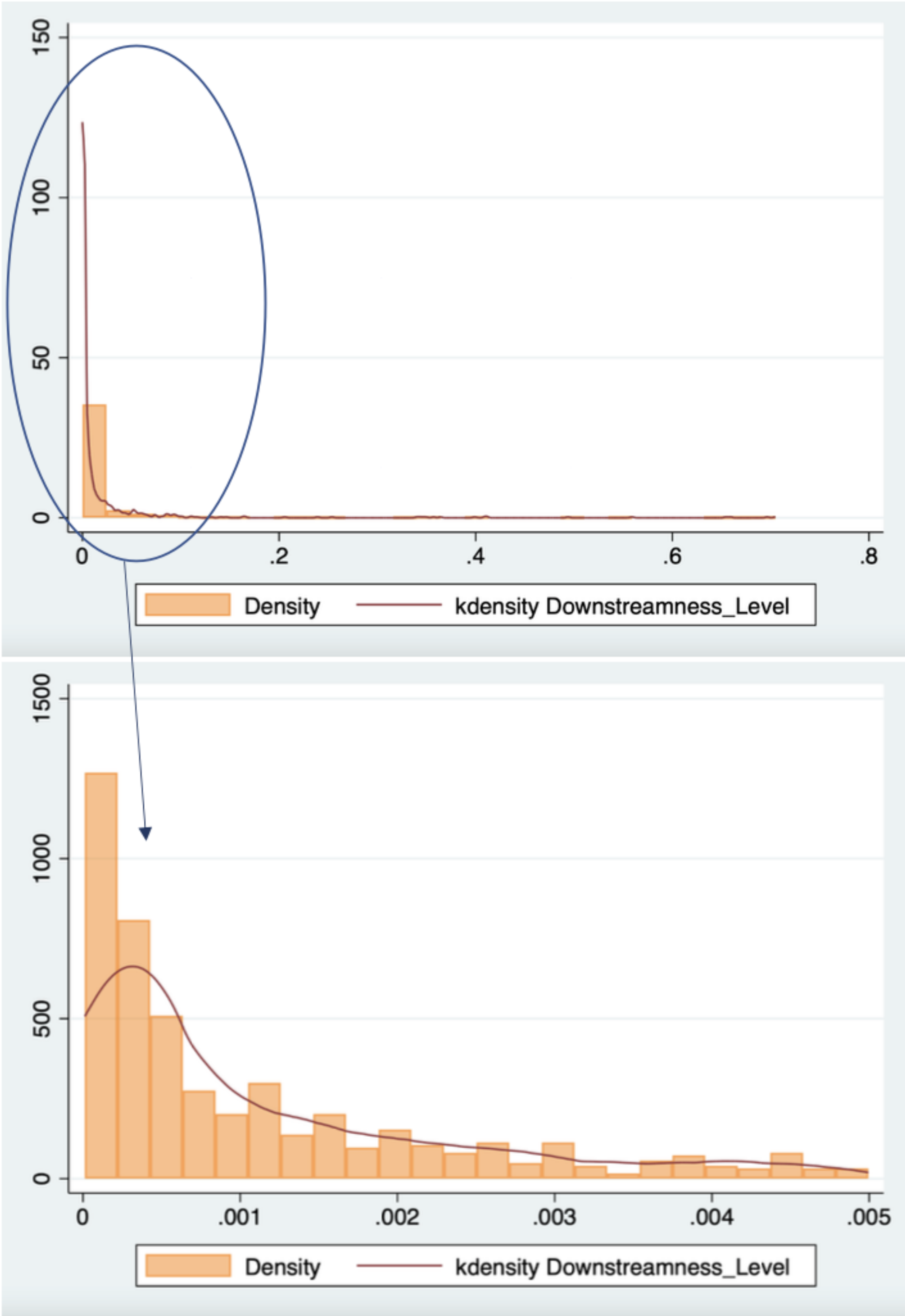

Table A.4: Sample Bias – Panel FE with the Heckman Correction

	Food Consumption		Total Consumption	
	(1) Heckman	(2) FE	(3) Heckman	(4) FE
	Wave Fixed Effects	Wave Fixed Effects	Wave Fixed Effects	Wave Fixed Effects
Downstreamness	50.88*	26.41**	48.15+	22.92**
	(30.07)	(12.26)	(30.42)	(11.63)
Controls	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes
Constant	7.57***	7.79***	7.64***	8.15***
	(0.42)	(0.61)	(0.31)	(0.57)
N. of Observations	1,457	1,389	1,457	1,389
N. of HH_id		1,098		1,098
R-squared Adjusted		0.26		0.25

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.
Note: Control variables "household average education level" and "crop code" are excluded as their inclusion in the regression models does not allow convergence in the Heckman Fixed Effect computational tools. Bootstrap replications are set to 50.

Table A.5: Self-Selection Bias – Control Function Method

	Food Consumption			Total Consumption		
	(1) Wave Fixed Effects	(2) District-Wave Fixed Effects	(3) District-Wave FE HH Trends	(4) Wave Fixed Effects	(5) District-Wave Fixed Effects	(6) District-Wave FE HH Trends
Downstreamness	27.23*	43.03***	41.03***	24.28+	36.23***	35.86***
	(15.71)	(13.04)	(13.07)	(14.97)	(11.23)	(11.20)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Wave FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes	Yes		Yes	Yes
Trends			Yes			Yes
ρ	0.14	0.01	-0.01	0.10	-0.01	0.01
	(0.09)	(0.10	(0.10)	(0.08)	(0.09)	(0.09)
Constant	7.97***	6.24***	6.25***	8.31***	6.84***	6.95***
	(0.63)	(0.99)	(0.98)	(0.59)	(0.85)	(0.86)
N. of Observations	1,387	1,387	1,387	1,387	1,387	1,387
N. of HH_id	1,097	1,097	1,097	1,097	1,097	1,097
R-squared Adjusted	0.22	0.71	0.69	0.24	0.72	0.72

Standard errors, clustered by households id, in parentheses: *** p<0.01, ** p<0.05, * p<0.1, +p<0.15.