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Research Supporting African MSMEs
To Provide Safe and Nutritious Food

EXTENT AND DRIVERS OF COORDINATED PURCHASE AND SALES OF SELECTED AGRI-FOOD WHOLESALE MARKETS IN NIGERIA

November 2024

Authors: Babalola, Daniel, Liverpool-Tasie, Lenis Saweda O, Kolade, Yinka, Reardon, T and Wineman, A



Authors

Babalola, Daniel, Professor of Agribusiness & Resource Economics, Department of Agriculture and Industrial Technology, Babcock University, Nigeria.

Liverpool-Tasie, Lenis Saweda O., MSU Foundation Professor, Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

Kolade, Yinka., Independent consultant, IITA, Ibadan, Nigeria

Reardon, Thomas., MSU Distinguished Professor, Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

Wineman Ayala Assistant Professor, Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

Acknowledgments

The authors wish to thank all the market leaders, traders, and stakeholders who contributed their time and perspectives during data collection across the wholesale markets in Nigeria. Their insights into the dynamics of coordinated purchases and sales for tomatoes, green leafy vegetables, and fish were invaluable to this study. This research was supported by the Research Supporting African MSMEs to Provide Safe and Nutritious Food (RSM2SNF) project, funded by the Bill and Melinda Gates Foundation. The authors appreciate the contributions of all project partners and collaborators who facilitated this work. The contents of this report are the responsibility of the authors and do not necessarily reflect the views of the Bill and Melinda Gates Foundation or Michigan State University.

About Research Supporting African MSMEs to Provide Safe and Nutrition Food (RSM2SNF)

The Research Supporting African MSMEs to Provide Safe and Nutritious Food (RSM2SNF) is funded by the Bill and Melinda Gates Foundation. RSM2SNF dives deep into the wholesale, logistics, processing, and retail segments of the value chains of several products, such as fish, tomato, and green leafy vegetables. The goal is to understand the midstream of these food value chains with a focus on Micro, Small and Medium Enterprises (MSMEs), and to inform policies and interventions to support MSMEs in providing safe and nutritious foods at affordable prices. This five-year project (2022–2026) is led by Michigan State University (MSU) working with partners in Nigeria and Tanzania.

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Abstract

Coordinated marketing activities are identified as a means to support price bargaining and reduce transaction and transportation costs in food supply chains. This is particularly important for perishable food products that are moved over long distances. Despite the call for coordination to enhance marketing efficiency in emerging economies, there are very limited studies on the prevalence and drivers of coordinated purchases and sales in food markets in developing regions and particularly across Africa. Most studies on coordination are at the farm level and focused on farmer organizations such as cooperatives. Thus, this study explores the extent and drivers of coordinated sales and purchases in agri-food wholesale markets across Nigeria, focusing on tomatoes, green leafy vegetables (GLVs), and fish. Data collected from a census of 299 wholesale markets across seven Nigerian states and Abuja between July 2023 and February 2024 reveal that coordination practices are more commonly provided by market leaders for tomato and GLV traders in northern and Middlebelt regions than for fish traders and among all commodity traders in the south. Using a bivariate probit model, we confirm the regional and product level differences in the institutional provision of coordinated sales and/or purchase. We also find that coordinated activities (particularly sales) are significantly associated with production areas with higher supplies (relative to demand) necessitating coordination to minimize losses and price collapse. Policy recommendations emphasize increasing market leader awareness of coordination benefits, supporting logistical interventions for product movement and processing to increase shelf life and minimize product loss. We note that further research is needed to better understand regional and product-based variations in the provision of market coordination services across Nigeria and similar settings across developing regions.

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List of Acronyms

- FAO** - Food and Agriculture Organization
- FCT** - Federal Capital Territory
- GLVs** - Green Leafy Vegetables

1. Introduction

When enterprises face high search costs to access markets or challenges bargaining with their suppliers, it is requisite that they find strategies to minimize these constraints (Rehme, Kowalkowski, & Nordigarden, 2013; Mabuza, Ortman & Wale, 2014; Lang, 2020). One approach to minimizing high search costs and bargaining challenges is coordination, particularly coordination among enterprises in the same segment (e.g. among farmers or among traders). An alternative to coordination is competition where for example a wholesaler or processor may give a better price to farmers with higher quality produce to “capture” that supply from other wholesalers/processors in a market. Another alternative is to ignore the actions of other actors and proceed independently. This obtains where for example a commodity wholesaler or a processor goes to a farm zone to find whichever farmers have products for sale and propose a price without first considering what prices other buyers are offering.

There is a rich literature and wide debate about coordination (vs. competing among enterprises) by farmer groups such as cooperatives or farmer organizations that support farmers in output marketing or input purchase. These farmer organizations act as an intermediary (representing farmer members) to source from its member farmers, and either find, bargain with, and source from input sellers, or with output buyers, or both. While these are the actions and motives of these kinds of organizations, in practice there is great heterogeneity as to what extent the coordinate actions occur and lead to improved outcomes such as better prices or lower transaction costs for the members (see for example Abdul-Rahaman and Abdulai (2020) for positive results for rice coops in Ghana; compared with Sebhatu et al. (2021) that find mixed results, conditioned by structural and organizational factors in the cooperatives in Ethiopia.

Far less common in the literature and development debate is the adoption of these coordination services among wholesale market traders in the agrifood industry. The rareness of analysis of wholesaler coordination, at least in developing country food systems, is partly the fruit of a general neglect to date of the midstream segments of value chains (Reardon, 2015). It also seems to arise from the dearth of sample surveys on wholesale markets and on groups of traders within them. However, the activities of wholesalers (e.g. high costs of their operations and the decisions they take to ameliorate these costs) can affect the price farmers receive, and the ultimate price and quality of food consumers get (Liverpool-Tasie and Parkhi, 2021). Failing to recognize the important role that these wholesalers play can undermine state, national and/or regional efforts to promote food security.

This paper presents a first-in-the-literature sample survey analysis of the adoption of the above kind of collective action by agrifood wholesalers in Africa. We analyze tomato, green leafy vegetables (GLV), and fish wholesalers across ~300 wholesale markets in Nigeria. To fix in the mind of the reader what behavior we are analyzing we provide an example here of what could be the actions and motives of coordination among for example tomato wholesalers in a wholesale market in Nigeria. We also note how incentives for coordination could vary across decisions of product procurement (from suppliers) versus those of product sales to customers.

At first glance, one might think that it is “natural” for traders in a wholesale market to coordinate their purchases to gain the above advantages, and that in reality one would observe this happening in all wholesale markets (particularly in developing regions with high transportation and other transactions costs) as a matter of course. However, there is no empirical evidence to confirm this. While coordination is often perceived as a natural solution to address high search and logistical costs, the value and hence rationale for coordination rather than competition depends on several factors such as the location of an enterprise and the nature of the product being sold by the enterprise. For an enterprise located in a surplus region (where supply outweighs demand), the value of coordination to maximize sales is higher than for one operating in a deficit region where demand outweighs supply. Regarding product characteristics, the value of coordination is likely much higher for a commodity that is undifferentiated in the market than for a niche product with unique characteristics appealing to a subset of the market. Similarly, coordination is likely more important for perishable items compared to non-perishable items.

The impact of location and product characteristics on incentives for coordination can vary for product procurement versus product sales. For example, while being in a surplus region might incentivize wholesalers to coordinate the sales of their products (to avoid a glut and price decline), they might be less interested in coordinating the purchase of the product from suppliers (e.g. farmers) given the high supply of the product in the region. On the contrary, among traders in a deficit region, there might be less incentives to coordinate sales because of the large demand for the product the traders face, but there could be a strong incentive to coordinate purchases to enable wholesalers compete with other wholesalers for the product (from both surplus and other deficit areas). Still within surplus and deficit regions, factors such as poor infrastructure, product perishability and logistical considerations are also able to affect incentives for coordinating either the procurement or sales (or both) for products.

Despite the call for coordination to reduce costs in agri-food markets in developing regions (FAO, 2021b) and the potential gain but likely variation in incentives for coordination in food markets, there are very limited studies on the prevalence and drivers of coordinated purchases and sales in these markets in developing regions and particularly across Africa. As far as the authors are aware, there are no empirical studies on the extent and drivers of coordinated purchases and/or sales in food markets in Africa using a large sample of markets. Thus, this study contributes to filling this knowledge gap by investigating the extent to which the market leadership in food markets provide the services of coordinated purchases and/or sales to food traders in wholesale food markets in Nigeria, Africa's most populous nation. Unique in this paper is our focus on governance structures within food markets as an institutional mechanism within markets to support traders in reducing search and other transaction and transportation costs rather than an analysis of individual traders coming together to coordinate their activities.

In this study, coordinated purchases is defined as existing when the leadership (in a wholesale market) coordinates the purchases of products (on behalf of traders) from suppliers such as farmers (typically in main production areas of the country) and/or other markets. Similarly, coordinated sales exists where the leadership of product traders coordinates the sales of products (on behalf of traders) to buyers such as restaurants,

processors and/or other markets typically in consumption areas of the country. As noted earlier, we consider coordinated purchases and sales separately given the possible differences in incentives for these different types of coordination.

We used data collected from a census of food markets where fish, tomatoes, or green leafy vegetables (GLVs) was sold wholesale across seven Nigerian states and Abuja, the Federal Capital Territory (FCT). The set of products considered in this study allow us to confirm if incentives to coordinate vary by product characteristics (i.e. among highly perishable products such as tomatoes and GLV compared to fish that is usually processed) and by location (major production areas versus largely consumption areas).

The rest of this paper is structured as follows: Section 2 provides a summary of the literature on coordinated purchases and sales among businesses across the globe. Section 3 presents our data and empirical strategy while section 4 presents the result and discussion of our empirical analysis. Section 5 concludes.

2. Coordinated purchases and sales in business enterprises

While the use of coordination to facilitate marketing functions such as product sales and input purchases has been documented in the literature worldwide (Hogeland, 2006; Moraru, 2018; Sidiqqi, 2023; El et al., 2023), studies on coordination are often under cooperative arrangements among farmers (worldwide), usually for products with low perishability and high export potentials and relatively more common in studies in higher income countries for non-staple commodities or non-farm actors (FAO, 2005; Hogeland, 2006; Moraru, 2018; Baraka, 2022). The facilitation of coordinated sales by the cooperative systems in Sweden has contributed to fast-tracking the development of the dairy industry. Similarly, in the United States, the sale of almond fruits to processors via coordinated marketing has contributed to the growth and sustainability of the almond fruit enterprise (Hogeland, 2006). Hogeland further noted that US pork producers leveraged on coordinated arrangements within the cooperative arrangement to increase their volume of supply to processors thereby improving their bargaining power as well as industrialization of the pork industry in the 1990s. This is similar to the case for the Japanese rice markets where coordinated marketing was found to occur in more than 70 percent of the rice product markets (Kurimoto, 2004).

In their study on the role of cooperatives in the strawberry value chain, Kireziova et al. (2016) note that wholesalers benefit from coordinated procurement of their products because it ensures effective management of transactions in the supply chain. With these benefits, the probability of ensuring sustained uniformity in terms of product quality and safety will increase, and they tend to have more confidence in their engagement with off takers including provision of product attributes. However, their study focused on coordination among farmers to meet these needs of the wholesalers but not on the need or value for coordination among the wholesalers

In developing regions, there are a few studies reporting the necessity of coordination in the face of poor infrastructure, high logistics costs and limited support from government (Sidiqqi, 2023; Adesope, Awoyinka & Babalola, 2009; Kireziova et al., 2016; Kuguyo & Gandiwa, 2023). For example, Sidiqqi (2023) find that many rice farmers in Bangladesh

resort to coordinated arrangements under cooperatives to sell their paddy rice to processors. In Ethiopia, coordinated marketing arrangement exists among farmers for coffee, sesame, grains and more recently for dairy products with positive impact in reducing postharvest losses and marketing cost (Mojo, Degefa & Fischer, n.d). In addition, El et al. (2023) observed that the coordination of apple marketing by farmers in the Atlas Mountains of Morocco assisted them in reducing marketing costs. Baraka (2022) in his review of studies on cooperative performance in Tanzania between 2017 and 2021, observed that coordinated marketing has improved supply chain system of many agricultural products thereby boosting profit efficiency among agribusiness enterprises. Baraka recognized the role of managerial and governance structure and achieving this feat. Despite the potential value for coordination to secure better prices for non-farm actors such as processors and traders, no studies were found across Africa that explored the extent or value of coordination among these non-farm actors.

The Nigerian studies that have assessed wholesale food markets as a main mechanism or space for the distribution of fresh food products to small and large retailers, and food service entrepreneurs are few (Dirven & Faiguenbaum, 2008; Shepherd, 2004; Clark, 1994; Clark, 2000; Katsuhide, 2022; Ayiti et al., 2024). While some of these studies have focused on the efforts of individual traders to maximize their sales and/or assessed regional differentials in marketing, cultural and gender dimensions in the marketplace, none have considered whether purchases or sales are coordinated at the level of the governance structure within markets. The two studies in markets were focused on traders in one market and largely descriptive. For example, Lutrel (1994) assessed the benefits derived from the activities of a trader-association in a yam and cassava flour wholesale market in Ibadan, south of Nigeria and found that a benefit of membership in the trader-association was marketing which was able to reduce individual traders' transaction cost, and hence the marginal cost of trading. Adesope et al. (2009) assessed the influence of trader participation in coordinated marketing of selected pineapple traders from six markets in Osun state on their marketing margin. They found that coordinated marketing reduced fruit losses and increased traders' profitability considerably. Both of these studies are dated (over 30 and 15 years respectively) and neither explores how widespread these coordination activities are across Nigerian markets nor what drives the provision of such services by these associations or market governance structures. They also do not reflect some of the major changes that have taken place in Africa's food systems due to the expansion of food supply chains for products such as horticulture and animal source proteins due to changing consumption patterns across Africa (see Liverpool-Tasie et al., 2024; Liverpool-Tasie et al., 2023 for a description of these recent changes in Nigeria).

Thus, this study contributes to filling this gap in the literature using information from a survey of 300 food wholesale markets across 8 Nigerian states to explore the extent to which this institutional innovation of coordinated purchases and sales exists in these markets and for whom they are provided. We present some hypothesis about the factors that are likely to drive incentives for coordination among traders. Then we use data collected from a census of food markets where fish, tomatoes, or green leafy vegetables (GLVs) was sold wholesale across seven Nigerian states and Abuja, the Federal Capital Territory (FCT).

The set of products considered in this study allow us to confirm if incentives to coordinate vary by product characteristics (i.e. among highly perishable products such as tomatoes and GLV compared to fish that is usually processed) and by location (major production areas versus largely consumption areas) and if the incentive to coordinate varies for purchasing from suppliers (e.g. farmers) versus selling to customers (such as processors, restaurants or other traders) in such locations and for these products

3. Methodology

3.1 Data and descriptive statistics

This study uses data collected from a census of food markets where fish, tomatoes, or green leafy vegetables (GLVs) was sold wholesale across seven Nigerian states and Abuja, the Federal Capital Territory (FCT). These 8 states are major regional producers of at least one of the priority commodities (tomatoes, GLV or fish) and represent a wide diversity of agro-ecological, and socio-economic conditions in Nigeria (see Figure 1). The data was collected via a structured questionnaire administered to a focus group consisting of market leaders and traders between July 2023 and February 2024. Each focus group was designed to be composed of a diverse group of market actors knowledgeable about the history and current operations of the market. This included overall market leaders (e.g., the market chairman, treasurer, or other executives of the market association); product level leaders (i.e. leaders of product specific associations), traders who have a long history in the market, female traders and other stakeholders.

The questionnaire captured detailed information on market level characteristics such as infrastructure available in markets (e.g., electricity, roads, storage), number of traders and businesses in the market, location (rural vs. urban) and proximity to towns, proximity to product production area. It also captured information on market governance including who runs the day-to-day operations of the market and how are they selected as well as whether the overall market and/or product traders and if the leadership in the market coordinates the purchases of products for their traders and/or coordinates the sales of commodities for traders. The study sample consists of market level information for the entire universe of 299 wholesale markets that were found in the seven study states and Abuja. These 299 wholesale markets gave us 471 product level governance observations about the extent to which the institutional governance structure for product traders coordinate purchases or sales of the study commodities on behalf of the commodity traders in the market.

To capture important agroecological, socioeconomic and cultural variation across Nigeria, we distinguish between trading and market characteristics in northern Nigeria (northeast and northwest), the Middlebelt (North central) and the south (southeast, southwest and south south). This disaggregation was informed by some factors that contributed to variations in these markets. Generally, marketing conducts in African markets are influenced by societal traditional beliefs and cultural norms (Darley & Blankson, 2008). Furthermore, at the time of data collection, some of the markets in northern Nigeria are relatively new and has better infrastructure as compared with those in the south.



Figure 1: Map of Nigeria showing the eight study locations

Table 1 presents the distribution of the study markets in terms of the existence of coordinated purchase and/or sales and how it varies across geographical location (region of the country and in rural and non-rural locations). Table 1 highlights one key point, i.e. that in Nigerian produce wholesale markets, the diffusion of coordinated purchases and/or sales is not as widespread as might be imagined given the high search and logistical costs. Only a subset of markets (35%) have the market leaders undertaking any of such collective arrangements for traders and with wide variation, from 15% in the south to 55% in the Middlebelt region.

Table 1. Distribution of the study markets with the existence of coordinated purchase and sales

Variable (market level)	Overall	North	Middlebelt	South	Rural	Non-rural
Coordinated purchases	0.26	0.32	0.40	0.13	0.28	0.25
Coordinated sales	0.29	0.41	0.39	0.13	0.31	0.27
Both coordinated sales and purchases	0.21	0.28	0.25	0.11	0.22	0.19
Either coordinated sales or purchases	0.35	0.45	0.54	0.15	0.37	0.33
Number of observations	299	123	57	119	138	161

Variable (Product level)	Overall	North	Middlebelt	South	Rural	Non-rural
Coordinated purchases	0.26	0.35	0.4	0.12	0.29	0.24
Coordinated sales	0.29	0.45	0.39	0.11	0.33	0.26
Both coordinated sales and purchases	0.20	0.29	0.22	0.1	0.23	0.18
Either coordinated sales or purchases	0.36	0.51	0.56	0.13	0.4	0.33
Number of observations	471	170	98	203	199	272

Source: Authors calculation

At the market level, markets in the Middlebelt region had highest share of markets with coordinated purchases (~40%) while the markets in the northern Nigeria had highest share of markets with coordinated sales (~40%). The southern region of Nigeria had very few markets with existence of coordinated purchases or sales at ~10%. Assessing across rural/urban areas, coordinated purchase and sales are both more common in the rural areas (~30%) which is not surprising if markets located in rural areas are closer to farming communities where the concentration (and likely glut) of products are higher and the need for coordination around movement to urban areas and/or consumption zones might be more important. Similar results were seen when the markets were assessed at product level. The Middlebelt (Abuja and Plateau) had most cases with coordinated purchase at the level of the product governance (40%) while coordinate sales were most common in the northern Nigeria markets at the product level (45%).

3.2 Empirical methodology

To estimate the drivers of coordinated purchases and sales in wholesale markets, we use a bivariate regression analysis conducted at the level of the overall market and at the product level among traders of our three study products (tomatoes, GLVs and fish). To capture the presence of coordinated purchases in a market, we created a dummy variable equal to 1 if the market had the market authority/association coordinating the purchase of commodities (tomatoes, GLV or fish) from buyers (e.g. farmers or other traders) on behalf of traders and zero otherwise. We also created a dummy for the presence of coordinated sales in a market equal to 1 if the market had the market authority/association coordinating the sales of commodities (tomatoes, GLV or fish) to customers on behalf of traders and zero otherwise.

At product level we construct similar variables (i.e. a dummy variable) for the presence of coordinated purchase for traders of our study products of tomatoes, GLV and fish. Within our 299 markets, there are 471 products (tomatoes, GLV and/or fish) being sold wholesale. In some markets, there were commodity associations who governed the activities of the traders of particular products. In other markets the overall market authority was responsible for the governance of the product traders. Thus, the product governance variable was developed as follows. For markets with commodity associations, we created a dummy for the presence of coordinated purchases in a market equal to 1 if the commodity association coordinated the purchase of commodities (tomatoes, GLV or fish) from buyers (e.g. farmers or other traders) on behalf of traders and zero otherwise. For those markets where the overall market governed the trading activities, we created a dummy for the presence of coordinated purchases for products in that market equal to 1 if the overall market authority/association coordinated the purchase of commodities on behalf of traders and zero otherwise. We had about 20 markets where there were some products that had product form associations governing their trading activities (e.g. dried fish versus fresh fish or dried tomatoes versus fresh

tomatoes), for these cases, we created a dummy for the presence of coordinated purchases for the product equal to 1 if any of the product form associations coordinated the purchase of commodities from buyers on behalf of traders and zero otherwise.¹ The same approach was applied for coordinated sales at the product level.

Using the bivariate probit (an extension of the binary probit model), allowed us to evaluate the possibilities of either or both coordinated purchase and sales in a market simultaneously and in relation to one another (Aurier & Meijja 2014). Formally, let Y_{im} denote the presence of coordinated sales or purchase Y for each product m sold in market i. The bivariate probit model can be expressed as:

$$Y_{im}^* = \beta'_m X_{im} + \epsilon_{im}, m = 1, 2 \quad (1)$$

$$Y_{im} = 1 \text{ if } y_{im}^* > 0 \text{ and } 0 \text{ otherwise} \quad (2)$$

Where $\epsilon_{im}, m = 1, 2$ are bivariate normal distributed error terms, with a mean of zero (Capellari & Jenkins 2003; Green, 2006). The corresponding variance-covariance matrix Ω , has values of 1 on the leading diagonal and correlations $\rho_{jk} = \rho_{kj}$ as off-diagonal elements (Capellari & Jenkins 2003). X_{im} is the vector of explanatory variables included in the model while β'_m is a vector of parameters to be estimated. We evaluate the bivariate probit model and extract the marginal effects of all explanatory variables.

The explanatory variables were selected based on their expected probability to influence market structure and conduct (Asongu, 2023). This includes geographical variables (e.g. proximity to a production area and consumers or processors, region of the country, being in a rural or non-rural setting), market governance variables (such as election process, literacy level of leaders and female participation in governance), products sold (highly perishable tomatoes and GLV versus fish) along with a list of control variables about the markets such as the age of the market, number of businesses operating in the market, hours of operation and land ownership arrangement. As noted earlier, we expect that the incentives and thus presence of coordinated purchases and sales are likely to vary across locations and products. We also expect that within the same region and or for traders of the same product, the incentives to coordinate purchases might be different from the incentives to coordinate sales.

For a market located in a surplus region (where product supply outweighs demand) such as the north (for tomatoes) and or production areas within each region (where majority of supply within a region comes from), the value of coordination to maximize sales is expected to be higher than for one operating in a deficit region where demand outweighs supply such as the south (for tomatoes) and non-production areas within each region. We also hypothesize that the value of coordination is likely much higher for perishable products (such as tomatoes and GLV) compared to less perishable products such as fish that is either processed to forms with longer shelf life (such as smoked fish) or

¹ Given the few markets with product form associations (18), we were able to check and confirm that there was no case where one product form associations engaged in coordinated sale or purchase but the other did not at product form level.

easier to preserve with ice and or water compared to tomatoes and GLV that begin to deteriorate very quickly once harvested.

We also hypothesize that the impact of location and product characteristics on incentives for coordination can vary for product procurement versus product sales. For example, we hypothesize that markets located in a surplus region (such as the north for tomatoes) will be more interested in coordinating the sales of tomatoes to markets in other parts of the state or country to avoid an impending glut and price decline compared to coordinating purchases from suppliers (e.g. farmers) given the abundance of the product in the region. However, among markets located in deficit areas, we hypothesize that there will be less of an incentive for the market leaders to coordinate sales because of the large demand for the product faced in those markets (due to limited supply) but a strong incentive to coordinate purchases to enable wholesalers in these deficit markets compete with other wholesalers for the product (from both surplus and other deficit areas).

Finally, within both surplus and deficit regions, we expect that factors such as market remoteness and poor infrastructure, product perishability and exposure to opportunities for market identification and bargaining (e.g having market leaders in national associations) also directly increase the incentives for coordinating either the procurement or sales (or both) for products.

4. Result and Discussion

4.1 Descriptive results

Table 2 presents the extent to which product leaders (or leadership) in markets coordinates sales and purchases for wholesalers by product (tomatoes, GLVs and fish) and region of the country. Four key points emerge. First, while the extent to which coordinated sales and purchases are provided by product leaders across the study market appears low at 35%, the provision of coordinated purchases and/or sales is very common among tomato and GLV wholesalers, particularly in the north. Coordinated purchases or sales are provided by approximately 60% each of tomato product associations/governance structures in markets in the core north (Kaduna and Borno) and Middlebelt (Plateau State). They are also provided by 70% of the product leaders for GLVs in the core north and 55% in the Middlebelt. Second, the provision of coordinated purchases and/or sales by product leaders is much more common (over four times more) among traders of horticultural products compared to fish in the core north and Middlebelt. While coordinated purchases or sales are provided by 45% and 40% of the product leadership for tomatoes and GLVs respectively, they are only provided by about 10% of the product leadership for fish. Again, in the north, this is 60% and 70% for tomatoes and GLV compared to 9% for fish. Even in the south where coordinated purchases and sales are generally low, coordinated purchases and sales are more commonly provided

by the tomato traders leadership (20%) compared to fish traders (~10%). However, coordinated purchases and sales are provided by similar share of product leaders for GLV and fish (10%) in the south. This difference between tomatoes and GLVs in the south might be due to the important role that northern wholesalers play in many southern tomato wholesale markets.

Third, while coordinated purchases and sales among horticultural products is much lower in the south compared to the north, the provision of coordinated purchases and/or sales among fish traders is quite similar in the core north and south (~10%) but lower than the Middlebelt (Abuja) where 30% (3 of the 10 fish wholesale markets) provide coordinated purchases or sales.

Fourth, while coordinated purchases and sales are often likely to be provided together in the core north and the Middlebelt, this is not always the case. While 60% of the leaders of tomato traders provide coordinated purchases or sales (in the core north and Middlebelt), only about 40% (in the core north) and 25% (in the Middlebelt) provide both. A similar pattern is observed for GLVs. While about 35% of the leaders of GLV traders provide coordinated purchases or sales only about 20% do both. In the core north and Middlebelt these differences are starker with 70% and 55% providing either of the coordinated services but less than half (~30% and 20% respectively) providing both. In the core north, these results appear to be driven by higher provision of coordinated sales. However, in the Middlebelt, while the share providing coordinated purchases or sales is similar for tomatoes (~45%) and GLVs (~40%), the share providing both is still lower indicating that both are common in the Middlebelt but not necessarily provided together.

Table 2: The extent of coordinated purchase and sales by product and region

Tomatoes	Overall	North	Middlebelt	South
Share of tomato traders' leadership that coordinates purchases	0.34	0.43	0.44	0.16
Share of tomato traders' leadership that coordinates sales	0.39	0.52	0.44	0.18
Share of tomato traders' leadership that coordinates both purchases and sales	0.28	0.38	0.26	0.16
Share of tomato traders' leadership that coordinates either purchases or sales	0.45	0.57	0.63	0.18
Number of observations	203	92	43	68
GLV	Overall	North	Middlebelt	South
Share of GLV traders' leadership that coordinates purchases	0.25	0.43	0.38	0.09
Share of GLV traders' leadership that coordinates sales	0.29	0.59	0.38	0.11
Share of GLV traders' leadership that coordinates both purchases and sales	0.18	0.32	0.2	0.09
Share of GLV traders' leadership that coordinates either purchases or sales	0.37	0.7	0.55	0.11

Number of observations	174	44	45	85
Fish	Overall	North	Middlebelt	South
Share of fish traders' leadership that coordinates purchases	0.09	0.03	0.30	0.10
Share of fish traders' leadership that coordinates sales	0.07	0.09	0.20	0.04
Share of fish traders' leadership that coordinates both purchases and sales	0.05	0.03	0.20	0.04
Share of fish traders' leadership that coordinates either purchases or sales	0.11	0.09	0.30	0.10
Number of observations	94	34	10	50

Source: Authors calculation

Table 3 presents the summary statistics for our key explanatory variables i.e. the characteristics of the study markets. Several key points emerge. Forty percent of the study markets are in the core north (Kebbi, Borno and Kaduna) and 40% in the south (Oyo, Ebonyi and Cross River). Just about 20% are in the Middlebelt region of the country (Plateau and FCT). Tomato is sold in most markets (~70%) compared to GLV (~60%) and fish (~30%) the markets are almost equally split between rural and non-rural (urban and peri-urban) areas. Over 85% of the markets in the study sample are in production areas; meaning majority of what they sell comes from within the states. This might reflect the fact that the study states are among the top producing states in their respective geopolitical zone/region of Nigeria. In terms of size, markets in the core north tend to have fewer traders operating on a typical day (mean=1224) compared to those in the Middlebelt (mean = 2669) and south (mean=2021). This might reflect higher population densities in the Middlebelt and south compared to the north but could reflect fewer but larger traders in the north.

More of the markets in the Middlebelt region of the country have their markets represented at the state or national level (~45%) compared to about 35% in the north and south. Being represented at state or national level means that the market authority or leaders of any product association or a trader in the market holds a leadership position in the state or national level chapter of the traders' association for their product. Results also show that most markets across the country are largely on land owned by the government though there appears to be slightly higher shares of markets on private land in the Middlebelt. The extent to which markets are on government owned land might affect the extent to which the traders can independently make decisions e.g. providing infrastructure and/or services in these markets.

The election of market leadership is more common in the Middlebelt (~50% at market level and ~60% at product level) compared to ~30% and 35% in the north and south respectively. Not surprising, the share of the overall market leadership that is female is

higher in the south (~30% market and ~60% at product level) followed by the Middlebelt (market level = ~15%; product level = ~14%) but very low in the north (market level=~5% and product level is 2%). Education levels among market leadership is also higher in the south (~40% of market leaders have completed secondary education) compared to the Middlebelt and the north with only 20% and 15% respectively. Education levels are lower when we consider leadership at product level. Only about 25% of leaders (at product level) in the south have completed secondary education and this is much lower at about 10% and 5% in core north and Middlebelt respectively. This is important if education is an important driver of access to information and/or innovations.

Table 3. Descriptive characteristics of markets assessed

	North	Middlebelt	South	Overall
Region of Nigeria market is located	0.41	0.19	0.40	-
Market in in a rural area (1/0)	0.46	0.40	0.39	0.46
Market is in a production area (1/0)	0.96	0.82	0.82	0.86
Average number of traders	1224	2669	2414	2021
Age of market	44	46	54	48
Market represented at state or national level (1/0)	0.35	0.44	0.33	0.49
Government land ownership	0.91	0.89	0.97	0.93
Average number of businesses operating	40.92	73.37	19.84	37.00
Tomato is sold in the market	0.74	0.75	0.57	0.68
GLVs are sold in the market	0.37	0.79	0.71	0.58
Fish is sold in the market	0.28	0.18	0.42	0.31
Average distance to town of 50,000 (km)	18	1	9	10
Market Leaders are elected (1/0)	0.31	0.51	0.33	0.47
Share of market leadership that is female	0.05	0.15	0.28	0.16
Mkt Leader has completed secondary school (1/0)	0.14	0.20	0.39	0.25
Number of observations	123	57	119	299
Product level leaders are elected (1/0)	0.50	0.60	0.32	0.44
Share of product level leadership that are females	0.02	0.14	0.59	0.29
Product level leader has post-secondary education	0.08	0.06	0.23	0.14
Number of observations	170	98	203	471

Source: Authors calculation Note. The leadership variables at product level were developed based on the governance structure of the market as was done for the coordinated sales and purchase level information

4.2 Bivariate probit model results

The results of the bivariate probit model on the drivers of institutional provision of coordinated purchases and sales in the study markets are presented in Table 4 for market level analysis and Table 5 for the product level analysis. Three key points emerge from the market level results. First is that location matters. Compared to states in the core north

(where about 30% of markets have coordinated purchases), there is a significantly lower probability of having the market authority coordinating product purchase for traders (CP) in wholesale markets in the south (14 percentage points less all else equal). However, markets in middle-belt states (Plateau and FCT) are just as likely to have coordinated purchases as states in the core north. Also, related to location we find that CP is more likely in markets located in production areas, i.e. where majority of the product sold in the markets is produced in the same state. All else being equal, a market in a production area has a 29-percentage point higher probability of having CP. Second, we find that CP varies with products. CP is more likely in markets where tomatoes are sold in wholesale (14- percentage points higher, *ceteris paribus*) and markets where fish is sold tend to be less likely (13 percentage points lower) to have CP. These are all significant at 5% or less. Third, related to governance we find that being in a market whose leader has at least a secondary school education is positively associated (10 percentage points) with having CP.

For coordinated sales (CS), the results indicate that CS is more likely to occur in the core northern states compared to both the Middlebelt (i.e Plateau or FCT) and the southern markets (Ebonyi, Oyo or Cross River). All else being equal, being in a market in the Middlebelt or south is associated with a 14 and 29 percentage point lower probability of having CS compared to a market in the northern region (i.e Borno, Kebbi or Kaduna). This result is consistent with our hypothesis that while coordination on average might be higher in certain locations, incentives to coordinate sales are likely to be higher in major production areas such as the core north for tomatoes and some green leafy vegetables (facing higher supply relative to demand necessitating coordination of sales to minimize losses and price collapses relative) than coordinated purchases. We also find that markets that are represented at the state or federal level also tend to be more likely to have CS. Being represented at state or national level is associated with a 22-percentage point higher probability of having CS, all else equal. This further bolsters the point that all else held constant, markets with better networks and associated information about market opportunities or better bargaining power outside of the market area are more likely to see opportunities for and the value of providing such coordination services

Similar to the case of CP and in relation to market location, markets that are located within production areas are more likely to have coordinated sales ($dy/dx = 0.23$; $P > z = 0.01$). This is what we expect in a high supply region. In contrast with CP where markets with tomatoes are more likely to have CP, all else equal, we find that controlling for region and other factors, CS is more likely in markets where green leafy vegetables are sold. A market where GLV is sold in wholesale is associated with a 16-percentage point higher probability of having CS, all else being equal. Though initially surprising, this is consistent with the argument that conditional on other factors, highly perishable products with more niche characteristics or consumer preference for particular attributes are likely to see

higher incentives for coordination. Thus, relative to fish and tomatoes, it appears that markets where GLV is sold in large quantities face additional challenges in securing markets at acceptable prices and thus have an incentive to coordinate their sales.

As hypothesized, we find that markets where fish is sold in wholesale tend to be less likely to engage in CS (as was the case for CP), consistent with a lower incentive for any form of coordination for a relatively less perishable product.

The correlation matrix for the bivariate probit model indicates the complementarity and or substitutability of our two study practices within markets. A negative correlation coefficient between coordinated purchases and sales suggests that in markets, these practices are substitutes or that one practice is more suitable for supporting trading activities than the other. This is possible if trader networks are stronger with suppliers than with buyers (thus facilitating CP but not CS) or if the costs associated with one activity (e.g. product procurement from farms) was much more difficult than trader access to markets making CP more important than CS. Conversely, a positive correlation indicates complementarity between CP and CS. This could occur if logistics associated with both procurement and sales are high (e.g. in rural areas with poor infrastructure) and or where there are spillovers from the realized benefits of one that encourage the adoption of the other. We observe a positive correlation (0.852 and significant at 5%) between the presence of CS and CP in our study markets. This is not surprising given that we are dealing with perishable products, particularly tomatoes and GLV where coordination is likely important to minimize losses. However, finding that coordinated sales is more likely in the core north (relative to all other regions) and also that coordinated purchases is more likely to occur in wholesale markets where tomatoes are sold while coordinated sales is more likely in markets where GLV is sold all else equal indicates that there are likely important differences in the benefits of coordinated purchases and sales across these perishable products as discussed above.

Table 4. Market level analysis (bivariate probit)

	prob of coordinated purchases =1		Prob of coordinated sales =1	
	dy/dx	P>z	dy/dx	P>z
Market in Plateau or FCT	0.048	0.459	-0.136**	0.028
Market in Ebonyi, Oyo or Cross river	-0.148**	0.027	-0.297***	0.000
Market in rural location	0.001	0.975	0.059	0.200
Within production area	0.291**	0.012	0.196**	0.050
Average number of traders on a regular day	0.000	0.126	0.000	0.372
Age of market	0.000	0.713	-0.001	0.253
Share of land owned by the government	0.000	0.846	-0.001	0.329
Represented at state/national level	0.075	0.124	0.215***	0.000
Average number of businesses operating	0.000	0.575	0.000	0.910

Tomato is sold in the market	0.139**	0.019	0.058	0.339
GLVs are sold in the market	0.061	0.314	0.158***	0.010
Fish is sold in the market	-0.134**	0.036	-0.126*	0.052
Average distance to town of 50,000 people	0.000	0.847	-0.002	0.270
Leaders are elected	-0.046	0.327	0.026	0.579
Share of market leaders that are female	-0.044	0.401	-0.035	0.474
Market leader has post-secondary education	0.104*	0.064	0.036	0.485
	284		284	

Source: Computed from field survey (2024) * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5 presents the results at product level. Here we exploit variation among different products within markets and across regions to understand the drivers of the institutional provision of coordinated purchases and sales for wholesalers in Nigerian markets. The results from the product level analysis are consistent with those of the market analysis and show that three key factors are important predictors of the availability of CP and CS. First, at the product level, location matters. Coordinated purchases are less likely in the south but just as likely to occur in northern and Middlebelt states. Wholesalers in markets in the south are ~15-percentage points less likely to have the purchases of their products coordinated by the product level leaders. Being in a production area is associated with a 26-percentage point higher probability of having the product leadership providing coordinated purchases of products from farmers or other traders and these location factors are statistically significant at 5% or less. With respect to products (with fish as the reference product), CP is higher for tomato traders (22- percentage points higher, all else equal) and GLV (19-percentage points higher). The results for coordinated sales at product level are similar to those at market level. Wholesalers in the south and Middlebelt are less likely to have their product leaders coordinating sales compared to their counterparts in the north. These results are large (~13-percentage points and 27 percentage points lower for the Middlebelt and South respectively) and statistically significant at 1%. Compared to fish, traders of tomatoes and GLV are more likely to have their leadership provide assistance of coordinated sales. These associations are also large (about 20 percentage points and 19- percentage points for tomatoes and GLV respectively) and significant at 5% or less. Though only significant at 10% markets that are further away from towns with 50,000 people or more are less likely to have coordinated sales all else equal. Finally, while product or market leaders being represented at state level is not a significant predictor of the probability of having coordinated purchases, it is an important predictor of coordinated sales. A market where the market authority, leaders of any product association or a trader in the market holds a leadership position in the state or national level chapter of the traders' association for their product is associated with a 15-percentage point higher probability of having the product leadership assisting traders in coordinating their product sales. Similar to the market level, the correlation matrix for the bivariate probit model at product level reveals a positive

correlation (0.802 and significant at 5%) between the presence of CS and CP among product governance structures in the study markets.

Table 5. Product level analysis (bivariate probit)

	Probability of coordinated purchases =1		Probability of coordinated sales =1	
	dy/dx	P>z	dy/dx	P>z
Market in Plateau or FCT	0.041	0.411	-0.125***	0.009
Market in Ebonyi, Oyo or Cross river	-0.148**	0.028	-0.273***	0.000
Market in rural location	0.001	0.990	0.039	0.334
Within production area	0.261***	0.008	0.210**	0.026
Average number of traders on a regular day	0.000	0.614	0.000	0.507
Age of market	0.001	0.199	-0.001	0.405
Share of land owned by the government	0.000	0.914	-0.001	0.272
Represented at state/national level	0.022	0.629	0.146***	0.001
Average number of businesses operating	0.000	0.906	0.000	0.887
Product is Tomato	0.219***	0.002	0.194***	0.002
Product is GLV	0.156**	0.049	0.187***	0.010
Average distance to town of 50,000 people	0.000	1.000	-0.002*	0.092
Leaders are elected	0.036	0.386	0.060	0.150
Share of product leadership that is female	-0.112	0.145	-0.041	0.607
product level leader has post-secondary education	0.057	0.392	-0.028	0.688
Number of observations	436		436	

Source: Computed from field survey (2024) *p<0.1, **p<0.05, ***p<0.01

4.3 Discussion of key findings

From the descriptive statistics and bivariate probit analysis in this study, we find that the existence of coordinate sales and purchases is significantly more in the Middlebelt and northern regions of Nigeria. However, the few studies from Nigeria highlighting the existence of this marketing strategy have largely focused on southern markets. For example, Adesope et al. (2009) observed that farmers in southern Nigeria (particularly those selling horticultural products), sell their products themselves in output markets. Similarly, Oyebami (2019) observed that women farmers cultivating different kinds of green leafy vegetables in Ibarapa, Oyo state, under the cooperative arrangement, usually coordinate the sale of their vegetables and this has helped to boost their production level. Karigidi (2018) also reported that small holder cassava farmers and traders especially in Ekiti, southwest Nigeria, leveraged on coordinated sales in order to

increase bargaining power and scale up their access to consumers and processors. The bivariate probit results showed that probability of coordinated purchases and sales is significantly higher in markets in production areas. This likely reflects the need for coordinated services in areas of product concentration to minimize losses. If many of these areas are in more rural and remote areas, then the logistics costs associated with accessing and/or moving them are likely to be higher and a strong incentive for institutional coordination by market and product leaders. However, conditional on high logistics costs and other factors, more remote markets that are further away from major consumption areas around them tend to be less likely to have coordinated sales compared to those closer to these urban areas and for which any costs associated with coordination would be lower.

Our bivariate probit model result further showed that the provision of coordination services for traders are higher in markets where tomatoes and green leafy vegetables are traded compared to fish. This is not surprising given the higher perishability of tomatoes and green leafy vegetables compared to fish. For tomatoes that typically have long supply chains (up to 1000 km from the north to the south), the need for timely movement of product and coordinating purchases and sales is important to minimize product loss due to long distances which creates an incentive for coordinated logistics to procure and sell. Most fish traders market dried and smoked fish which are easier to preserve than the fresh fish (Liverpool-Tasie, 2021), however, tomato and GLV are predominantly sold in the fresh form (Idah et al., 2007). The logistics of marketing these highly perishable products may be an additional reason for more existence of coordinated purchase and sales in the Middlebelt and northern Nigerian markets. However, the practice of bulk sales of agricultural products to other regions of the country from the northern markets in Nigeria has been observed by Abdul-Quadri (2024) and consistent with our finding of the highest occurrence of coordinated purchases and sales in the north at both market and product level

Our results are largely consistent with the concept that transaction cost is a key driver for coordination. Given that the study products are perishables and producers in Nigeria are largely small holders, geographically dispersed and operating on farms with bad road network (Harsmar, 2007; Giller et al., 2021), traders that must find buyers outside the market regions will face high transaction cost for searching and reaching these buyers.

It is interesting to note that though over eighty percent of the study markets are in the area where the study products marketed are produced yet their motivation to coordinate purchases is only about 10% in the south. The low use of coordinated purchases and sales in southern markets might be due to cultural norms in the south that often resist changes to the way things are done (Omar et al., 2003; Darley & Blankson, 2008). It might also be driven by the relatively low production in the south compared to

production in the north and demand in the south. If products are flooding the markets (e.g. from many traders and farmers in the north (major production zone facing higher supply relative to demand) and finding buyers is not a problem (because of the large demand for these products in the south), then there might be more incentive for traders in these markets in the south to compete and less incentives for them to coordinate their purchases or sales (Abdul-Quadri, 2024).

The role of market governance in facilitating coordinated marketing has been identified (Baraka, 2022; Ayiti et al., 2024). Our results show that markets with traders who are in the leadership at state and/or national level are more likely to have coordinated sales provided by the market leadership. Leaders with influence at state and/or national influence may have more information about opportunities for accessing products and links to markets in high potential areas. They may also be more likely to access resources to facilitate the provision of infrastructures such as storage and investments in market infrastructure which are important in easing coordinated purchases and sales of perishables.

5. Conclusions and policy implications

Though coordination is noted as a natural solution to ameliorate high search and transaction and transportation costs in developing countries (particularly among markets for perishable foods such as horticultural products), there are limited studies on the extent and drivers of their use in African food markets. Thus, this study assessed the presence and drivers of institutional support for product coordination in the wholesale markets of three important products (tomato, GLV and fish) in 8 Nigerian states that cut across the northern (core north), southern and the Middlebelt (middle region) of Nigeria.

We found that though coordinated purchases or sales were only provided by about 15% of market leaders in southern markets, they were very common among horticultural traders in the core north and Middlebelt, provided by about half of markets in the core north and Middlebelt region of the country. In addition, we found that the provision of coordinated purchases and/or sales by product leaders is much more common (over four times more) among traders of horticultural products compared to fish in the core north and Middlebelt with approximately 60% each of tomato product associations/governance structures in markets in the core north (Kaduna and Borno) and Middlebelt (Plateau State) and by 70% of the product leaders for GLVs in the core north and 55% in the Middlebelt.

We find that while coordinated purchases and sales are often provided together, this is not always the case. The share of market and/or product leaders providing both coordinated purchases and sales was typically smaller than the share providing either. Furthermore, markets in the core north tend to be more likely to engage in coordinated

sales than purchases consistent with a higher incentive for coordinating sales in a surplus region facing a glut and potential price collapse.

Our regression analysis confirms the important regional and product variation in the provision of coordinated services in markets (north and Middlebelt compared to the south as well as more for tomatoes and GLVs compared to fish). It also reveals that coordinated purchases and sales are more common in markets located near where traded products are produced and that having an educated leader is positively associated with the existence of both coordinated purchase and sale as is the participation of traders in the leadership of state and national level trade associations.

These findings indicate a potential value of increasing traders' awareness of the importance of coordinated purchase and sale especially in the southern markets and among fish traders. The findings also highlight that while coordination of sales and purchases might appear as a natural response to high search costs, challenges with bargaining power or logistical challenges, the incentives to coordinate rather than compete vary with the location of markets and/or enterprises, the nature of the product being sold and the infrastructure challenges associated with markets. Thus, these factors need to be recognized among policy makers and development partners trying to support the operation of MSMEs in developing regions.

Finally, further analysis is needed to understand the significant variation in the presence of coordinated purchases and sales across regions of Nigeria for the same products (e.g. tomatoes and GLVs) and the low use on average among fish traders. This might be driven by product specific factors (e.g. level of perishability and availability of options for storage and/or processing) or by norms and trading cultures across regions. However, further studies are needed to better understand the significant variation in the presence of coordinated purchases and sales across Nigeria to inform why this institutional arrangement appears to be low on average (30%) and in the south (10%) but quite common (about 40%) in the Middlebelt and north and very high among horticultural traders. Additional studies are also needed to understand the costs and benefits to traders of this provision of coordination services by market and or product leaders to better understand how to support their use and benefits among food traders in Nigeria.

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