# Market dynamics and institutional coordination of food marketing among wholesale markets in Nigeria

Daniel A. Babalola[1], Lenis Saweda O. Liverpool-Tasie[2], Yinka Kolade[3], Thomas Reardon[2] and Ayala Wineman[2]

[1]Department of Agriculture and Industrial Technology, Babcock University, Nigeria.

[2]Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

[3]Independent Data Analyst, Marsha Drive, Scarborough, Ontario Canada

[2]Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

[2]Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA.

**Correspondence**
Lenis Saweda O. Liverpool-Tasie[2], Department of Agricultural, Food, and Resource Economics. Justin S. Morrill Hall of Agriculture, 446 W. Circle Drive, Room 202, East Lansing, Michigan 48824, USA. ORCID: https://orcid.org/0000-0002-2990-5888

Email: lliverp@msu.edu

**ABSTRACT**

**Motivation:**
Coordinated marketing activities can be an important mechanism for negotiating prices and reducing transaction and transportation costs in food supply chains. Yet there are few studies on the prevalence and drivers of coordinated marketing among food wholesale markets in lower-income countries, particularly in Africa. Most studies on coordination are on farmer organizations/groups. We address this gap.

**Purpose:**
This study explores the extent and drivers of institutional coordination for trader sales and/or purchases among wholesale markets.

**Approach and methods:**
The study explores heterogeneous contexts of product supply and demand, as well as product perishability over which trader coordination could prevail. We used primary data collected from ~470 product leadership committees in a census of 299 wholesale markets across eight Nigerian states. We combined descriptive analysis with non-linear regression estimations.

**Findings:**
(1) Coordination occurs much more for tomatoes and GLVs (perishable horticultural products) than for fish. (2) Competition prevails over coordination in major consumption areas. (3) Traders coordinate less

when they trade products they can easily source from many places, compared to situations where traders have limited sourcing locations.

**Policy implications:**

Government investment in wholesale markets is a crucial element of food market policy. However, the governance system of these markets can also be considered an element of public policy that could be wholly or partly led by the government and private sector. Wholesale market governance systems in developing countries have, in general, been little researched. We also argue that understanding whether, how much and why coordination is occurring is the first step that governments need to guide the design of policies that support coordination where it is determined to improve market operations.

**KEYWORDS**

Coordinated marketing, food supply chains, agri-food wholesale markets, Nigeria

**JEL CLASSIFICATION**

Q11, Q12, Q13, C83

## 1. Introduction

Inter-enterprise coordination can be vertical, such as between buyers and suppliers, and it can be horizontal, among firms in the same value chain segment. In this paper, we focus on the latter. Inter-firm coordination refers to firms aligning their actions to achieve a common purpose; examples of coordination include jointly setting standards, sharing price or sourcing information, and agreeing on marketing or sourcing actions. Inter-firm coordination can increase efficiency of a sector, but it can also be undertaken for anti-competitive ends (Carlton and Klamer, 1983). In high as well as lower income economies, inter-firm coordination is observed to be undertaken: (1) to reduce transaction costs, such as costs of buyer and supplier search by sharing information about the buyers or suppliers and even selling to or buying jointly from these actors; search and logistics costs are likely to be higher in low income country markets compared with high income countries (Barrett et al., 2008; Benson et al., 2018); (2) to standardize outputs to meet quality or safety standards of a target market; (3) to increase bargaining power to raise output prices or lower input prices. A given enterprise can choose to coordinate with other firms (such as traders in a wholesale market, the relevant case for this paper), but also can compete with or ignore other firms.

Coordination in its various forms and motivations has been widely studied in the economics of industrial organization (IO), as well as in agricultural and development economics such as in studies of farmer cooperatives (Cook and Grashuis, 2018; Höhler and Kühl, 2014) and food supply chain inter-firm interactions (see Bonanno et al. 2018; Sexton 2013). Coordination has commonly been studied in empirical IO to detect anti-competitive behaviour such as price collusion, e.g., in the food industry in the US (Cotterill, 2019). It has commonly been studied in both high and low income countries to analyse how firms such as processors or retailers vertically coordinate with farmers (such as Swinnen and Maertens, 2007) including with a lens of "coordination problems" between small farmers and value chain clients such as processors (Shepherd, 2018). Coordination has also been commonly studied in relation to how farmers coordinate in cooperatives, and nonfarm enterprises coordinate in "commodity associations" (e.g., Shepherd et al. 2009).

In the agrifood sector, research has often been case studies studying the emergence of an association or collective and its subsequent strategies and actions, such as: (1) a case study of

the emergence of the Citrus Association of South Africa and its strategies to defend South Africa's export share in world markets during COVID-19 (Meyer et al. 2022); (2) a case study of the local formation of a group to manage coordination among farmers and winemakers in Languedoc, France, to implement standards and create a label; see Montaigne, 2001).

By contrast, in general it is uncommon for there to be survey-based studies of adoption of coordination across heterogeneous localities. More specifically, and focused on the gap addressed by the present paper, it is rare and to our knowledge missing in the literature for there to be survey-based analysis of inter-wholesale market adoption of coordination (versus competing or ignoring), especially in low income countries. At most there have been a small set of case studies of one or a few wholesale markets with respect to coordination of prices or quantity flows in or out by food traders (such as in Ghana (Lyon, 2003) and Nigeria (Smith and Luttrell, 1994), and even for US wholesale markets in the 1930s and 1940s, Converse, 1957), there has been a lack of survey-based studies of coordination using as the units of analysis a heterogeneous sample of wholesale markets.

This gap triangulates with two more general gaps in empirical research on midstream actors. The first is a dearth of research on wholesalers per se (Barrett et al. 2022; Reardon, 2015), with some exceptions such as Minten et al. 2012 in India. The second is a dearth of inter-wholesale market survey studies. The exceptions are price integration studies that use the market as the unit of analysis (such as a study in Nigeria on price transmission and market integration in Oyo State, Oladapo and Momoh, 2008 or in China, Ahmadi-Esfahani 2006) and hygiene and quality assurance practices over wholesale markets (such as Cadilhon, Gálvez-Nogales, and López Saavedra 2013, over 115 wholesale markets in Asia and Latin America).

While a case study in a given location (implying a relatively static set of demand and supply forces representing incentives and capacity variables that can affect coordination decisions) can show why coordination emerged or declined over time at the market level, a survey of markets (as done in this study) is needed to test the effect of heterogeneous locations, and thus varied demand and supply conditions, on the coordination decision.

To address the aforementioned gaps in the determinants of inter-market coordination, we conducted a sample survey analysis of the adoption of coordination (versus competition) by agrifood wholesalers in Africa. We analysed over 470 market-product level observations of coordination governance (or lack of it) by market authorities and section leaders of wholesalers of tomato, green leafy vegetables (GLV), and fish across 299 wholesale markets in Nigeria.

In addition to filling a research gap in the literature, the findings of this study are potentially valuable for governments and policymakers. Government investment in the public infrastructure of wholesale markets is a crucial element of food market policy in low incomecountries. However, the governance system of these markets (and indeed of any public infrastructure) is also an element of public policy (Dhanshyam & Srivastava, 2021). That system can be fully public, or private, or a mix of public and private and also de facto market policy in the broad sense that policy regulates the function of food markets and thus food value chains (FVCs). Wholesale market governance systems in low incomecountries have, in general, been little researched in general; and more specifically relevant to our paper, there has been no survey-based research on one aspect or potential function of those systems, that of trader coordination. In addition, while governments have in various cases shown interest in and/or taken action concerning coordination in wholesale markets. the approximate sequence have been:

(1) assess whether there is coordination undertaken by wholesale markets;

(2) assess what the effects of the coordination are, such as whether it leads to negative externalities (e.g. "excessive" trader margins or constraints on supply due to speculation) or positive externalities such as traders coordinating to create new markets for local produce; or that the wholesalers are coordinating to balance market power of suppliers or clients (such as wholesale markets/traders did in the 1930s in the US with the advent of supermarket chains);

(3) undertake regulations or policies to limit the negative externalities or promote the positive externalities, such as US did in the 1930s with PACA regulations for negative or did with wholesale market linkages in China in the 2010s.

The present paper focuses on the first of the three steps above, to assess whether and where there is coordination. For a country like Nigeria or other African countries, this is key given the limited data on wholesale markets and the numerous needs and limited resources faced by national and subnational governments. This study provides a methodology to do the initial assessment and opens a new debate on the continent about coordination in wholesale markets. A further research agenda is to delve into the second step and assess the effects of the coordination such as on trader margins using micro survey data on traders and guided by the findings from this study.

The rest of this paper is structured as follows: Section 2 describes the data used while section 3 presents our empirical strategy. Section 4 presents the results and discussion of our empirical analysis. Section 5 concludes.

## 2. **Data and descriptive statistics**

This study utilizes data collected through a census of wholesale food markets across seven Nigerian states and the Federal Capital Territory (FCT), Abuja, where fish, tomatoes, or green leafy vegetables (GLVs) are sold in wholesale quantities. For the purpose of this study, a wholesale market is defined as a physical location where two or more wholesalers engage in the sale of at least one of the study commodities. The emphasis is on recognized trading locations — whether formally registered or not—that are known for wholesale trade of fish, tomatoes, or GLVs.

The markets were identified using a multi-stage approach. First, initial lists were obtained from government sources in each state. These were then supplemented through field visits to food markets and inquiries with wholesalers, retailers, processors, and local government officials. A snowball sampling approach was applied to ensure comprehensive coverage, especially of seasonal or informal markets, with market identification taking place over a 12-month period to account for seasonal dynamics.

The eight focal states were selected based on their role as major regional producers of at least one of the three study commodities (NAERLS, 2022). They also reflect the diverse agro-ecological zones and socio-economic settings of Nigeria. These include states from what we treat as the three study regions: (1) the Core North (Northwest and Northeast) hence referred to as North; (2) the Middlebelt (North Central); (3) the South (Southeast, Southwest, and South-South), allowing the study to capture important geographic, cultural, and institutional variation (see Figure 1).

The South is relatively more affluent than the North, with higher population density and less favourable agroecological conditions for tomatoes (Van den Broek et al., 2021). But at the same time, the South is a heavy consumer of tomato, so that the South is an area of excess demand for tomatoes.

The North, considered an excess supply area for tomatoes and GLVs, has lower population density and higher poverty rates, of about 75%, compared to 60% in the Middlebelt and 45% in the South (Otekunrin et al., 2019; NBS, 2025; Cableindex, 2025).

The Middlebelt, known as the "food basket of the nation," has favourable conditions for horticulture (specifically relevant to our paper are GLVs and tomatoes) and is home to (or in close proximity) to major consumption cities like Abuja. Thus, in contrast to the North that is more clearly an excess supply region, the middle belt also experiences excess demand.

While above we characterize a region as excess demand or excess supply, inside each zone there are distinct zones that we will refer to as being urban (consumption zones that have excess demand) and rural areas (that potentially have excess supply of these products). Within rural, there are areas that are more hinterland (further from towns/cities) and are more just production zones and rural zones near cities that are production and consumption zones and transit points for product supplies from other zones or regions.

The data were collected between July 2023 and February 2024 using a structured questionnaire administered to focus groups in each market.[1] These focus groups consisted of a diverse set of stakeholders with in-depth knowledge of the market's operations and history, including the overall market leaders (e.g., chairpersons, treasurers, executive members), product-level leaders (e.g., heads of tomato, fish, or GLV associations), long-established traders, female traders, and other relevant stakeholders.

The survey instrument captured information on:

(1) Market-level characteristics: infrastructure (electricity, road access, storage facilities), number of businesses, market size, rural/urban classification, and proximity to towns or production areas;
(2) Governance structures: who manages daily operations, how leaders are selected, and whether coordination services (such as information about prices in other markets and harvests in villages in the area and in other regions) are provided;
(3) Coordination practices: whether market or product-level leadership structures coordinate purchases from suppliers (e.g., farmers and traders coming to the market as suppliers) or coordinate sales to buyers (e.g., processors, restaurants, or other traders coming to the market as buyers). We specifically asked if *"traders in the market work together to purchase their goods* ***through their commodity associations and/or the market authority***"

The questionnaire was answered by respondents in the focus group and implemented via the SurveyCTO platform on tablets by trained enumerators to ensure consistency and data quality. Enumerators were trained to check for consistency in responses and work with the group to come to a consensus in potentially controversial responses. Ultimately, the study includes market-level information from all 299 wholesale markets identified across the study areas. From the focus group discussions carried out in these 299 markets, we generated 471 product-level governance observations across the three commodities (fish, tomatoes, GLVs). Our main variable of interest captures whether the product-level governance structure (such as product leaders or executive committees) provides coordinated purchasing and/or selling services on behalf of traders within the market. By incorporating variation in product characteristics, market function (purchase vs. sales), and regional context, this dataset enables a robust investigation of the determinants and prevalence of coordination practices in Nigerian wholesale food markets.

[1] Majority of the data collection took place between July and December 2023 with call backs for clarifications done in 2024.

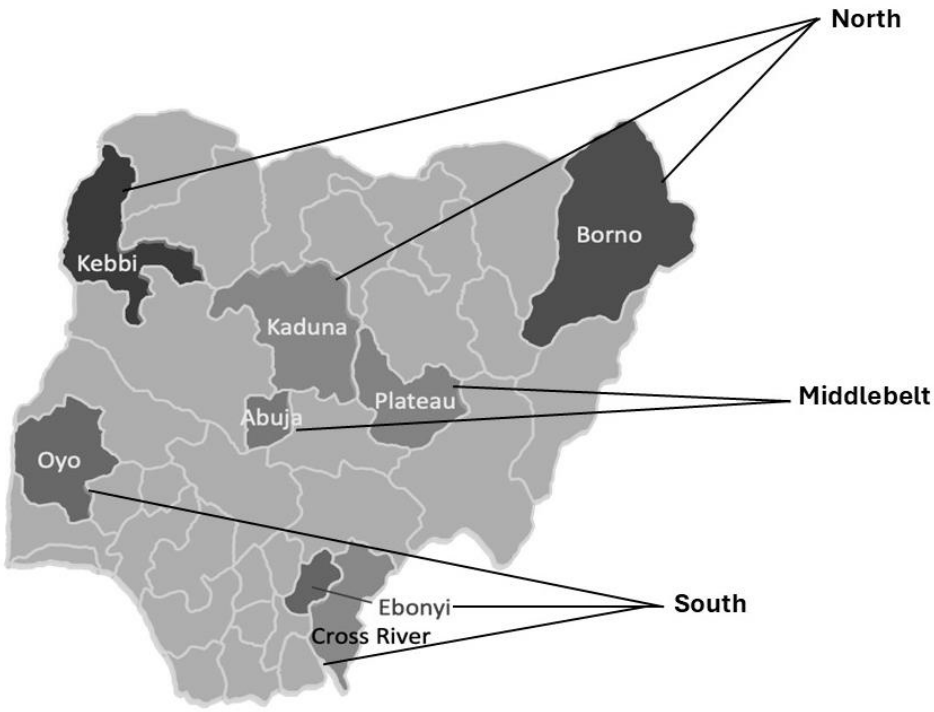


Figure 1: Map of Nigeria showing the eight study locations

Table 1 presents the distribution of the study markets in terms of the existence of coordinated purchase and/or sales services and how it varies across location. Several key points stand out.

First, we see that the diffusion of the provision of coordinated purchases and/or sales by product leaders or committees is not as widespread (at ~35%) as might be imagined given the high search and logistic costs discussed in the introduction. However, there is wide variation across geographical areas, from ~15% in the South to ~50% and ~55% in the North and Middlebelt regions, respectively.

Second, we find some variation in the provision of coordination services for procurement versus sales across markets. The Middlebelt region had the highest share of product leadership committees providing coordinated purchases (40% compared to 35% and 10% in the North and South respectively) while the North had the highest share providing coordinated sales (~45% compared to 40% in the Middlebelt and 10% in the south).

Third, comparing rural and urban areas, coordinated purchase and sales are both more common in the rural areas (~30% and 35% respectively) compared to ~25% in urban areas. This is not surprising if markets located in rural areas are closer to farming communities where the concentration (and likely glut) of products is higher and the need for coordination around movement to urban areas and/or consumption zones might be more important. Also, urban areas have product flowing into them continuously from different regions so already have a more diversified base than in rural areas.

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

| Variable (Product-market level) | Overall | North | Middlebelt | South | Rural | Urban |
|---|---|---|---|---|---|---|
| Coordinated purchases | 0.26 | 0.35 | 0.40 | 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 | 0.10 | 0.23 | 0.18 |
| Either coordinated sales or purchases | 0.36 | 0.51 | 0.56 | 0.13 | 0.40 | 0.33 |
| **Number of observations** | **471** | **170** | **98** | **203** | **199** | **272** |

**Source**: Authors' calculation from the wholesale market study data

## 3. Empirical methodology and research hypotheses

We developed three measures to assess the existence and intensity of institutional coordination services provided by product leaders or associations in wholesale food markets. First, we created a dummy variable that equals 1 if the product leader(s) or the leadership committee facilitates coordinated purchases from suppliers (such as farmers or other traders) to traders in their wholesale market, and 0 otherwise. Second, we generated another dummy variable that equals 1 if the leadership offers coordinated sales services to their wholesale market's traders' clients (such as processors or other traders in different markets), and 0 otherwise. Third, we created a variable to capture the intensity of the institutional coordination services provided in wholesale markets. This binary variable equals 1 if the product leader(s) or leadership committee offers **both** coordinated purchases and coordinated sales, and 0 otherwise.

In some markets, commodity associations govern the activities of traders dealing with specific products (e.g., fish versus tomatoes). In other instances, the overall market authority, typically a leadership committee, is responsible for overseeing all the traders in the markets. We collect the information about coordinated services provision for each of our study products (tomatoes, GLV and/or fish) that is sold in each market. Thus, across our 299 markets, we gathered 471 observations regarding whether the commodity association or market authority provided coordination services for traders of each product sold in the market at wholesale.

Given our measures are binary, we used a series of probit models (Greene 2000), each based on a cumulative distribution function and the probability that coordination is provided ($Y = 1$) or not can be calculated as:

$$p_{ij} = Prob[Y = 1 \,|\boldsymbol{x}_{ij}] = \boldsymbol{\phi}(\boldsymbol{X}_{ij}^{'}\beta) \qquad (1)$$

With $p_{ij}$ being the probability that the leadership committee for product $i$ in market $j$ coordinates purchases and/or sales on behalf of product traders. The cumulative distribution function of a standard normal variable is represented by $\boldsymbol{\phi}$, while $\boldsymbol{X}_{ij}'$ are product- and market-level factors and $\beta$ represents the respective parameter estimates. To determine the effect of each variable, we estimated the marginal effect for each observation and then calculated the average. Holding other variables constant, the marginal effect of independent dummy variables can be expressed as:

$$\Delta = \phi(\bar{X}\beta, d = 1) - \phi(\bar{X}\beta, d = 0), \qquad (2)$$

with $d$ being the indicator variable for binary explanatory variables in the model. For continuous independent variables, it can be derived as:

$$\frac{\partial \mathrm{p_i j}}{\partial \mathrm{x}_{ijk}} = \phi(X_{ij}'\beta)\beta_k. \qquad (3)$$

The explanatory variables were selected to evaluate three hypotheses about drivers of coordination, based on literature from network governance and transaction cost economics (Williamson, 1979; Gafarmy, 2012; Shahzad et al., 2018; Resnick et al., 2025). A summary is in Table 2.

The first aspect pertains to **market dynamics**. We anticipate that wholesale markets situated in regions with excess supply (such as the North tomato areas) have a greater incentive to coordinate their sales compared to wholesale markets operating in regions where demand exceeds supply (such as the South tomato areas), i.e., deficit areas. In these regions of excess demand, traders may be more inclined to compete against each other and the wholesale market product committees would then not opt to try to coordinate them.

On the other hand, we expect that a wholesale market in a region with excess demand might be more inclined to coordinate purchases among its traders from other markets or regions to secure adequate product and minimize the risk of supply chain disruptions. By contrast, those in areas of excess supply might be less interested in coordinating purchases as they are in areas where search costs are low to find farmers or traders with the product.

To analyse these dynamics, we consider two factors: (1) whether most of the product sold comes from within the state or from other states, and (2) the region of the country where the market is located; specifically, the Middlebelt and North, which are areas of excess supply of tomatoes, and the South, which is a tomato deficit region.

The second hypothesis examines product characteristics, focusing on two aspects: (1) perishability and (2) location specificity for sourcing (Williamson, 1985; Mishra and Dey, 2018; Garfarmy, 2012). We hypothesize that coordination in purchasing and selling will be more critical for highly perishable items. Thus, we expect greater coordination for tomatoes and green leafy vegetables (GLVs) than for fish, which is often sold in processed forms (dried and smoked) in Nigeria (Liverpool-Tasie et al, 2021; Idah et al., 2007). We include dummy variables in each regression to distinguish among tomatoes, GLVs, and fish.

For location specificity, we posit that products with a limited number of supply sites (such as tomatoes, grown in the North and the Middlebelt, and fish, captured or farmed near lakes and rivers) will require more coordination than those sourced more broadly (such as GLVs, which are grown throughout the country).

The third hypothesis examines market governance and its impact on the provision of coordination services (Williamson, 1985; Shahzad et al., 2018; Mishra and Dey, 2018; Resnick et al., 2025). We expect that markets with democratic leadership are better at addressing traders' needs and providing support services, such as coordinated purchasing and sales (Resnick et al., 2025). We model governance with three variables: 1) whether product leaders are elected (which should positively relate to service provision); 2) Whether governance is exercised at multiple levels, such as at the market and then the product section level (which may enhance service provision by improving communication between traders and their leaders but could also hinder it by creating power hierarchies); 3) Whether product leaders have at least a secondary education (which is also expected to positively associate with service provision).

The fourth hypothesis examines how market characteristics, including infrastructure and market size, influence logistics costs and coordination incentives (Williamson, 1985; Shahzad et al., 2018). We propose the following. 1) Coordination of purchases is likely to be higher in markets where traders can store products, minimizing spoilage risks from efforts to minimize supply disruptions. 2) Larger markets with more wholesalers are expected to have higher incentives for the coordination of purchases and sales due to lower logistics costs spread across more traders, particularly useful in areas with excess supply. 3) Coordination of sales may be

lower in markets with more retailers as this implies lower transaction costs to retail the market locally compared to those with fewer retailers. 4) The effect of remoteness (distance from cities) is ambiguous. On one hand, remote markets with poor road access would make coordination more costly (in logistics costs terms). But those very costs might themselves spur coordination to counter the costs of poor infrastructure. Moreover, hinterland areas might already have a "parcelling" or territorialization of the farmers by local rural assemblers whose territories protect their supply access and obviate the need to coordinate with other traders. (Note that we measure infrastructure and other logistical costs with the market's location (urban vs. rural) and proximity to paved roads and cities of at least 50,000 people.)

Our fifth hypothesis is that the incentives for coordination differ between procurement and sales. In surplus regions, wholesalers may focus on coordinating sales to prevent oversupply and price declines but might be less interested in coordinating purchases from suppliers due to high product availability. In deficit regions, traders may lack incentives to coordinate sales because of strong demand, but they may have a significant incentive to coordinate purchases to compete for products from both surplus and other deficit areas.

**Table 2: Key hypothesis related to provision of coordination services (Expected direction)**

| Variable | Purchases | Sales |
|---|---|---|
| ***Product characteristics*** | | |
| High perishability | + | + |
| High location specificity for sourcing | + | - |
| ***Market dynamics (Demand and supply)*** | | |
| Location with excess supply | ? | + |
| Location with excess demand | + | ? |
| ***Market governance*** | | |
| Market leaders are elected (vs. appointed or volunteers) | + | + |
| Market has multiple governance (market authority and product associations) | + | + |
| Product leader education | + | + |
| ***Market characteristics (infrastructure and logistics)*** | | |
| Access to storage | + | + |
| Number of potential collaborators (other wholesalers) | + | + |
| Number of potential ready buyers (retailers) | - | - |
| Rural market | **?** | **?** |
| Distance from a city/town of at least 50,000 people | **?** | **?** |

## 4. Results

Figure 2 shows how product leaders or wholesale market leaders (for both of which we will use the simplified "leaders") coordinate sales and purchases for wholesalers by product type and region. Four key observations emerge. First, coordinated sales and purchases are relatively low overall at 35%, but more common among tomato and GLV leaders, especially in the North. About 60% of the leaders for tomatoes and 70% for GLV in the North offer these coordinated services.

Second, coordinated purchases and sales are considerably more common for tomatoes and GLV than for fish, with 45% and 40% of leaders for tomato and GLV providing coordination, respectively, compared to only 10% for fish.

Third, in the North, this is 60% for tomatoes and 70% for GLV. In the South, coordinated purchases and sales are low, with tomato leaders undertaking coordination more frequently (20%) than fish leaders (10%). For GLV and fish, leaders provide coordinated transactions at a similar rate of about 10%. The difference between tomatoes and GLVs may stem from the significant influence of North wholesalers operating in South tomato markets and the ubiquitous nature of GLV supply in all regions.

Fourth, while coordination is less common in the South, coordination by fish leaders is around 10% in both the North and the South; however, this rises to 30% in the Middlebelt.

Fifth, coordinated purchases and sales are often provided together in the North and the Middlebelt, but this is not always the case. About 60% of tomato leaders in the North and Middlebelt offer coordinated purchasing or selling, but only 40% in the North and 25% in the Middlebelt provide both services. A similar trend is seen with GLVs, where 35% of leaders offer coordinated services, and only about 20% provide both.

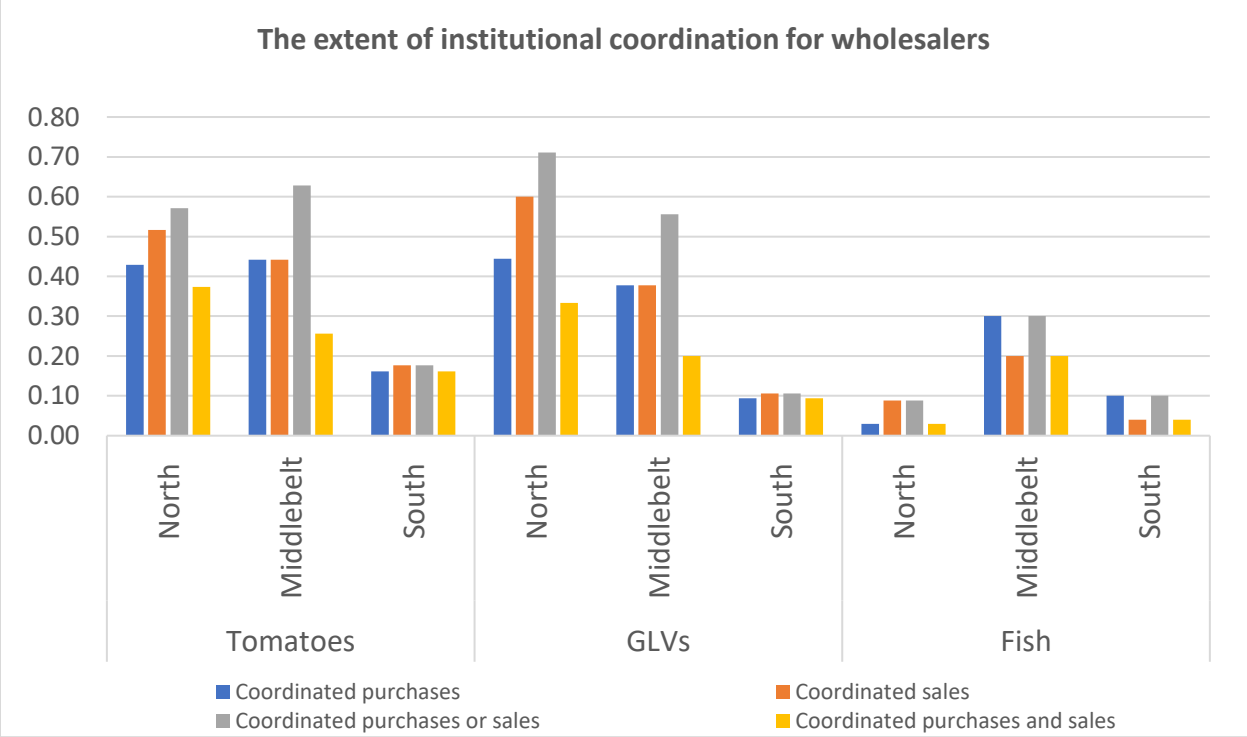


Figure 2: The extent of coordination by product leaders in wholesale markets
Source: Authors calculation from the wholesale market data

Table 3 summarizes the statistics for the studied markets and product leaders that we expect will explain the variation in the institutional provision of coordinated sales and purchases. The wholesale markets are nearly evenly divided between rural and urban areas with most within a kilometre of a paved road and about 12 km from a town with at least 50,000 people. For tomatoes, only 65% of South region wholesale markets are in production areas versus 95% and 97% in the North and Middlebelt regions respectively, which makes sense as the majority of tomatoes are produced in those two regions. Thus, even though the southern markets are often in production areas given the criteria used for selecting the study states, southern markets are still more dependent on imports from other states compared to markets in the North and Middlebelt.

For GLV, almost all wholesale markets in the study states are in production areas (97%-99%). This makes sense as GLVs are grown all over Nigeria.

For fish, 97% of Northern wholesale markets are in production areas versus 10% in the Middlebelt and 45% in the South. This distinction is also consistent with our above point that fish production tends to also be located around water bodies (in the North and Middlebelt), and pond clusters in the South and Middlebelt. The dependence on fish from outside the Middlebelt region is likely because the Middlebelt fish markets are in or close to Abuja, a large consumption area.

Most markets have a market authority operating alongside product-specific committees. Product leaders are elected in roughly half of the markets, ranging from 35% in the South to 70% in the Middlebelt.

**Table 3: Descriptive statistics of key study variables**

| **Market level** | **Overall** | | **North** | | **Middle Belt** | | **South** | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** |
| Tomato is sold (1/0) | 0.68 | 0.47 | 0.74 | 0.44 | 0.77 | 0.42 | 0.57 | 0.50 |
| GLV is sold (1/0) | 0.59 | 0.49 | 0.37 | 0.48 | 0.79 | 0.41 | 0.71 | 0.45 |
| Fish is sold (1/0) | 0.32 | 0.47 | 0.28 | 0.45 | 0.18 | 0.38 | 0.43 | 0.50 |
| Distance to paved road (Km) | 0.49 | 2.30 | 0.14 | 0.33 | 1.25 | 4.23 | 0.49 | 2.08 |
| Distance to closest town of 50,000 (km) | 11.5 | 17.8 | 19.8 | 23.2 | 0.3 | 1.5 | 8.3 | 9.8 |
| Market is in a rural area | 0.48 | 0.50 | 0.50 | 0.50 | 0.47 | 0.50 | 0.45 | 0.50 |
| Age of the market (years) | 50 | 32 | 45 | 25 | 47 | 19 | 57 | 41 |
| Market is in a production area for tomato (1/0)* | 0.85 | 0.36 | 0.95 | 0.22 | 0.97 | 0.15 | 0.63 | 0.49 |
| Market is in a production area for GLV (1/0)* | 0.97 | 0.17 | 0.93 | 0.25 | 0.98 | 0.15 | 0.99 | 0.11 |
| Market is in a production area for fish (1/0)* | 0.58 | 0.49 | 0.97 | 0.17 | 0.10 | 0.31 | 0.43 | 0.50 |
| Market has overall market authority and product level associations (1/0) | 0.71 | 0.46 | 0.73 | 0.45 | 0.84 | 0.37 | 0.61 | 0.49 |
| Average number of tomato wholesalers* | 63 | 91 | 88 | 101 | 67 | 117 | 28 | 25 |
| Average number of GLV wholesalers * | 46 | 49 | 36 | 46 | 71 | 52 | 37 | 44 |
| Average number of fish wholesalers * | 74 | 118 | 144 | 169 | 53 | 69 | 31 | 30 |
| Average number of tomato retailers* | 57 | 125 | 33 | 47 | 143 | 242 | 34 | 28 |
| Average number of GLV retailers* | 68 | 79 | 44 | 50 | 124 | 101 | 51 | 63 |
| Average number of fish retailers* | 106 | 250 | 195 | 398 | 70 | 51 | 53 | 54 |
| Market has some temperature- | 0.07 | 0.26 | 0.01 | 0.09 | 0.21 | 0.41 | 0.08 | 0.27 |

controlled storage (1/0)

| **Number of markets** | **299** | | **123** | | **57** | | **119** | |
|---|---|---|---|---|---|---|---|---|
| **Product level** | **Overall** | | **North** | | **Middle Belt** | | **South** | |
| **Variables** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** | **Mean** | **SD** |
| Gender of product leader (male=1) | 0.75 | 0.44 | 1.00 | 0.00 | 0.92 | 0.28 | 0.44 | 0.50 |
| Product section leader has at least secondary education | 0.18 | 0.39 | 0.11 | 0.32 | 0.09 | 0.29 | 0.29 | 0.45 |
| Product leaders are elected | 0.51 | 0.50 | 0.59 | 0.49 | 0.71 | 0.45 | 0.35 | 0.48 |
| **Number of observations** | **471** | | **170** | | **98** | | **203** | |

Source: calculated by authors from the wholesale market survey data * means that these means are conditional on the market selling that particular product, and thus the sample size will not necessarily equal the total number of markets in the sample or region

### 4.2. Empirical estimates of the drivers of institutional provision of coordinated purchases and sales

The average marginal effects (AMEs) derived from the non-linear probit estimates concerning the institutional provision of coordinated purchases and sales in various markets are presented in Table 4. Five key points related to our study hypotheses emerge.

First, coordination services are less likely in the South region. While product leaders are just as likely to provide coordination services in the North and Middlebelt, Southern region markets—mainly in consumption areas — have a significantly lower likelihood of providing these services, with probabilities dropping by 16 and 25 percentage points for coordinated purchases and sales, respectively, all else equal. Though we do not find strong evidence that the drivers of coordination vary distinctly between sales and purchases (as hypothesized), we find that the magnitudes by which interest in coordination is reduced in major consumption areas is much higher for sales (by 9 percentage points) than purchases, as expected.

Second, and consistent with the study hypotheses (see Table 2), the provision of coordination services for (mainly processed) fish, a less perishable product, shows a significant negative probability of 22 percentage points for coordinated purchases or sales, and 19 percentage points for both services combined, with effects significant at the 1% level.

Third, market governance structures affect the likelihood of coordination services. In markets with multiple governance levels, there is a 21 percentage point higher likelihood of coordinated purchases and an 18-percentage point higher probability for both services. Product leader selection method is not significant for either coordinated purchases or sales.

Fourth, as hypothesized, market characteristics influence service provision. Markets with temperature-controlled services have a 13 percentage point higher probability of offering coordinated sales and purchases. Conversely, for every additional 10 km from paved roads, the likelihood of coordinated sales decreases by 1.2 percentage points; this points to the transaction cost effect. Additionally, having more wholesalers in a given wholesale market increases the probability of coordinated sales by 1 percentage point for every 10 additional wholesalers.

Lastly, markets with more retailers see a 1 percentage point lower likelihood of having coordinated sales (but not for purchases) provided. This is also consistent with the study hypothesis (Table 2)With mean retailer numbers ranging from 30 to 145 for tomatoes and 50 to 195 for fish, a market with 10 more retailers is associated with a 1 percentage point lower probability of having coordinated sales alone or in combination with coordinated purchases holding all else constant.

**Table 3. Multivariate regression results**

| VARIABLES | Coordinated purchases | Coordinated sales | Coordinated purchases and sales |
|---|---|---|---|
| Market in the Middlebelt | 0.065 | -0.024 | -0.000 |
| | (0.056) | (0.057) | (0.054) |
| Market in the South | -0.160*** | -0.245*** | -0.129** |
| | (0.061) | (0.060) | (0.055) |
| Market in a rural area | 0.034 | 0.062 | 0.036 |
| | (0.042) | (0.041) | (0.038) |
| Age of the market | 0.001 | -0.000 | 0.000 |
| | (0.001) | (0.001) | (0.001) |
| GLV (base=tomato) | -0.070 | -0.018 | -0.052 |
| | (0.046) | (0.046) | (0.044) |
| Fish (base=tomato) | -0.219*** | -0.223*** | -0.185*** |
| | (0.049) | (0.051) | (0.042) |
| Temperature controlled storage available | 0.046 | 0.067 | 0.127** |
| | (0.062) | (0.064) | (0.058) |
| Market is in a production area | 0.063 | 0.003 | 0.004 |
| | (0.066) | (0.064) | (0.061) |
| Number of product wholesalers in the market | 0.000 | 0.001** | 0.0001* |
| | (0.000) | (0.000) | (0.000) |
| Number of product retailers in the market | -0.000 | -0.001*** | -0.001*** |
| | (0.000) | (0.000) | (0.000) |
| Average distance to town of 50,000 people | 0.000 | -0.002 | 0.000 |
| | (0.001) | (0.001) | (0.001) |
| Product leaders are elected | -0.038 | -0.026 | -0.094** |
| | (0.048) | (0.049) | (0.044) |
| Gender of product leader (Male=1) | 0.089 | 0.041 | 0.058 |
| | (0.064) | (0.061) | (0.056) |
| Product leader has at least secondary education | 0.083 | -0.019 | 0.005 |
| | (0.053) | (0.056) | (0.051) |
| Multiple governance structures | 0.208*** | 0.214*** | 0.175*** |
| | (0.060) | (0.062) | (0.055) |
| Distance to a paved road | -0.009 | -0.012* | -0.010* |
| | (0.006) | (0.007) | (0.006) |
| Observations | 459 | 459 | 459 |

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

**Source**: Computed from field survey (2024)

### 4.2.1 Analysis across regions

Several key insights emerge from our regional level analysis of the drivers of the provision of coordination of purchases and sales (See Table 4).

First, in the North, the likelihood of providing coordination services for fish is significantly lower than for tomatoes, by 44, 30, and 35 percentage points for purchases, sales, and both, respectively. Similar results are seen in the Middlebelt. However, in the South, there is a 9-percentage point lower likelihood for coordinated purchases for GLVs compared to tomatoes. While GLV is relatively more perishable than tomatoes, this initially surprising result is consistent with our hypotheses that coordination would be less likely for products that are ubiquitously available (the case for GLV compared to tomatoes, which have higher product specificity being largely produced in the North and Middlebelt regions). This finding for GLV being restricted to the South might be because the region is generally a huge consumption area of GLVs due to a large population as well as a consumption rate per capita of GLV double that in the North (Parkhi, et al., 2023).

Second, markets sourcing most of a given product from within their state are 44 percentage points less likely to have coordinated sales than those which source from outside their state. This is contrary to our hypothesis but possible if all else equal, traders in an excess supply region where access to a product is easier have less of an incentive to coordinate (because they can more easily plan procurement times and quantities without fear of not getting the product) compared to traders in markets that need to source from locations outside of the state. Again, these findings hold for the Middlebelt region but not the South where traders in markets in production areas are actually more likely to coordinate both purchases and sales.

Third, governance matters but the aspects of governance that matter vary across regions. Traders in markets with elected leaders are more likely to experience coordinated purchases and sales in the North (by 20 and 27 percentage points for purchases and sales, respectively) and Middlebelt (25 percentage points for coordinated purchases). However, this effect is not significant in the South. The lack of significance might be due to the generally low levels of institutional provision of coordinated purchases or sales in the region.

Markets in the Middlebelt with a product leader with higher education are also more likely (by 48 percentage points) to have coordinated sales provided as are those with female leaders (by 28 percentage points) which constitute around 10% of product leaders in study markets in this region. Education and gender do not emerge as drivers in the South (with very low incidence of institutional provision of coordinated services) and there are no female product leaders in the North; consistent with the conservative norms in the region (Osuntade et al., 2024).

Fourth, markets in the North with multiple governance levels are 32 percentage points less likely to have coordinated purchases than those with a single authority. This is consistent with the idea that multiple levels of governance in northern markets may be creating power hierarchies that inhibit support for coordination needs for traders (Resnick et al., 2025). In contrast, Southern markets with both market authorities and product associations enjoy higher coordination rates; more consistent the idea that multiple levels of governance enhance service provision by improving communication between leaders and traders.

Fifth, traders in markets in the Middlebelt with more wholesalers are more likely to have coordinated sales and purchases compared to those with fewer wholesalers.

Sixth, all else equal, traders in markets in rural areas of the Middlebelt and the South have a higher incentive to coordinate, as do those with temperature-controlled storage in the Middlebelt. Storage availability does not emerge as a key factor in the South, and its effect is unidentified in the North, where there is only one market having temperature-controlled storage.

### 4.2.2 Analysis across products

We examine whether the factors driving coordinated purchases and sales differ across our three study products. This breakdown allows us to explore whether the incentives for coordination are distinct among wholesale markets for GLVs (the most perishable product and ubiquitously grown product), versus tomatoes (a medium perishable product grown mainly in the North and the Middlebelt), versus (mainly processed) fish (a low perishable product grown in the pockets of high access to water). We highlight three key findings from our analysis.

First, although coordinated purchases and sales are generally less common among fish traders, we observe a notable result: in the Middlebelt region of the country, the likelihood of coordinated purchases among fish traders is 32 percentage points higher, and for both purchases and sales, it is 16 percentage points higher. This finding aligns with our hypothesis regarding market dynamics and product specificity, as the Middlebelt region experiences excess demand for fish, relying heavily on imports from other regions (See Table 2) while also often having preferred sources for specific types and sizes of fish desired by their clientele.

Second, across all three products and consistent with the study hypotheses, coordination is less likely to occur in the South and in markets with many retailers available to sell to (specifically for tomatoes and GLVs). Where statistically significant, coordination tends to be more likely in markets located in production areas (for tomatoes and fish) and in markets with a higher number of wholesalers (for tomatoes and GLVs). Refer to Table 5 for estimates of the marginal effects.

Third, the value of temperature-controlled storage is relevant only for GLVs and not for the other products. Moreover, GLV traders in markets with male product leaders and multiple levels of governance are more likely to have coordinated purchases (or both coordinated purchases and sales) provided. Among fish traders, having leaders with at least secondary education is particularly important, whereas, for tomato traders—where coordinated purchases and sales are already the norm (and general education levels much lower)—such education is actually associated with a lower probability of coordinated services.

## 5. Discussion, conclusions and policy implications

### 5.1. Discussion of key findings

The findings reveal that coordination services are rarely available in the southern markets of Nigeria, with only about 15% of product leaders providing such services. In contrast, these services are more prevalent in the northern and Middlebelt regions, where approximately 60% of product leaders offer coordination, particularly among GLV product leaders (60% in the north and 70% in the Middlebelt). Additionally, while coordinated purchases and sales are frequently provided together, this is not always the case. The proportion of product leaders offering both coordinated purchases and sales is typically less than those providing either one individually. Markets in the North tend to focus more on coordinated sales than purchases, likely due to greater incentives for coordinating sales in a surplus region facing potential price collapses.

Our multivariate regression analysis shows that incentives for coordination services are influenced by market dynamics (demand and supply), product characteristics, governance, and infrastructure, with varying impacts across regions and products. Consistent with our hypothesis, we found that incentives for coordinated sales are higher for wholesale markets operating in

regions with excess supply (North and Middlebelt regions for horticultural products) rather than excess demand (South), especially for more perishable products (GLV and tomatoes relative to fish).

However, when we compare markets within the same region, we find that markets that source a majority of their products from within the same state in the North and Middlebelt region (where there is large excess supply) are less likely to provide coordination services compared to the South. This within-regional incentives to coordinate (in a region of relatively high food demand) is consistent with efforts to lower trading costs in a region where the magnitude of excess supply might be lower than in the north thus not enough to disincentivize coordination, even if for particular periods.

We also found that markets in the South in rural areas are more likely to have coordinated purchases, and both coordinated purchases and sales. This is consistent with the idea that traders in markets in rural areas might find it more valuable to coordinate to expand their market access and reduce logistical costs.

We found that the impact of the type of product (correlated with characteristics of perishability and ubiquity versus location specificity) also varies across regions. While coordination among fish traders is generally less common in the North and Middlebelt, it remains consistent in the South. On the other hand, there is evidence of lower coordination among GLV traders in all regions, likely because GLVs typically have shorter supply chains and are more widely available, reducing the need for coordination compared to tomatoes and fish, which have more specific sourcing requirements.

Overall, these results highlight the significance of market dynamics and product characteristics, aligning with the literature on transaction cost economics as discussed above. While we do not find strong evidence that the drivers of coordinated sales and purchases are too different, we find consistent evidence that the magnitude impacts and significance of the drivers often vary for purchases versus sales.

Our findings align with existing literature (discussed above) on governance, demonstrating that governance plays a significant role. However, when we compare the impact of governance across different regions, we observe an interesting divergence. In the South, multiple governance structures are positively and significantly associated with coordinated purchasing. In contrast, these same structures are negatively associated with coordinated purchasing in the northern regions.

This discrepancy supports the hypothesis that markets with various levels of governance can provide better mechanisms for communicating and advocating for traders' needs, which enhances service provision (Scheiterle & Birner, 2023). For others (as suggested by the negative effects observed in the North) a simpler governance structure helps prevent situations where the market authority's roles are undermined by strong product associations or the reproduction of power hierarchies, which can decrease effectiveness (Resnick et al., 2025).

### 5.2. Policy implications and agenda for research

As noted in the introduction, the primary contribution of our analysis to policymaking is to provide governments with a method and perspective to determine whether and where there is coordination occurring in food wholesale markets. This is the first step that governments need to take in order to then determine whether investments or regulations are needed to enhance adoption

of coordination where it provides positive externalities such as great market efficiency and consistency of food access, or constrain it where it produces negative externalities like higher prices from collusion.

The latter points to the needed research agenda. We recommend further analysis to comprehend the significant variations in the presence of coordinated purchases and sales across different regions of Nigeria for similar products (e.g., tomatoes and GLVs) and the comparatively low usage among fish traders. Additional studies are necessary to evaluate the costs and benefits of these coordination services provided by market and product leaders. This understanding will help identify ways to support and enhance their use and benefits among food traders in Nigeria and other similar contexts.

**Table 4: Region specific results for the provision of coordination**

| | North | | | Middle Belt | | | South | | |
|---|---|---|---|---|---|---|---|---|---|
| VARIABLES | purchases | sales | Purchases AND sales | purchases | Sales | Purchases AND sales | Purchases | Sales | Purchases AND sales |
| Market in a rural area | -0.10 | 0.06 | -0.03 | 0.22* | 0.26*** | 0.19** | 0.14** | 0.06 | 0.11** |
| | (0.07) | (0.07) | (0.07) | (0.12) | (0.09) | (0.09) | (0.06) | (0.06) | (0.05) |
| Age of the market | 0.01*** | -0.00 | 0.002** | -0.00 | -0.00 | -0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| GLV (base=tomato) | -0.04 | 0.05 | -0.05 | -0.08 | -0.10 | -0.09 | -0.09* | -0.08 | -0.08 |
| | (0.09) | (0.09) | (0.09) | (0.09) | (0.08) | (0.07) | (0.06) | (0.06) | (0.06) |
| Fish (base=tomato) | -0.44*** | -0.30*** | -0.35*** | -0.45*** | -0.48*** | -0.30*** | -0.05 | -0.10 | -0.09 |
| | (0.06) | (0.11) | (0.06) | (0.07) | (0.06) | (0.06) | (0.07) | (0.06) | (0.06) |
| Temperature controlled storage available | - | - | - | 0.14 | 0.27** | 0.25*** | - | - | - |
| | | | | (0.14) | (0.11) | (0.10) | | | |
| Market is in a production area | -0.12 | -0.44*** | -0.18 | -1.35*** | -0.73*** | -1.13*** | 0.19*** | 0.19** | 0.17** |
| | (0.16) | (0.16) | (0.14) | (0.28) | (0.21) | (0.24) | (0.07) | (0.08) | (0.07) |
| Number of product wholesalers in the market | -0.00 | 0.00 | -0.00 | 0.00 | 0.004*** | 0.002*** | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Number of product retailers in the market | 0.00 | -0.00 | -0.00 | -0.00 | -0.003*** | -0.002*** | -0.002** | -0.003*** | -0.003*** |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Average distance to town of 50,000 people | 0.00 | -0.002* | 0.00 | - | - | - | -0.00 | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | | | | (0.00) | (0.00) | (0.00) |
| Product leaders are elected | 0.19** | 0.27*** | 0.07 | 0.25* | -0.18 | -0.07 | -0.07 | -0.07 | -0.05 |
| | (0.09) | (0.10) | (0.09) | (0.14) | (0.14) | (0.11) | (0.05) | (0.05) | (0.05) |
| Gender of product leader (Male=1) | - | - | - | 0.05 | -0.28* | 0.03 | 0.07 | 0.05 | 0.06 |
| | | | | (0.19) | (0.16) | (0.14) | (0.05) | (0.05) | (0.05) |
| Product leader has at least secondary education | -0.01 | -0.19 | -0.21 | 0.48*** | 0.65*** | 0.25 | 0.02 | -0.02 | -0.00 |
| | (0.10) | (0.12) | (0.14) | (0.18) | (0.13) | (0.16) | (0.05) | (0.05) | (0.05) |
| Multiple governance structure (product plus | -0.32*** | -0.05 | -0.17 | 0.11 | 0.21 | 0.06 | 0.29*** | 0.24*** | 0.26*** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| market level committees) | | | | | | | | | |
| | (0.12) | (0.14) | (0.12) | (0.20) | (0.18) | (0.15) | (0.07) | (0.07) | (0.07) |
| Distance to a paved road | 0.13 | 0.16 | 0.24** | -0.02* | -0.02* | -0.03** | -0.01 | -0.00 | -0.00 |
| | (0.14) | (0.12) | (0.12) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Observations | 164 | 164 | 164 | 95 | 95 | | 175 | 175 | 175 |

Source: Author calculations

Table 5: Product level regression results

| **Product level** | **Tomato** | | | **GLV** | | | **Fish** | | |
|---|---|---|---|---|---|---|---|---|---|
| **VARIABLES** | **Coordinated purchases** | **Coordinated sales** | **Coordinated purchases AND sales** | **Coordinated purchases** | **Coordinated sales** | **Coordinated purchases AND sales** | **Coordinated purchases** | **Coordinated sales** | **Coordinated purchases AND sales** |
| Located in the Middlebelt region | -0.01 | -0.02 | -0.07 | 0.05 | -0.07 | -0.01 | 0.32*** | 0.12 | 0.16* |
| | (0.10) | (0.10) | (0.09) | (0.08) | (0.08) | (0.08) | (0.12) | (0.11) | (0.08) |
| Located in the South | -0.18* | -0.21** | -0.16 | -0.18* | -0.36*** | -0.12 | 0.06 | -0.12 | -0.05 |
| | (0.11) | (0.11) | (0.10) | (0.10) | (0.10) | (0.09) | (0.10) | (0.11) | (0.08) |
| Located in a rural area | 0.03 | 0.07 | 0.05 | 0.05 | 0.07 | 0.06 | 0.00 | 0.06 | -0.10 |
| | (0.07) | (0.07) | (0.07) | (0.06) | (0.06) | (0.06) | (0.06) | (0.07) | (0.07) |
| Age of the market | 0.00 | -0.00 | -0.00 | 0.002** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Market is in a production area | 0.31** | 0.20 | 0.22* | 0.08 | 0.07 | 0.02 | 0.15* | 0.10 | 0.15* |
| | (0.13) | (0.12) | (0.12) | (0.07) | (0.07) | (0.06) | (0.09) | (0.08) | (0.08) |
| Number of wholesalers | -0.00 | 0.001* | 0.00 | 0.00 | 0.002** | 0.00 | 0.00 | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Number of retailers | -0.00 | -0.001** | -0.0004* | -0.00 | -0.002*** | -0.002*** | -0.00 | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Temperature controlled storage | 0.06 | 0.14 | 0.15 | 0.18** | 0.18** | 0.27*** | - | - | - |
| | (0.14) | (0.14) | (0.14) | (0.09) | (0.09) | (0.08) | | | |
| Distance to a town of 50K people | 0.00 | -0.00 | 0.00 | 0.003** | -0.00 | 0.00 | 0.00 | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Product leaders are elected | 0.02 | 0.03 | -0.07 | -0.10 | -0.09 | -0.15** | -0.02 | -0.00 | 0.06 |
| | (0.09) | (0.09) | (0.09) | (0.07) | (0.08) | (0.07) | (0.06) | (0.06) | (0.05) |
| Gender of product leader (Male=1) | 0.00 | -0.02 | -0.06 | 0.24** | 0.05 | 0.15* | -0.04 | 0.04 | -0.02 |
| | (0.11) | (0.11) | (0.11) | (0.10) | (0.10) | (0.08) | (0.07) | (0.07) | (0.06) |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Product leader has at least secondary education | -0.09 | -0.19* | -0.20* | 0.14* | -0.01 | 0.04 | 0.13** | 0.15** | 0.19*** |
| | (0.10) | (0.10) | (0.11) | (0.08) | (0.08) | (0.07) | (0.05) | (0.06) | (0.07) |
| Market has multiple levels of governance | 0.13 | 0.13 | 0.12 | 0.51*** | 0.44*** | 0.37*** | 0.02 | 0.01 | -0.08 |
| | (0.10) | (0.10) | (0.09) | (0.11) | (0.11) | (0.09) | (0.09) | (0.10) | (0.09) |
| Distance to a paved road | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.02 | -0.01 | 0.00 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Observations | 196 | 196 | 184 | 171 | 171 | 171 | 81 | 81 | 81 |

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