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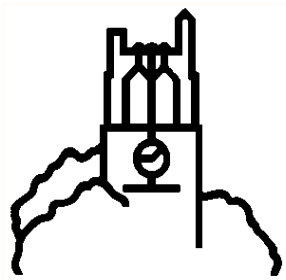
Food System Transformation and Market Evolutions: An Analysis of the Rise of Large-Scale Grain Trading in Sub-Saharan Africa

by

Nicholas J. Sitko, T.S. Jayne, William J. Burke, and Milu Muyanga



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by

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September 2017

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EXECUTIVE SUMMARY

Ongoing transformations of agri-food systems in Sub-Saharan Africa (SSA) are garnering considerable attention from policy-makers, researchers, and development partners. While a growing body of literature has examined transformations occurring within the farm production, processing and retail segments of the food systems, there has been surprisingly little attention to the so-called *middle* segments—trading and wholesaling. Beneficial changes in African grain markets hold considerable potential to improve livelihoods in the region, because grain-marketing costs typically account for 50-60% of the price paid for staple foods by African consumers (Jayne et al. 2010). This lack of empirical attention, particularly for staple cereals, is an important blind spot in our knowledge of recent transformations of these food systems.

The exceptional pace of transformation in the region's food systems suggests that the evidence generated about grain market performance ten or fifteen years ago is losing relevance for guiding beneficial investments and policies today. In particular, grain market policies and development interventions in the region typically presuppose a dysfunctional grain market structure, dominated by small, poorly capitalized, and often geographically isolated market actors, which limits market efficiency, imposes major transactions costs on market participants, and impedes supply chain coordination and risk management (Poulton, Kydd, and Dorward 2006; Fafchamps 2001; Barrett 2008). While this image of an incoherent and jumbled commodity aggregation market certainly still holds in many areas, recent survey data suggests major changes are underway that require fundamental reassessment of development policy and programmatic options.

Using data from nationwide farm surveys over time and from surveys of the population of large-scale traders operating in Zambia, Kenya, and Tanzania this article explores how grain markets in SSA are evolving by examining the rise of large-scale grain trading firms in smallholder grain markets. Nationally representative rural household survey data shows that in Zambia between 2012 and 2015 farmer maize sales to large-scale traders (LSTs) increased from 3% to 12% of total maize sales volume, or from approximately 40,000 metric tons (mt) to over 240,000 mt. In Kenya, we find virtually no sales to LSTs in 2004, increasing to 21% of all maize sales by volume in 2007, and expanding further to 37% in 2014.[1]

Key Findings

Drawing on survey data with large-scale traders in Kenya, Zambia, and Tanzania, combined with rural household survey date we show that LSTs are co-evolving with other important transformations occurring in the demand and production segments of regional agri-food systems, namely, the rapid growth in larger African farms and sustained regional grain demand caused by rapid population growth, dietary changes, and urbanization.

We show that the rise of LSTs is having important effects on market coordination and prices. Trader survey data shows that the majority of LSTs in all countries utilize upstream contracts with processors and downstream contracts with small-traders to coordinate supply chain activity, suggesting an important shift away from typical spot market arrangements in grain markets. As a consequence of improved supply chain coordination and scale economies, we find that, *ceteris paribus*, farmers that sell to LSTs receive 4.9 and 3.6% higher prices for maize, in Zambia and Kenya respectively, than farmers that sell to other commercial market channel.

[1] Similar time series data on smallholder sales is not available in Tanzania.

We find that LSTs are particularly active in areas where medium-scale farms account for a relatively large share of area under cultivation. Medium-scale farms tend to have larger surpluses to sell per farm and entail lower transaction costs per sale for traders, so no wonder that large traders tend to set up buying operations in areas with a large concentration of medium-scale farms. We show that farms of 5 hectares or more are 14.4 and 19.6 % more likely to sell to LSTs than small farms of 1 hectare or sell, all else equal. Once operating in these areas, large traders likely also provide additional access to markets for small-scale farmers—for inputs as well as for crops.

In addition to offering higher prices, LSTs are increasingly providing smallholders with services, including extension advice, price information, and input credit. We show that farmers that sell to large traders are statistically more likely to get price information (in Zambia) and more likely to receive seed credit (Zambia) and cash input credit (Kenya) than those selling to traditional small-scale traders.

Conclusion and Recommendations

The rise of LSTs in SSA grain markets suggests that important transformations are occurring in the middle segment of the agri-food system that challenges the dominant understanding of the constraints and opportunities in these markets. An important policy concern is how to effectively leverage the benefits of growing LST investment in grain markets, while managing downside risks associated with market power and limited market participation by poorer, more marginal segments of the rural population.

Policy tools and investments to help strike this difficult balance include: 1) Support competition from domestic traders through competitively priced and accessible commercial credit markets. The ability to leverage grain stocks through warehouse receipts or moveable collateral legislation may be particularly important; 2) support horizontal aggregation structures to help small farms with limited surpluses to sell to cost effectively link to LST market channels; 3) implement policies to improve grain price predictability, including clearly defined policies for triggering government action in cross border trade and marketing board activities; and 4) develop innovative financial tools to help defray risk and costs to LSTs of providing input credit and other services to smallholders in order to help expand the scope and scale of these activities to marginal regions, communities, and producers.

For African agriculture to contribute to a broader process of economic transformation, in the context of rapid population growth and increased climate uncertainty, marketing arrangement that create incentives and services to support smallholder intensification is critical. With effective policies and investment, the rise of large-scale grain trading offers new opportunities to support smallholder intensification.

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ACRONYMS

AEZ	Agro-Ecological Zones
CSO	Central Statistical Office
EAGC	East African Grain Council
FDI	foreign direct investment
FRA	Food Reserve Agency
GTAZ	Grain Traders Association of Zambia
IAPRI	Indaba Agricultural Policy Research Institute
IFPRI	International Food Policy Research Institute
KNBS	Kenya National Bureau of Statistics
LSTs	large-scale traders
MAL	Ministry of Agriculture and Livestock
mt	metric tons
MSU	Michigan State University
NCPB	National Cereals and Produce Board
NGOs	Non-Governmental Organizations
RALS	Rural Agricultural Livelihoods Survey
SSA	Sub-Saharan Africa

1. INTRODUCTION

Ongoing transformations of agri-food systems in Sub-Saharan Africa (SSA) are garnering considerable attention from policy-makers, researchers, and development partners. However, while a growing body of literature has examined transformations occurring within the production, processing, and retail segments of the food systems,[2] there has been surprising little attention to the so-called *middle segments*—aggregation and wholesaling— and particularly for the staple cereals.[3] Cereal crops still account for over 60% of total cultivated land across Sub-Saharan Africa (FAOSTAT 2017). The dearth of evidence at the first-buyer and wholesaling stage of cereal food systems is an important blind spot that may impede our understanding of the causes and consequences of rapid transformation in African food systems.

Improved grain market performance holds considerable potential to improve food security and economic welfare in the region. Post-farm marketing and processing costs have historically accounted for 50-60% of the price paid for staple maize meal by African consumers (Jayne et al. 2010; Sitko and Jayne 2014). Therefore, a 10% reduction in marketing and/or processing margins could confer greater benefits to farmers and consumers than a 10% reduction in grain production costs (Jayne et al. 2010).

Grain market policies and development interventions in the SSA typically presuppose a dysfunctional grain market structure, dominated by small, poorly capitalized, and often geographically isolated market actors, which impedes supply chain coordination and risk management, thus imposing major transactions costs on market participants (Poulton, Kydd, and Dorward 2006; Fafchamps 2003; Barrett 2008). While this image of a chaotic and inefficient commodity aggregation market may still hold in many areas, recent survey evidence points to major changes in recent years that require a fundamental reassessment of the direction and pace of innovation in grain value chains.

Using data from Zambia, Kenya, and Tanzania this study explores how grain markets are evolving by examining the rise of large-scale grain trading firms in smallholder grain markets. Nationally representative smallholder household survey data shows that in Zambia between 2012 and 2015 maize sales to large-scale traders (LSTs) increased from approximately 40,000 mt to over 240,000 mt, with their share of total private sector maize purchases from farmers rising over this 3-year period from 23% to 41%. In Kenya, we find virtually no sales to LSTs in 2004, increasing to 21% of all maize sales by volume in 2007, and expanding further to 37% in 2014.[4] In Tanzania, 34% of maize sales by volume in 2016 was sold directly to LSTs.

The rise of LSTs suggests important transformations are occurring in the middle segment of the grain markets that challenges the dominant understanding of constraints and opportunities in these markets. This article seeks to expand our understanding of these changes and their implications for grain market and agricultural development policy. In particular, this article has three interrelated objectives to identify the alternative functions and comparative advantages of large- and small-scale grain traders, and their potential synergies; 2) to identify factors driving the rapidly growing role of

[2] This includes evidence of rapid land accumulation by medium-scale farms in many countries (Jayne et al. 2016; Sitko and Jayne 2014) and growth in food processing and retail market formalization in response to changes in urban food preferences (Tschirley et al. 2015).

[3] While a few studies have examined horticulture and dairy (e.g., Neven et al. 2009), virtually no attention has been given to potential structural change at the aggregation and wholesaling stages of the main staple commodities in Africa.

[4] Similar time series data on smallholder sales is not available in Tanzania.

LSTs in Kenya Zambia, and Tanzania, and to consider the extent to which these trends may reflect similar trends more broadly in SSA; and 3) to assess what the rise of LSTs tells us about the on-going process of food system transformation in SSA and the implications for the future of small-scale farming.

The study has a particular focus on the relationship between the rise of LSTs and important changes in farm structure in many African countries as documented by Jayne et al. 2016. The recent rise in the share of total farmland under the control of *medium-scale* and *domestic investor* farms may have provided incentives for LSTs to invest in such areas. Using nationwide farm survey data that identifies the type of buyer to whom farmers sell enable us to examine the relationship between local farm size distributions and the share of LSTs as first buyers in the markets.

This study is organized as follows. Section 2 discusses a detailed conceptual framework for understanding the rise of LSTs. Section 3 discusses data sources. Section 4 uses trader survey data to examine the evolution of LSTs in the region and how they engage in smallholder grain markets. Section 5 draws on household survey and other data sources to explore important drivers of the rise of LST. Section 6 uses survey data to assess the implications of the rise of LST on grain prices and access to farm credit and services. Section 7 offers concluding remarks and policy recommendations.

2. HOW AND WHY MARKETS EVOLVE: A CONCEPTUAL FRAMEWORK

Our thinking on the cause and consequences of the rise of LST in SSA is informed by two interrelated strands of literature: the economic structural transformation literature and the literature on food system transformation and modernization. The structural transformation literature highlights several stylized facts about how economies shift from being predominately agrarian to relatively more industry and service oriented (Johnston and Mellor 1961; Johnston and Kilby 1975; Mellor 1976). In countries where the primary source of employment is agriculture, agricultural productivity growth typically initiates the process of transformation. Farms selling the greatest surpluses lead this process and their earnings generated from the expansion of production creates demand for goods and services in the local rural economy. This, in turn, generates employment opportunities in the non-farm economy, thereby inducing rural to urban migration, labor force shifts from farm to non-farm, gradual farm consolidation by those that remain in agriculture, and ultimately a declining agricultural share to the Gross Domestic Product. An important outcome of this process is that *all* labor productivity increases through a combination of inter-sector gains—i.e., the movement of lower productivity labor from agriculture to manufacturing and services—and agricultural productivity growth achieved through technology adoption, scale economies, shifts in the mix of agricultural products, and improved market access (Jayne et al. 2016; Haggblade, Hazell, and Reardon 2010).

Initiating and sustaining a process of transformation, therefore, requires modes of exchange that trigger and sustain agricultural productivity growth among a broad segment of the rural population. This often boils down lowering transactions costs in ways that increase farm gate prices relative to input costs, combined with supply chain exchange mechanisms that overcome the idiosyncratic market failures that limit participation of small farms in agricultural supply chains (Poulton, Kydd, and Dorward 2006; Barrett 2008; Reardon and Timmer 2012).

Traditional market arrangements in SSA are often ill equipped to spur broad-based productivity growth. This is because myriad individuals and very small firms, with limited capital and asset bases, typically dominate traditional grain markets in SSA (Fafchamps 2003). In this context, farm products often undergo numerous discreet, small volume, spot market transactions before reaching consumers (Poulton, Kydd, and Dorward 2006). As a consequence, while these markets may be reasonably competitive (Sitko and Jayne 2014a), they are also high-cost, due to a lack of scale economies and the accumulation of transactions costs (Poulton, Kydd, and Dorward 2006). Moreover, prices in these markets are typically volatile, due to market segmentation (Gabre-Madhin, Barrett, and Dorosch 2003; Barrett 2008), and limited financial capacity to store grain and withstand production fluctuations (Poulton, Kydd, and Dorward 2006). Finally, due to high risk of contract default, transactions are often on a cash and carry basis, with limited capacity for supply chain coordination through forward contracts (Fafchamps 2001). Taken together, these market attributes tend to inflate marketing margins, and consequently push down producer prices, which undermines incentives for intensification.

Transformation of traditional market arrangements is therefore critical for triggering broader processes of economic transformation. The literature on food system transformation, drawing largely on experience from Asia, suggests that as traditional market arrangements give way to more modern forms, four changes typically occur in their structure and conduct. First, there is consolidation of food system functions at both the farm level (Neven et al. 2009) and beyond (Reardon et al. 2009). Second, there is entry of global agri-business firms into some segments of the food system (Reardon

and Barrett 2000). Third, there is an institutional shift away from spot market transactions toward greater vertical and horizontal integration in supply chains facilitated through supply chain contracts (Reardon and Timmer 2012). Finally, private grades and standards become commonplace in governing supply chain relationships (Reardon et al. 1999). However, virtually none of these shifts have been empirically tested or validated in staple food supply chains involving African smallholders.

We hypothesize that the transformation of food systems may be driven both by changes at the consumer end as well as from exogenous changes affecting farm structure. For example, the rise in global food prices during the 2005-2012 period has led to rapid new investment in commercialized medium- and large-scale farms (Jayne et al. 2016). Exogenous changes in land tenure policy and land use policies, such as the rise of integrated block farms in countries such as Ghana, Ethiopia, Nigeria, Tanzania and Zambia, have also changed the scale of farming and surplus production in many areas, thus requiring new modes of commodity purchase, distribution, and finance to accommodate these larger scales of farm production.

Food system transformations produce several potentially important effects that are relevant to our analysis. Consolidation of farm and first-buyer stages of the food system provide opportunities for scale economies in production, transport, and market information, and can lead to lower transactions costs and, often, greater capacity to absorb investment risks (Poulton, Kydd, and Dorward 2006). Multi-nationalization brings with it global and regional supply chain expertise, experience in a range of risk management strategies, and considerable financial capabilities.

Consolidated agri-business firms gain footholds in traditional markets by driving down costs and offering higher prices to producers. Porter (1985) argued that to drive down costs, firms typically deploy supply chain governance strategies, including vertical coordination mechanisms such as contracts (Reardon and Timmer 2012). Other ways in which multinational traders may face lower cost structures than smaller local traders include economies of scale in transport and lower costs of capital to finance their operations, as large traders generally have access to international capital, where interest rates are typically lower than those charged by local banks, often by a significant margin (Sitko and Jayne 2014a).

Vertical coordination and contracting serve two important functions. On the production side, resource supply contracts, such as input credit systems, help to address the idiosyncratic market failures that typically inhibit smallholder technology adoption and can increase and smoothen the surpluses available for firms to purchase (Reardon 2015). Further down the supply chain, contracts enable supply chain actors to coordinate activities and investments. In some cases, contracts can be collateralized, thus leading to improved liquidity conditions within supply chains (Reardon 2015). These contracts typically emerge in conjuncture with standards, which can lower the costs associated with ensuring production consistency, and can lay the foundation for the emergence of more sophisticated forward contracting arrangements (Coulter and Onumah 2002).

The literature identifies three fundamental factors that drive transformations in food system arrangement: 1) policy interventions: including market liberalization, changes in regulations influencing the ease of foreign direct investment, and public investments affecting farm and food system productivity and volumes of trade (Jayne et al. 2002; Jayne, Mather, and Mghenyi 2010); (2) demand pull, caused by population growth, urbanization, rising incomes, and dietary changes (Byerlee et al. 2013; Reardon and Timmer 2012); and (3) supply side pushes caused by FDI and investments from domestic food system actors aimed at achieving economies of scale, scope, and

specialization (Reardon et al. 2009; Byerlee et al. 2013). In the context of grain markets in SSA, two factors are likely of particular importance. First, rapid population growth in the region drives aggregate food supply demand and puts upward pressure on food prices. Second, rapid changes in production systems, namely the growth of medium-scale farms in SSA, creates a segment of the rural population that is better capitalized and can produce on considerably higher scale than most African farms (Jayne et al. 2016). A greater number of farms seeking to sell relative large volumes offers traders (with the capacity to purchase these volumes) much lower transaction costs per exchange (and hence higher profits).

Food system transformation can affect broader processes of income differentiation, productivity growth, and economic transformation in several ways. At a production level, Reardon and Timmer (2012) find that there is convergence in the literature that the impact of participation by farmers in modern versus traditional supply chains on incomes is moderately to substantially beneficial. This is achieved through some combination of lower transactions costs within modern supply chains, as well as contract premiums. *A priori*, we anticipate the rise of LSTs to positively affect farmers that sell to them, through some combination of access to contracts and supply chain services (e.g. input credit, market information, etc.) and higher farm-gate prices. The possibility exists, however, that the rise of LSTs will squeeze out local supply chain actors,—a process referred to as disintermediation —leading to less competitive market condition and opportunities for LSTs to push down farm-gate prices due to their market power (Reardon 2015).

This framework leads us to a four-step analysis. First, we use nationwide survey data to document changes in the importance of LSTs in staple maize markets in Kenya and Zambia. Second, we use LST trader survey data to examine the role of the rise of LSTs in transforming and modernizing grain markets. Third, we examine why LSTs are expanding in smallholder markets, focusing on changing supply and demand conditions. Fourth, we use survey data and, controlling for a range of household-level and market access variables, examine the effects of selling to LSTs on access to input credit and services, and farm gate prices.

3. DATA SOURCES

The data in this paper comes from two primary sources: structured surveys with LSTs in Kenya and Zambia, and farm household survey data. LST trader surveys were carried out in September and October of 2016. In Kenya, LSTs were identified using the membership roster of the East African Grain Council (EAGC). EAGC is a membership organization that lobbies for grain market integration in east Africa. Its membership roster is considered representative of grain market actors in the region. In total, 26 firms registered with EAGC from Kenya list *trader* as their primary business. Of these, trader surveys were carried out with 24, including all the multinational traders involved in domestic grain sourcing in Kenya. The remaining two firms were either not available or refused to be interviewed for this study. Thus, while not a full census of LSTs in Kenya, our survey captures data from the majority of large-scale firms involved in grain trading.

In Zambia, LSTs were identified through Grain Traders Association of Zambia (GTAZ), the primary lobbying organization for grain traders in Zambia. In total interviews were conducted with 24 managing directors or owners of LST firms in Zambia. This included all domestic and multinational firms categorized as *large-scale* in the GTAZ membership roster. Because membership in GTAZ is required to access a trading license in Zambia, we consider this membership roster to include all LSTs in Zambia.

In Tanzania, LSTs were identified using the using the membership roster from the East African Grain Council (EAGC), as was done in Kenya. This initial respondent list was complimented with field visits to Tanzania's largest wholesale markets. These include the Tandale and Manzese market in Dar es Salaam, the largest consumer market in the country, and the major markets in producing regions, including Kibaigwa in Dodoma region and Makambako in the southern highlands region. In each market, the largest traders by volume were identified with the help of the market commissioners.

Household survey data in Kenya comes from panel data collected by researchers at the Tegemeo Institute of Agricultural Development and Policy of Egerton University, in partnership with Michigan State University (MSU). The sampling frame was originally prepared in consultation with the Kenya National Bureau of Statistics (KNBS) in 1997. KNBS used census data to identify all non-urban divisions in the country, and these were allocated to Agro-Ecological Zones (AEZ). Divisions were selected from each AEZ proportional to the size of population. Beginning in 2004, questions on marketing channel were added to the survey instrument to allow us to distinguish between small- and large-scale traders. Since 2004 three waves of the survey have been conducted (2004, 2007, 2010), consisting of a balanced panel of 1,200 maize-growing farm families living in 120 villages across 24 countries and eight AEZ.

Household survey data in Zambia comes from the Rural Agricultural Livelihoods Survey (RALS) carried out by the Indaba Agricultural Policy Research Institute (IAPRI) in partnership with MSU and the Central Statistical Office (CSO). This is a nationally representative longitudinal survey of smallholder households in Zambia carried out in 2012 and 2015. In total, 7,254 households in 442 standard enumeration areas were interviewed in both panel waves. Like the Kenya survey, these surveys capture data on farm households' crop sales behavior, including the characteristics of buyers for each crop sold, in addition to a range of other household level information.

Household survey data in Tanzania comes from the Sokoine University of Agriculture/Michigan State University Agricultural Land Dynamics Survey (ALDS). The survey was conducted in eight

rural districts of Tanzania (Njombe, Kilombero, Mvomero, Moshi, Magu, Mkuranga, Liwale, and Kiteto), which were purposively selected to capture changes in land use dynamics. A total of 1,200 farm households were interviewed in this survey. The survey provides representative data on small (<10 acres), medium (10 to 50 acres), and large-scale farms (>50 acres) in the eight districts.

An important challenge in collecting smallholder market channel data is ensuring that the distinction between large- and small-scale trader is consistent across households and countries. To address this challenge, enumerators in all three countries were trained to ask three clarifying questions when respondents indicated that they sold grain to a trader. First, to their knowledge, does the trader purchase more grain than the average trader in the area? Second, how does the trader typically buy grain? Do they personally come to villages to buy or do they operate buying points and hire agents to buy on their behalf? Third, does the trader have a business name or are they an individual? If the respondent answers yes to the first question and yes to either question 2 or 3, the market channel was classified as *large-scale trader*.

4. FINDINGS: THE RISE OF LARGE-SCALE TRADING AND SHIFTING MARKET ARRANGEMENTS IN ZAMBIA, KENYA, AND TANZANIA

Table1 documents how smallholder-marketing behavior has changed over time in Kenya and Zambia[5], and provides a cross section snapshot of sales in Tanzania. In Kenya and Zambia, two important observations come out of this table. First, of market channels captured in survey data, LST is the fastest growing in terms of the share of total maize sales in both countries. Second, the rise of LST appears to coincide with a decline in the share of total maize surplus purchased by national marketing boards, the Food Reserve Agency (FRA) in Zambia and the National Cereals and Produce Board (NCPB) in Kenya. This suggests that not only are LSTs the most dynamic market channel in the region, but that they are highly responsive to changes in government marketing policies.

In the following sub-sections, we draw on our conceptual framework and data from the trader survey to comparatively examine the rise of LSTs in Kenya, Zambia, and Tanzania, and its implications for smallholder grain supply chains.

4.1. Market Entry and Structure

Table 2 compiles data from large-scale trader surveys carried out in Kenya, Zambia, and Tanzania. This table allows for a comparative assessment of the firm history of LSTs, and their market conduct and structure.

Table 1. Share in Total Smallholder Maize Sales by Volume, Kenya, Zambia, and Tanzania Various Years

		Small-scale trader	Large-scale trader	Marketing board/Coop	Processor/ miller	Retailer/ consumer	Other	Total
		% of total kg sold to….						
Kenya	2007	38	21	29	5	7	0	100
	2014	39	37	8	4	9	3	100
Zambia	2012	10	3	81	3	2	1	100
	2015	17	12	60	8	2	1	100
Tanzania	2016	46	34	11	1	8	0	100

Source: Zambia, CSO/MAL/IAPRI 2012 and 2015; Tegemeo, 2004, 2007, and 2014.

[5] Farm household survey data with comparable market channel information is not available in Tanzania.

Table 2. Summary Statistics of Large-Scale Trader Survey

Variable	Kenya (n=24)	Zambia (n=24)	Tanzania (n=25)
Mean year firms began buying grain	2002	2008	2002
Median year firms began buying grain	2005	2008	2004
Share of firms that are multinational	11.1	29.2	8.0
Domestic *Maize* Purchases 2015/16 marketing season (MT)			
Mean	9,103	21,603	17,576
Median	5,000	3,500	3,600
Sum	163,850	518,461	439,420
Domestic *All Grain* Purchases 2015/16 marketing season (MT)			
Mean	20,334	38,215	29,689
Median	5,550	4,830	5,000
Sum	366,020	917,171	742,240
Purchase channels (% of MT purchased) 2015/16			
Small-scale farms (<5 ha)	3.06	34.0	11.2
Medium-scale farms (5-20 ha)	22.22	40.83	20.0
Commercial farms (>20 ha)	3.33	3.67	15
Other traders	52.5	21.5	47.28
Imports	18.89	0	6.52
Sales channel (% of MT sold) 2015/16			
Large-scale mills	56.94	41.71	16.2
Small-scale mills	8.61	4.58	34.4
Animal Feed Processor	5.83	9.58	6.2
Oilseed crusher	1.67	2.71	3.6
Other trader	16.67	14.17	30.6
Export market	2.22	13.54	8.6
NGOs	8.06	13.71	0.4
Contract Utilization (% yes)			
w/small-scale traders	61	54	64
from processors/retailers	78	54	42
forward delivery contracts with farmers	17	58	16
Financing			
% that borrow to fund grain trade	89	46	88
Source of trade finance (% of those that acquired)			
Domestic commercial bank	75	8	83
Overseas commercial bank	6	13	4.3
Internal borrowing within firm/family	13	67	4.3
Informal credit	6	4	8.7
Other	0	8	0

Source: Tegemeo Institute (2016).

As shown in Table 2, large-scale grain trading is a relatively recent phenomenon. In all three countries, the average and median LST was established after the turn of the century. In Tanzania and Kenya on average firms were established in 2002, while in Zambia the average start date is 2008. Open-ended questions about the timing of LST market entry converge around three causal factors. First, the maturation of domestic credit markets, including declining interest rates, and an increasing range of collateralizable assets, including grain stocks, has enable domestic entrepreneurs to access capital to buy and store grains. This was particularly evident in Kenya, and to a lesser extent Tanzania and Zambia. Second, many LSTs were established in response to the global food price spike of 2007/08, which gave rise to a range of food system investments across Africa, most notably in commercial farm land acquisitions (Deininger and Byerlee 2011; German, Schoneveld, and Mwangi 2013). This was particularly the case in Zambia, where multinational firms make up a large share of LSTs. Third, there was broad consensus that the timing of LST market entry was associated with deepening, albeit partial, commitment to market liberalization of grain markets by African governments.

The contribution of multinational participation in large-scale grain trading varies across the three countries. Zambia has the largest share of multinational participation, with seven of the 24 firms (29%) of multinational origin. In Tanzania, only one multinational firm, ETG, is involved in grain trading. This firm, however, is of Tanzanian origin.

The higher concentration of multinational firms in Zambia relative to Kenya and Tanzania reflects several important underlying differences in the structure of the markets. According to interviews, including one respondent who at different times managed grain-buying activities in Kenya and Zambia, the higher level of multinational activity in Zambia is due to three primary factors. First, grain-trading profit margins in Kenya and Tanzania are narrower and come mostly from spatial rather than temporal arbitrage due to the two-season nature of production in those countries and a staggered surplus production season with neighboring Uganda.

Spatially varying domestic surplus production, coupled with relatively limited domestic market surpluses (particularly in Kenya), and large geographic distances between major production and consumption regions (particularly in Tanzania), place limits on the total available surplus and the pace that grain is off-loaded to the market. These factors limit the attractiveness of Tanzanian and Kenyan markets to multinational firms.

Second, domestic commercial lending rates in Kenya and Tanzania are lower than in Zambia, and banks are more willing to lend to local grain traders. In Zambia, benchmark interest rates set by the Bank of Zambia held at 15.5% throughout 2016, compared to rates between 8.5% and 11.5% in Kenya and 12% in Tanzania. As shown in Table 2, amongst financed traders, 75% of the respondents in Kenya and 83% in Tanzania indicated that domestic commercial lending was their primary source of grain trade financing, compared to just 8% in Zambia. Moreover, a larger share of trading firms in Kenya and Tanzania borrowed money (89% and 88% respectively) than in Zambia (46%). Amongst all traders interviewed, two out of three in Kenya and Tanzania were financed domestically, compared to less than one in twenty in Zambia.

The low share of domestic borrowing in Zambia reflects the high concentration of multinational firms involved in grain trading. Of the 46% of respondent that borrow to financing grain trading, the majority are multinational; only four domestic LSTs in Zambia indicated that they borrow to finance grain trading while all seven multinational firms indicated that they borrow. Multinational firms

have access to overseas financing or financing divisions internal to the firm. In both cases, multinational firms can access capital at significantly lower rates than traders that depend on domestic credit. Lower cost credit for multinationals places these firms at an important comparative advantage relative to domestic traders.

Finally, both Kenya and Zambia have substantially better policy environments for private investment. The World Bank's Doing Business report for 2017 ranks Kenya 92nd and Zambia 98th out of 190 countries. While low at a global level, this places them near the top in Sub-Saharan Africa. By contrast, Tanzania is ranked 132nd, with particularly low scores for trading across borders (180th) and protecting minority investors (145th). Unfavorable investment policies substantially impedes multinational investment in various aspects of the food system, including grain trading.

4.2. Scale and Supply Chain Structure

The scale and composition of crops purchased by LSTs varies between countries, based on domestic production and demand conditions, as well as export market opportunities. As shown in Table 2, in Kenya our sample of large traders accounted for over 163,000 mt of domestic maize purchases (excluding imports) in 2015/16. On average, respondents purchased over 9,000 mt of maize in that year from domestic suppliers. In the same year, Tanzanian LSTs purchased 439,000 mt of domestically, while in Zambia total purchases exceeded 500,000 mt. In Zambia, where accurate anticipated maize sales data are available through the annual Crop Forecast Survey, LSTs purchased 37% of the total maize sales in the country for 2016[6] (GoZ 2016). At the mean, LSTs in Zambia and Tanzania purchased 21,600 mt and 17,500 mt, respectively, in 2016. However, median purchases were substantially lower, indicating considerable heterogeneity in the scale of LST activities in the two countries.

While maize is the most widely traded crop for large-scale traders in all three countries, LSTs typically buy and sell a range of other grains and export crops. In Kenya, traders purchase a wide range of pulses, such as green gram, pigeon pea, and groundnuts, for both domestic retail markets and export to deep-sea markets. Wheat is also an important commodity for some traders. In Zambia, traders focus primarily on wheat and soybeans, but are increasingly adding groundnuts, pigeon peas, and to a lesser extent sunflower to their crop portfolio. In Tanzania, rice is widely traded, while LSTs also trade more modest volumes of pigeon pea, sunflower, and groundnuts. When the full range of grains are included, respondents purchased a total of 366,000 mt, 917,000 mt, and 742,000 mt of grains in Kenya, Zambia, and Tanzania respectively in 2015/16. This amounts to an average annual purchase volume of over 20,000 mt of grain per firm in Kenya, 38,000 mt in Zambia, and 29,000 mt in Tanzania.

The share of total grain purchased by market channel varies across the three countries. When total grain purchases are disaggregated by market channel we find that large-scale traders in Tanzania and Kenya rely heavily on other intermediary traders, often small and medium-scale aggregators, to acquire grain, while a limited share of total purchases comes directly from producers. In Kenya and Tanzania only 25 and 31% of total purchases, respectively, are made directly from farms under 20 hectares. Conversely, in Zambia 75% of all purchases come directly from farms under 20 hectares.

[6] Kenya does not collect comparable data on forecasted maize sales.

What explains this stark variation in grain acquisition strategies between the Tanzania and Kenya, on the one hand, and Zambia on the other? Respondents indicate that purchase strategies are largely an outgrowth of the geography of production. As mentioned earlier, grain production is East Africa is characterized by staggered harvests; in Kenya and Tanzania grain harvests are occurring somewhere at most times of the year. Given the considerable local knowledge and social capital required to navigate complex smallholder markets, large traders in these countries rely on small local aggregators to assemble grain on their behalf. Only in large and well-established production zones, such as the Rift Valley of Kenya or the Southern Highlands of Tanzania, do LSTs establish semi-permanent buying centers. In most cases, LSTs in East Africa will not store grain for long, preferring instead to earn margins through spatial arbitrage.

By contrast, Zambia produces grain according to a uni-modal rainfall pattern. Consequently, large-traders in Zambia typically establish fixed buying points in major production regions, which they operate during the main marketing season. Grains are stored in these locations for onward sale to domestic and export markets later in the year. By locating buying centers in production regions, LSTs are able to develop relationships with local producers and acquire a larger share of their total grain purchases directly from small and medium-scale farmers than is the case in the East Africa countries in the study.

This suggests that process of market disintermediation, frequently observed in the context of food system transformation (Reardon 2015), is not an inevitable outcome of grain market consolidation and the rise of LSTs. Prevailing production systems and market geography play an important role in how markets evolve. Disintermediation in grain markets appears linked to uni-model production systems. We, therefore, anticipate that the future prospects for small-scale grain trading in the context of grain market transformation are lower in southern African than in Eastern. In Eastern Africa, small assembly traders are likely to continue to serve as the primary market channel for smallholders for the foreseeable future. Because small-scale trading is an important source of non-farm rural employment, grain market disintermediation may have adverse labor market effects (Barrett 1997). This is an important area for future research.

Grain sales patterns by large-scale traders exhibit important points of convergence and divergence between countries. In both Kenya and Zambia, large-scale mills that process maize meal and wheat flour are the primary markets for LSTs. These large processing firms typically have predictable demand requirements, both in terms of grain quantities and quality. As a result, contracting between processors and LSTs is more pronounced in Kenya and Zambia, a point we return to below. By contrast, small-scale processors and other traders, typically wholesale traders and brokers in urban centers, are the most important market channels in Tanzania. In total, 75% of grain sales by LSTs in Tanzania were made to other traders or small-scale processors, while in Kenya and Zambia the figure is 25% and 20% respectively.

This difference in sales market channel is indicative of a substantially different set of market arrangements in Tanzania than in the other two countries. While traders in all three countries trade is fairly large volumes of grain (20,000 to 38,000 mt/year depending on the country), Kenyan and Zambian LSTs are integrated into large-scale industrial food processing, while Tanzanian LSTs more frequently serve as a link between more traditional, smaller-scale grain aggregation, processing, and retailing sectors. The lack of significant large-scale grain processing in Tanzania, particularly for maize, will likely limit the pace of growth and consolidation in grain trading relative to Kenya and Zambia.

Export markets are particularly important for Zambia traders. Despite restrictive export licensing requirements for maize, Zambian LSTs exported over 13% of total grain purchases, compared to only 8% in Kenya and just 0.4% in Tanzania. In Kenya, exports are primarily for pulses, which are exported to India. In Tanzania, export bans on maize and other grains have severely hampered export opportunities. Prohibition on grain exports, and the often ad hoc application and removal of export bans, is considered by respondents in Zambia and Tanzania as a significant barrier to future growth and investment. Particularly investment in grain storage, as changes in trade policy add considerable unpredictability to grain prices, thus elevating price risks of grain storage.

4.3. Supply Chain Contracts and Coordination

As discussed in our conceptual framework, a shift from predominantly spot market transactions to more coordinated contractual relationships along supply chains is an important element of food system transformation (Reardon and Timmer 2012). Contracts, which can be formal or informal, help to mitigate and spread price and supply risks along supply chains, relative to traditional spot market transactions. Using contracts, market actors can more effectively anticipate future supply and demand, thus lowering the risk of investment at various nodes of the supply chain, including storage and input financing.

Table 2 shows that the majority of large-scale traders in the three countries utilize contracts with other, often smaller scale traders to purchase grain on their behalf. This practice is especially pronounced in the East African countries, where LSTs rely heavily on other traders to acquire grain. In Kenya and Tanzania, 61 and 64% of LSTs, respectively, utilize contracts with small traders to purchases grain on their behalf, compared to 54% in Zambia.

Respondents in all countries indicate that due to a lack of formal contract enforcement mechanisms, these contracts are typically conducted with local traders that have an established business record, and often an established physical presence, such as a house, farm or shop, in the region they operate. At a minimum, the contracts specify the price, quantity, and delivery point. In some cases, quality requirements, particularly moisture content and color are included in the contracts.

In some cases, smaller-scale trader are provided with financing to purchase grain for the LST. This is particularly the case in Kenya and Zambia, where 60% and 71% or LSTs that contract smaller traders provide these traders with financing. Conversely, in Tanzania, only 42% provide financing, and this occurs on a limited basis. This difference is associated with variation in downstream market opportunities. Large-scale processors in and Zambia make up a substantially larger share of total sales by LSTs than in Tanzania. As indicated earlier, these large processors frequently contract LSTs to supply specified quantities and qualities of grain, at predetermined prices and locations. As shown in Table 2, 78 and 54% of traders in and Zambia, respectively, are contracted to buy grain for processors or retailers, compared to 42% in Tanzania. Downstream contracts serve to lower the risk of investments in other nodes of the supply chain. on the production end of the supply chain we see limited evidence of forward contracting arrangements with farmers in and Tanzania, where only 16 and 17% of respondents indicated they provide some form of forward contracting to farmers, mostly for higher value, thinly traded legumes such as pigeon pea. In Zambia, conversely, forward contract is widespread, with 58% of respondents engaging in forward contracting. This, however, is concentrated in the commercial farm sector, and to a lesser extent with smallholders to grow pulses and oilseeds. In all cases, forward contract for widely grown and politically sensitive crops such as maize is not done.

Taken together, the rise of large-scale trading is helping to drive a fledgling transition from predominantly spot market transactions to more formal marketing arrangements. However, variations are evident across countries, mostly related to the structure of downstream market opportunities. Where large-scale processing is well-established, such as in Kenya and Zambia, contracts play an increasingly prominent role in supply chain governance. While contracting is also apparent in Tanzania, the lack of large commercial downstream buyers places limits on the willingness of LSTs to govern their supply chains with contracts, and to provide contract recipients with financing.

4.4. Supply Chain Evolution

The growth of large-scale trading is driving important processes of supply chain integration and investment. Table 3 presents data on the share of LST respondents that engaged in a particular activity when their firm began, as of 2016, and the difference. It shows that in the three study countries, LSTs are carrying out an increasingly wide range of supply chain activities associated with vertical integration, supply chain logistics, and procurement and trade. Respondents indicate that several factors are driving this process of firm development and supply chain integration.

In all three countries, we find evidence of increasing investment in input supply, grain storage, and processing, although occurring at different rates and beginning at different levels. In 50% of firms had some investments in input retailing or wholesaling when their firms began. This has increased to current levels of 63%. In Kenya and Tanzania, initial levels of input supply investment were lower, 22.2% and 4% respectively, but have increased substantially over time. Currently, 39% of LSTs in and 20% in Tanzania are involved in input supply.

In all countries, over 90% of all LSTs own some grain storage, though with significant variations in quality and quantity. Investment growth has been particularly sharp in Kenya, where only 40% of firms initially owned storage facilities. Finally, in all countries an increasing share of LSTs are investing in some form of grain processing, including maize milling and legume processing. Processing is particularly evident in Kenya and Tanzania, where 44 and 40% of firms now own processing facilities.

Investment growth in these functional areas is associated with several important changes in grain markets. First, in all three countries, LSTs indicate that processors are increasingly unwilling or unable to assume the costs and risks of grain storage. Through contractual relationships, processors are devolving the risks and costs of financing grain procurement and storage and ensuring minimum quality standards to LSTs. While 10 or 15 years ago most large-scale processors would physically store roughly three months of grain stocks, processors are now replacing physical stock holdings with supply contract with large-traders. These arrangements allow processors to forecast supply and specialize in their market niche of processing and retailing, traders to forecast demand, and allow both to hedge price risks.

According to interviews, processors often lack skill and experience in price risk hedging that LSTs possess. In addition, respondents indicated that access to financing, from overseas credit markets or from within their own firms, enable LSTs to borrow at lower rates than many domestic processors. The combination of these factors gives LSTs a comparative advantage in storage over many processing firms. These factors are particularly evident in Kenya and Zambia, where large-scale processors comprise a greater share of total LST sales.

Second, in order to manage supply chain risks and declining margins, a growing number of large-scale traders are investing in grain processing. This is more widespread in Kenya and Tanzania, where investments in pulse processing and medium-scale *posho* or hammer milling is common. In Zambia, processing investments have been concentrated in oil expelling and peanut butter processing. Investments in processing allow trading firms to spread risk vertically along supply chains, and thus enables more speculative buying and supply chain investments, such as input credit and trader financing, than would be the case otherwise. This is because with through vertical integration, losses incurred at one point in the supply chain can be made up elsewhere.

In addition to risk management, investments in input supply, through credit arrangements with farmers, licensing agreements with global suppliers, or investments in agro-dealer retail outlets, are also motivated by an interest in stimulating farmer productivity growth and production diversification, leading to greater production volumes and a wider range of crops LSTs can buy.

Taken together, the evidence presented here is indicative of a dynamic supply chain development and vertical integration, being driven by firms' operating primarily in the middle of grain supply chains.

Table 3. Evolution of Supply Chain Responsibilities/Activities

	Zambia			Kenya			Tanzania		
Supply chain activity	% that engaged in ….when the company began	% that engage in …. Currently	Diff	% that engaged in ….when the company began	% that engage in …. Currently	Diff	% that engaged in ….when the company began	% that engage in …. Currently	Diff
	A	B	C	D	E	F	G	H	I
Purchase grain from commercial farmers	50.0	50.0	0.0	44.4	72.2	27.8	20.0	72.0	52.0
Purchase grain from small-scale farmers	87.5	100.0	12.5	88.9	88.9	0.0	88.0	96.0	8.0
Import or export grain	41.7	33.3	-8.3	16.7	83.3	66.7	28.0	72.0	44.0
Process grain	12.5	29.2	16.7	11.1	55.6	44.4	0.0	40.0	40.0
Store grain	75.0	91.7	16.7	38.9	94.4	55.6	72.0	96.0	24.0
Supply inputs	50.0	62.5	12.5	22.2	38.9	16.7	4.0	20.0	16.0
Own grain transport	20.8	12.5	-8.3	27.8	88.9	61.1	48.0	72.0	24.0

Source: Tegemeo Institute 2016.

Table 4. Drivers of the Rise of LSTs

	Kenya		Zambia		Tanzania	
Rank	Driver of growth	% respondents	Driver of growth	% respondents	Driver of growth	% respondents
1st	Increased demand from processors and retailers	33	Increased cross border trade opportunities	21	Increased demand from processors and retailers	56
nd	Increased production from medium-scale farms	14	Increased production from medium-scale farms	17	Improved access to finance	25
3rd	Improved infrastructure	14	Increased demand from processors and retailers	15	Increased production from medium-scale farms	21

Source: Tegemeo Institute 2016.

5. CHANGING GRAIN SUPPLY AND DEMAND CONDITIONS AND THE RISE OF LSTS

Table 4 summarizes survey responses to the question, "what factors explain the growth of large-scale trading?" It shows that two fundamental drivers of LST growth, occurring within the production and demand nodes of the supply chain, are shared across the three countries: The first is increased demand growth from retailer and processors, including demand in cross border markets. The second is related to changing supply conditions, particularly increased production coming from the medium-scale farm sector. We examine these factors in detail below.

5.1. Evolving Demand Conditions

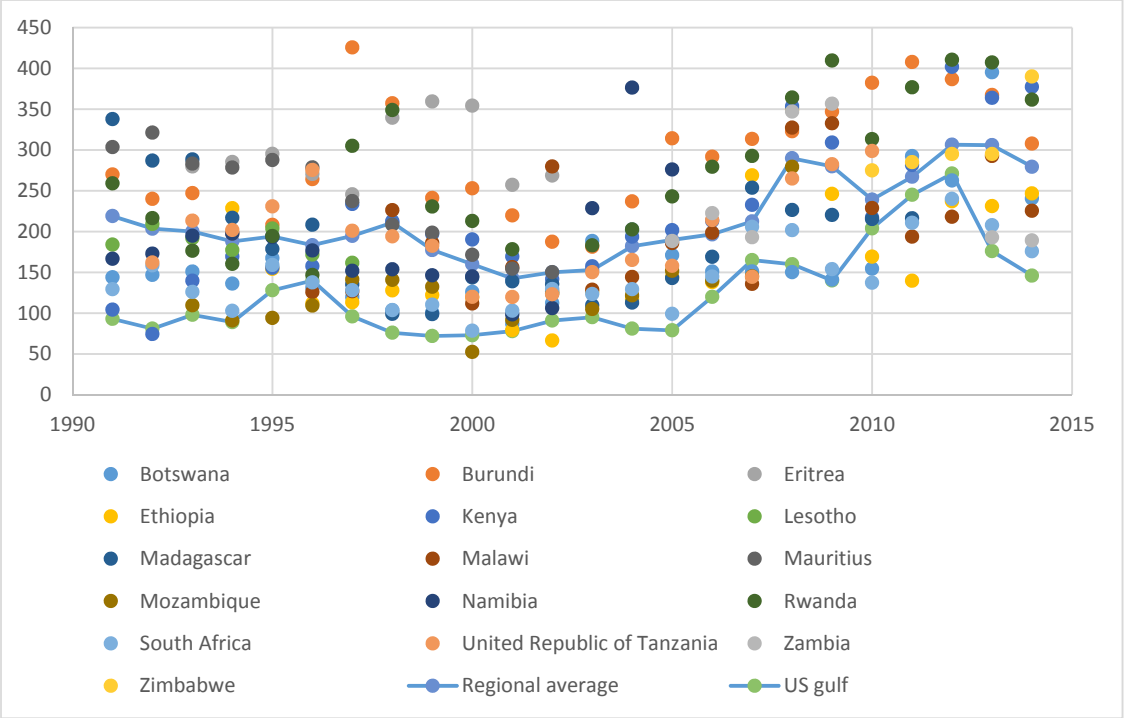
Large-scale traders indicate that domestic and regional demand growth from processors and retailers drivers their investment decisions and firm expansion. This demand growth has both quantitative and qualitative elements. The quantitative expansion of demand is linked to the dual processes of rapid population growth and urbanization occurring throughout SSA. In all three countries, populations have doubled between 1990 and 2015. Regionally as well, large and growing populations create tremendous demand growth for staple foods. As of 2014, estimates total net maize demand in eastern and southern Africa is approaching 40 million tons, with no sign of diminishing. This creates opportunities for food processors and wholesalers.

However, the nature of the opportunity is somewhat different in the three countries. Nearly 14% of Kenya's maize consumption over 2009-2013 was imported from world markets, while Zambia and Tanzania have been in either an export or neutral grain trade positon over the same period. Kenya's increasing dependence on imported grains is raising opportunities to link demand in burgeoning cities with supplies from global markets. Processing is thriving regardless of the source of the raw maize. In Kenya, for example, large-sale processors have increased total grain processing capacity by over 30% between 2005 and 2015 (EPZA 2005; Global Agriculture Information Network 2015). As domestic large-scale processing capacity increases, total formal market demand for grain increases which creates considerable opportunities for large-scale traders from local, regional and global sources. In Zambia and Tanzania, by contrast, essentially all of the urban demand for maize since 2010 has been sourced from domestic production. This provides greater investment and employment growth in the development of local supply chains dedicated to pulling surplus production off the farm and into cities, from local aggregation, wholesaling, processing, and retailing. In Kenya, LST investment is responding to opportunities from both local and import supply chains.

In many countries, demand growth is outpacing domestic supply growth, pushing prices toward import parity (ReNAPRI 2015). Figure 1 presents national annual nominal maize prices (in dots) against regional price averages and US gulf maize prices. It shows that prices in the region have trended upward since 1990, yet with significant inter-annual fluctuation at a country level and high levels of price heterogeneity between countries. This creates both regional arbitrage opportunities in grain trading and investment opportunities for processors and traders.

Finally, urbanization and income growth are creating qualitative changes in demand, particularly increased consumption of oils and animal proteins (Byerlee et al. 2013; Tschirley et al. 2015; Masters et al. 2013). This drives demand for primary products, including both oilseeds and maize. In Zambia, for example, animal feed processing capacity has increased from less than 10,000 mt per year in 2000 to over 320,000 mt in 2015 (AgriProFocus Zambia 2015).

Figure 1. Average Annual Maize Producers Prices for Countries in Eastern and Southern Africa, Regional Averages, and U.S. Gulf Prices 1990-2014



Source: FAOSTAT.

The combination of these demand side factors create tremendous growth and profit opportunities for domestic and multinational firms willing to assume the risk of operating in these uncertain markets and capable of accessing the requisite capital to do so.

5.2. The Co-evolution of Medium-scale Farms and Large-scale Traders

Alongside the demand growth in the region, and partially as a response to it, SSA is witnessing a rapid expansion of medium-scale farms (Jayne et al. 2016; Sitko and Jayne 2014b). Medium-scale farms (defined here as farms between 5 and 100 hectares) have increased over the last decade to control roughly 20% of total farmland in Kenya, 32% in Ghana, 39% in Tanzania, and over 50% in Zambia (Jayne et al. 2016). Investment in medium-scale farms in the region has been driven in large measure by increased interest in land by urban-based professionals and influential rural people. This investment followed many projections that the rise in world food prices represented a long-term structural change in global food conditions driven by US biofuels policy and rising long-term demand for grain in large middle-income countries (e.g., see von Braun 2007). It remains to be seen whether domestic investment in medium-scale farms continues in the current period of moderate global food prices, but in any event, the rapidly rising urban population growth and demand for food in Africa still presents strong incentives for local farm investment.

A priori, we anticipate that the growth in larger, better-capitalized farms, with larger surpluses to sell would require better-capitalized market actors than traditional small-scale traders. This is particularly the case as government marketing boards in the region are increasingly unable to compete with the private sector on price or timing of payment (Kirmi et al. 2011; Chapoto et al. 2015).

We progressively build a probit model to estimate the relationship between land size and market channel choice for Zambia, Kenya and Tanzania in Table 5. Amongst the population of farmers selling maize, the dependent variable is whether or not the farm sold maize to a large-scale trader. The first model is an unconditional correlation between two farm size category variables, farms with 2-5 hectares and farms of 5 hectares or more, and the dependent variable. The coefficients estimate the difference in the probability of selling to a LST between farms in these categories relative to farms less than two hectares, which make up roughly 70% of the total smallholder population in both countries. In subsequent columns we progressively add variables. In the second column, we add district fixed effects and month of sale variables. In the third column, we remove the fixed effects and add household characteristics. In the fourth column, we add grain transport costs, the number of traders operating in the village, and prices. In the full model, we reintroduce district and year dummies to the model.

Table 5 shows that in Zambia and Tanzania, across the five models, the correlations between farm sizes and selling to LSTs remain stable and significant. In the full model, we find that in the probability of selling maize to LSTs increases by 0.14 as we move from the less than two hectare farms to farms measuring five hectares and above, all else equal. Similarly, the probability increases by 0.21 in Tanzania. In Kenya, we find a similar relationship between farm size and selling to LSTs. However, in models 2 and 5 the relationship is not statistically significant for farms with 5 hectares or more. This is likely due to collinearity in the relationships between district fixed effects, farm size, and selling to LSTs.[7] Despite this limitation, these data provide compelling evidence that the rise of LSTs, and the structural changes it creates in grain markets, is likely co-evolving with rapid growth in relatively larger producers.

[7] In the Kenya data, more than half (54%) of the farmers selling to large traders and 40% of the farms over 5 hectares are in just two districts—Uasin Gishu and Kakamega.

Table 5. Probit Model Results of Factors Associated with Selling to a Large-scale Trader in Zambia, Kenya, and Tanzania

Dep var: sold to LST(1=yes)	Model I			Model II			Model III			Model IV			Model V		
	1Zam	2Ken	3Tan	4Zam	en5	Tan	Zam	Ken	Tan	Zam	Ken	Tan	Zam	Ken	Tan
	Z1	K2	Z3	K4	55	K6	Z7	K8	Z9	K10	11	12	13	14	15
	0.082***	0.151***	0.096	0.077***	0.090***	0.079	0.093***	0.134***	0.088	0.095***	0.140***	0.097	0.092***	0.086***	0.072
	(0.02)	(0.03)	(0.09)	(0.02)	(0.03)	(0.10)	(0.02)	(0.03)	(0.09)	(0.02)	(0.03)	(0.09)	(0.02)	(0.02)	(0.09)
	0.145***	0.188***	0.228***	0.147***	0.042	0.231***	0.136***	0.182***	0.214***	0.134***	0.196***	0.214***	0.144***	0.074	0.208***
	(0.04)	(0.05)	(0.08)	(0.04)	(0.04)	(0.08)	(0.04)	(0.05)	(0.08)	(0.04)	(0.05)	(0.08)	(0.04)	(0.05)	(0.08)
	-	-	-	-	-	-	0.004	0.013***	-0.006	0.005	0.011***	-0.007	0.002	0.005*	-0.007
							(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
	-	-	-	-	-	-	-0.007***	0.002	0.001	-0.006**	0.002	0.003	-0.005*	0.005***	0.005
							(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
	-	-	-	-	-	-	-0.034	0.024	0.021	-0.034	0.025	0.024	-0.024	0.064**	0.010
							(0.02)	(0.03)	(0.12)	(0.02)	(0.03)	(0.11)	(0.02)	(0.03)	(0.11)
	-	-	-	-	-	-	-0.023	-0.001	-0.010	-0.017	0.002	-0.010	-0.036	0.022	-0.007
							(0.03)	(0.02)	(0.07)	(0.03)	(0.02)	(0.07)	(0.03)	(0.02)	(0.07)
	-	-	-	-	-	-	0.001***	-0.000	0.002***	0.001***	-0.000	0.002***	0.000**	-0.000	0.002***
							(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	-	-	-	-	-	-	0.025***	-0.000	-	0.025***	-0.000	-	0.019***	0.000*	-
							(0.00)	(0.00)		(0.00)	(0.00)		(0.00)	(0.00)	
										-0.002	0.003*	-0.413***	0.035	0.004*	-0.681***
										(0.02)	(0.00)	(0.17)	(0.02)	(0.00)	(0.21)
	-	-		-	-	-	-	-	-	0.050	-0.006**	-	0.060	-0.007***	-
										(0.05)	(0.00)		(0.04)	(0.00)	

Table 5 cont.

Dep var: sold to LST(1=yes)	Model I			Model II			Model III			Model IV			Model V		
	1Zam	2Ken	3Tan	4Zam	en5	Tan	Zam	Ken	Tan	Zam	Ken	Tan	Zam	Ken	Tan
	Z1	K2	Z3	K4	55	K6	Z7	K8	Z9	K10	11	12	13	14	15
	-	-	-	-	-	-	-	-	-	-0.012	-	-	-0.005	-	-
										(0.03)			(0.03)		
	-	-	-	-	-	-	-	-	-	-0.010	-	-	0.017	-	-
										(0.03)			(0.03)		
	-	-	-	0.023	0.109***	-	-	-	-	-	-	-	0.003	0.060**	-
				(0.02)	(0.02)								(0.02)	(0.03)	
Monthly dummy variables for time of sale	-	-	-	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
District dummy variables	-	-	-	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Observations	2,794	1,411	337	2,555	1,373	337	2,794	1,411	337	2,720	1,410	337	2,496	1,372	337

Sources: Zambia, CSO/MAL/IAPRI, 2012, 2015. Note – N changes because of missing data in columns 10. In Columns 4 and 13 there are several districts where no-one sold to large traders, so the observations from these districts are dropped. Kenya: Tegemeo Institute survey data 2007, 2010. Note, 38 observations are in a district where no farmers sold to large scale traders (and, thus, present an incidental parameter problem if included in the district fixed-effect regression), so they are omitted from columns 5 and 14. One observation is missing month of sale data, and so is omitted from columns 11 and 14. Tanzania: Sokoine University of Agriculture (SUA) and Michigan State University (MSU) Land Studies Survey data, 2016. Out of 1010 households, only 337 households sold maize.

6. IMPLICATIONS OF THE RISE OF LSTS ON SERVICE PROVISION TO FARMERS AND FARM-GATE PRICE

The literature reviewed in the conceptual framework suggests that as traditional markets give way to more consolidated and integrated supply chains, the capacity to coordinate investments along the supply chain, including investments in input credit and other services, increases (Poulton, Kydd, and Dorward 2006). This is because larger firms can often better manage the sorts of risks, including default and price risk, which typically imped these investments in traditional market arrangements (ibid). Moreover, due to economies of scope and scale, access to lower cost credit (in the case of multinational firms), coupled with other supply chain governance tools, such as price hedging and supply contracting, LSTs may be able to drive down transactions costs in ways that allow them to pay higher farm gate prices than traditional market actors (Reardon and Timmer 2012). Evidence of these outcomes would suggest that the rise of LSTs is contributing in important ways to broader processes of economic transformation.

6.1. African Farmers Improving Access to Markets and Services

According to interviews, input credit and extension services are provided by LSTs to farmers in order to increase available tradable surpluses and to help farmers meet quality standards, particularly for pulses and oilseeds.

Table 6 summarizes data on the provision of input credit and extension services to farmers collected in the LST survey. It shows that credit and extension service provision are common attributes of LSTs businesses in all three countries, though with important variations. It shows that that while more than half of LSTs in Zambia offer input credit to some farmers, only a quarter of LSTs in Kenya and Tanzania do. Zambia's large commercial farm sector is an important recipient of input credit. While the mean number of farmers provided with input credit for grain by LSTs is over 3,400 in Zambia, the median is just 20. Many LSTs provide input credit to a small handful of large commercial farms, while a minority also extends credit to the smallholder sector. These are mostly multinational LSTs in Zambia have a history of investment in smallholder cash crop production. Through these investment, these firms have assumed many of the screening costs of providing input credit to smallholders through this side of their business (Sitko and Chisanga 2016). This, combined with cheap access to internal or international financing and risk hedging tools, enable these firms to extend significant input credit to farmers.

In Kenya and Tanzania, where LSTs are dominated by domestic firms, the average number of farmers that LSTs provide input credit to is more modest, 256 and 756 respectively, with corresponding median figures of 100 and 250 farmers. These input credit schemes typically focus on a handful of producer groups, with linkages between LSTs and farmers often facilitated by NGOs. These input credit investments primarily occur for non- staple food crops.

In Zambia, the total value of input credit distributed by LSTs is astounding. In 2015, LSTs estimate that they provided over 44,000 commercial and smallholder farmers with a combined $US 70 million in input credit for maize, soy, and wheat production. Again, in Kenya and Tanzania the scale of input credit provision is much more modest. Respondents estimate that in Kenya a total of US$144,000 in grain input credit was distributed to 1,200 farmers, while in Tanzania 5,200 farmers received over $US260,000 in input credit for grain.

Table 6. Input Credit and Extension Service Provision by LSTs

Input credit	Kenya	Zambia	Tanzania
% that provide to farmers	28	54	28
# of recipients			
mean	256	3,423	756
median	100	20	250
sum	1,281	44,504	5,292
total value (US$)			
mean	28,940	5,352,710	38,333
median	7,000	9,960	26,250
sum	144,700	69,585,224	268,331
Extension			
% that provide to farmers	33	42	48
# of recipients			
mean	1,378	5,675	736
median	125	200	250
sum	8,271	51,076	8,840

Source: Large-scale Trader Survey 2016.

Extension services area also an important element of LSTs business models. In Kenya, LSTs provide extension services, mostly for pulse production, to 8,200 farmers. In Tanzania, 8,800 farmers received extension advice from LST, focused primarily on post-harvest grain handling and to a lesser extent pulse production.

In Zambia, extension advice was provided to 51,000 farmers by LSTs. Extension services were provided for smallholder pulses, oilseeds, and maize, as well as for commercial wheat and soy production. One might ask what kind of extension services a trader is providing, or even qualified to provide. Multi-national firms are likely to provide specialists and host field days educating farmers on a range of topics including plant spacing, fertilization, marketing, and so on. Supplemental discussions with our respondents suggest that many domestic large-scale traders are farmers themselves and often trained by either government or other extension agents. The primary focus of the advice from these actors seems to be on encouraging fertilizer and improved seed use.

Trader survey responses on input credit are supported by evidence from smallholder household survey data. Table 7 uses household survey data to estimate the share of producers that receive input credit in Kenya and Zambia, and market information in Zambia, by market channel.[8] It shows that, consistent with the trader interviews, farmers that sell to large traders are statistically more likely to get price information (in Zambia) and more likely to receive seed credit (Zambia) and cash input credit (Kenya) than those selling to traditional small-scale traders.

[8] In Kenya, information on price information is not collected, however input credit information is more thorough and disaggregates by cash and in-kind while in Zambia only data on seed credit is available. In Tanzania, survey data were not collected in a way that allow us to generate comparable figures.

Table 7. Smallholder Access to Farm Credit and Information by Market Channel

	Zambia		Kenya	
Market channel for largest transaction	Did the HH receive price information from… (% yes)	Did the HH receive seed on loan from… (% yes)	Did the household receive cash credit for agriculture from … (% Yes)	Did the household receive in-kind credit for agriculture from … (% Yes)
Small trader	13.3	1.1	9.5	21.5
Large trader	17.7	5.5	14.2	12.8
FRA/NCPB	15.3	0.9	17.2	13.8
Miller	18.3	0.7	9.1	9.1
Other households	14.9	1.2	8.8	26.9

Source: Zambia: CSO/MAL/IAPRI 2012-2015; Kenya: Tegemeo Institute survey data 2007 and 2010.

While the share of smallholder households receiving input credit from LSTs remains small relative to the total population, the fact that input credit for grain production developing is encouraging. Given widespread capital constraints among smallholders, coupled with weather related production uncertainty, functional input credit systems are likely essential for achieving sustainable smallholder land productivity growth, particularly if these are linked to effective extensions services.

6.2. Price Effect of Selling to LSTs

To estimate the price effect of selling to LSTs relative to other commercial market channels (e.g., traditional small-scale traders and processors) we regress the log of the price the farmer reported receiving per kg of maize using ordinary least squares (OLS), on a dummy variable for whether or not the farm sold to a LST using transaction-level data from Zambia, Kenya, and Tanzania. In Table 8 we then build on this model to control for an increasing number of factors. The first column shows the unconditional correlation between price and whether a farmer sold to a LST. We subsequently add transportation costs, farm size, year and month of sale *fixed* effects, and finally district dummies. It is important to note that in these models we are *not* making any attempt to control for selection bias, since we are not really looking for a causal relationship. Instead, we are trying to develop a nuanced understanding of the factors associated with commercial prices received and the role of market channel.

We find that in all five specifications in Zambia and four out of five specifications in Kenya, selling to an LST is associated with receiving a statistically significantly higher price than other commercial market channels. Looking at column 5, we find that, once the full range of seasonal, household, and geographic variables are included, selling to a LST is associated with a 4.9% higher price per kg of maize than other commercial market channels (compared to a 6% unconditional price difference) in Zambia and 3.6% higher price per kg in Kenya (compared to a 6.9% unconditional price difference).[9] In Tanzania, selling maize to LST is associated with 5.7% lower price per kg of maize.

[9] Seasonal price variation is substantial and statistically significant with up to 25% higher prices during the lower-volume trading months.

Table 8. Factors Associated with Maize Commercial Spot Prices in Zambia, Kenya, and Tanzania

Dep. var.: ln(Price)	Model I			Model II		Model III			Model IV			Model V		
	Zam	Ken	Tan	Zam	Ken	Zam	Ken	Tan	Zam	KKen	Tan	Zam	Ken	Tan
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	0.060***	0.069***	-0.052*	0.058***	0.070***	0.047***	0.082***	-0.057**	0.028**	-0.009	-0.077***	0.049***	0.036**	-0.057***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.03)	(0.01)	(0.02)	(0.03)
	-	-	-	0.006	0.002	0.006	0.004	-	0.008	0.004**	-	0.011**	0.005***	-
				(0.01)	(0.00)	(0.01)	(0.00)		(0.00)	(0.00)		(0.00)	(0.00)	
	-	-	-	-	-	0.033***	-0.025**	0.001	0.002	0.008	0.001	0.017**	0.019**	0.002*
						(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
Year=2015	-	-	-	-	-	-	-	-	0.240***	0.489***	-	0.242***	0.469***	-
									(0.01)	(0.01)		(0.01)	(0.01)	
Month of sale dummies (Base: January)														
_February	-	-	-	-	-	-	-	-	-0.089	-0.021	_	-0.075	-0.023	_
									(0.10)	(0.02)		(0.09)	(0.02)	
_March	-	-	-	-	-	-	-	-	-0.023	-0.022	-0.063	0.019	-0.020	-0.082
									(0.10)	(0.02)	(0.19)	(0.11)	(0.02)	(0.24)
April	-	-	-	-	-	-	-	-	-0.044	-0.016	-0.151***	-0.117	-0.011	-0.312***
									(0.08)	(0.02)	(0.05)	(0.10)	(0.02)	(0.12)
_May	-	-	-	-	-	-	-	-	-0.208***	-0.067**	-0.410***	-0.240***	-0.066**	-0.428***
									(0.08)	(0.03)	(0.05)	(0.06)	(0.03)	(0.08)
_June	-	-	-	-	-	-	-	-	-0.228***	-0.043	-0.366***	-0.219***	-0.009	-0.339***
									(0.07)	(0.03)	(0.06)	(0.05)	(0.03)	(0.07)
_July	-	-	-	-	-	-	-	-	-0.195***	0.027	-0.395***	-0.193***	-0.022	-0.364***
									(0.07)	(0.05)	(0.04)	(0.05)	(0.04)	(0.06)
_August	-	-	-	-	-	-	-	-	-0.158**	0.042	-0.333***	-0.145***	-0.023	-0.304***
									(0.06)	(0.03)	(0.03)	(0.05)	(0.03)	(0.05)

Table 8 cont.

Dep. var.: ln(Price)	Model I			Model II		Model III			Model IV			Model V		
	Zam	Ken	Tan	Zam	Ken	Zam	Ken	Tan	Zam	KKen	Tan	Zam	Ken	Tan
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
_September	-	-	-	-	-	-	-	-	-0.133**	0.073***	-0.218***	-0.139***	0.024	-0.209***
									(0.07)	(0.02)	(0.04)	(0.05)	(0.02)	(0.05)
_October	-	-	-	-	-	-	-	-	-0.131*	0.050*	-0.183***	-0.148***	-0.001	-0.173***
									(0.07)	(0.03)	(0.04)	(0.05)	(0.03)	(0.06)
_November	-	-	-	-	-	-	-	-	-0.062	-0.010	-0.066	-0.094*	-0.041	-0.042
									(0.07)	(0.03)	(0.07)	(0.06)	(0.03)	(0.08)
_December	-	-	-	-	-	-	-	-	-0.054	-0.001	-	-0.072	-0.013	YES
									(0.07)	(0.02)		(0.06)	(0.02)	
District fixed effects	-	-		-	-	-	-		-	-		*Yes*	*Yes*	*Yes*
Constant	- 0.0439***	2.710***	6.054***	-0.0457***	2.707***	-0.0510***	2.713***	6.034***	0.0069	2.504***	6.345***	-0.0438	2.666***	6.373***
	(0.008)	(0.01)	(0.02)	(0.008)	(0.01)	(0.008)	(0.01)	(0.02)	(0.034)	(0.02)	(0.03)	(0.042)	(0.05)	(0.07)
Observations	2,438	1,411	337	2,438	1,410	2,438	1,410	337	2,429	1,410	337	2,429	1,410	337
R-squared	0.01	0.006	0.01	0.01	0.006	0.01	0.010	0.01	0.24	0.561	0.13	0.35	0.627	0.22

Sources: Zambia; CSO/MAL/IAPRI 2012 and 2015, Kenya Tegemeo Institute survey data 2007, 2010; Tanzania, Sokoine University of Agriculture/Michigan State University Agricultural Land Dynamics Survey (ALDS) 2016.

7. CONCLUSIONS

In this article, we have shed empirical light on the rise of large-scale grain trading firms in Kenya, Zambia, and Tanzania. We have shown that these LSTs are co-evolving with other important transformations occurring in the farm-level and retail-level segments of regional agri-food systems, namely the rapid growth in larger African farms and sustained regional grain demand caused by rapid population growth, dietary changes, and urbanization. As these processes continue to unfold, we anticipate continued growth in large-scale grain trading and wholesaling.

Using available data, we have shown that the growth of LSTs in smallholder grain markets has important implications for producers. The rise of LSTs creates new opportunities for grain intensification through the provision of input credit, extension services, and higher farm gate prices. On balance, this transformation has the potential to bring significant social welfare benefits with it, but the process also carries societal risks. For example, the strong relationship between farm size and whether or not a farm sells to an LST suggests that, on the production end, the rise of LSTs is generating benefits that are disproportionately accruing to already relatively better-off producers. While 95% of Kenyan farms and 75% of Zambian farms cultivate less than five hectares, our results indicate that these farms are significantly less likely to sell to LSTs than medium- and large-scale farms. Therefore, while the rise of LSTs may bring beneficial spillover effects for small farms and small farmers, it may simultaneously contribute to agricultural growth without poverty reduction and widening rural wealth inequality in SSA.

An important policy concern is how to leverage the benefits growing LST investment in grain markets, while managing downside risks associated with market power and limited market participation by poorer, more marginal segments of the rural population. Broader welfare benefits from the rise of LSTs will depend on its effects on consumer prices. This will hinge on on a range of factors, including the degree of concentration in markets brought about by the rise of LST and levels of competitiveness in grain processing. Assessing the effects of the rise of LSTs on consumer prices and marketing margins is an important area for future research.

Policy tools and investments to help strike this difficult balance include:

- supporting competition from domestic traders through competitively priced and accessible commercial credit markets, where the ability to leverage grain stocks through warehouse receipts or moveable collateral legislation may be particularly important;
- support horizontal aggregation structures to help small farms with limited surpluses to cost effectively link to LST market channels;
- implement policies to improve access to grain price information and predictability, including clearly defined policies for triggering government action in cross border trade and marketing board activities; and
- develop innovative financial tools to help defray risk and costs to LSTs of providing input credit and other services to smallholders in order to help expand the scope and scale of these activities to marginal regions, communities, and producers.

For African agriculture to contribute to a broader process of economic transformation in the context of rapid population growth, urbanization, and changing diets marketing arrangements that create incentives and services to support smallholder productivity growth are critical. With effective policies and investment, the rise of large-scale grain trading offers new opportunities to support smallholder intensification.

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