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THE TRANSFORMATION OF VALUE CHAINS IN AFRICA: EVIDENCE FROM THE FIRST LARGE SURVEY OF MAIZE TRADERS IN NIGERIA

By

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1. INTRODUCTION

Nigeria is the most populous country in Africa, and maize is one of its main staples. Most Nigerians eat some maize, half of Nigeria's population is urban, and about half of Nigeria's farmers grow maize. Consequently, about 75% of Nigeria's 160 million people depend on maize traders to supply them maize. However, in the past 20 years after dismantling of parastatals, there has been an under-emphasis in research and policy discussions on the role of such intermediaries. Reardon (2015) calls the intermediaries and processors the "hidden middle," as it is hidden from research and debate, but forms roughly 40% of cost of food in developing countries – the same as farmers.

Specifically, despite maize trading's huge importance to Nigerian food security, there has been very scant attention paid to the structure and conduct of maize trading as a key part of the maize value chain. This is all the more striking a gap when one considers that little of the maize consumed by Nigerians is imported making the domestic value chain critically important. Despite significant survey research on maize farming in Nigeria, an exhaustive literature search revealed that in the past 2-3 decades, there has been no large sample survey of Nigerian maize traders. The policymakers' and researchers' impressions of traders are largely based on scattered local small sample studies, or on old studies, in the 1960s and 1970s. Yet Nigeria's food economy has changed in so many ways since then. For instance, rural-urban supply chains have grown enormously: in 1970, 25% of Nigeria was urban; by 2015 it is 50% (Block et al. 2015).

With Nigerian cities burgeoning, livestock and fish feed sectors now depending on long – and vulnerable - maize supply chains in which traders play a fundamental role, we considered it urgent and imperative to update knowledge on maize traders. It was also essential that we do it with a formal survey, with a substantial sample in the North and South, and avoid only anecdotal discussions from key informants.

Our study focuses on traders based in main cities and regional markets in secondary cities. These urban traders source from farms and other traders, assemble bulk, and transport or buy transport services. Our survey was conducted in North and South Nigeria. This was crucial because the North is the main source of maize and both South and North are major consumers of the grains. The sample totaled about 1400 traders, far greater than for any Nigerian trader study, and we would argue, than for any African study in the past 50 years.

The report proceeds as follows. Section 2 presents the sample and survey. Section 3 presents the main findings. Section 4 concludes. The annex contains the tables and the market list.

2. SAMPLE AND SURVEY

In city markets and regional markets, we first listed then sampled traders. We first chose the states and the cities with the main "feed the city" maize markets – Ibadan in the South and Jos, Kaduna, Kano, and Katsina in the North. We listed all the maize traders in the city markets, a universe of 903. This also became our sample and we interviewed all of them.

We then went to all the main regional markets in the four Northern states, known to be

important as conduits of maize to the rest of the country. We listed all the wholesalers in these regional markets: 6358 traders across 61 markets. From those, we sought a sample of 600 traders (as even 385 gave a confidence interval of 95%). We then selected the top 5 regional markets (by total maize volume per market) in each study state and for each of the 30 traders picked, that is, 150 per state in four North states. The 30 traders in each market were selected at random from strata: to ensure 15 of them came from a "large trader stratum" (above 32 tons a month as the average trader volume) and 15 from a "small trader stratum" (below 32 tons a month as the average trader volume).

The survey was administered to traders individually. The formal questionnaire covered their start up investments and assets, their procurement behavior, any value added such as drying or processing and how that compares with five years ago. We also collected information on their marketing behavior over the low and high seasons of the past year.

The rest of this report presents the key findings arranged in three sections informed by traditions of analysis of value chains – structure, conduct, and performance.

3. KEY FINDINGS ON THE STRUCTURE OF THE MAIZE TRADER SEGMENT

a) **Urban traders are substantial SME's.**

The average Northern trader is a substantial small - medium enterprise (SME) managed by an educated male while in the south (and Plateau State) females dominate (table 1). The average firm sold about 700 tons of maize in the high season of 2015/6 (and 450 tons in the low season). This is similar to what they reported in 2010/11. The average trader in the Northern markets is roughly similar, except for those in Katsina which are 2-3 times larger.

Assuming an average price of 380 USD per ton of an average of white and yellow maize, and 1150 tons moved in the year by the trader, the Northern trader is averaging about 440,000 US dollars per year gross income. If we assume the average small farmer cultivates 1.5ha of maize and grain yields of about 1.25 tons/ha in our study areas (Liverpool-Tasie et al. 2017), then one farm produces almost 2 tons of maize. The trader's volume of 1150 tons would mean each trader serves 575 farmers in the North (direct or via other traders, as noted below).

By contrast, the Southern trader sold only about 85 tons all season in the high season (and 100 tons in the low season), hence had less seasonal variation than in the North, as expected in a more consumption rather than production area. The Southern trader is therefore averaging about 70,000 US dollars per year gross income. Thus the Northern trader is averaging 7 times more than the Southern trader. The ratio of these trader volumes roughly matches the volumes of maize produced in the North versus the South. However, total grain sold in the South in 2010/11 was reported to be 50% higher, around 150 tons.

b) The trading sector is very concentrated

The Gini coefficient of sales over all traders is 70%. This means the sector is very concentrated. (In the land or income literature, 35% is normal in smallholder agriculture and 50% is very concentrated). Note that the average (over states) of the Gini in just the Northern sample is 65%,

and the South, a stunning 85%. Segregating the sample into large and small traders, we find that even just among the large traders the overall sample's Gini is 57%. By contrast, it is but 38% for the small trader sample. The concentration is no doubt caused by significant entry barriers, related to access to capital. We find below that it is not caused by ownership of trucks or warehouses, as traders typically source those from third-party logistics (3PLS) and rental markets.

c) **There is some vertical integration into farming, little into milling**

First, in traditional views of traders, traders are seen as separate from farmers. This is so in our Southern trader sample, as Southern traders do not typically also farm. But in the North, 40% of the traders are also maize farmers. This occurrence of traders as farmers tends to be in the regional market sample, as one would expect. But own farming is a minor source of maize for Northern traders overall: only about 10% of maize sold by traders was procured from own-farming of the traders (except for Katsina which procured 30% of own production).

Second, very few traders are also maize millers. Only 3% on average also mill feeds, and 8% also mill flours, and all those are only in the North.

d) **Maize traders mainly specialize in maize**

About 70% of the grain sold by maize traders in both North and South is maize. The rest is mainly sorghum and soya. This was similar in the two years.

4. KEY FINDINGS ON THE CONDUCT OF THE MAIZE TRADER SEGMENT

a) The great majority of urban maize traders are wholesalers (take possession) not brokers (work on a commission for intermediation services)

The traders are mainly "wholesalers" (taking possession) instead of "brokers" (moving the maize just for a broker fee without buying and selling it). In the South, only 4% are brokers; in the North, about 20% are brokers. This is interesting because taking possession means assuming risk.

Mirroring this information, 95% of the "last transactions" were wholesale (possession) not brokering (commission) by the trader. Interestingly, Southern traders pay no brokerage fee for collection. This makes sense as they typically (for the last transaction) bought from a Northern trader who sold them the lot and it was then just transported usually by third party logistics to the South.

By contrast, half of the Northern traders paid a brokerage fee. This makes sense also as they are in the main maize production zone and are sometimes (see below) paying local field brokers to collect for them. Note the fee paid is roughly 5 dollars a ton, a little bit more than a 1% fee (comparing 5 dollars with the prices above). Off-loading fee is about 1 dollar/ton in the North and 3/ton in the South.

b) Procurement – reliance on North, surprising disintermediation, few contracts

First, surprisingly, around half of the on-market traders collect maize directly from farmers (rather than rely on the traditional system of using field brokers as first stage). This is a surprise because the

few decades old traditional system was a "long fragmented chain" with field brokers buying from farmers and traders buying from field brokers.

In the South, about 60% of traders buy direct from farmers, and 40% use field brokers. The North is somewhat more traditional in its collection system compared with the South. About 60% of Northern traders receive some of their maize from field brokers, but also around 50-60% of traders themselves collect directly from farmers. The latter is as expected more prevalent in regional markets near the production zones than in the city markets. In terms of maize volumes, about 70% of Northern traders' volumes are procured from brokers or wholesalers selling to them in wholesale markets. About 30% is procured from farmers. (Katsina again is an outlier with only 50% from wholesale markets.)

Second, as expected, the great majority (85%) of maize bought is from the North. Nearly all the Northern traders' purchases are from the North. 80% of the Southern traders' purchases are from the North. Southern traders buy 20% of their maize from the South. This supports the centrality of the North as the main upstream of the maize supply chain.

c) Marketing – sales are mainly to other traders and retailers and only about 20% to feed and flour mills

First, 95% of Northern traders' maize is sold in the North. Northern traders note that usually their last procurement and sale was in the North, The average distance of transaction for Northern traders is only 70km. But some of the time the maize is in fact destined to go South. That is corroborated by the finding that 80% of the Southern traders' maize comes from the North. The sale takes place in the North (by a cell phone call or occasionally a visit by the Southern trader to the North) and the Southern trader merely has it transported to the South. Our "last transaction" data show that 70% of the Southern traders had their last transaction in the North and only about 30% of Southern traders had their last transaction originating in the South. Southern traders on average undertook transactions in which the distance between where they bought and where they sold is 450km indicating this was likely coming from the north.

Second, in the high season of 2015/6, Northern traders sold a third of their maize to other traders, a third to retailers, and a fifth to consumers (meaning that some wholesalers doubled as retailers). Only about 10% of the Northern traders' maize went to feed mills in the high season. That is only 5% if one excludes Jos and the Plateau state regional market where traders sell a quarter of maize to feed mills. The same pattern occurs for maize-as-food mills: 8% goes to those overall in the North, and 4% if one excludes Jos and the Plateau regional market. These patterns are similar in the two years. Assuming a tenth of the volume the traders sold to other traders goes to feed mills, then that adds about 3% to the feed mill share for a total of near 13%. In the low season the figures did not differ much.

The Southern traders (selling only in the South) sales' targets were not too different from the Northern traders in terms of market channels. Only 9% was sold to feed mills, and 9% to food mills. Interestingly similar to the North, a third of the Southern traders' volume was sold to other traders, a third to retailers, and a fifth to consumers (meaning that wholesalers are doubled as retailers, probably in the case of the smaller ones). Assuming a twentieth of the volume the traders sold to other traders goes to feed mills, then that adds about 2% to the feed mill share for a total of near 8%.

Third, there were around 20 clients for one transaction in both the North and the South. This is interesting especially in the South, where the lot size was quite small, so this means that the trader is selling to a lot of small brokers and retailers not a few big clients, on average. This shows the system is still quite fragmented "downstream."

d) There is very little use of contracts

First, the "spot market" is by far the main mode of exchange – for 95% of transactions. Only 5% of the transactions are done "on contract". Only about 11% of the purchases from farmers are done "on contract", and the share of maize bought from farmers is 25%, so that means that overall only 1.5% of the maize is bought from farmers on contract. Only 10% of transactions with field brokers are on contract, and these field brokers are the source for 37% of traders' volume. So that is another 3.7% on contract, overall. That means about 5% of all transactions are on contract.

The feed and flour mills are the only "formal sector" actors and one might think these relations are mediated by contracts. Of the Northern traders' small amount (13%) that goes to feed mills, only 22% is sold to the mills on contract. If Jos and Plateau state regional market traders are excluded, that share is only 5%. This is similar between the two years. About 30% is sold to food mills on contract. Thus, in general about 3% of traders' sales are on contract to feed mills, and another 3% to flour mills.

The Southern traders' share under contracts is similarly tiny: about 2% of the Southern traders who sold to feed mills did so under contract, and only 8% who sold to food mills did so under contract.

Second, among the 22% of Northern traders who sold on contract to feed mills, the price received, while varying a lot over markets, averaged 198 US dollars per ton in the high season. By contrast, the average for the whole body of traders who sold on the market without a contract, was 366 US dollars per ton in the high season, and predictably (as a much "thicker" market), the spread was much less. Interestingly, the average price was only slightly higher in the low season, at about 377 (8% lower than in the high season), and the spread again was low across North markets. The average for the near totality of Southern traders who sold on the market without a contract got 367 dollars a ton – nearly twice that received by the Northern traders on the market.

The data on the "last transaction" again illustrates the contract price being below the spot price. The North contract price for yellow low-humidity was 15% lower than the spot price (270 versus 227 US dollars/ton). This is even more extreme in the South (317 for spot versus 170 dollars per ton on contract). Echoing this latter point, we find with white/low humidity maize that the spot price (paid by the trader to the seller as this is a procurement finding not a sales finding) is well above the contract price. In the South this is 299 dollars/ton versus 148/ton. For the North this is 255/ton for spot, and 216/ton for contract. For white/high humidity spot in the South it is 176/ton compared with 159 for contract. For the North, the white/high humidity spot price is 217/ton (much below the low humidity price so there is a "dryness premium"). The contract price in the North is 202, not much different from the spot price.

This may be an example of a situation where traders are willing to take a lower average price to thus "buy" the "insurance" of stability from a contract, relative to the spot market; this is analogous to that found for farmers with supermarket contracts versus spot wholesale markets for vegetables in Nicaragua (Michelson et al. 2012).

e) Most traders rely on hire of third-party logistics, not own or rented trucks

First, a key finding is the major importance of third party logistics (3PLS), and the near disappearance of own transport by urban maize traders. This is borne out by our finding that only 4% of traders own trucks in 2016. Half have motorcycles and 13% participate in motorcycle pools. Only 40% of the traders report being near a place they can rent (for their own direct use) trucks. But 87% in 2016 and 83% in 2011 have access to 3PLS – and that share is 90% in the North. Triangulating with the above, for Northern traders buying from the North, the great majority is done by 3PLS (third party transporters).

Selling, only a third of traders deliver maize to their buyers, with little difference between the South and North. Only a twentieth of the maize was delivered in Northern traders' own trucks. Nearly half was picked up by the buyer or his transporter, and nearly half was dispatched by the trader by 3PLS. As in the North, Southern traders deliver nearly none of the maize in their own trucks. About half of them get it picked up by the buyer (or his third-party transporter) and the other half hires a third party transporter.

Second, we expected that a maize trader would have a stall in a North market and one in the South to coordinate his purchases. But there is no such need, with all traders owning cell phones and 3PLS currently ubiquitous. Only 20 out of 1000 from the North have a stall in the South, and only one trader in the South had a stall in the North. Traders by and large, sell where they are based. 94% of the Southern traders sell in the South, and 91% of the Northern traders sell in the North.

Third, commensurate with trader size differences, we found differences in transported lot size between South and North. The lot or transaction size is seven times larger for North compared with Southern traders (8 tons to 2). Half the procured maize is transported by trailer (large truck) by Northern traders, 30% by small truck, 20% by big truck, and 10% by car, none by motorcycle. Southern traders are buying space in larger trucks coming from the North, rather than moving maize in small trucks: in the South, 80% is by trailer; given the smaller loads, that suggests there are several traders' loads per contracted trailer.

f) **Nearly all maize, traders' deal with, is already bagged, and then labeled**

First, contrary to the traditional market system with bulk loose maize, currently, nearly all the 90% of procured maize was bought, already bagged, from farmers or traders. Only 10% was procured from own farming and thus bagged by the trader.

Second, contrary to the fragmented and anonymous traditional system, there is now a high degree of traceability in the system – back to the trader (but not beyond that back to the farmer). A surprisingly high share (70 to 80%) of traders label bags with their name and location, and this practice differs little between North and South. This "traceability" may be important for 3PLS with mixed trader loads (more than one trader using a given truck).

However, as expected, there is a very low branding rate, about 2% in the South and 10% in the North. This is probably because when maize is sold in retail shops it is in flour form, and there may be no label or it might be labeled with the miller's label, and not the wholesaler's.

g) Relatively few traders store maize

First, only 24% of traders store maize - 20% in the South and 30% in the North (with an outlier of 55% in Katsina, a state whose maize wholesaling is on a larger scale per trader than in the other study sites in the North). Even more striking is the short part of the season the traders store in: the share of weeks of storage of the average trader who did store (of the 25% of traders that stored at

all), is only 51% in 2015 and 52% in 2010. So a third of the traders store, and those only store half the time. That is on average. The Southern traders only stored for 30% in 2015 and 44% in 2010 of the weeks of the high season. The picture that emerges is that the storage activity is strongly concentrated over traders, and in the North, and for a relatively short time. The norm, by contrast, is moving the maize quickly from origin via the trader to destination. In the low season, the concentration of storage behavior is even more marked. Only 12% in 2015 and 23% in 2010 of traders stored. For those few who store, they store for about half the weeks of the season.

Second, in the South nearly no trader owns a warehouse, but a third of the traders rent one. These however are just 10-ton capacity stores, just for the day, or week's grain movement. In the North, 11% owned warehouses in 2011, and 10% in 2016. Only 15% rented warehouses in the North, and those averaged about 50 tons each (a week or so of grain movement). The owned warehouses were bigger than in the South, averaging 30 tons (about a week of movement of maize).

Third, in the high season, traders in the South only stored in the South, and traders from the North mainly stored in the North. The exception is a third of traders from Jos, and from Plateau state regional market in the North that stored some maize in the South in 2015.

Fourth, there is an emerging warehouse rental market. In the high season in the North, only a third is stored in the traders' own warehouses; 40% is stored in rented warehouses, and 25% interestingly get storage services from other traders. This indicates an active market for storage services and rental – for the minority of traders who store. It is even more active in the South, where only 7% of storing traders store in their own warehouses, and the other 93% is split evenly between storing in rented warehouses and getting storage services from other traders.

Finally, our "last transaction" data corroborates the small amount of storage. The whole "transaction cycle" from buy the lot to sell all the lot is only one week in the North and 10 days in the South.

h) Few traders dry or clean or fumigate maize

First, the great majority of traders do not dry maize. In the North, the exception is a fifth of the traders in Kaduna and Kano. Of these few who dry, two-thirds are also farmers (so they are drying the maize they produce and then bag and sell). In both seasons, fewer than 10% of the traders who store maize in the South dry or fumigate before storing in 2015. Most traders do not dry maize because they procure it already bagged.

Second, there is a small difference between white and yellow maize as pertains to drying. We find here that nearly all white maize was already dried before the traders bought it. But apart from in the South (Ibadan), 83% of yellow maize was already dried before the traders bought it (in the North).

Third, the few traders who dry the maize do not do so with a drying machine. In fact no trader owns a dryer or rents one. Surprisingly, only about a tenth own humidity measuring sticks, and that is only in the North, not in the South. Only 2% of traders access a laboratory for testing maize humidity. Of course, there are "hand and eye and teeth" assessment of the kernels by traders and buyers taking a few kernels from the bag, or comparing a measure of volume with weight against a bag-weight humidity benchmark. Opening one bag and examining its degree of shrinkage and its weight for volume can provide a rough measure for the trader.

Overall, the great bulk is of low humidity corn (already dried and in sacks when the trader bought), and sold on the spot market, and the main shares, from a third to a half, are in yellow versus white. By contrast, very few of the transactions are under contract or are high humidity

Fourth, only about half of the traders in the North have debris cleaning machines, while none have them in the South. This could be more linked to the avocation of the traders in the North that are also farmers, because traders are buying bagged maize and thus not cleaning it after purchase.

Fifth, in both seasons, fewer than 10% of the traders who store maize in the South fumigate before storing in 2015. Only 1% have access to a laboratory to test fungus on maize. Of the 20% of Southern traders who store maize, only a third, use binders/fumigants during storage. That implies that roughly .20*.30 or 6% of Southern traders use binders/fumigants (to control fungus). That share is two-thirds of those who store in the North, hence about 0.3*0.6, or 18%. This average of about 10% of traders using chemical fumigants (and 7% using traditional fumigants like ash) seems surprising, but not when we recall that nearly all the traders are receiving maize already bagged and selling it bagged. They would thus not be opening the bags and mixing in fumigants.

i) No advances from traders to farmers

First, despite the conventional wisdom that traders advance farmers money or inputs, our findings negate the idea that traders are making advances to farmers or other traders. Essentially 0% of traders gave fertilizer or seed on credit to farmers. And they were making extremely few transactions where they paid an advance (credit) to the seller: 6% of the time in the South, 10% of the time in the North. (This is corroborated by LSMS data from farm households in four African countries including Nigeria; see Adjognon et al. 2017.)

Second, only 10% of Northern traders get an advance (credit) from their buyers (such as other traders and retailers). That figure is a mere 2% in the South. By contrast, traders give credit to their buyers in general, by letting the buyers pay later. Only 10% of Northern traders are paid immediately by their buyers, so 90% of their buyers get to pay later and thus enjoy credit. That figure is but 2% for Southern traders. But the "credit" is not substantial; the traders are paid by their clients within a week so it is just a revolving cycle.

j) Cell phones are ubiquitous but their use for final market agreement is moderate

Only 40% of Northern traders agree with their buyers by phone on the price before the sale. 27% of Southern traders do. This is a lower share than we expected; hence the wholesale market "haggling" is still important.

k) **There is very little waste in the trader segment of the value chain**

Our data for the "last transaction" shows that during transportation, extremely little maize is lost as "waste"; approximately on 0.02 ton (10 kg) for the whole shipment, basically no waste. Recall that there is very little storage and maize is in sealed bags.

5. CONCLUSIONS

This report is the result of the first large survey of maize traders in Nigeria in the past several decades. The sample of 1406 traders covered one state in the South and four in the North, with traders in city wholesale markets and regional markets. We surveyed assets and behavior in 2011 and five years later. The key findings are as follows.

First: interesting findings about the structure of the segment. The average trader is a substantial SME – grossing 440,000 dollars per year in the North and 70,000 in the South. But the overall maize trade segment is quite concentrated – with a Gini coefficient of 70%. Traders are mainly specialized in trading rather than trading and farming (none engage in maize production in the South and just 40% of them in the North with own maize, forming only 10% of their trade). Traders also specialize in maize (accounting for about 70% of their volumes) and in wholesaling (taking possession) rather than brokering (for a fee).

Second: interesting and surprising findings with respect to the client and spatial configuration of the segment. The maize supply chain is North-North and North-South. It depends overwhelmingly on the North, with even the Southern traders buying 80% of their maize from the North. Surprisingly, compared to the traditional view of wholesalers buying from rural brokers and thus being long and fragmented, it is partially "dis-intermediated", with Northern urban traders buying 50% of their maize from farmers, and Southern urban traders buying 60%. Further, 80% of maize is sold by the traders to other traders and retailers, and only about 20% to feed and flour mills. The latter are still an emerging sector. In all these exchanges, contracts cover only a tiny share, about 5%.

Third, our survey provides insights into the conduct of trading sector that contrasts with the traditional view. Traders own very little of the transport and warehousing they use. In the main they rely on a well-developed 3PLS (third party logistics service) sector market, and a warehouse rental market. Moreover, traders buy the great majority of maize (except for the minority they produce as farmers) already bagged. Thus, few traders dry or fumigate the maize. Most traders label the bags with their own information, but then often ship the maize in mixed lots with other traders in 3PLS trucks. Few traders (only 24%) store their maize, and then only for a short time. We found there is extremely little waste/loss of maize in their handling of the bags.

Fourth, we find that a long-held view of traders advancing funds or inputs to farmers (or other traders) to "tie output with credit" is simply not the case among maize traders in Nigeria today. We find that to be near absent – 6% of transactions in the South, 10% in the North, for advance of funds, and 0% for advance of inputs.

We turn now to the policy implications of our findings.

A first crucial point is that the rural-urban maize supply chain in Nigeria is like a huge hour-glass in shape. At the broad base are millions of small farmers growing maize, and at the top of the hour glass are 100 million people buying maize (directly or via animals fed on feed of maize). In the middle of the hour glass, the passageway or funnel between the base and the top, are some 10,000 urban maize traders. The urban food security of Nigeria (and of rural maize buyers which are millions) is conditioned, mediated, determined by those 10,000. Yet the policy debate on food security has focused nearly only on the broad base of farmers. The funnel of traders that intermediate and determine the efficiency and price and continuity of flow of maize from rural to urban areas has been largely neglected. These 10,000 also determine whether there is an acceptable financial incentive and level of risk for farmers to adopt new technologies that can significantly increase their productivity. Thus agricultural policy is necessary but not sufficient both for farmers and consumers: the support of a vibrant trader segment is the further necessary condition. The policy implication is that government and researchers need to understand this segment better and attend to its needs and conditions to do its job best.

A second crucial policy point is that these traders were found in our study to depend a lot on markets for third party services, in particular transport and warehousing. The great majority of traders own neither truck nor warehouse. They rent them and depend on that market's good functioning. But again, the conditions for those markets and actors, such as trucking companies, have been given little attention in the policy debate in Nigeria. An anecdote is in order. In Myanmar, transport sector liberalization was undertaken recently, inducing massive private sector investment in trucks and busses. This in turn spurred exports over the borders of Myanmar of fruit, and inter-regional shipments (on busses with cold shelves) of hundreds of thousands of tons of aquaculture fish from south to north Myanmar (Belton et al. 2017), the same distance as from Ibadan to Kaduna. Thus, supporting the development and successful operation of the logistics segment in Nigeria is worthy of more attention.

A third crucial point for policymakers that we found is that Southern Nigeria traders depend for three quarters of their maize on maize traders and farmers 1000 km North. This is good for Northern farmers and traders, and for the transport business that employs 1000s. But policymakers need to keep an eye on how vulnerable that makes the long maize chain – energy and climate shocks, road washouts, sociopolitical unrest, all these can disrupt that flow. That does not imply a retreat from market integration; that is good for all. But it is important to work on conditions for that flow to be secure and fluid and protected. Furthermore, while undoubtedly maize production is more amenable to the agroecology in the north, we see that about 20% of maize traded in the south comes from the south. With climate change and other implications of dependence on the north, a better understanding of the agronomics and economics of maize production (including cost implications and quality) in the south and its ability to complement with maize supply from the north should be explored.

Finally, as the feed market grows (it grew 600% in just over 10 years in Nigeria!), and urban maize milling transforms and develops, markets will look for new varieties of maize, for quality, for traceability, for disease control. In all these things, farmers will play a role. But the traders will be the main conduit of incentives and investments. Exploring what incentives and conditions are needed to facilitate this is a new agenda that needs to be prioritized.

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ANNEX

Table 1: Demographic characteristics and structure of the urban maize trading segment in Nigeria (2016)

Variable	Overall	Ibadan: on-market	Kaduna -city on-market	Kaduna state regional markets	Kano - city on-market	Kano state regional markets	Katsina-city on-market	Katsina state regional markets	Plateau-(Jos) city on-market	Plateau state regional markets
N observations in 2016 (2011)	***1406 (1096)***	***128 (111)***	***62 (20)***	***137 (98)***	***252 (202)***	***401 (291)***	***68 (65)***	***150 (127)***	***57 (36)***	***151 (126)***
1. Age (years)	43	45	42	43	43	41	43	42	46	45
2. % males	90	30	80	100	90	100	100	100	40	60
3. % literate	80	90	90	80	80	80	90	80	80	90
4. % above primary education	60	80	70	70	50	50	50	40	60	80
5. Tons of all grain sold all season by traders in high season 2016 (2011)	525 (546)	85 (146)	215 (148)	446 (574)	359 (447)	378 (461)	1469 (1,330)	1425 (1,091)	208 (414)	566 (440)
6. Tons of all grain sold all season by traders in **low** season 2016 (2011)	358 (384)	70 (113)	209 (123)	412 (426)	304 (349)	356 (452)	865 (795)	622 (539)	125 (178)	307 (266)
7. For traders who sold on market, what price were you paid (USD) per ton in high season 2016 (2011)	367 (311)	444(308)	219(253)	222 (NA)	NA (NA)	NA (NA)	NA (NA)	NA (NA)	444 (324)	141 (373)
8. For traders who sold on market, what price were you paid (USD) per ton in **low** season 2016 (2011)	323 (332)	356 (339)	213 (303)	NA (NA)	NA (NA)	550 (NA)	NA (NA)	NA (NA)	356 (NA)	141 (NA)
9. Gini coefficient of maize sales for all traders in high season 2016	0.696	0.845	0.727	0.650	0.741	0.655	0.708	0.674	0.698	0.469
10. Gini coefficient of maize sales for small traders in high season 2016	0.375	0.695	0.518	0.562	0.635	0.519	0.588	0.583	0.516	0.397
11. Gini coefficient of maize sales for large traders in high season 2016	0.571	0.405	0.476	0.381	0.376	0.347	0.348	0.303	0.389	0.201
12. % of traders who also farm maize in 2016	34	2	24	56	34	34	29	69	2	28
13. % of maize volume traded in 2016 that the trader grew in the North	10	0	14	18	3	5	31	30	5	7

14. % of maize volume traded in 2016 that the trader grew in the South	0.5	0	0.8	0.8	0.7	0	2.6	0	1	1
15. % of traders who mill maize into food flour	8	0	29	6	22	3	15	1	12	3
16. % of traders who mill maize into feed	3	0	15	7	4	1	7	1	0	1
17. Average share of maize in total volume traded in 2016 (%)	66	68	56	64	61	60	66	70	72	90

Source: authors' estimation

Table 2 Maize sourcing and sales among urban maize traders in Nigeria

Variable	Overall	Ibadan: on-market	Kaduna-city on-market	Kaduna state regional markets	Kano - city on-market	Kano state regional markets	Katsina-city on-market	Katsina state regional markets	Plateau-(Jos) city on-market	Plateau state regional markets
N observations	*1406*	*128*	*62*	*137*	*252*	*401*	*68*	*150*	*57*	*151*
1. % of traders who are only brokers (i.e. do not take possession but trade for fee)	15	4	23	34	12	17	21	9	4	10
2. % of traders who took possession (wholesaling) and not brokering in their last transaction	95	100	98	85	100	93	100	100	98	85
3. % of traders who went to collect maize from farmers in 2016	48	41	53	61	34	33	50	69	23	91
4. % of last transaction's lot, that was from farmers (share of volume)	28	39	18	22	17	17	36	39	12	59
5. % of traders who went to collect maize from field brokers in 2016	64	13	69	61	70	69	56	63	79	85
6. % of traders that paid broker fee for procurement of lot in 2016	44	0	44	27	51	46	50	51	61	67
7. If paid broker fee, what is the price (dollars/ton)	3	NA	4	3	3	3	3	3	4	4
8. % of traders with last transaction in South	4	32	0	0	0	0	0	1	2	1
9. % of traders with last transaction in North	96	68	100	100	100	100	100	99	98	99
10. tons bought (of all maize), for traders in 2016	12	2	8	11	3	4	30	26	6	18
11. Average number of sellers the trader engaged for the lot*	4	3	5	5	3	3	5	6	4	6
12. Avg. distance (km) from where buy to where sell	70	450	20	10	120	120	135	100	68	0
13. % of traders who sold last transaction in their locale of residence	82	89	65	74	79	83	77	76	98	95

14. % of maize volume trader bought in North	85.7	78.43	84.68	80.14	95.74	94.68	63.77	67.69	89.42	85.76
15. % of maize volume trader bought in South	2.69	21.57	0	0.16	0	06	0.35	0	2.89	3.97
16. % of total maize sold in/to North in high season 2016 (2011)	87 (86)	1 (NA)	97 (96)	97 (96)	99 (99)	98 (98)	89 (91)	95 (97)	93 (92)	90 (88)
17. % of total maize sold in/to North in low season 2016 (2011)	87 (86)	0 (NA)	94 (94)	99 (96)	99 (99)	98 (98)	91 (91)	95 (96)	92 (93)	90 (86)
18. f sold in North % going to **feed mills** in high season 2016 (2011)	7 (8)	NA (NA)	10 (9)	6 (5)	2 (2)	2 (1)	6 (5)	4 (7)	28 (34)	27 (28)
19. % sold in North going to other traders in high season 2016 (2011)	29 (29)	NA (NA)	24 (27)	50 (57)	23 (24)	25 (25)	34 (28)	40 (34)	16 (19)	27 (29)
20. of sold in north, % to food industry/food mill in high season 2016 (2011)	6 (6)	NA (NA)	4 (7)	6 (5)	2 (2)	3 (3)	4 (4)	5 (4)	11 (15)	24 (20)
21. of sold in north, % to retailers in high season 2016 (2011)	31 (30)	NA (NA)	29 (29)	28 (24)	36 (35)	35 (35)	28 (31)	30 (32)	31 (23)	19 (18)
22. of sold in north, % to consumers in high season 2016 (2011)	27 (27)	NA (NA)	34 (29)	11 (9)	38 (38)	35 (36)	29 (33)	21 (23)	15 (11)	4 (5)
23. % of total maize sold in/to South in high season 2016 (2011)	13 (14)	99 (100)	3 (5)	3 (4)	1 (1)	2 (2)	11 (9)	5 (3)	7 (8)	10 (12)
24. % of total maize sold in/to South in low season 2016 (2011)	13 (14)	100 (100)	6 (6)	1 (4)	1 (1)	2 (2)	9 (9)	5 (4)	8 (7)	10 (14)
25. Of sold in South, % to **feed mills site** in high season 2016 (2011)	9 (8)	6 (5)	33 (23)	13 (0)	NA (0)	0 (0)	NA (NA)	100 (100)	0 (0)	40 (43)
26. of sold in South, % to other traders in high season in 2016 (2011)	35 (42)	36 (41)	40 (25)	67 (100)	NA (100)	30 (90)	NA (NA)	0 (0)	50 (50)	12 (7)
27. of sold in South, % to food industry/food mill in high season 2016 (2011)	9 (8)	6 (5)	0 (7)	20 (0)	NA (0)	0 (0)	NA (NA)	0 (0)	50 (50)	40 (50)
28. of sold in South, % to retailers in high season 2016 (2011)	26 (22)	30 (25)	20 (25)	0 (0)	NA (0)	3 (10)	NA (NA)	0 (0)	0 (0)	0 (0)
	22	23	7	0	NA	67	NA	0	0	8

29. of sold in South, % to consumers in high season 2016 (2011)	(20)	(24)	(20)	(0)	(0)	(0)	(NA)	(0)	(0)	(0)

Source: authors' estimation

Table 3.Contracting and use of third party logistics among urban traders in Nigeria

Variable	Overall	Ibadan: on-market	Kaduna -city on-market	Kaduna state regional markets	Kano - city on-market	Kano state regional markets	Katsina- city on-market	Katsina state regional markets	Plateau- (Jos) city on-market	Plateau state regional markets
N observations	*1406*	*128*	*62*	*137*	*252*	*401*	*68*	*150*	*57*	*151*
1. Of total maize procurement from farmers in North, % bought on contract in high season 2016	11	0	13	6	0.9	6	0	0.2	0	40
2. Of total maize procurement from field brokers in North, % on contract in high season 2016	10	0	8	8	3	4	4	2	2	49
3. Of maize from other wholesalers in North, % on contract in high season 2016	4	0	8	7	5	5	2	2	0	0
4. Of total maize procurement from farmers in south,% bought on contract in high season 2016	5	0	0	0	0	0	0	0	0	14
5. Of total maize procurement from field brokers in south, % on contract in high season 2016	0	0	0	0	0	0	0	0	0	0
6. Of total maize procurement from wholesalers in South, % on contract in high season 2016	6	0	0	0	0	0	0	0	100	50
7. % of sales in the north made to feed mills on contract in high season 2016 (2011)	22 (20)	NA (NA)	14 (19)	14 (0)	13 (7)	6 (0)	0 (0)	0 (1)	42 (23)	37 (46)
8. % of sales in the north made to retailers on contract in high season 2016 (2011)	7 (8)	NA (NA)	5 (9)	2 (0)	7 (6)	6 (7)	1 (3)	0 (0)	3 (5)	27 .4 (38)
	31	NA	6	8	8	5	1	3	40	71

9. % of sales in the north made to food industry on contract in high season 2016(2011)	(32)	(NA)	(15)	(0)	(0)	(0)	(0)	(0)	(66)	(72)
10. % of sales in the north made to consumers on contract in high season 2016(2011)	4 (5)	NA (NA)	4 (6)	4 (4)	5 (5)	4 (4)	6 (4)	4 (4)	3 (4)	4 (4)
11. for traders sold on contract to mills, what price got USD per ton in **high** season 2016 (2011)	198 (270)	NA (NA)	258 (212)	215 (477)	103 (242)	135 (370)	NA (437)	NA NA	257 (283)	179 (241)
12. of sold in north to food industry on contract, what price USD per ton got in high season 2016 (2011)	181 (252)	NA (NA)	225 (429)	182 (311)	71 (177)	181 (184)	333 NA	333 NA	203 (246)	175 (237)
13. for traders sold on contract to retailer, price got USD per ton in high season 2016 (2011)	192 (226)	NA (NA)	231 (150)	191 (331)	186 (182)	187 (158)	234 (466)	56 (295)	228 (349)	175 (256)
14. for traders sold on contract to consumers, price got USD per ton in high season 2016 (2011)	158 (257)	NA (NA)	178 (152)	175 (337)	152 (257)	131 (195)	218 (335)	232 NA	171 (453)	161 (273)
15. for traders sold on market (not contract to any), what price USD got per ton in high season 2016 (2011)	208 (193)	NA (NA)	226 (151)	243 (201)	184 (215)	168 (173)	196 (167)	NA (179)	269 (216)	233 (214)
16. for traders sold on market (not contract to any), what price USD got per ton in **low** season 2016 (2011)	221 (230)	NA (NA)	210 (173)	202 (193)	229 (278)	229 (215)	209 (193)	236 (165)	213 (262)	202 (252)

Source: authors' estimation

Table 4: Maize branding and handling, among urban traders in Nigeria

Variable	Overall	Ibadan: on-market	Kaduna-city on-market	Kaduna state regional markets	Kano - city on-market	Kano state regional markets	Katsina-city on-market	Katsina state regional markets	Plateau-(Jos) city on-market	Plateau state regional markets
N observations	*1406*	*128*	*62*	*137*	*252*	*401*	*68*	*150*	*57*	*151*
1. % of wholesalers who own trucks in 2016 (2011)	4 (3)	0 (0)	7 (0)	1 (4)	2 (2)	0 (0)	17 (18)	23 (7)	2 (0)	1 (0)
2. % of traders with access to truck rental in **2016 (2011)**	40 (37)	51 (58)	48 (44)	34 (29)	28 (24)	18 (14)	64 (58)	53 (42)	70 (82)	72 (60)
3. % of traders with access to transport service in **2016 (2011)**	87 (83)	91 (94)	72 (80)	75 (77)	92 (85)	88 (80)	92 (84)	93 (86)	86 (94)	82 (71)
4. Average number of trucks rented in 2016 (2011)	3 (4)	19 (21)	13 (6)	4 (10)	0.13 (0)	0.47 (1)	2 (1)	1 (1)	1 (1)	0 (0)
5. % of wholesalers that own a motorcycle in 2016 (2011)	39 (32)	2 (2)	44 (48)	45 (32)	35 (31)	39 (34)	87 (63)	82 (66)	4 (8)	17 (11)
6. % of traders using motorcycle pool in 2016 (2011)	13 (13)	5 (1)	23 (26)	15 (12)	13 (15)	17 (18)	17 (15)	16 (18)	0 (0)	1 (0)
7. % of traders who delivered maize to their buyers in 2016	30	33	47	35	19	21	43	51	14	40
8. % transported maize in own truck in the last transaction	3	0	6	6	2	1	12	12	0	0
9. % transported maize in rented truck in the last transaction	31	71	59	52	10	18	62	55	5	1

10. % transported maize by hired transporter in the last transaction	78	89	95	89	90	83	86	98	100	28
Number of traders with stall in the north in 2016	*1136*	*0*	*54*	*110*	*231*	*358*	*60*	*142*	*49*	*132*
11. Number of traders with stall in the south in 2016	**147**	**127**	**3**	**0**	**1**	**2**	**1**	**0**	**3**	**10**
12. % of traders with cell phones in 2016 (2011)	95 (83)	99 (91)	98 (90)	93 (80)	91 (84)	94 (83)	100 (89)	100 (86)	95 (91)	94 (65)
13. % of traders who agreed on price by phone before sold in the last transaction	40	27	52	50	29	30	47	45	68	55
14. Tons bought (of all maize) in last transaction	12	2	8	11	3	4	30	26	6	18
15. % who bought maize already in bags/sack in 2016	96	95	95	93	97	95	97	97	100	97
16. % who sell maize already in bags/sack in 2016	94	91	87	93	96	92	96	97	98	97
17. % who labelled maize with a brand name in 2016	7	2	10	14	1	4	24	9	4	11
18. % of traders who store d maize in 2016	24	20	44	45	19	13	51	57	9	1
19. % of wholesaler who own warehouse in 2016	11	3	26	26	11	4	18	21	2	0
20. If owned warehouse in 2016, capacity in tons (only those who owned)*	30	10	25	20	28	30	98	50	30	NA
21. .% of wholesaler who rented warehouse in 2016	9	34	34	25	10	6	47	45	5	0
22. If rented warehouse in 2011, capacity in tons (only those who rented)*	30	10	20	13	50	30	84	100	50	NA
23. Percentage of weeks in season trader stored maize in high season 2016	13	4	26	16	11	6	27	36	8	11

24. Percentage of weeks in season trader stored maize in low season 2016	6	4	21	9	3	3	17	10	4	1
25. % of traders who dried the maize they procured in 2016	9	0	21	19	12	8	7	10	0	1
26. % of wholesalers who own maize dryer in 2016	0.7	0	4.9	2.9	0.8	0.3	0	0	0	0
27. % of wholesalers who rent maize dryer in 2016	0.3	0	3.3	0.7	0	0	0	0.7	0	0
28. % of wholesalers who use debris cleaning machines in 2016	17	0	51	27	13	22	23	20	0	1
29. % of traders who treat stored maize with binder or fumigant	52	31	78	69	41	46	63	43	80	100
30. % who add ash or pepper to stored maize	12	4	7	13	12	4	17	19	0	0
31. If bought from farmer, what % of farmer's fertilizer did trader provide in advance in last transaction	2	0	2	4	0	2	7	1	0.5	0
32. If bought from farmer, what % of farmer's maize seed did trader provide in advance in last transaction	2	0	9	4	0	2	6	0.1	3	0
33. % of transactions where trader paid advance to seller (farmer or trader) in last transaction	8	6	17	15	4	3	14	8	9	14

Source: authors' estimation