INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
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Rethinking
Food Markets

INITIATIVE TECHNICAL PAPER 1 AUGUST 2023

The rapid rise in domestic value chains of nutrient-dense foods (fruits, vegetables, and animal products) in Sub-Saharan Africa: Policy implications

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Abstract

Despite African consumers under-consuming nutrient dense fruits and vegetables (FV) and animal products (AP), and the farm production and supply chains of these products are fraught with constraints that keep them from operating optimally, we find abundant recent evidence of dynamism in these sectors. To wit: (1) consumption of these products in levels and shares is already substantial and growing rapidly; (2) supply of these products is growing rapidly, just not yet much faster than population growth; (3) supply growth is manifested in a number of countries by dynamic “meso booms” with diffusion of farming and growth in midstream ("Hidden Middle") value chain segments; these booms are “grass roots” driven, without subsidy or management by government or NGOs or large companies. We reviewed recent survey-based evidence of these booms and discussed the drivers. The policy implications are the need for governments to invest in the conditions we found to be enabling these booms, that is, roads and wholesale markets and electrification and other infrastructure hard and soft.

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1. INTRODUCTION

The supply and demand of nutrient-dense foods, such as fruits and vegetables (FV) and animal products (AP), have been found to be inadequate and too expensive for most consumers in Sub-Saharan Africa (SSA) (FAO, IFAD, UNICEF, WFP, WHO, 2023). The international debate has mainly focused on the constraints and problems fueling this inadequacy. While we acknowledge the challenges and inadequacies, we believe that the debate's focus on them has led to inadequate attention to the rapid growth of consumption and supply of these products, and to a widespread reference to a "missing middle", the idea that there has been little to no growth in the midstream segments of domestic value chains (VCs) of the products in SSA.

By contrast, we find substantial levels and rapid growth of both demand and domestic supply of these products, and "meso booms" including rapid growth in farming of these products and dynamism in the growth of the midstream of their VCs. We contend that rather than a "missing middle" there is a "hidden middle" (Reardon 2015; Reardon et al. 2021), as the dynamism of the midstream, and the rural production that fuels it, has been "hidden" from the debate. We believe that the debate's focus on the constraints has caused a relative neglect of the evidence of this growth. That neglect limits the international debate's ability to learn policy lessons from these booms and better support the growth of these value chains in a way that can improve the per capita consumption of these products.

In this paper we lay out evidence of substantial (but still inadequate) and growing consumption and supply of these products. We use a mix of macro supply data, micro consumption and enterprise survey findings, and "meso" level analysis of findings from survey data on spontaneous (as opposed to government or NGO managed) clusters of farms and midstream firms, supplying inputs and agricultural services, wholesaling and processing output, and providing third-party logistics or 3PLS.

Our case illustrations focus on "meso booms" that feature "endogenous growth", that is, spontaneous and "grass roots" rapid development in situations where enabling conditions were present. We chose this focus for three reasons. First, we want to show that when enabling conditions exist, in particular where there is a demand pull from urban growth and governments invested in roads, electricity and wholesale markets, rapid spontaneous growth in local SMEs occurred. That challenges the myth that domestic SMEs are stymied and not demand responsive. That further opens the debate about how to get governments to make more of these crucial investments. Second, we want to show that SME farms and midstream firms made their own investments when the enabling conditions were in place. This counters what we think is a skewed focus in international debate on investments made "for them" by external actors (like big companies or agroparks or NGOs or government subsidy projects).

We pointedly do not discuss cases where NGOs or governments or large companies set up and/or subsidized growth, because we think these cases are already very visible in the debate and literature, and these programs form a small share of supply. We seek to show what the market actors are doing in non-artificial (non-subsidized) situations where only the enabling environment was in place. We focus on domestic markets, not export markets. This is again because we want to consider the most common situations; exports are less than 1% of output of FV and AP in SSA (Awokuse et al. 2019). We also focus on cases of proliferation and growth of small and medium enterprise (SME) farms and midstream firms. This is because the great majority of the SSA food economy is in the "transition stage" of VC transformation where SMEs dominate. The "modern stage" is still small and just emerging in Africa (Reardon et al. 2019), although there is evidence of its emergence spurring inclusive development in some situations (Maertens and Swinnen, 2009).

We proceed as follows. Section 2 shows macro data concerning the growth in supply (and consumption) of FV and AP foods in SSA. Section 3 reviews micro data showing substantial levels (though still inadequate) and growth in consumption of FV and AP. Sections 4 and 5 present recent survey-based studies of "meso booms" of farms and firms in value chains (VCs) of FV and AP in various countries in SSA: fish in Nigeria, dairy in Ethiopia, and vegetables in Tanzania, Zambia, and Ethiopia. Section 6 concludes with policy implications and an agenda for further research.

2. MACRO VIEW OF SUPPLY OF FV AND AP: LINGERING PER CAPITA INADEQUACY BUT ASIA-MATCHING TOTAL GROWTH

Dolislager et al. (forthcoming) shows macro data adapted from FAO Food Balance Sheets for domestic output and imports and the degree of adequacy (relative to requirements for a healthy diet drawn from Harris et al. 2022). They cover 10 years (2020 versus 2010). Several points stand out.

First, the great majority of supply (and consumption) of animal products, fruit, and vegetables in SSA is from domestic supply: 90% of animal products, 98% of fruit, and 96% of vegetables. Imports (in tonnage terms) form only 10%, 2%, and 4% of the consumption by disappearance of these three product categories in SSA. The low shares of imports for FV and AP are at odds with what we believe to be the widespread view that SSA is strongly import dependent for these products. SSA's import shares are close to those in Asia and both are below the average import shares globally.

Second, SSA's per capita supply of AP and FV is starkly below (about half) that of Asia and the world. It is also well below (33%, 40%, and 55%) the healthy-diet adequacy level for AP, fruits, and vegetables, respectively. Asia by contrast is above adequacy by 18% and 9% for AP and vegetables, but in fruit inadequate in a degree similar to SSA. SSA's degree of adequacy in these products barely changed from 2010 to 2020.

Third, in contrast to the problems of adequacy and stagnancy per capita over a decade, total output of these products soared over the decade in SSA: 29% for animal products (versus 31% in Asia), 43% for fruits (versus 26% in Asia), and 35% in vegetables (versus 25% in Asia).

We next explore the trends with a longer time lens, focusing on AP. Delgado (2003) noted that there had been a "livestock revolution" - a rapid growth in AP consumption per capita in developing countries from the 1970s to the mid-1990s, driven by increases in population, urbanization, and incomes. The increase in meat and milk consumption was more than twice the market value of the increase in cereals consumption that occurred in the "Green Revolution." While the growth was rapid, by the late 1990s, consumption per capita was still only one third the meat and one fifth the milk consumed in developed countries.

In sharp contrast to Asia, SSA's meat and milk consumption stagnated per capita in the 1980s-1990s (Delgado 2003). We analyzed FAOSTAT FBS (food budget sheet) data comparing 2000 to 2020 to see if the situation had improved. Keep in mind that SSA population increased nearly 2-fold over those two decades.

We found that in absolute terms output grew rapidly but did not exceed population growth in red meat (whose output increased 2-fold) and fish and seafood (whose output grew 1.7-fold). Thus though both

sets grew fast they just kept up with population growth so per capita output did not grow. By contrast, dairy output grew 2.6-fold and poultry and eggs, 3.8 fold, both faster than population growth, so output per capita grew.

This points to an important paradox. While SSA is experiencing major success in increasing total supply (still largely domestic), SSA still has limitations in the adequacy of these nutrient-dense foods. This inadequacy is because supply (though increasing) is not yet outpacing population growth except in fruit and dairy and poultry. The good news is that there is rapid growth in these foods and this is reflected in a number of booms at the meso level in the supply of these products. The challenge is that the growth of these products in the aggregate is not yet sufficient to remove the macro level inadequacy – and thus the need for domestic supply to grow even faster.

3. SUBSTANTIAL CONSUMPTION OF FRUITS/VEGETABLES (FV) AND ANIMAL PRODUCTS (AP) IN SSA: VIEW FROM HOUSEHOLD DATA

3.1 Urban SSA shares of AP+FV already exceed those of starchy staples – and are similar to developing Asia

Dolislager et al. (forthcoming) analyzed LSMS consumption data for 11 SSA countries and compared "high-food-budget countries" (in relative terms), including Côte d'Ivoire, Ethiopia, Mali, Nigeria, and Senegal with "low-food-budget countries" (including Benin, Burkina Faso, Guinea-Bissau, Malawi, Niger, and Togo). Note that these are not higher income and lower income countries, just higher food budget and lower food budget. Here we examine their urban findings.

Consumption patterns in urban SSA are of special interest for several reasons: (1) urban areas consume around 50-60% of all food consumed in SSA and 60-70% of marketed food (Liverpool-Tasie et al. 2021); (2) urban areas form the main market for farmers and thus are crucial in creating the incentives for farmers to produce AP & FV; (3) while consumption patterns in urban areas usually have higher rates of consumption of AP and FV than rural areas (in part because of Bennett's Law; Popkin and Bisgrove, 1988), historically it is common for the rural consumption patterns to eventually shift toward the urban ones.

For urban areas of high-food-budget SSA countries, Dolislager et al. (forthcoming) found that the consumption share of AP+FV [1] exceeds that of starchy staples (grains and roots and tubers): 34% (AP+FV) versus 30% (starchy staples). Urban areas of low-food-budget SSA countries show a surprising similarity with the high-food-budget countries. Again, the consumption share of AP+FV exceeds that of starchy staples: 40% versus 28% (starchy staples).

These urban patterns are similar to those of developing Asia. For example, Indonesia urban food consumption is 37% AP+FV versus 26% for starchy staples; Nepal urban food consumption is 39% AP+FV versus 28% for starchy staples (Reardon et al. 2014).

[1] For at-home consumption, as food-away-from-home is a category unto itself without a product breakdown.

3.2 Rural SSA shares of AP+FV are still below those of starchy staples – and are just a bit below those of developing Asia

In upper-food-budget SSA countries the share of AP+FV is 26% versus 42% for starchy staples. Again surprisingly, in lower-food-budget countries the shares are close, with 29% of AP+FV versus 43% for starchy staples. If one can call a diet where starchy staples dominate diversification foods a “traditional diet”, the rural areas are still in that mode, but arguably more diversified than decades ago.

As with urban areas, there is a similarity, but somewhat lower in AP+FV of rural SSA compared with developing Asia. For example, in Indonesia in rural areas AP+FV form 37% and starchy staples, 34%. In Nepal, the shares are 35% for AP+FV versus 36% for starchy staples (Reardon et al. 2014).

3.3 Focus on FV: SSA countries have substantial (and in some zones or countries growing) shares and levels of FV in household consumption

Normal First, there are several studies that show substantial shares of FV in food consumption. Using LSMS data, Dolislager et al. (forthcoming) show for high-food-budget countries that 15% of urban, 13% of peri-urban, and 12% rural of rural food consumption (in value terms) is in FV. Low-food-budget countries show 17%, 16%, and 15% for the three areas, respectively. This is interesting for several reasons: (1) the shares are similar to developing Asia (as discussed below); (2) contrary to the conventional view, the shares are similar over urban and rural areas and over high and low food-budget countries. There is thus evidence of convergence in patterns of behavior.

There is of course substantial variation over countries. For instance, in Ethiopia, Minten et al. (2020) show, using HCES data for 2016, a share of FV of 9% overall (but 19% in the capital city, Addis Ababa). By contrast, for Senegal, Faye et al. (2023) show 27% for urban areas and 17% for rural areas; interestingly, they show there is little variation in shares over zones of the rural area, with rural peri-urban at 17%, intermediate zones at 16%, and hinterland (far from towns) at 16%, suggesting penetration of FV supply chains deep into rural areas. Amfo et al. (2019) found 34% for urban Ghana. Smale et al. (2020) found 13% in rural and 20% in urban areas in Mali. In earlier work, Ruel et al. (2005) found (we round)14% for FV for rural and urban together in Mozambique, 12% in Tanzania, 10% in Kenya and 11% in Ghana. Ayieko et al. (2005) found 26% for Nairobi.

Again, we note that these FV shares in Africa, despite variation over countries and zones, are substantial and roughly similar to findings from developing Asia. Examples include in Nepal where 15% of food consumption in value terms is in FV in urban areas and 14% in rural areas, and in Indonesia, 15% urban, and 17% rural.

Second, Bennett’s Law and the few regression studies of FV shares (e.g., Faye et al. 2023) show that the share of non-staples in the diet rise with income. Yet survey evidence also shows that this increase starts even among households with incomes below the poverty level (Dolislager et al. 2022).

Moreover, lumping fruits and vegetables masks differences between fruit (usually a luxury) and vegetables (usually a necessity) in the few studies that break down these by income groups or income elasticities. For example, in Nigeria, Parkhi et al. (2023) find most vegetables to be income inelastic while fruit is highly income elastic. Dolislager et al. (forthcoming) found for "high food-budget countries” in Africa that vegetables had a steady 11% over income terciles, while the share of fruit went from 2% for the lower and middle tercile to 3% for the upper. In low-food-budget countries, the share of vegetables in

food consumption dropped with income tercile, from 14% to 13% to 13%. This makes sense when one thinks of fruit mainly as a dessert in those food cultures while vegetables are a basic element of sauces for lunch and dinner.

Third, as expected from Bennett's Law, macro data show that FV consumption is growing much faster than cereals consumption in SSA. For Senegal, cereal consumption grew 2.6-fold and FV consumption grew 4.4-fold over 1990 to 2018 (Faye et al. 2023). The few household survey studies that show FV shares over time have often shown a rise. For Ethiopia, Minten et al. (2020) show the share rose from 4.5% to 9% over 2000-2016; Hassen et al. (2017) show the rise in the share FV was partly at the expense of the cereals share; the latter dropped from 46% in 1996 to 36% in 2011.

The evolution of FV shares can differ by the level of economic development of a country's region and by fruits versus vegetables. Parkhi et al. (2023) for Nigeria show over 2010-2019 that the share of households consuming fruits (a relative luxury) jumped from 32% to 63% in the poorer North, versus 58 to 83% in the richer South (while the share of households consuming vegetables stayed near 100% over the period in both regions). The share of FV in overall food consumption stayed at around 12-13% over the decade in the combined urban plus rural North versus growing from 13 to 16% in the richer south.

Fourth, levels of FV consumption have risen, even in per capita terms in some countries and zones (but with levels still inadequate when with the WHO-recommended minimum consumption of 146kg/capita of FV per year; Harris et al. 2022). For example, for Ethiopia, Bachewe and Minten (2023) show that consumption of FV per capita grew 1.6-fold in urban and 1.3-fold in rural areas from 2011 to 2016. This is rapid growth, but it should be noted that it starts from a low base and reaches a still-inadequate consumption level of 59 kg/capita overall in 2016 (with urban at 72 and rural at 56kg).

For Senegal, consumption per capita is 80kg/year (similar to Ruel et al. (2005) finding for Ghana of 75kg/year), with urban Senegal at 128kg and rural Senegal at 63kg by 2018. Note that in Dakar the consumption is at 137/kg, near to adequacy levels (although it is below the 177kg/capita found by Ayieko et al. (2005) for Nairobi, a higher average income city than Dakar).

For Nigeria, Parkhi et al. (2023) found for 2019 FV consumption at 89kg/capita in the richer South, and 54 in the poorer North (as low as rural Ethiopia). Moreover, they show that the North had even declined over the decade from 58 to 54, while the South had increased from 65 to 89, a 1.4-fold increase in a decade.

Fifth, another indicator of rapid transformation is that the composition of FV consumption in Africa has changed over several decades. It has undergone what can be called "Westernization" with a shift from a focus on traditional vegetables (such as African eggplant, okra, and indigenous green leafy vegetables) to non-indigenous vegetables and fruits especially tomatoes, onions, and chili peppers, now the dominant vegetables in the diet (e.g., in Senegal, Faye et al. (2023), and Nigeria, Parkhi et al. (2023)).

An important driver of the rise of tomatoes/onions/chili peppers is that they are versatile to adapt to traditional dish forms as well as relatively new (over a half century) dishes such as rice jollof in Nigeria.

Sixth, purchases now form a high, even majority share of rural FV consumption in SSA (for Senegal, Faye et al. 2023; Mali, Smale et al. 2020; Nigeria, Parkhi et al. 2023). This jibes with Sibhatu and Qaim (2018) finding that there is little correlation in SSA between diversity of diet (such as in FV) and own-farming of FV. For example, in Senegal, in rural peri urban areas, 75% of FV (in value terms) is purchased; that share is 78% in intermediate rural areas and 75% in hinterland rural (Faye et al. 2023).

Much of SSA's FV production takes place in a few commercial zones (focused on domestic markets) supplying via medium to long VCs the urban areas (and other rural areas). Examples include vegetables from the Rift Valley three hours to Addis Ababa (and other cities) (Minten et al. 2020), tomatoes from a few main irrigated tomato zones to consumers all around Tanzania (Ijumba et al. 2023), and tomatoes mainly from a few areas in Northern Nigeria to Southern Nigeria (Liverpool-Tasie et al. 2023b).

3.4 Focus on AP: SSA countries have substantial (and in some zones or countries growing) shares and levels of AP in household consumption

First, there are several studies that show substantial shares of AP in food consumption in SSA. Using LSMS data, Dolislager et al. (forthcoming) shows for high-food-budget countries that 19% of urban, 14% of peri-urban, and 14% rural of rural food consumption (in value terms) is in AP. Low-food-budget countries show 23%, 16%, and 14% for the three areas, respectively. As with FV, these findings for AP are interesting because contrary to the conventional view, the shares are similar over urban and rural areas and over high and low food-budget countries.

Keep in mind that the above shares of AP are underestimated. This is because food-away-from-home is an important share of food consumption in high-food-budget countries (averaging 11%) and 5% in low-budget countries, and that many "food service" dishes at street vendors have animal products in them (such as dairy with grain porridge; meat in traditional sauces; and the popular "chicken with chips" found in many SSA cities). LSMS data in SSA generally do not show the composition of food away from home.

Shares of AP in food consumption in SSA are only (we say "only" because we feel the conventional wisdom is that there are sharp differences with Asia) a bit below findings from developing Asia. Reardon et al. (2014) shows the AP shares in food consumption in Indonesia as 22% in urban and 20% in rural; in Nepal, 24% in urban and 21% in rural.

Second, Dolislager et al. (forthcoming) found for "high food-budget countries" in SSA that AP in food consumption was 10% for low, 14% for middle, and 19% for upper tercile households. In low-food-budget countries, the pattern was similar: 11%, 15%, and 23% over the three terciles. The finding of AP as luxury foods is expected (and similar to other findings in SSA, such as for Ethiopia (Abegaz et al. 2018), and in developing Asia, Reardon et al. 2014).

Third, as expected from Bennett's Law, macro data show that AP consumption is growing much faster than cereals consumption in SSA. Moreover, the few household survey studies that show AP shares over time have shown a rise in the share. For example, for Ethiopia, Minten et al. (2020) show the share rose from 8% to 13% over the period 2000-2016.

Fourth, levels of AP consumption have risen over 2000-2020, during which dairy macro data showed for overall SSA a 2.4-fold rise in consumption per capita. Some micro studies reflect this. For Ethiopia dairy, Minten et al. (2020) show for Addis Ababa that annual intake per adult equivalent increased by 31% in only 10 years (2005-2016). For fish in Nigeria, Liverpool-Tasie et al. (2021b) show that the share of households consuming fish rose from 59 to 72% over just 5 years, 2010-2015. That masks sharp regional differences: in the poorer North the share only went from 46 to 49%; while in the south, from 71 to 90% in those 5 years. In the North, the kg/capita stayed at about 6.3kg, while in the richer South, from 17 to 18.7 kg.

For chicken and eggs, in Ethiopia, Abegaz et al. (2018) show that intake doubled from 3.8 birr/capita per year to 7.1 in 15 years (1996-2011). In Ghana, Knößlsdorfer and Qaim (2023) show that intake of chicken rose from 40,000 tons in 1999 to 260,000 tons in 2018, although 75% is supplied by imports. The latter is far higher than the all-SSA share of imports in chicken/egg consumption of 22%, with an even lower rate (15%) in Nigeria (Ogunleye et al. 2016).

4. MESO BOOMS IN ANIMAL PRODUCT CLUSTERS AND DOMESTIC VCS

4.1 Fish in Nigeria

Research is emerging on fish-capture and aquaculture clusters and rapid development ("booms") in domestic supply in SSA, such as in Kenya (Naziri et al. 2023) and in Nigeria, which we illustrate here. Nigerian domestic fish output in tons (per FAOSTAT data) grew 4.1-fold (twice the pan-SSA rate noted above). Imports into Nigeria rose only 2-fold. These data point to a boom in domestic fish supply. By 2020 this supply was 75% by (equal parts) marine capture and inland capture and 25% by aquaculture (which was nearly 0% in 2000) (Liverpool-Tasie et al. 2023).

a) Fish Production clusters supplying short and long supply chains in Nigeria

There are several important aquaculture and capture fishery clusters feeding the fish supply boom in Nigeria. We focus here on three, in the Southwest in Oyo State (near Ibadan and Lagos), the Southeast in Ebonyi, and in the North in Kebbi State, drawing on a rapid reconnaissance study of hundreds of supply chain actors (Liverpool-Tasie et al. 2023); and Gona et al. (2018) based on a "meso inventory" with a 10-year recall of supply chain actors in the four main fishing/fish farming clusters in Kebbi State.

All three of these cluster-sets: (1) are based in areas with good enabling conditions for fish production (well-watered); (2) due to government investments are well-connected by highways to major cities near and far and well served by wholesale markets; (3) have displayed dynamic transformation of both the structure and the conduct of the value chains/clusters; (4) are characterized by dominance of SMEs who responded to increasing demand and favorable conditions; (5) supply in their large majority domestic markets in general and urban markets in particular.

b) Diffusion of capture fishers and fish farms

To illustrate the size and growth of primary producers in these clusters, we focus on findings from the Kebbi State clusters (one big cluster and a few smaller ones), by 2018 around 21,000 fishers and fish farmers. (Small scale farms form 61% and medium farms 28% of the total). Over the prior 10 years there had been a 182% increase in fishers and a 200% increase in fish farmers (Gona et al. 2018). This growth rate was even greater than a boom qualified as a "Quiet Revolution" in aquaculture in Bangladesh (Hernandez et al. 2018).

There has been transformation of the conduct of primary producers in the Kebbi as well as the Oyo and Ebonyi clusters, in particular intensification of aquaculture (Liverpool-Tasie et al. 2023).

Examples include: (1) diffusion of mobile fiber and tarpaulin tanks to adapt to small landholdings and high pond construction costs; (2) and diffusion of antibiotics and commercial fish feed use (at all scales of farms).

c) Growth in the midstream of farm inputs VC

There has been rapid growth in the fish farm inputs value chains (Liverpool-Tasie et al. 2023): (1) emergence of long-distance (cross state) trade in fish seed from clusters of hatcheries in areas with good environmental conditions and transport (similar to what happened in Bangladesh, see Hernandez et al. 2018); (2) emergence of markets for broodstock for hatcheries; (3) emergence of specialized long-distance fingerling traders; (4) spillovers from poultry feed sector (processing and marketing) development to supplying fish farms, again, similar to what has happened in Asia; (5) emergence of "rural-hub one-stop-shops" such as Chi Farms in Oyo that sells and distributes juveniles, live catfish, frozen catfish, fillet, and fish feed to fish farmers and provides training to farmers.

d) Growth in the midstream and downstream of the fish VCs

There were nearly 9,000 midstream actors (wholesalers, processors, and transport logistics) in the Kebbi clusters by 2018. Growth in these segments was dynamic. For example, the number of rural and urban wholesalers in the clusters grew 1.3-fold over the decade (as fish producers increased 1.9-fold, this implies an increase in trader scale over the decade). Urban fish retailers in the state jumped 2.5-fold. These midstream intermediaries were in urban and rural retail markets, rural and urban wholesale markets, farmgate markets, and trader collection points totaling around 255 over the period (Gona et al. 2018).

The conduct of midstream actors transformed in the Kebbi as well as the Oyo and Ebonyi clusters (Liverpool-Tasie et al. 2023). Examples include: (1) indigenous innovation in processing, such as locally manufactured kilns and adoption of gas burners for fish frying (reducing wood use); (2) lengthening of value chains of smoked fish to markets around Nigeria and to neighboring countries; (3) improvements in cold storage infrastructure by private and public investments; (4) rapid development of third party logistics (3PLS) in private and public transport (again, similar to what occurred in Asia, for Myanmar see Belton et al. (2018)).

4.2 Dairy in Ethiopia

Above we noted that in one decade (2005-2016), dairy consumption per capita in Addis Ababa (a city of 4.5 million) grew 31%. The city was expanding and household incomes were rising quickly in that decade and it became the demand, and partly the supply, center of a boom in dairy. To supply this increase there was a rise in dairy farming and processing.

a) Dairy farming grew quickly in one decade – SME-dominated but with increasing concentration

Milk farming has developed quickly both inside and around the city. Minten et al. (2020) found that 31% of the city's supply comes from 29,000 dairy cows inside the city: 26% from suburban

areas, and 37% from rural areas. 89% of the milk supplied to Addis comes from small farms (below 25 cows).

Medium farms with more than 25 cows supply 11% of the milk supply but are growing much more quickly than small farmers: they increased 8-fold from 2007-17 (mainly in the suburban areas). Moreover, medium farms have nearly 5 times greater productivity per cow and 15 times higher per worker than small farms. Productivity is also correlated with proximity to Addis: milk yields are 5 times higher for farms close to Addis versus those far out. Milk yields among medium farms grew substantially over the decade while those of small farms stagnated. The medium farms tend to be urban or peri-urban; this phenomenon has also been noted in India (Burkitbayeva et al. 2023). Medium farms are the “change agents” driving the boom in the farm sector of the dairy supply chain to Addis. Minten et al. (2020) show that the medium farms are much more likely to undertake capital-led intensification: (1) cross-bred cows rather than traditional breeds; (2) use artificial insemination; (3) commercial feed; (4) access to animal health and dairy-related extension services. These in turn were supplied by growing input and services supply chains, and the proliferation of commercial feed mills.

b) Midstream boom – with increasing concentration

Minten et al. (2020) noted that milk processing firms tripled (from 8 to 25) in only 10 years; this rapid growth is similar to what Minten et al. (2016) documented for teff processors, transporters, and wholesalers in and to the Addis market in the same decade. Dairy processing reached 200,000 liters of milk per day.

As expected, concentration in processing has proceeded faster and further than in the farming sector: the four largest processors produced three-quarters of the pasteurized milk. The concentration is far less among processors producing unpasteurized milk as expected. Cooperatives only have a 5% share in processing.

5. MESO BOOMS IN VEGETABLE CLUSTERS AND DOMESTIC VALUE CHAINS: TANZANIA, ZAMBIA, ETHIOPIA, ZAMBIA

5.1 Vegetables in Tanzania

Aggregate supply of domestic FV grew very rapidly over the past several decades: Tanzanian FV output in tons (per FAOSTAT data) increased 4.1-fold from 1990 to 2020; vegetable output grew 2.3 times and fruit output, 7-fold. This rapid growth kept up with population growth (2.4-fold) in for vegetables and well exceeded it for fruit. Fruit supply responded to growth in fruit demand which is income-elastic while for vegetables is inelastic. Tanzanian income per capita increased 6-fold in constant dollars over the 3 decades (per World Bank data).

This domestic supply growth translated nearly fully into domestic consumption growth: less than 1% of SSA agricultural output is exported and less than 1% of consumption is imported. The composition of vegetable output changed, with tomatoes shifting from 9% to 17%, and onions from 3% to 7%, mirroring a consumption shift toward tomatoes and onions in Tanzania as in other SSA countries (as discussed above). Tomato output leapt 4.4-fold in those three decades. These macro trends were reflected in evidence of meso booms as follows.

a) Rapid ingress of farmers into FV at the national level

Farmers were responsive to the growth in domestic demand. There was a rapid diffusion of FV farming per agricultural census data (NBS 2021). In 2008, 9.5% of Tanzania farms grew FV; just 12 years later (2020) the share doubled to 21%. The fastest shift was among small farmers, from 8% of farms to 20%. For medium farms, the shift was from 24% to 38%, and large farms, from 16% to 26%. Overall, area under FV jumped 130% - adding 240,000 hectares in that decade. Half of that increase in area was a jump in area under tomatoes. By contrast, cereal area expanded only 27%.

b) Rapid rise of zone-specific clusters of FV production linked by long supply chains to consumption centers

While green leafy vegetables are grown throughout Tanzania in small plots in rural areas or near cities, most of the other main vegetables and fruits are grown on farms clustered in specific zones with favorable climates and soils and water. Examples are citrus and bananas in the hot areas of the coast; and tomatoes in well-watered areas mainly in the interior and near highways. The combination of similar FV consumption patterns all over Tanzania (Ijumba 2021) combined with FV-growing farms (apart from green leafy vegetables) producing in specific “lead zones” has meant that these commercial FV zones send FV all over the country in long supply chains. An example is the clusters of irrigated tomato farms, such as in the center of the country (Morogoro-Dodoma), in the Southern Highlands (such as Iringa), and in the eastern region of Dar es Salaam, send out tomatoes to cities and rural areas all over the country. These findings are similar to what we show below for Zambia and Ethiopia, and what was found in Nigeria for the case of tomato; Liverpool-Tasie et al. 2023b).

This reality is in sharp contrast to the traditional view of FV produced in backyard gardens (an image dating from decades ago when most FV consumption was subsistence and most of the population rural and little purchased) or small bands of “peri-urban horticulture” around the few cities such as in the 1990s and 2000s in Tanzania.

c) Rapid growth in domestic value chains with a proliferation of wholesalers & public investment in wholesale markets

The long supply chains noted above feed an urban population that has been growing rapidly: from 1990 to 2020 the urban population grew 4.5-fold and went from 19 to 35% of the population (World Bank). The urban share of consumption of FV reached 60% by 2012 and nearly 100% of urban consumption of FVs comes from purchases from supply chains (Ijumba 2021). Long supply chains are not aimed only at cities. Ijumba (2021) found that nearly 60% of rural consumption of FV is from purchases and most of those purchases of a given zone are of FV (like tomatoes and onions) that are not grown in that rural zone.

Urban and rural consumers are supplied via retailers who are in turn supplied via urban and peri-urban FV wholesale markets. These markets have spread very quickly in a short time, keeping pace with rapid urbanization and income increases. The first multiple city survey of these markets was undertaken in 2023 (Ijumba et al. 2023). They found 55 FV wholesale markets in 8 cities in Tanzania, of which 31 wholesale tomatoes. Nearly all started in the past 3 decades and two-thirds of them in only the past 20 years: about 10 of those markets were started in each of the past 3 decades. 84% of the markets were started by municipal/district governments and represent important public investments in the "enabling environment" over time. Moreover, the number of wholesalers in these 31 markets nearly doubled in just the past 10 years.

5.2 Vegetables in Zambia

a) Vegetable farming and commercialization boom over a decade

First, there has been a rapid ingress of SME farmers into horticulture as well as commercial horticulture per se. Kabwe et al. (2023) shows that the share of SME farms growing fruits and vegetables jumped from 38% in 2007 to 79% in 2018; the share of SME commercial farms in the total of SME farms (growing all crops) jumped from 18 to 30% over those 10 years.

The latter implies a 1.6-fold leap in a decade in the number of commercialized farms. In absolute numbers, 664,000 started horticulture, of which 188,000 farmers entered commercial horticulture. The result was that by 2018, 1.3 million farmers produced fruits and vegetables, and 486 thousand sold them. This boom in SME commercial horticulture can be compared with the only 1.1-fold increase in maize farmers, and 1.4-fold increase in maize sellers, to 1.4 million maize farmers and 489 thousand maize sellers. Moreover, the commercial horticulture farmers are 3.8 times more numerous than cotton sellers (although cotton commercial farming dominates the debate on "cash cropping").

Second, the farming boom has involved in some cases shifting from grain farming into vegetables for some plots while staying in the traditional communal farming areas, and in other cases starting vegetable farms outside communal areas, in peri-urban areas, along rivers, and near roads to access water and transport to urban markets. These new areas became "spontaneous clusters" of vegetable farms with complementary services such as input retailers, rural traders, and truckers. They were not formed by or coordinated by large firms, any NGOs, or the government.

Third, vegetable commercial farmers early in the decade were mainly small scale; over the decade many scaled up into medium and even some large commercial farms. While there are many small farms participating, the bulk of the vegetable marketed volume is formed by medium farms. Many have sunk boreholes for irrigation both in communal and non-communal lands.

Fourth, vegetable farm output composition diversified and "climbed the value ladder" over the decade, from half tomatoes, a quarter leafy greens ("low entry costs" basic greens, cabbage and rape), and a tenth other (high value) vegetables, to two-fifths tomatoes, a quarter greens, and a quarter, other vegetables. The other tenth is fruit.

Fifth, vegetable farming has intensified. Compared with traditional off-season vegetable farming in communal villages, which relies little on inputs other than labor, the vegetable boom clusters grow vegetables with irrigation (from rivers or from the ground via boreholes and pumps) and with external inputs (seeds, including hybrid tomato seeds, fertilizer, fungicides, and insecticides to control the heavy disease pressure during the growing season).

b) Growth of midstream of the VC

Vegetable farming has commercialized with a concomitant growth in the VC midstream. There has been a shift of over time from the bulk of vegetables being home produced and consumed in rural households decades ago to the commercialized SME producers mainly selling their produce. Most is sold to urban areas such as Lusaka, a city with a metro area of 3 million, or Kitwe, a city of nearly a million, as well as a dozen other large and medium cities and to Kasumbalesa the border town in the Democratic Republic of Congo.

The great bulk of vegetables are sold through wholesale markets by wholesalers, with the great majority going to the domestic market (Tschirley and Hichaambwa 2010). The wholesale markets are crucial public goods in the rapidly expanding and already huge volume of marketed vegetables. But one should keep in mind what an achievement the markets and the wholesalers working them have made: the total sales volume jumped 4-fold in just 10 years, a massive influx that the markets handled to feed cities. Moreover, the government has upgraded the infrastructure of several large markets such as the Soweto Wholesale Market in Lusaka in the past decade.

c) Non-government drivers of the boom

Kabwe et al. (2023) outline non-governmental drivers of the boom. First has been the massive and growing demand from urban areas, and overall income growth. The urban population of Zambia tripled in 20 years from 3.5 million to 9 million. Average per capita GDP nearly doubled in 2 decades from 774 (constant USD) in 2000 to 1274 in 2021.

Second, rural nonfarm employment and migration remittances funded at least in part the start and development of SME vegetable farmers. Formal credit sources played little to no role. After starting, own savings were important to funding the farming development, such as for purchase of pumps.

Third, private input suppliers such as sellers of pumps and seeds and chemicals, and seedling producers played an important role. Government and NGO sources of these were minor or nil.

Fourth, there was little role played either by NGOs or donor schemes, in terms of the share of total vegetable output affected, and no role by multinational firms, except for supermarket chains buying a small share of the vegetables. It was a “grass roots”, SME-driven spontaneous undertaking.

d) Government investment and policy drivers of the boom

Kabwe et al. (2023) outline several public sector drivers of the above boom. First, clusters of farms, seedling nurseries, wholesalers, and truckers spontaneously formed in the main vegetable areas near cities and rivers and main roads, there was no “management” of those clusters by government. Moreover, there were no government subsidies of any kind for the vegetable boom, not for pumps, nor inputs, nor land.

Second, however, government investment in infrastructure was crucial, in particular in rural electrification (important for pumps), wholesale markets, and roads. But the government National Agricultural Research System (NARS) has so far played little role in the vegetable boom. The hybrid tomatoes were the main varietal innovation and those were adopted from foreign seed sources. There was also little role of public extension services as the latter are focused on foodgrains in Zambia.

5.3 Vegetables in Ethiopia

a) Ingress of small and medium farmers and boom structure

Minten et al. (2020) present survey findings regarding a vegetable farming boom in the Rift Valley of Ethiopia. They showed rapid entry of SME farmers and growth of output and commercialization. A “spontaneous cluster” developed of vegetable farms, wholesalers, input retailers, and outsource agricultural services. This cluster mainly supplies the huge Addis Ababa market, with none of the products exported; moreover, the Addis vegetable market is mainly supplied by this cluster. The main findings are as follows.

First, there was a rapid increase in vegetable production in the 2010s in the Rift Valley. The boom was driven on the supply side by private (farmer) investment in pump irrigation. The irrigated area in the cluster more than doubled over a 10-year period.

Second, while 40% of the area is operated by small farms, almost 60% of the vegetable area is cultivated by medium-scale tenant (land renting) farmers who produce 70% of the vegetable output of the cluster. The medium farms cultivate on average almost 5 hectares of vegetables. The area operated by the medium farmers tripled over the decade, pointing to concentration in farming.

b) Conduct: value ladder and technological change (intensification)

Minten et al. (2020) found that the small farms in this cluster, as shown for Zambia above, specialize in “easy entry” (low investment) green leafy vegetables such as Ethiopian kale. The medium farms specialize in vegetables that require more investment, such as (high return) tomatoes. Tomatoes require more labor and spraying than do other vegetables like onions. But tomatoes and onions are both higher value and have higher production costs than leafy greens, so medium farmers grow the two former items.

Second, the farms in the cluster have undertaken rapid intensification of production, with large investments in pump irrigation, purchase of seedlings, fertilizers, and pesticides. Farming costs for the medium farmers were twice those for small farmers of vegetables. But these costs are about 10 times more than costs for producing staple grains and thus there are significant entry costs. The great majority of seeds, including hybrid seeds, as well as pesticides, are from private agro-dealers (with the government supported cooperatives playing a small role). Fertilizer is bought mainly from the cooperatives.

Pump ownership a decade before was about half by the farmers themselves; a decade later three-quarters were owned by the farmers themselves. The pumps are mainly imported from China. Minten et al. (2020) cite Hossain (2009) who noted that the availability of cheap pumps (imported) was crucial to the intensification and yield increase of rice in Bangladesh. Minten et al. note the similarity with the drivers of the vegetable boom in Ethiopia.

c) Booms in the midstream of the agricultural services and output value chains

First, driven by the medium farmers requiring heavy inputs of labor and inputs, combined with their assets constraints (equipment and skills), SME outsource services have rapidly developed and sell the farmers the following: (1) equipment and labor teams (managing migrant labor) for digging wells and ponds; (2) mechanized plowing; (3) planting seedlings; (4) applying chemicals; (5) harvesting; (6) loading of trucks; (7) marketing. This is similar to “one-stop-shop” outsource services in mango areas in Asia (e.g., for Indonesia, Qanti et al., 2017).

Second, the commercialized SME farmers in the cluster market the great majority of their vegetables to urban areas, especially to Addis Ababa, a city of 5 million. In Ethiopia, the great majority of vegetables are sold through wholesale markets by wholesalers. The wholesale markets are crucial public goods in the rapidly expanding and already huge volume of marketed vegetables.

d) Non-government drivers

First, of fundamental importance to the vegetable boom in the Rift Valley has been the large and growing demand from urban areas, and overall income growth. The urban population of Ethiopia nearly tripled in 20 years from 10 million to 26 million. Average per capita income in Ethiopia has nearly doubled in 2 decades: Ethiopian GDP/capita more than tripled from 262 (constant USD) in 2000 to 852 in 2021.

As one can predict from Bennett’s Law, with such rapid increase in income/capita, the FV share in consumption baskets doubled over 10 years, from 4.5% in 2006 to 9% in 2016. FV consumption per capita increased 1.3-fold in urban areas and 1.4-fold in rural areas between 2011 and 2016. In the case of Addis Ababa, 19% of the food basket was going towards vegetables in 2020, significantly higher than national levels. In 2020, per the survey in Minten et al. (2020), almost three-quarters of the four main vegetables in Addis Ababa were procured from the Rift Valley vegetable cluster.

Second, there was a major role by private input suppliers such as sellers of pumps and imported seeds and chemicals, and seedling producers. The outsource services noted above were major facilitators of the boom.

Third, factor markets have played major roles. On the one hand, there has been a major influx of intra-Ethiopian migrant labor into the vegetable cluster. About 4300 workers are employed in the cluster. On the other hand, land markets especially for rental land have been crucial as many medium farmers entered by renting land.

Fourth, there was very little role played either by NGOs or donor schemes, nor by microcredit institutions or banks. It was a "grass roots", SME-driven spontaneous undertaking.

Fifth, the natural and constructed context was favorable to the rise of the cluster. The Central Rift Valley is near lakes and crossed by rivers and endowed with shallow water tables, all good for irrigation. The area is on a good road and a three-hour drive to Addis Ababa. It is close to three major secondary cities. The area's climate zone (sub-tropical semi-arid) is good for vegetable farming when irrigation water is available.

e) Government's role

First, there was no "management" of that cluster by government or any entity. Moreover, there were no government subsidies of any kind for the vegetable boom, not for pumps, nor inputs, nor land.

Second, government investment in infrastructure has been crucial, in particular in rural electrification (important for pumps), ICT infrastructure, wholesale markets, and roads (Dorosh and Minten, 2020).

Third, the government National Agricultural Research System (NARS) played little role in the vegetable boom. Hybrid tomatoes were the main varietal innovation and those were adopted from foreign seed sources. There was also little role of public extension services as the latter are focused on foodgrains in Ethiopia.

6. CONCLUSIONS AND POLICY IMPLICATIONS

This paper showed that despite the incontrovertible facts that SSAs under-consume nutrient dense fruits and vegetables (FV) and animal products (AP), and the farm production and supply chains of these products are fraught with constraints that keep them from operating optimally, there is abundant recent evidence of dynamism in these sectors. To wit: (1) consumption of these products in levels and shares is already substantial and growing rapidly; (2) supply of these products is growing rapidly, just not yet much faster than population growth; (3) supply growth is manifested in a number of countries by dynamic "meso booms" with diffusion of farming and growth in midstream VC segments. We reviewed recent survey-based evidence of these booms and discussed the drivers of them. That leads to policy implications as follows.

First, the policy debate itself has to "refresh" and take into account the dynamism that already exists along value chains across Africa where the enabling conditions are present. The policy debate also needs to recognize that this dynamism is "grass roots", that is, it is a product mainly of domestic SME farms and midstream enterprises investing vigorously and spreading and growing. There is little need to

“reinvent the wheel” based on what we contend is a myth that there is a missing middle, that growth is absent. Rather, transformation is afoot and rapid, spontaneous clusters are emerging over the past several decades, and the middle is not missing but rather is a “hidden middle.” (Reardon 2015).

Second, the SME farms and midstream firms discussed in the cases presented were responding to the enormous pull of both urban and rural demand of consumers to purchase FVs and APs. We contend that demand is the builder of both incentives and eventually capacity for this supply response and we emphasize the massive domestic market opportunity in SSA fueling these booms.

Third, there was a fascinating consistency over the five case studies (and more that we did not have space to include) in the elements of the enabling environment of the meso booms. Important is what was consistently absent; i.e., the direct “hand” of the government actually starting and managing the clusters, or the hand of NGO microcredit actions or contracts and help from large companies, or government subsidies, or special economic zones or “agroparks”.

Rather, government investment was always an important context and foundation of the booms: government investment usually at the district and municipal level (not national level) in wholesale markets; national government investment in roads and in some cases electrification; in some cases government investment in NARS providing adapted breeds of cows and varieties of tomatoes. Not directly noted was government provision of a modicum of security at least for the immediate clusters. We did not discuss policies of certification and registration because the great majority of the actors in all segments of these chains were informal and small to medium.

There is much left out of this paper and much still to do in research; the most glaring and promising ones follow. First, there is more research to do to study these spontaneous clusters in the meso booms from the perspective of “empirical industrial organization”, understanding their effects on the efficiency of value chains bringing food to consumers, on consumer pricing, on sector restructuring, and on the development of “relational contracts” between these SME clusters and small farms (Macchiavello et al. 2022; Liverpool-Tasie et al. 2020) as well as their resilience to climate shocks and violent conflict (Reardon and Zilberman, 2018; Vargas et al. 2023).

Second, there is research to do on what might be constraining the further growth and proliferation of these meso supply booms such as input costs and transaction costs. That would also help to point the way to further development of policies and public investments.

Third, there is more research to do on the implications for employment of youth and women and alleviation of poverty by these growth cases, including how “inclusive” they are of the asset poor in these areas, and what conditions their degree of inclusion.

Fourth, there is more research to do on food safety and hygiene, as well as environment issues facing these clusters and the existing and potential institutional arrangements that could improve on the ability of these clusters to be an environment where affordable, safe and nutritious foods could be accessed by consumers. These crucial issues could imply important trade-offs between food quality, environment-friendly practices and affordability of and access to food, that requires further research to assess the dynamic growth seen on merits against these multiple food system objectives.

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ACKNOWLEDGMENTS

This work is part of the CGIAR Research Initiative on Rethinking Food Markets and Value Chains for Inclusion and Sustainability. Launched in January 2022, the Rethinking Food Markets initiative is a collaborative effort of seven CGIAR centers, including the International Food Policy Research Institute (IFPRI), the Alliance of Bioversity International and the International Center for Tropical Agriculture (Alliance Bioversity-CIAT), the International Institute of Tropical Agriculture (IITA), the International Maize and Wheat Improvement Center (CIMMYT), the International Center for Agricultural Research in the Dry Areas (ICARDA), International Water Management Institute (IWMI), and WorldFish. The initiative further collaborates with national and international partners to leverage innovations and policies that improve the functioning of food markets and value chains in order to address food insecurity and malnutrition, reduce poverty and income inequality, and minimize food systems' ecological footprint.

The initiative is currently undertaking research testing the effectiveness and scalability of market and value chain innovations in seven countries in Africa, Asia, and Latin America. In partnership with the ISEAL Alliance, the initiative has further launched the Knowledge Platform for Inclusive and Sustainable Food Markets and Value Chains (KISM) to help farmer organizations, food businesses, governments, and practitioners make better-informed investment and policy decisions on inclusive and sustainable food value chains. The Initiative's leadership thanks all funders for supporting this research through their contributions to the CGIAR Trust Fund, and in particular also the Bill and Melinda Gates Foundation for

designated funds received. Barry Popkin is grateful to the Global Food Research Program at the University of North Carolina Chapel Hill for financial support.

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