Capacity Development for Modernizing African Food Systems (MAFS) Working Paper

Food System Dynamics: Projecting Changes in Food Demand in East and Southern Africa through 2040

By

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The Modernizing African Food Systems (MAFS) Consortium

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Objective: The MAFS Consortium aims to help African agricultural education and training (AET) institutions develop the technical skills and institutional capacity required to modernize African food systems.

MAFS Consortium Members:

- Makerere University
- Michigan State University
- Stellenbosch University
- University of Pretoria

Activities and Outputs: The MAFS Consortium has assembled a technical team from four major agricultural universities to produce a series of empirical background studies that will provide evidence necessary for informing capacity development efforts in African AET institutions. Substantively, the activities center around the following four thematic areas.

Theme 1. Food System Dynamics in Africa and Consequent Skill Requirements in the Private and Public Sectors
Theme 2. Models of AET Engagement with Private and Public Sector Employers
Theme 3. Existing Capacity of African AET:
Case studies of African universities with
regional footprints
Theme 4. Impact of past AET institution-building efforts in Africa

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1. Introduction

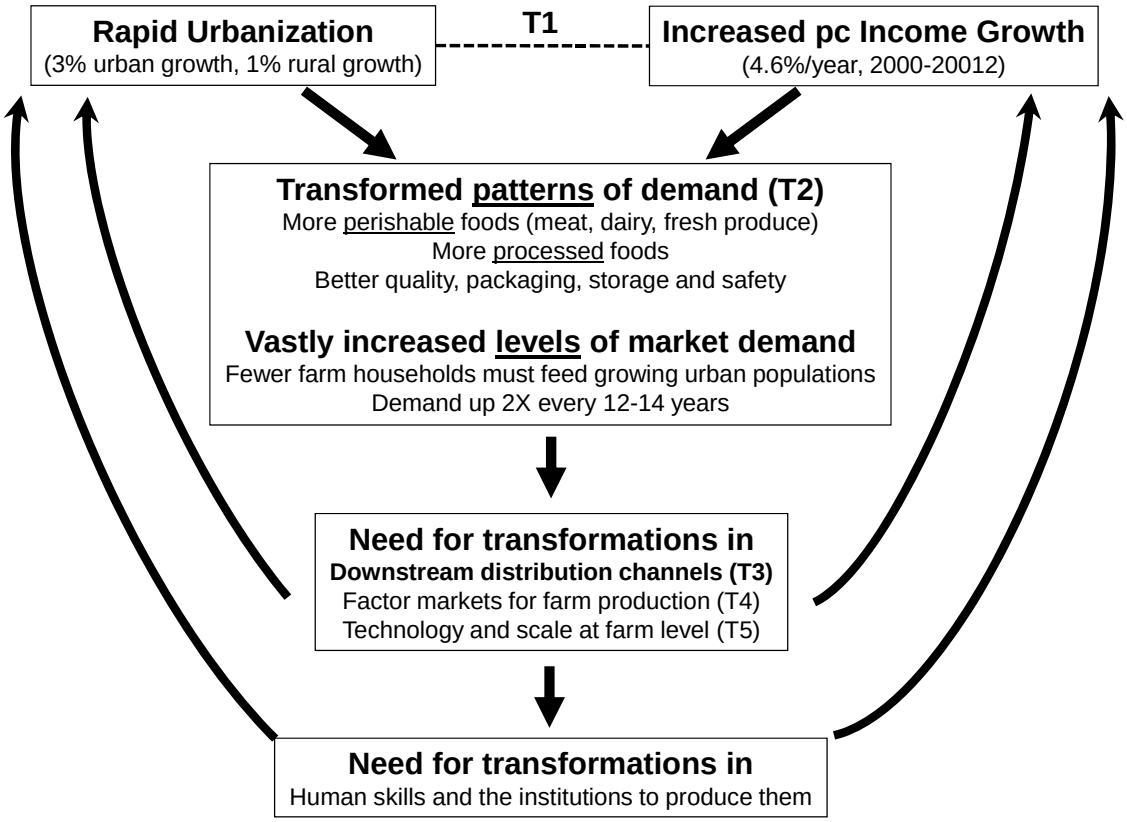
Sub-Saharan Africa (SSA) has been rapidly urbanizing for many years. Current estimates from the UN are that urban population growth in East Africa is over 4% per year, while in Southern Africa, which has higher urbanization levels, the growth is estimated at 2%. Overall in East and Southern Africa (ESA), urban populations in the region are growing about 3% per year, but with great variability as these figures indicate. Rural populations, meanwhile, are estimated to be increasing only by 2% per year in East Africa and near zero in Southern Africa. Across ESA, rural populations are rising about 1% per year but again with much variation across countries and regions.

Prior to the late 1990s, this rapid urbanization was occurring without the growth in per capita incomes that usually accompanies it. Since that time, however, SSA's macroeconomic performance has improved dramatically, with average growth of nearly 5% per year in real per capita incomes. Since 1998, per capita income growth in SSA has *exceeded* that in every area of the world except for developing East Asia and South Asia, and it did not lag those regions by large margins.

The continent is also projected by the United Nations (UN) to continue urbanizing faster than any other in the world, with the urban population share nearly doubling from its current 26% to 51% by 2040. This growth will represent a catching-up to areas of the world that are more urbanized (have a larger share of their population living in rural areas) but less rapidly urbanizing (that share is growing less rapidly): East Asia, where the urban share is projected to rise from 54% to 76%, South Asia (32% rising to 47%), and Latin America and the Caribbean (79% rising to 85%).

This combination of high rates of urbanization and rapid income growth, maintained over time, results in dramatic changes in consumption – a diet transformation (Figure 1). This transformation is in the patterns of consumption – what people eat – and the level of consumption. With rising incomes and urbanization households eat more, they eat more fresh perishable and more processed foods, and this together with the growth in numbers of people delivers explosive growth in some types of foods (meat, dairy, some fresh produce items, wheat and wheat products, many new highly processed items), slow growth or even decline in others (maize and other coarse grains, roots and tubers), and vast increases over time in the total amount of food that the

Figure 1. Transformation of developing country food systems: drivers, characteristics, and needed responses



Note: data on population and income growth are for developing Sub-Saharan Africa, World Bank. Income growth is per capita GNI in purchasing power parity terms

system has to produce, process, and distribute. It also drives greater demand for convenience, perceived quality and, eventually, perceived safety of the foods being consumed.

This paper explores this topic. We first describe recent food consumption patterns in East and Southern Africa, taking advantage of household level income-expenditure data sets in Mozambique, Tanzania, Uganda, Ethiopia, and South Africa. We highlight differences across countries, across rural-urban residence, and across levels of income. By including South Africa in the analysis – a country with far higher incomes and much greater transformation of its food system than its neighbors to the north – we develop initial expectations regarding how patterns in other countries of the region might change over time. We then present the Rest of Africa Maize Mixed food staple zone (FSZ) and describe current average consumption patterns of households at differing income levels across that zone. This becomes the basis for the simulation model that we use to project scenarios of diet change over the next 30 years across the zone. In the final section we discuss other qualitative changes in demand likely to occur over the next 30

years that were not incorporated into the projection model, and anticipate the rate at which they will occur.

2. Current Food Consumption Patterns in ESA

The countries of ESA are Namibia, South Africa, Swaziland, Lesotho, Botswana, Zimbabwe, Mozambique, Zambia, Malawi, Tanzania, Burundi, Rwanda, Kenya, Uganda, South Sudan, and Ethiopia. We present data on recent food consumption patterns in five of these countries that account for two-thirds of the region's population: South Africa, Mozambique, Tanzania, Uganda, and Ethiopia. Table 3.1 presents income and population data for each of these countries. Annual per capita purchasing power parity incomes in all but South Africa lie within a narrow range of $920 to $1,420, and urban population shares are all 31% or lower. South Africa stands out with a mean income roughly 10 times that of the others and an urban population share of over 61%.

Table 1. Population and income data for countries of ESA for which LSMS data is analyzed in this report

Country	Population (2010; '000s)	% Urban Population	Mean Purchasing Power Parity income, 2010 (World Bank)
South Africa	Rural: 19,278 Urban: 30,855 Total: 50,133	61.5%	$10,280
Mozambique	Rural: 16,149 Urban: 7,241 Total: 23,390	31%	$920
Tanzania	Rural: 33,057 Urban: 11,784 Total: 44,841	26.2%	$1,420
Uganda	Rural: 28,358 Urban: 5,067 Total: 33,325	15.2%	$1,240
Ethiopia	Rural: 69,050 Urban: 13,900 Total: 82,950	16.8%	$1,030

Figures 2 and 3 show mean food expenditure shares in the five countries with two unique aggregations of consumed foods. Figure 2 classifies all production items collected in the LSMS surveys by consumed own production or purchased, then classifies purchased items by processing level: unprocessed (e.g. whole maize grain or cassava), processed in small-scale informal establishments (e.g. dried cassava), and two levels of processing in larger-scale processing facilities[1]. An example of the "formal

[1] See the methodological document for a mapping of all food items from the LSMS surveys into these categories.

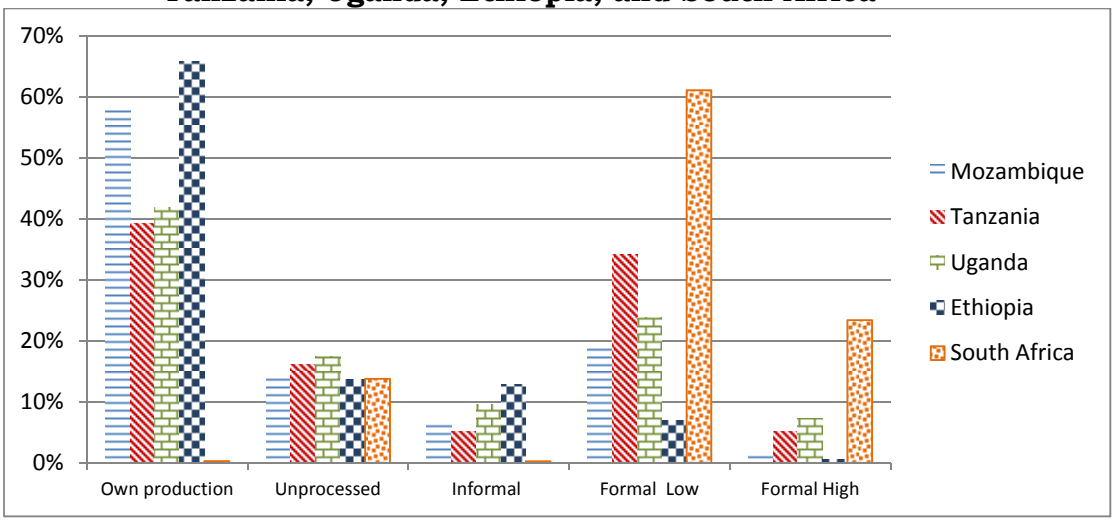
low" category is maize meal, nearly all of which in the region is processed in large-scale mills but which does involve much value-added. Examples of the "formal high" category are breakfast cereals, canned or bottled beverages, and others whose processing and packaging involves much more value added. Figure 3 groups all foods into seven food groups. The values in each graph are the % of total expenditure on food that is spent on the various categories of food. Henceforth we refer to these as our food item groupings, by processing level and by food group.

Focusing first on the four countries other than South Africa, five points stand out. First, consumption from households' own production takes the largest single share in every country, reflecting primarily the large percent of households that live in rural areas and also some consumption from own production among the urban poor. Second, given that food consumed out of own production is considered unprocessed[2], between about 50% (Tanzania) and 80% (Ethiopia) of all food expenditure is on unprocessed food in the four countries. Third, formal processing dominates informal in three of the four countries; only in Ethiopia does informal predominate. In all countries, however, the formal processing is largely of low value-added items; shares of the "formal high" category range from about 1% to 11%, compared to 7% to 31% for "formal low."

Fourth, starchy staples (cereals, roots, and tubers) occupy from nearly half to more than half of all expenditures in all four countries. Finally, animal sources of protein (meat, milk, eggs, and fish) have the second highest budget share in every country, but lie well below 20% in all cases – typically about one-third the level of starchy staples. These patterns are all expected, given what we know about the still low urbanization and income levels of these countries. The one pattern that might be considered surprising is the minimal share of informally processed foods, but this result is driven largely by the importance of maize meal in the diet in these countries and the long-established market penetration of large milling companies in that sector.

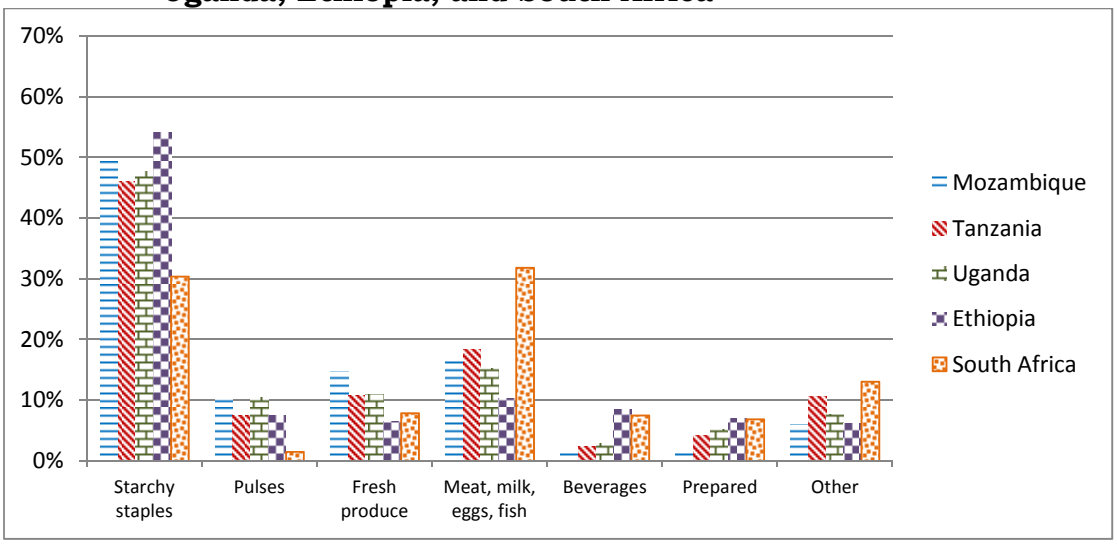
[2] If it is processed at home, this would typically involve simple physical transformation done by hand with without addition of additives.

Figure 2. Food budget shares by processing level in Mozambique, Tanzania, Uganda, Ethiopia, and South Africa



Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia.

Figure 3. Food budget shares by food group in Mozambique, Tanzania, Uganda, Ethiopia, and South Africa



Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia.

South Africa (the right-most bar in each grouping in the two figures) provides a stark contrast. Perhaps the most dramatic shift regards consumption of processed foods: informal processing nearly disappears, both types of formal processing more than double relative to its poorer neighbors, and overall, consumption of processed items increases to an 85% budget share, from a range of 20% (Ethiopia) to 47% (Tanzania) in the other countries. Consumption of own production also nearly disappears. While this may be reflect some data collection errors, the direction of change is fully expected, based on the low rural population share in RSA and the

heavy market reliance among these rural households, which is driven by the fact that their incomes are far higher than rural residents in the other countries.

The type of commodities consumed also differs greatly between South Africa and the other countries. Food budget shares for starchy staples and pulses are sharply lower, they are slightly lower for fresh produce, and budget shares for proteins (meat, milk, eggs, fish) are about double those in the other countries. While not a blueprint for the future of the other countries, patterns in South Africa are consistent with widely observed patterns in other areas of the world as incomes rise, and do provide a window into the direction of change of consumption patterns in these other countries.

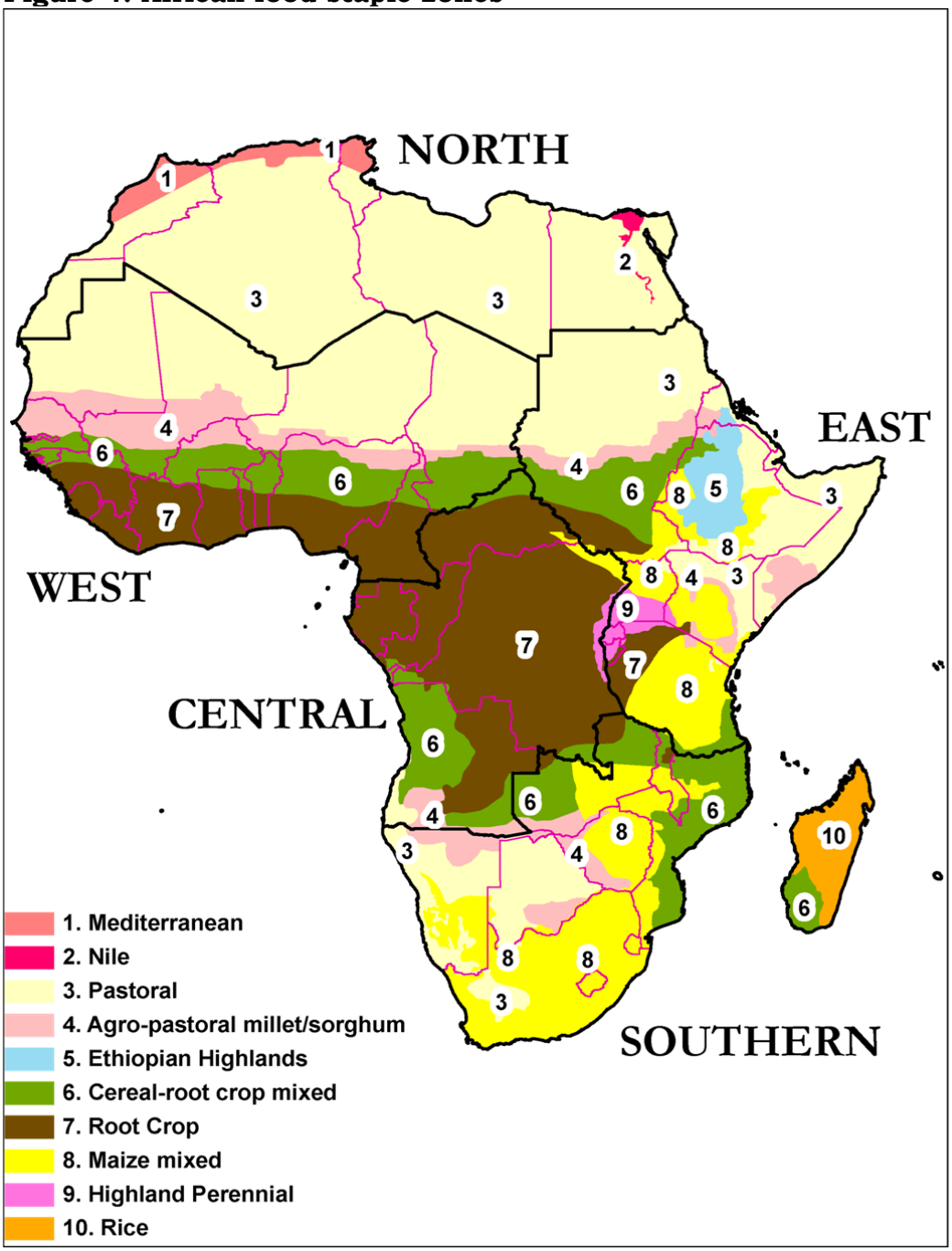
3. The "Rest of Africa" Maize-Mixed Food Staple Zone

Staple consumption patterns vary across the continent depending in part on agro-ecological conditions and related cropping patterns, influenced also by history.[3] For example, the share of maize in total food consumption ranges from 3% to only 6% in West and Central Africa, but from 11% to 21% in East and Southern Africa. Cassava's share ranges from 21% to 44% in West, Central, and East Africa but is only 6% in Southern Africa and 3% in the Sahel. Yam consumption shares are well over 10% in Coastal West Africa, Nigeria, and the Horn of Africa, but nowhere else on the continent do they exceed 1%. We have systematized these differences to define 10 "Food Staple Zones" across the continent (Figure 4; Haggblade et al. 2012). These sharp differences in staple consumption patterns suggest that the trajectory of change in consumption patterns may also differ across zones. Understanding what these differences might be and what they might imply for the types of skills that are needed is one important element in any forward-looking exercise.

The Maize Mixed FSZ is the largest in ESA, both spatially and in terms of population. In 2010, this FSZ held 49% of the region's population, with no other zone holding more than 17%. Major cities of the region, including Maputo, Lusaka, Blantyre and Lilongwe, Dar es Salaam, and Nairobi all lie within this FSZ. We therefore focus on this zone in this analysis, and use it to highlight how current consumption patterns differ widely by whether a household resides in urban or rural areas, and by the households' level of income. In what follows, we use LSMS data from the four poorest countries in Table 1 (all but South Africa) to characterize consumption patterns in this FSZ, calling it Rest of Africa Maize Mixed to highlight that we are not doing the

[3] For example, while much of southern Africa receives too little rainfall to be optimal for maize, it is a dominant staple due to historical factors related to its introduction during the colonial era.

Figure 4. African food staple zones



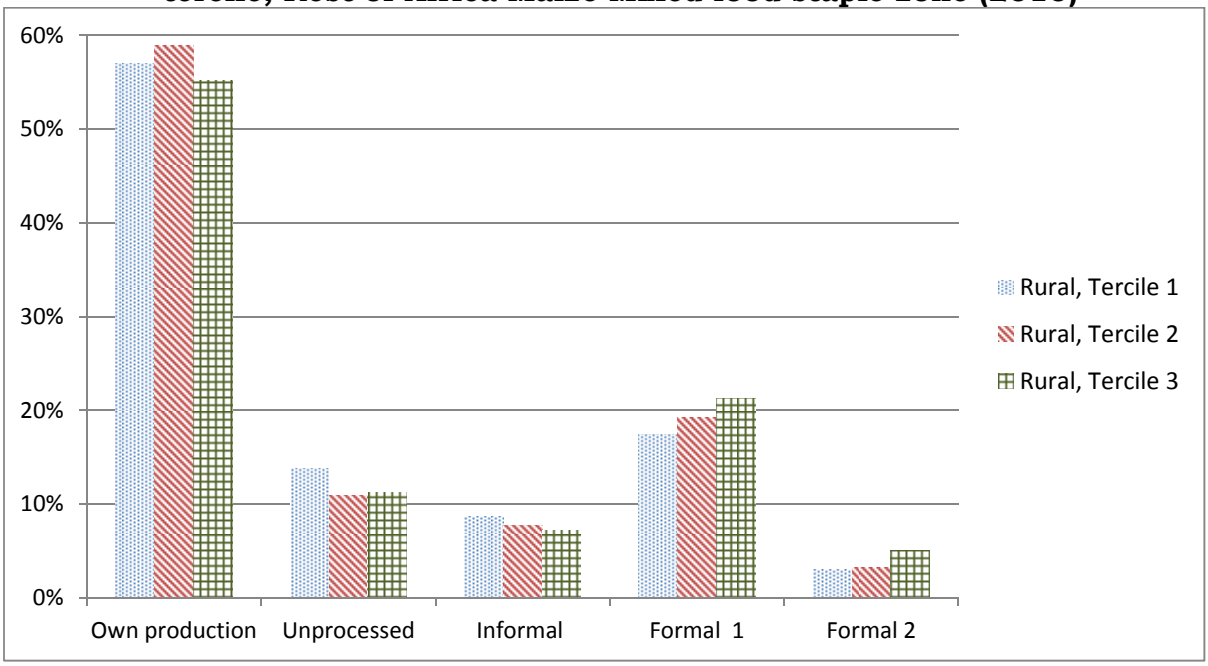
Source: Adapted from FAO (2000). www.**fao.org**/docrep/x8200e/x8200e05.htm

projections for South Africa. From each data set we use only those households who reside in this FSZ, as shown in the map, and we weight all results by population. Though not strictly statistically representative of the zone, the portion of the population in these countries that resides in this FSZ accounts for 52% of the total population of the FSZ, and is spread over the FSZ from far south (southern Mozambique) to far north (Ethiopia). Figures 5-8 present food budget shares across income terciles of these four

countries, using the same food classifications as described above. Terciles first order all households from lowest to highest income, then divide all households into three groups, each with one-third of the total population. Tercile 1 has the lowest incomes, while tercile three has the highest. Figures 5 and 6 focus on rural households, while Figures 7 and 8 focus on urban households.

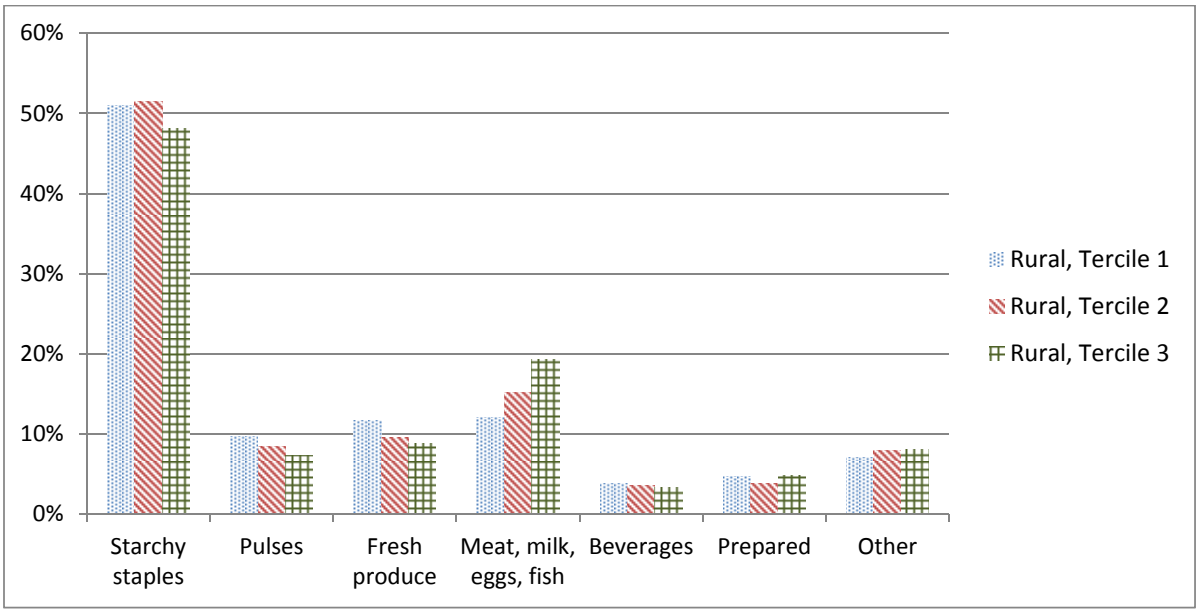
Two patterns stand out in rural areas. First, budget shares fall slightly as incomes rise for consumed own production and, among purchased items, for unprocessed food and informally processed food. Shares rise consistently with income for formally processed foods, whether of low- or high value added (Figure 5). The percentage rise in the third tercile is especially strong for high value added formal processing, but the shares on these items remain low. Second, across food groups, budget shares fall with rising incomes for starchy staples, pulses, and fresh produce, rise slightly for beverages and other foods, and rise sharply for animal protein sources and for prepared food consumed away from home (Figure 6). Overall, starchy staples consumed out of own production dominate even for the richest one-third of rural households (the top tercile).

Figure 5. Rural food budget shares by processing level and income tercile, Rest of Africa Maize Mixed food staple zone (2010)



Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia. Results weighted by population.

Figure 6. Rural food budget shares by food group and income tercile, Rest of Africa Maize Mixed food staple zone (2010)

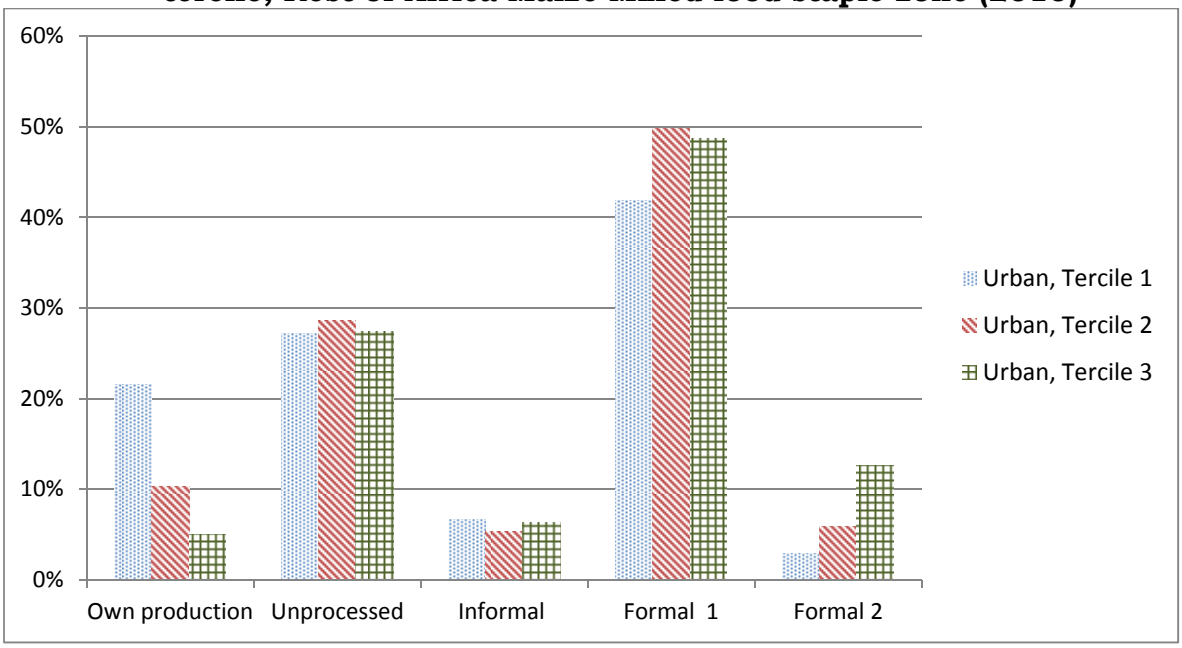


Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia. Results weighted by population.

Urban households show dramatically different consumption patterns from rural households (Figures 7 and 8). We highlight five patterns. First, formally processed foods (Formal 1 + Formal 2) dominate consumption at all income levels and rise with income. Bottom tercile households direct nearly 50% of their food spending to such foods, with this share rising to nearly 70% for top tercile households. This compares to shares of 22% to 28% in rural areas – less than half the levels in urban areas; urbanization clearly drives a sharp increase in the consumption of formally processed foods. Second, the share of processed foods with high value added rises sharply with income, from about 8% for the bottom tercile to about 33% for the top. Budget shares for low value added formally processed foods and informally processed change very little with income.

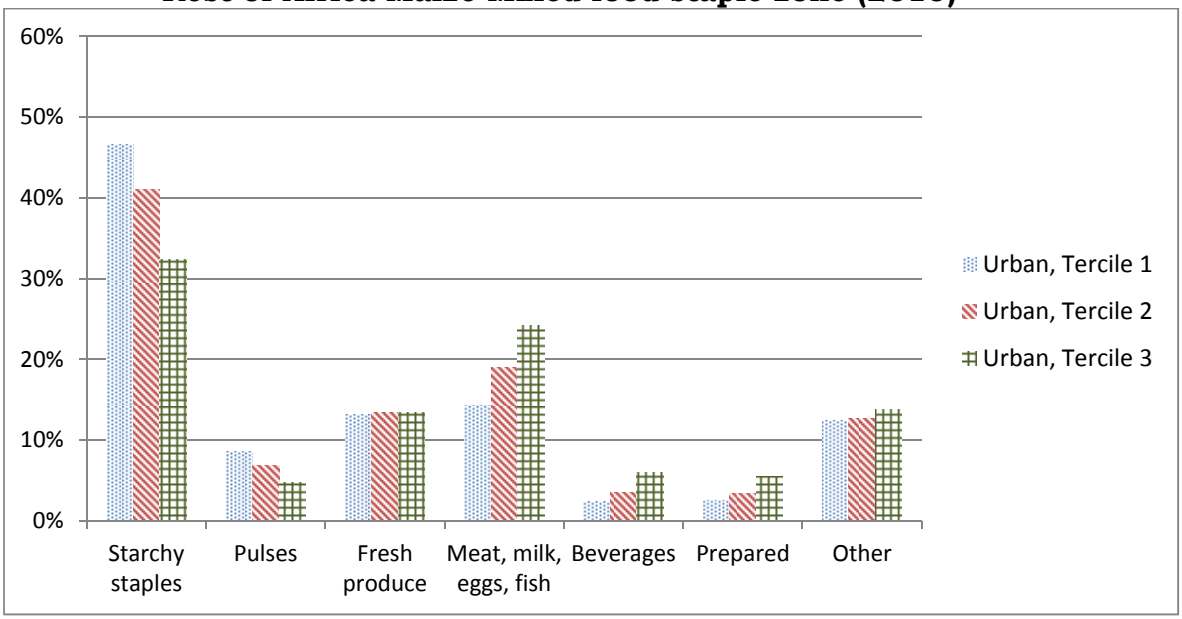
Third, consumption out of own production is important for the poorest one-third of urban residents, with a 20% expenditure share, but this drops to about 4% for the top one-third. Fourth, expenditure shares on starchy staples fall rapidly with income, while shares of meat, milk, eggs, and fish rise almost as rapidly. This latter food category absorbs the highest expenditure share of any food group among the top tercile of households. Finally, expenditure on animal protein sources nearly equals that on starchy staples among the top tercile households.

Figure 7. Urban food budget shares by processing level and income tercile, Rest of Africa Maize Mixed food staple zone (2010)



Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia. Results weighted by population.

Figure 8. Urban food budget shares by food group and income tercile, Rest of Africa Maize Mixed food staple zone (2010)



Source: Authors calculations from latest available LSMS data sets. Years are 2002/03 and 2008/09 for Mozambique (pooled), 2008/09 and 2010/11 for Tanzania (pooled), 2009/10 for Uganda, and 2004/05 for Ethiopia. Results weighted by population.

The changing consumption patterns seen today across rural and urban areas, and across income terciles, provide a window into future consumption patterns in the region. Examining today's consumption patterns in South Africa provides another such window, since the shifts across income levels within these four countries are quite similar to what we see when comparing mean values for those countries against South Africa.

4. The Projection Model

This section provides a non-technical overview of the projection model; for detailed information on the development and structure of the model, see the separate methodological report.

4.1. Structure and Data

The model projects the evolution of average food budget shares and total expenditure over the dimensions discussed above: processing level and food group. The food groups used in the projection, however, are more disaggregated than those above, with 23 groupings rather than seven. See the methodological paper for the listing and definition of all groups. All projections are broken down by rural/urban and, within each, by income tercile. Terciles are computed separately for urban and rural areas. The structure of the model is shown in Figures 9 and 10. This portion of the paper explains those components and the data and calculations that went into them.

The share of each country in the FSZ's total population: We computed these figures using Landscan shape files on spatial population distribution, overlayed on a GIS file of FSZ boundaries created by GIS specialists in MSU's Food Security Group. These figures were then used as weights in combining all country-level data into FSZ level estimates.

Food item aggregations: As explained above, we used two types of grouping: by processing level and by food group. Processing level groups are as follows:

- Own Production: Consumed food items that were produced by the individual consumer;
- Unprocessed foods: Food items such as maize grain or fresh fruits or vegetables that were purchased in unprocessed form. Our definition of processing involves any physical transformation of the commodity, from simple milling of maize grain into maize meal through to high value added products such as soft drinks, beer, breakfast foods, and others;

Figure 9. Structure of consumption projection sheet (1)

Scenario	Rest of Africa Maize Mixed						
FSZ:	Rural - Tercile 1						
Expenditure Growth rate:	6%						
Inequality:	0.67						
Urban Bias:	0.67						
	Rest of Africa Maize Mixed						
	2010	2015	2020	2025	2030	2035	2040
Population							
Rural	93,007,558	103,762,283	114,890,677	125,513,624	135,644,875	145,196,315	154,079,217
Urban	31,003,697	38,383,269	47,609,194	58,809,753	72,395,287	88,708,246	107,903,419
Total	124,011,255	142,145,552	162,499,872	184,323,377	208,040,162	233,904,561	261,982,636
Pc Expenditure quintiles							
National	Per Capita Daily Expenditure						
tercile 1	$0.68	$0.99	$1.44	$2.10	$3.04	$4.39	$6.34
tercile 2	$1.34	$1.84	$2.53	$3.48	$4.77	$6.52	$8.90
tercile 3	$3.68	$4.79	$6.23	$8.08	$10.47	$13.55	$17.49
Rural							
tercile 1	$0.62	$0.94	$1.42	$2.15	$3.26	$4.96	$7.54
tercile 2	$1.14	$1.62	$2.30	$3.27	$4.65	$6.62	$9.46
tercile 3	$2.75	$3.64	$4.84	$6.42	$8.53	$11.34	$15.11
Urban							
tercile 1	$0.88	$1.18	$1.56	$2.06	$2.74	$3.64	$4.85
tercile 2	$1.93	$2.46	$3.13	$3.97	$5.04	$6.42	$8.20
tercile 3	$6.46	$7.81	$9.47	$11.48	$13.92	$16.90	$20.56
LSMS Country Represented							
Ethiopia	23.97%	23.32%	22.56%	21.77%	20.92%	19.99%	19.05%
Mozambique	5.92%	5.79%	5.65%	5.53%	5.40%	5.25%	5.10%
Tanzania	39.59%	39.86%	40.31%	40.77%	41.27%	41.87%	42.55%
Uganda	30.52%	31.03%	31.48%	31.93%	32.42%	32.89%	33.30%
Expenditure elasticity of demand							
By processing level							
Own production	1.40	1.26	1.12	0.99	0.85	0.71	0.57
Unprocessed	0.62	0.60	0.57	0.54	0.51	0.48	0.46
Informal	1.01	0.90	0.78	0.67	0.56	0.45	0.33
Formal 1 (was 1&2)	0.98	0.93	0.88	0.83	0.79	0.74	0.69
Formal 2 (was 3)	2.04	1.87	1.71	1.55	1.39	1.23	1.06
Non-food	1.05	1.07	1.08	1.10	1.11	1.13	1.14
By commodity type							
Wheat products	2.33	2.01	1.69	1.38	1.07	0.75	0.43
Maize & maize products	0.99	0.86	0.74	0.62	0.49	0.37	0.25
Sorghum plus millet & other cereals	1.02	0.98	0.94	0.90	0.86	0.81	0.77
Rice (Milled Equivalent)	2.23	1.92	1.63	1.33	1.03	0.73	0.43
Cassava	-0.21	-0.20	-0.19	-0.18	-0.16	-0.15	-0.14
Yams, potatoes, other roots and tubers	1.24	1.10	0.96	0.81	0.67	0.53	0.38
Plantains	1.19	1.02	0.86	0.70	0.54	0.38	0.22
Sugar and sweets	1.26	1.12	0.99	0.86	0.73	0.59	0.46
Pulses	1.28	1.12	0.95	0.79	0.63	0.46	0.30
Oilcrops and vegetable oils	1.31	1.16	1.02	0.87	0.72	0.58	0.43
Staple veggies (tomato, onion, green leafy, cabbage	1.05	0.94	0.84	0.73	0.62	0.52	0.41
Other veggies (okra, green beans)	-0.20	-0.07	0.06	0.19	0.31	0.44	0.57
Fruit	1.38	1.32	1.27	1.21	1.15	1.10	1.04
Non-alcoholic beverage (tea, coffee, cocoa, juices, s	1.29	1.20	1.11	1.03	0.94	0.85	0.76
Alcoholic beverages (beer, wine, spirits, fermented	0.79	0.84	0.89	0.94	0.99	1.04	1.09
Beef, fresh and frozen	1.60	1.51	1.42	1.33	1.24	1.15	1.05
Poultry, fresh and frozen	1.77	1.59	1.42	1.25	1.08	0.90	0.73
Meat, Other fresh including offals	1.78	1.64	1.50	1.37	1.23	1.09	0.96
Milk & animal fats	1.21	1.12	1.03	0.94	0.85	0.77	0.68
Eggs + (Total)	2.30	2.05	1.81	1.57	1.33	1.09	0.85
Fish	0.85	0.80	0.76	0.71	0.66	0.62	0.57
Prepared foods consumed away from home	1.80	1.72	1.64	1.56	1.48	1.40	1.33
Other foods (spices, treenuts,	0.45	0.53	0.61	0.68	0.76	0.84	0.92

Figure 10. Structure of consumption projection sheet (2)

Starting Avg Budget Shares (of totexp)							
By processing level							
Own production	39.57%	43.13%	45.57%	46.91%	46.98%	45.58%	42.48%
Unprocessed	9.63%	7.85%	6.44%	5.29%	4.34%	3.57%	2.94%
Informal	6.04%	5.68%	5.23%	4.70%	4.12%	3.51%	2.88%
Formal 1 (was 1&2)	12.12%	11.24%	10.41%	9.65%	8.95%	8.31%	7.74%
Formal 2 (was 3)	2.15%	3.05%	4.12%	5.40%	6.89%	8.54%	10.20%
Non-food	30.48%	29.06%	28.23%	28.06%	28.72%	30.48%	33.76%
By commodity type							
Wheat products	1.00%	1.77%	2.61%	3.43%	4.06%	4.32%	4.07%
Maize & maize products	17.06%	16.41%	15.04%	13.26%	11.28%	9.23%	7.21%
Sorghum plus millet & other cereals	5.36%	5.22%	5.00%	4.73%	4.46%	4.20%	3.93%
Rice (Milled Equivalent)	1.83%	3.06%	4.35%	5.54%	6.42%	6.73%	6.29%
Cassava	4.78%	2.88%	1.77%	1.09%	0.67%	0.41%	0.25%
Yams, potatoes, other roots and tubers	3.61%	3.86%	3.88%	3.73%	3.44%	3.03%	2.54%
Plantains	1.78%	1.86%	1.82%	1.69%	1.49%	1.25%	0.99%
Sugar and sweets	1.96%	2.10%	2.14%	2.08%	1.95%	1.76%	1.51%
Pulses	6.77%	7.37%	7.46%	7.18%	6.57%	5.71%	4.67%
Oilcrops and vegetable oils	1.74%	1.92%	1.98%	1.94%	1.83%	1.65%	1.42%
Staple veggies (tomato, onion, green leafy, cabbage	3.85%	3.80%	3.59%	3.28%	2.92%	2.51%	2.09%
Other veggies (okra, green beans)	3.18%	1.93%	1.24%	0.83%	0.58%	0.43%	0.34%
Fruit	1.08%	1.22%	1.34%	1.45%	1.55%	1.66%	1.77%
Non-alcoholic beverage (tea, coffee, cocoa, juices, s	1.37%	1.49%	1.56%	1.59%	1.58%	1.55%	1.48%
Alcoholic beverages (beer, wine, spirits, fermented	1.25%	1.11%	1.00%	0.93%	0.88%	0.87%	0.88%
Beef, fresh and frozen	1.32%	1.64%	1.93%	2.22%	2.52%	2.80%	3.06%
Poultry, fresh and frozen	1.15%	1.55%	1.90%	2.21%	2.44%	2.56%	2.54%
Meat, Other fresh including offals	1.11%	1.50%	1.87%	2.24%	2.59%	2.90%	3.11%
Milk & animal fats	2.87%	3.02%	3.05%	3.01%	2.90%	2.75%	2.53%
Eggs + (Total)	0.10%	0.17%	0.26%	0.35%	0.45%	0.53%	0.58%
Fish	1.84%	1.68%	1.50%	1.32%	1.16%	1.01%	0.87%
Prepared foods consumed away from home	3.25%	4.42%	5.70%	7.20%	8.99%	11.16%	13.67%
Other foods (spices, treenuts,	1.24%	0.97%	0.78%	0.65%	0.55%	0.49%	0.46%
Expenditure	$0.62	$0.94	$1.42	$2.15	$3.26	$4.96	$7.54
By processing level							
Own production	$0.24	$0.41	$0.65	$1.01	$1.53	$2.26	$3.20
Unprocessed	$0.06	$0.07	$0.09	$0.11	$0.14	$0.18	$0.22
Informal	$0.04	$0.05	$0.07	$0.10	$0.13	$0.17	$0.22
Formal 1 (was 1&2)	$0.07	$0.11	$0.15	$0.21	$0.29	$0.41	$0.58
Formal 2 (was 3)	$0.01	$0.03	$0.06	$0.12	$0.22	$0.42	$0.77
Non-food	$0.19	$0.27	$0.40	$0.60	$0.94	$1.51	$2.55
By commodity type							
Wheat products	$0.01	$0.02	$0.04	$0.07	$0.13	$0.21	$0.31
Maize & maize products	$0.11	$0.15	$0.21	$0.29	$0.37	$0.46	$0.54
Sorghum plus millet & other cereals	$0.03	$0.05	$0.07	$0.10	$0.15	$0.21	$0.30
Rice (Milled Equivalent)	$0.01	$0.03	$0.06	$0.12	$0.21	$0.33	$0.47
Cassava	$0.03	$0.03	$0.03	$0.02	$0.02	$0.02	$0.02
Yams, potatoes, other roots and tubers	$0.02	$0.04	$0.06	$0.08	$0.11	$0.15	$0.19
Plantains	$0.01	$0.02	$0.03	$0.04	$0.05	$0.06	$0.07
Sugar and sweets	$0.01	$0.02	$0.03	$0.04	$0.06	$0.09	$0.11
Pulses	$0.04	$0.07	$0.11	$0.15	$0.21	$0.28	$0.35
Oilcrops and vegetable oils	$0.01	$0.02	$0.03	$0.04	$0.06	$0.08	$0.11
Staple veggies (tomato, onion, green leafy, cabbage	$0.02	$0.04	$0.05	$0.07	$0.10	$0.12	$0.16
Other veggies (okra, green beans)	$0.02	$0.02	$0.02	$0.02	$0.02	$0.02	$0.03
Fruit	$0.01	$0.01	$0.02	$0.03	$0.05	$0.08	$0.13
Non-alcoholic beverage (tea, coffee, cocoa, juices, s	$0.01	$0.01	$0.02	$0.03	$0.05	$0.08	$0.11
Alcoholic beverages (beer, wine, spirits, fermented	$0.01	$0.01	$0.01	$0.02	$0.03	$0.04	$0.07
Beef, fresh and frozen	$0.01	$0.02	$0.03	$0.05	$0.08	$0.14	$0.23
Poultry, fresh and frozen	$0.01	$0.01	$0.03	$0.05	$0.08	$0.13	$0.19
Meat, Other fresh including offals	$0.01	$0.01	$0.03	$0.05	$0.08	$0.14	$0.23
Milk & animal fats	$0.02	$0.03	$0.04	$0.06	$0.09	$0.14	$0.19
Eggs + (Total)	$0.00	$0.00	$0.00	$0.01	$0.01	$0.03	$0.04
Fish	$0.01	$0.02	$0.02	$0.03	$0.04	$0.05	$0.07
Prepared foods consumed away from home	$0.02	$0.04	$0.08	$0.16	$0.29	$0.55	$1.03
Other foods (spices, treenuts,	$0.01	$0.01	$0.01	$0.01	$0.02	$0.02	$0.03

- Informal Processing: Food items that have been processed via an informal channel. This classification required judgment focused primarily

on the scale of operation. Examples include food sold by street vendors, fish dried artisanally by fishermen, or locally ground cassava;

- Formal Processing – Low: Food items which have been minimally processed through a larger-scale processing technology. This includes butchered fresh meat, breads, washed imported rice, and factory ground maize meal, among others. Meal ground in small hammer mills – if the questionnaire indicated this - was classified as informal;
- Formal Processing – High: Food items that have received higher value added in larger-scale processing. These include breakfast cereals, restaurant foods, manufactured alcoholic beverages and soft drinks, and others.

Note that there are potential differences in the processing allocation of similarly titled food items across multiple data sets. An example is sour milk. In South Africa we classified this as "Formal Processing – High" while in Mozambique we classified it as "Informally Processed", based on knowledge of how the item is primarily processed within each country.

Certain data sets include specifications of where foods were purchased for consumption and even designated foods as prepared foods for consumption away from home. We took advantage of the additional specification in these cases while in other cases we had to allocate certain items based on the food item titles which were given.

The 23 food groups are designed to generate more detailed expectations regarding the evolution of consumption patterns over time. Many food items such as maize grain or various fruits and vegetables can be easily allocated to one food group. Other items such as bread or ketchup require more explanation of the commodity groupings to properly allocate the items. Many products have multiple food ingredients that would fall into different groupings; in these instances the items are allocated according to the primary ingredient of the product. Therefore, for example, bread is put in the "wheat" group. Details are in the methodological document. A few issues of note are as follows:

- "Staple Vegetables" include tomatoes, onions, cabbages, and green leafy vegetables such as lettuce and spinach. "Other Vegetables" include all other vegetables. This distinction was based on knowledge of consumption levels of different vegetables and the dominance over many countries of these items in vegetable consumption;
- "Sweets" include candies and sugar-based items. Jams and marmalades are sweet, but are allocated within the "Fruit" grouping as their primary input is fruit;
- Although fruit and vegetable juices are non-alcoholic beverages, we allocate them according to their primary input; therefore these are "Fruit" and "Other Vegetables";
- "Prepared foods consumed away from home" was given its own group, given the impossibility of knowing what kind of food was consumed;
- Condiments were allocated to the "Other Foods" category;

- "Other Foods" is a miscellaneous category containing items that do not clearly belong to one of the other categories. Spices, soups, frozen dinners, and condiments are among the items that were placed in this category.

Population: We used rural and urban populations and projections from 2010 to 2040 from the United Nations;

Real per capita total expenditure: All expenditure values are in real per capita US dollars in purchasing power parity terms, using constant 2005 international dollars. When the latest data for a given country are prior to 2010, expenditure values are brought to 2010 levels using an assumed annual growth rate of 2%. A two-step process was used to calculated these numbers for each rural and urban expenditure tercile. First, the World Bank's PovcalNet online database was used to compute national tercile incomes for each country in the FSZ. This data base provides national mean total expenditure and expenditure shares by 20-tile of the income distribution (successive 5% slices of the population) for dozens of countries, computed from these countries' LSMS survey data. A 20-tile mean total expenditure breakdown is calculated for the FSZs by taking a population-weighted mean (using the share of each country's total population within the FSZ) of all countries within the FSZ. These FSZ level 20-tiles of mean total expenditure are aggregated into terciles. In a second step, and because PovcalNet reports only national figures not broken by rural/urban, we computed rural/urban total expenditure ratios in the LSMS data sets for our four countries and applied these ratios to estimate rural/urban incomes for each tercile in the FSZ;

Expenditure elasticities: Bennett's Law states that expenditure elasticities decline as total expenditure rises; households with higher incomes spend less of each additional dollar on food, and more on non-food items. Properly estimating by how much these elasticities decline with income becomes very important when projecting consumption patterns out 30 years with growth rates of total expenditure that range from 2% per year to 6% per year (see below for definitions of scenarios). Incomes over this time increase by, respectively, 1.8 times and 5.7 times at these annual growth rates. To generate reliable estimates for our purposes, we used LSMS data from all five countries in Table 1 – including South Africa. Inclusion of the latter was crucial to provide a range of income sufficient to generate good elasticity estimates for the incomes reached near the end of our projection period. We followed a three-step procedure. First, for each category in the two food item groupings (by processing level and by food group) we computed twelve midpoint arc elasticities: one for each total expenditure tercile in rural and urban areas, separately for the Rest of Africa Maize Mixed FSZ and for South Africa (3 terciles x 2 x 2 = 12). For each category we then estimated a simple linear-log relationship between elasticities and income level separately for rural and urban areas; each regression thus had six observations. Finally, we used the predicted elasticities from this linear-log regression for the elasticities in the projection model. Five processing

groups, a single non-food group, and 23 food groups, generated 29*6=174 estimated elasticities.

The essential gains from this approach are that (1) the regression captured the non-linear relationship that typically exists between elasticities and income – elasticities generally fall with income but this decline typically slows as incomes rise beyond some level – and (2) it did so over a range of income that included the highest projected incomes in the FSZ. For example, even at the top scenario growth rate of 6% per year, mean daily per capita income in the top tercile of rural areas rises only to US$8.83, compared to US$15.59 in South Africa's rural third tercile today. In urban areas of the FSZ, the top tercile under 6% growth rises to US$46.39 compared to US$58.71 in the top urban tercile in RSA today.

Starting average budget shares: We use LSMS data from the four non-RSA countries to compute two sets of budget shares for each of the 174 categories explained above in the elasticity discussion: the share of the group in total food- and non-food expenditure and its share in food expenditure only. These are aggregated to the FSZ using the population weighting factors discussed above.

Expenditure by category: Total per capita expenditure for each of the 174 groups is computed in real per capita purchasing power terms for 2010 from the 4-country LSMS data, using the same weighting scheme as for all other FSZ level figures.

4.2. Scenarios

Through a process of scenario thinking, three key drivers of uncertainty were identified and based on these uncertainties four plausible scenarios where developed. The three key uncertainties are the rate of growth in real per capita expenditure, the distribution of that growth across terciles (inequality of growth), and its distribution across rural and urban areas (urban bias). The four scenarios and the settings of each of these variables are shown in Table 2.

Business as Usual (BaU) is based on patterns observed in SSA over the past decade. During this time, real per capita GNI in purchasing power parity has grown about 5% per year on the continent (World Bank). While robust, available evidence indicates that this growth has been most concentrated in urban areas and has accrued primarily to those in the upper reaches of the income distribution. We define *inequality increasing growth* as growth in which the upper tercile of the income distribution enjoys 50% greater annual percentage growth than the bottom tercile (e.g., 6% vs. 4%, or 3% vs. 2%). *Inequality decreasing growth* reverses this pattern: the lowest tercile enjoys 50% higher annual percent growth than the upper tercile. We define *positive urban bias* as growth in which urban households enjoy 50% greater annual percentage income growth than rural households, independent of any distribution effects across income levels.

Table 2. Simulation Scenarios

Scenario	Mean Per Capita Income Growth	Inequality of Growth	Level of Urban Bias
Business as Usual (BaU)	5%	Increasing	Positive
BaU with unfavorable environment	2%	Increasing	Positive
Equitable Growth	6%	Decreasing	Neutral
Equitable Growth unfavorable environment	4%	Decreasing	Neutral

BaU with macro shock assumes the same pattern of growth (inequality increasing with positive urban bias) but with unfavorable macro-economic and other conditions that reduce average annual growth to 2% per capita in real terms.

Equitable Growth (EG) assumes that African governments adopt policy and public investment approaches that drive broader distribution of income gains, both across the income distribution and across rural and urban areas. Specifically, we assume that growth becomes (1) inequality decreasing, with average yearly percentage growth in the bottom tercile 50% higher than in the top tercile, and *urban bias neutral*, with rural and urban areas enjoying the same annual percentage income growth. Due to widely appreciated factors that tend to drive higher income growth in urban than in rural areas (World Bank, 2008), we believe that a negative urban bias – higher income growth in rural than in urban areas – is unrealistic under any reasonable set of policies and public investment priorities. Finally, we assume in this scenario that average income growth is slightly higher than in BaU – 6% vs. 5% - based on research that suggests that policies and public investments that promote more equitable growth and asset distribution can also drive higher average growth (Barro 2000; Ravallion and Chen 2002; Timmer 2004).

4.3. Results and Discussion

This section first presents results on income levels and distribution in 2010 and 2040 under the four scenarios outlined in Table 2. It then focuses on the implications of each scenario for (a) changing consumption patterns as captured by food budget shares, and (b) changes in the total real value of food expenditures in the FSZ, driven by changing patterns and levels at the household level, by rising populations, and by the urbanization of those populations.

Incomes: Table 3 presents incomes and income ratios for actual data in 2010 and for 2040 projections in the four scenarios. The income ratios are rural-to-urban and national first tercile to national third tercile, presented for the Rest of Africa Maize Mixed FSZ and for current (2010) values in RSA for comparison. Several points stand out. First, income distribution in the

FSZ is currently much less unequal than in RSA. Bottom tercile households nationally have 19% of the income of top tercile households, compared to only 7% in RSA, and rural households in the FSZ have nearly half the average income of urban households, compared to less than one-third in RSA. Second, under a BaU strategy, inequality in 2040 will be similar to what it is today in RSA; if growth falters in this strategy (BaU with Unfavorable Environment), inequality will still increase but not by as much. Income levels, however, will be far lower. Under an Equitable Growth strategy, income distribution will by construction be far more equal: rural households will slightly raise their share of income, and the share accruing to bottom tercile households will nearly double from BaU.

Finally, real incomes of the poorest will grow very little from 2010 to 2040 under BaU if the environment for economic growth turns unfavorable: first tercile incomes will rise barely 50% nationally and only about 30% in rural areas. In the meantime, growth in bottom tercile incomes under the two Equitable Growth scenarios is dramatic, with rises of between about 4.5 and 9.5 times nationally. Figure 11 presents income results by national tercile.

Consumption Patterns (Food Budget Shares): Table 4 and Figures 12-17 present food budget share results to capture changing patterns of consumption. Table 5 and Figures 18-23 then present total daily expenditure in the FSZ to capture the changing levels of consumption. Together, these scenarios on changing patterns and levels of consumer demand speak to the he midstream and downstream transformations – the profound changes in processing, packaging, wholesaling, and retailing - that need to take place in response to urbanization and income growth. Each graph presents results for 2010 along with two scenarios: BaU and BaU with unfavorable environment, and EG and EG with unfavorable environment.

The first major pattern is that the overall food budget share falls in every scenario, but not dramatically. Even in BaU and its 5% growth, and EG and its 6% growth, the share of food in total expenditures falls only from 58% to 38% and 44%, respectively (Figures 12 and 13). These are meaningful declines but, as seen below, population and income growth drive very large increases in total demand. The differences between the BaU and EG scenarios are not large at this level of aggregation.

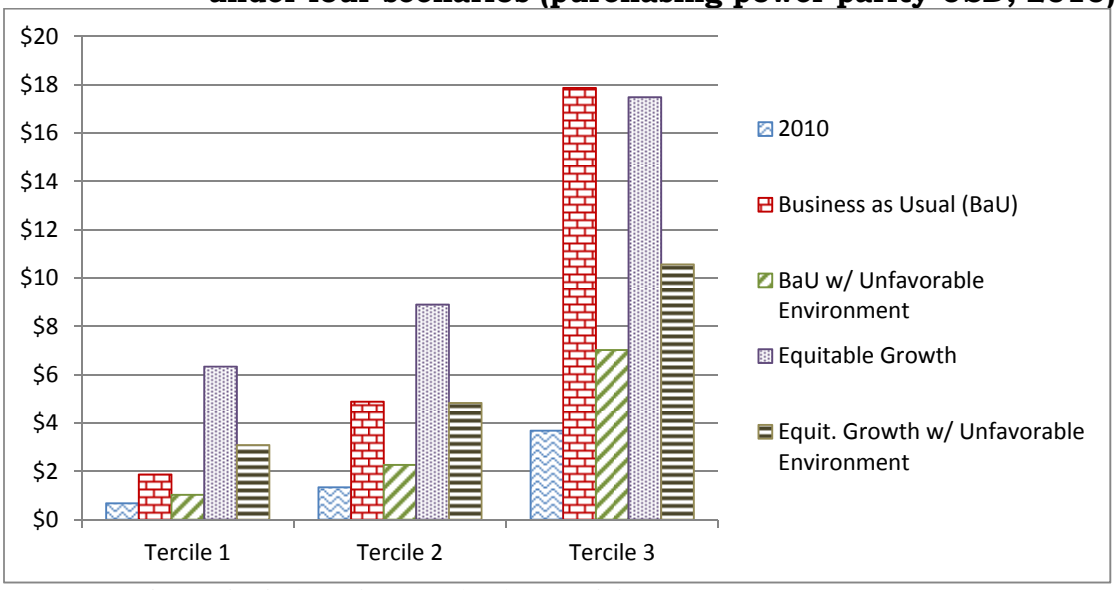
Table 3. Per capita income levels in 2010 and in 2040 under four scenarios (purchasing power parity USD, 2010)

		2040			
	2010	Business as Usual (BaU)	BaU w/ Unfavorable Environment	Equitable Growth	Equitable Growth w/ Unfavorable Environment

National					
tercile 1	$0.68	$1.87	$1.03	$6.34	$3.09
tercile 2	$1.34	$4.89	$2.27	$8.90	$4.83
tercile 3	$3.68	$17.87	$7.02	$17.49	$10.57
Rural					
tercile 1	$0.62	$1.21	$0.79	$5.39	$2.63
tercile 2	$1.14	$2.65	$1.54	$6.91	$3.75
tercile 3	$2.75	$7.19	$3.77	$11.25	$6.80
Urban					
tercile 1	$0.88	$2.74	$1.36	$7.69	$3.75
tercile 2	$1.93	$7.98	$3.30	$11.75	$6.37
tercile 3	$6.46	$33.29	$11.71	$26.39	$15.95
Ratios					
RoAMz Mixed					
Rural/Urban	0.49	0.25	0.37	0.51	0.51
T1/T3	0.19	0.10	0.15	0.36	0.29
Current RSA					
Rural/Urban	0.30				
T1/T3	0.07				

Source: Author calculations from projection model

Figure 11. National income levels by tercile, 2010 compared to 2040 under four scenarios (purchasing power parity USD, 2010)



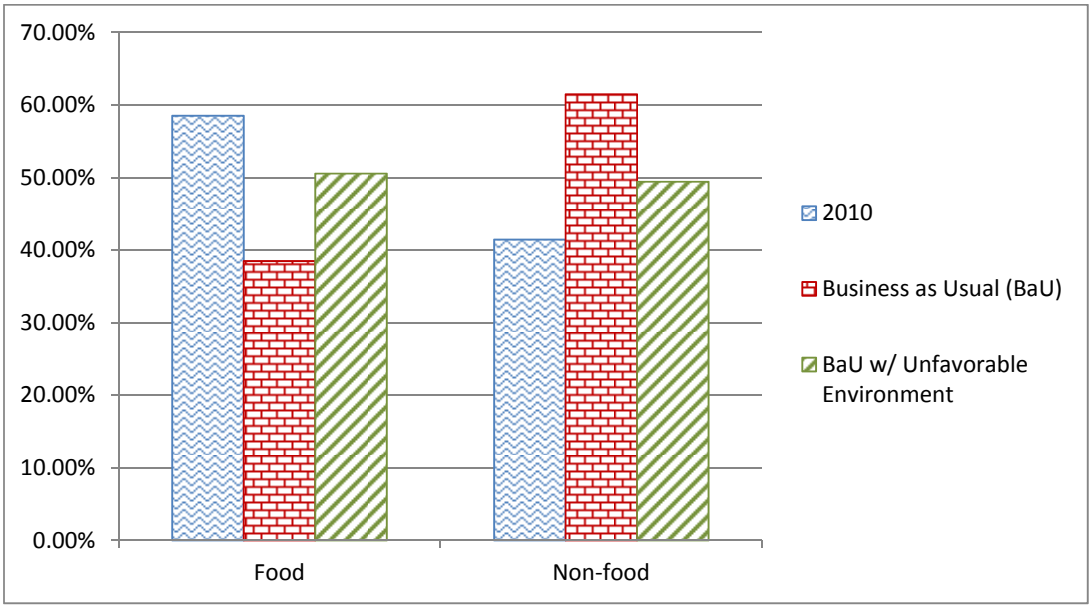
Source: Author calculations from projection model

Table 4. Food budget shares by food item groupings in 2010 and in 2040 under four scenarios

		2040			
	2010	Business as Usual (BaU)	BaU w/ Unfavorable Environment	Equitable Growth (EG)	EG w/ Unfavorable Environment
By processing level					
Own production	39.7%	25.5%	28.5%	34.0%	33.6%
Unprocessed	17.1%	18.6%	19.7%	15.1%	16.7%
Informal	7.1%	3.9%	5.7%	3.7%	4.7%
Formal 1	29.9%	36.7%	36.4%	32.7%	33.7%
Formal 2	6.2%	15.4%	9.8%	14.6%	11.4%
By commodity type					
Wheat products	4.5%	5.8%	5.8%	6.0%	6.1%
Maize & maize products	17.2%	9.1%	12.7%	8.5%	10.8%
Sorghum, millet & other cereals	5.4%	4.6%	4.6%	5.2%	5.0%
Rice (Milled Equivalent)	6.1%	6.7%	7.4%	7.6%	7.9%
Cassava	3.4%	0.9%	1.8%	0.6%	0.9%
Roots & tubers	5.6%	4.0%	4.6%	3.9%	4.5%
Plantains	2.6%	1.5%	2.1%	1.4%	1.8%
Sugar & sweets	4.0%	3.4%	4.0%	3.2%	3.6%
Pulses	7.2%	5.5%	6.4%	5.5%	6.2%
Oilcrops & vegetable oils	3.3%	3.1%	3.5%	2.9%	3.2%
Staple vegetables	6.1%	5.4%	6.4%	4.6%	5.5%
Other vegetables	2.1%	1.0%	1.4%	0.8%	0.9%
Fruit	2.6%	4.5%	3.3%	4.1%	3.6%
Non-alcoholic beverage	2.6%	4.0%	3.3%	3.5%	3.3%
Alcoholic beverages	1.4%	2.3%	1.7%	2.2%	1.9%
Beef	5.1%	9.7%	7.5%	10.2%	8.7%
Poultry	2.9%	3.0%	3.0%	3.3%	3.2%
Other meat	2.4%	2.8%	2.3%	3.5%	3.0%
Milk & animal fats	4.2%	4.3%	4.1%	4.2%	4.2%
Eggs	0.6%	0.9%	0.8%	0.9%	0.9%
Fish	3.6%	4.5%	4.3%	3.8%	3.9%
Prepared foods away from home	4.6%	9.9%	6.1%	11.7%	8.4%
Other foods	2.5%	3.5%	3.2%	2.7%	2.7%
By food/non-food					
Food	58.5%	38.5%	50.6%	43.8%	49.2%
Non-food	41.5%	61.5%	49.4%	56.2%	50.8%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

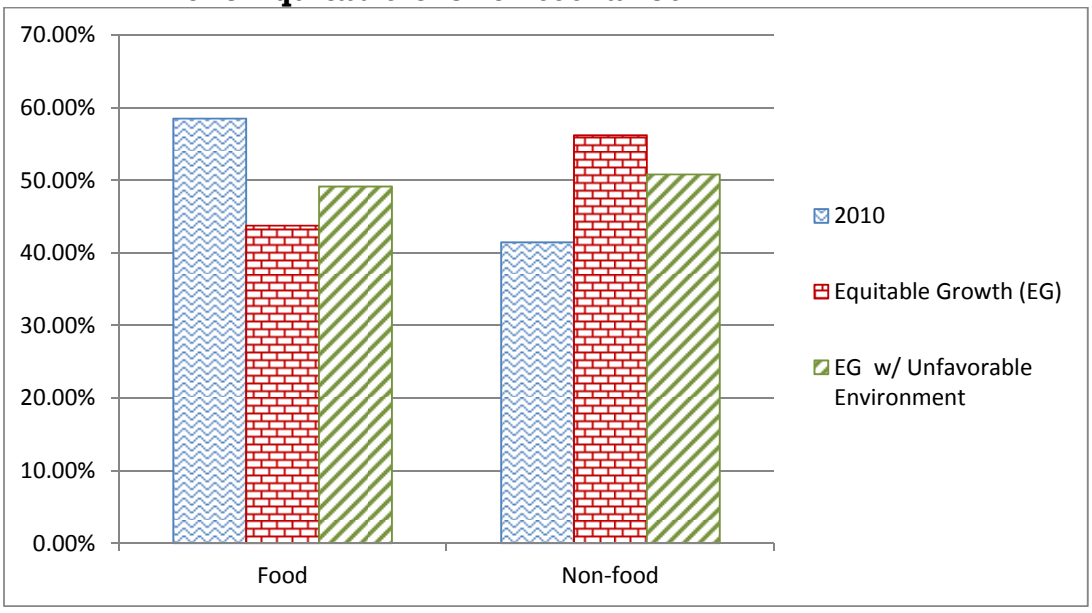
Source: Author calculations from projection model

Figure 12. Budget shares for food and non-food, 2010 and 2040 under two Business as Usual scenarios



Source: Author calculations from projection model

Figure 13. Budget shares for food and non-food, 2010 and 2040 under two Equitable Growth scenarios

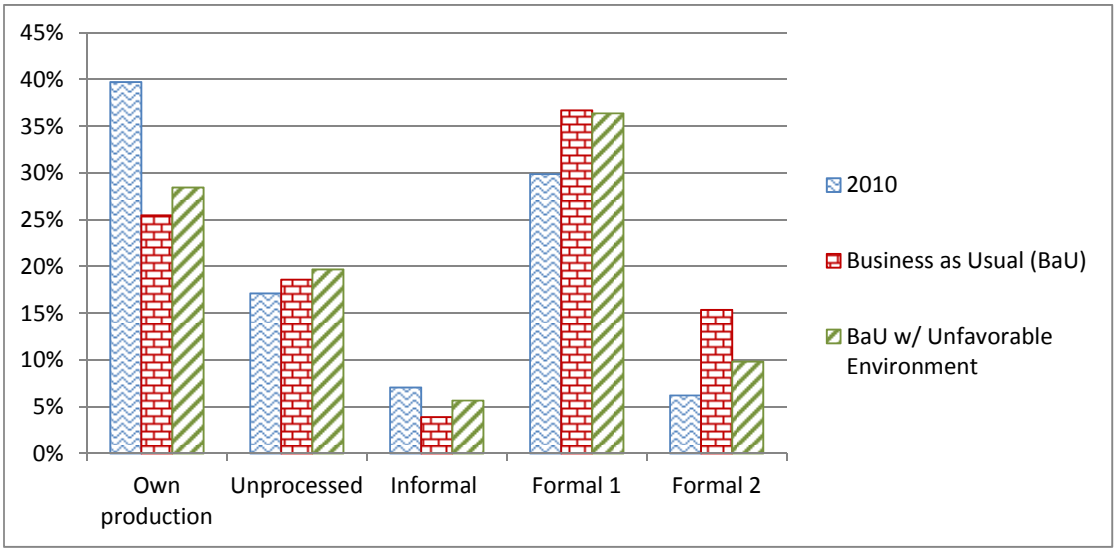


Source: Author calculations from projection model

The second major pattern is that consumed own production share falls in every scenario and is made-up almost entirely by increases in the budget shares of formal processing (Figures 14 and 15). Consumed own production

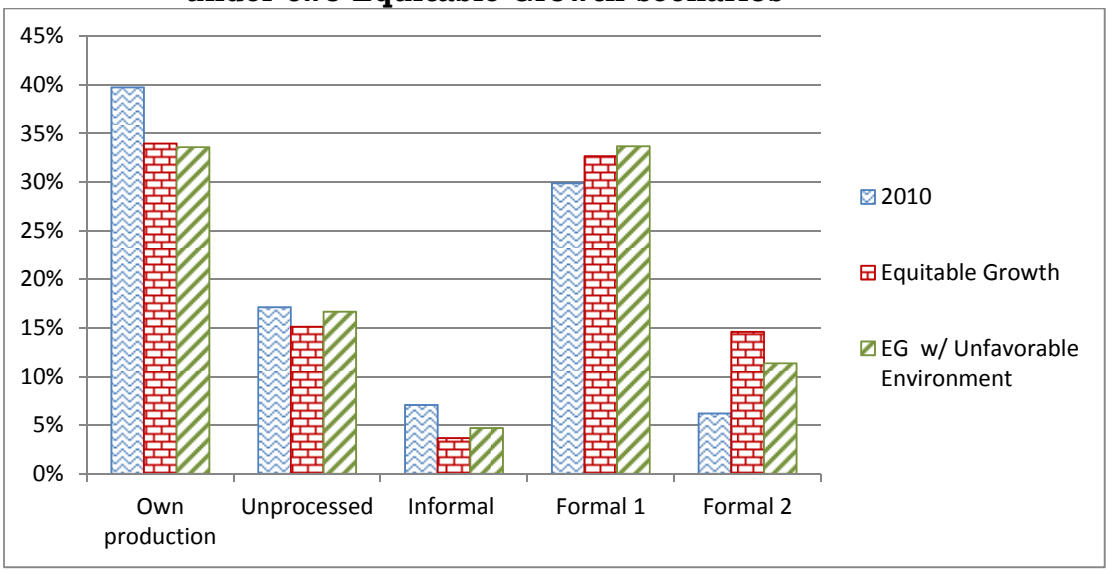
falls much less under EG than under BaU, due to the fact that EG results in more income growth for the poor and for those in rural areas, both of whom have higher elasticities of demand for own production than do the more wealthy and urban. Among formally processed items, Formal 1 with the lesser value added predominates but grows less in percentage terms; the more highly processed items in Formal 2 see their budget shares rise from about 6% to about 15% under BaU and EG, and to 10% to 12% in each of these scenarios under unfavorable conditions that deliver less total income growth.

Figure 14. Food budget shares by processing level in 2010 and in 2040 under two Business as Usual scenarios



Source: Author calculations from projection model

Figure 15. Food budget shares by processing level in 2010 and in 2040 under two Equitable Growth scenarios

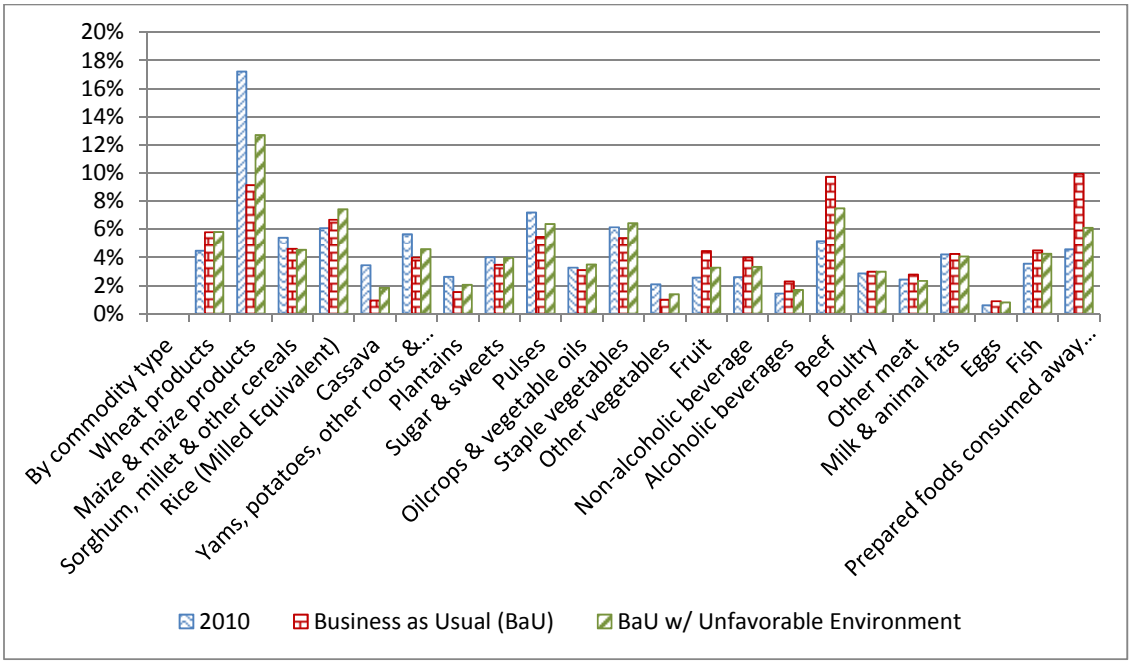


Source: Author calculations from projection model

Finally, both sets of scenarios drive large declines in food budget shares of maize, root crops (especially cassava and yams), and plantains, slight shifts within food staples towards wheat and rice, large increases in beef and prepared food consumed away from home, increases also in fruit and beverages, and relatively modest changes in all other items (Figures 16 and 17). Note that the budget share on poultry remains essentially flat from 2010 in all four scenarios. This result stems from sharp increases in quantities consumed paired with sharp declines in price; the world over, poultry production is the first meat production to industrialize as food systems transform, resulting in much higher productivity and lower prices. Consumers eat more poultry as their incomes rise but they pay much lower prices for it.

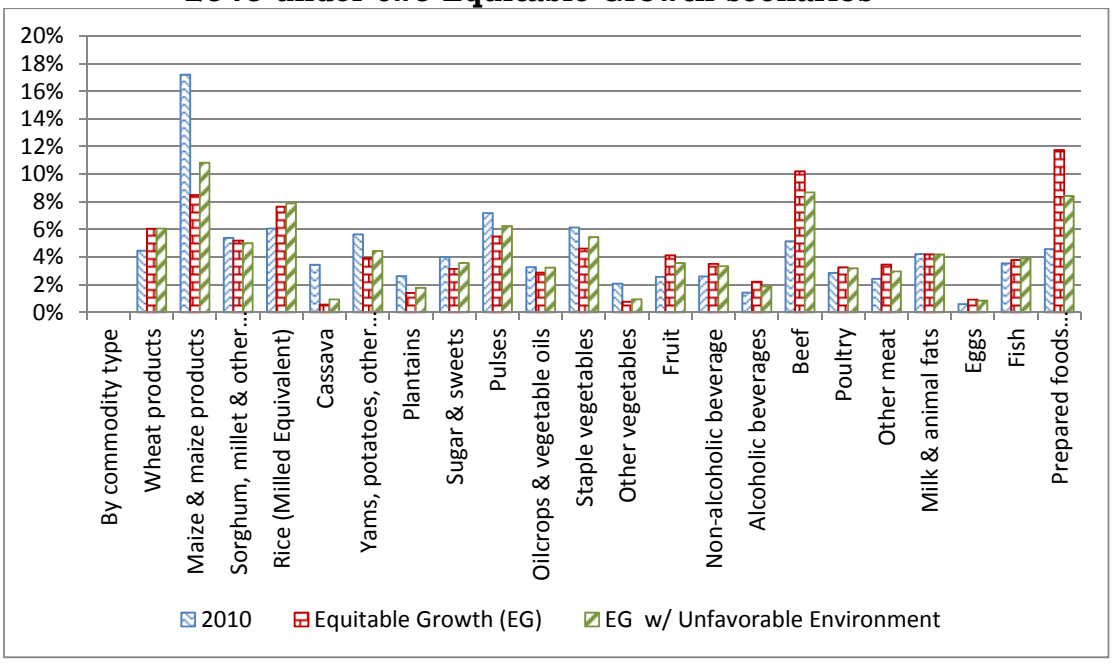
Perhaps the most noteworthy result on food budget shares is that they are not much different in our two sets of scenarios. In each case, lower growth results in less change, but the pattern of change across processing levels and food groups is similar.

Figure 16. Food budget shares by detailed food group in 2010 and in 2040 under two Business as Usual scenarios



Source: Author calculations from projection model

Figure 17. Food budget shares by detailed food group in 2010 and in 2040 under two Equitable Growth scenarios



Source: Author calculations from projection model

Level of Expenditure: Unlike expenditure patterns, total expenditure outcomes differ dramatically across scenarios (Table 5 and Figures 18-23). Due primarily to the way that the EG scenarios deliver more growth than BaU to poorer households and rural households, and because both types of households have higher elasticities of demand for food than richer and more

urban households, total demand for food grows much more rapidly under the two EG scenarios. Including consumed own production, total food demand in the FSZ rises 6 times (from $137 million per day to $828 million per day) under BaU but 9 times under EG (up to $1,251 million per day). Demand for food through markets –i.e. excluding consumed own production – rises by 7.5 times and 10 times, respectively. Rises in demand are far less but still very substantial under unfavorable environments that deliver less growth: total demand rises 3.3 times under BaU and 5.8 times under EG, while market demand jumps by 4 times and 6.3 times. On average over all scenarios, demand for food through markets rises about 7 time. Though very large, these results are comparable to those of Byerlee et al (2013) who project a quadrupling of the size of urban food markets through 2030 (our projections go to 2040).

The rise in demand is seen most sharply in the most highly processed food items, demand for which rise 15 times under BaU and 21 times under EG under favorable environments for growth. Even under an unfavorable environment, the EG scenario delivers a nearly 11-fold increase in demand for Formal 1 food items, due to the distribution of growth more heavily toward low income households and rural households compared to BaU. Informal processing grows the least under three of the four scenarios, while unprocessed foods and formal 1 foods grow similarly, each increasing between about four times and nearly 10 times depending on the scenario.

Among the food groups, the biggest winners in percentage terms are prepared foods consumed away from home, beef, and fruit. These grow under the EG (BaU) scenario with favorable conditions by 23 (13) times, 18 (11) times, and nearly 15 (10) times, respectively. Wheat and wheat products, beverages (alcoholic and non-alcoholic), fruit, and eggs are also big winners. In all cases the increase in total demand is much more pronounced under the two EG scenarios than under the two BaU scenarios, for the reasons explained above.

The key results from this analysis are as follows:

- Under all scenarios, changing patterns of demand (captured by food budget shares) are most evident for maize and overall own production (large declines), and for food away from home, beef, fruit, and high value added processed items (large increases). Wheat and wheat products, beverages (alcoholic and non-alcoholic), fruit, and eggs are also big winners;
- Differences among growth strategies (continuation of current policies producing unequal and urban-biased growth) are minor in this measure of transformation;
- Differences among strategies are very large when it comes to their impact on growth in demand; the two Equitable Growth scenarios deliver much higher multiples of growth than the two Business as Usual scenarios;
- In any case, urbanization combined with even modest economic growth will drive very large increases in overall demand for food; these increases range from 3.3 times under the least favorable scenario (BaU with

unfavorable conditions) and over 9 times in the most favorable (EG with favorable conditions).

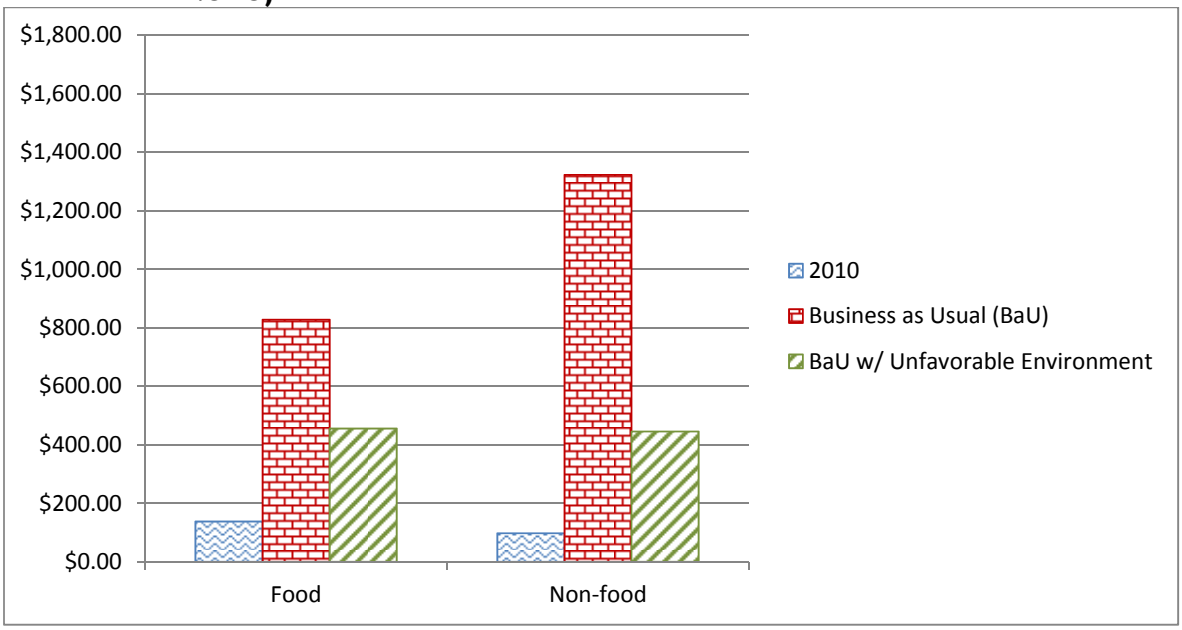
To meet this increased demand, and to produce the new foods and more value added foods that this analysis shows consumers will demand, local food systems will have to profoundly increase their level of investment and productivity at all levels, from farm through all the midstream and downstream segments.

Table 5. Total expenditure on food in Rest of Africa Maize Mixed FSZ by food item groupings, 2010 and 2040 under four scenarios ('000'000 PPP USD, 2010)

		2040			
	2010	Business as Usual (BaU)	BaU w/ Unfavorable Environ-ment	Equitable Growth (EG)	EG w/ Unfavorable Environ-ment
By processing level					
Own production	$54.76	$210.99	$129.66	$424.93	$266.63
Unprocessed	$23.61	$153.87	$89.71	$189.24	$132.33
Informal	$9.73	$32.12	$25.78	$45.81	$37.28
Formal 1	$41.19	$303.90	$165.84	$408.68	$267.30
Formal 2	$8.54	$127.13	$44.80	$182.54	$90.12
Non-Food			$445.55	$1,606.77	$820.27
By commodity type					
Wheat products	$6.16	$47.91	$26.47	$75.58	$48.11
Maize & maize products	$23.71	$75.59	$57.87	$106.34	$85.89
Sorghum, millet & other cereals	$7.43	$38.19	$20.72	$64.93	$39.79
Rice (Milled Equivalent)	$8.36	$55.24	$33.80	$95.60	$62.57
Cassava	$4.74	$7.79	$8.40	$7.02	$7.46
Roots & tubers	$7.77	$32.99	$20.89	$49.14	$35.29
Plantains	$3.61	$12.75	$9.34	$17.53	$14.04
Sugar & sweets	$5.52	$28.79	$18.05	$39.38	$28.35
Pulses	$9.91	$45.19	$29.03	$68.65	$49.51
Oilcrops & vegetable oils	$4.51	$25.62	$15.94	$35.94	$25.64
Staple vegetables	$8.46	$44.42	$29.31	$57.73	$43.25
Other vegetables	$2.87	$8.25	$6.30	$9.64	$7.48
Fruit	$3.54	$36.84	$14.91	$51.57	$28.37
Non-alcoholic beverage	$3.58	$33.13	$15.16	$43.82	$26.49
Alcoholic beverages	$1.97	$18.95	$7.69	$27.83	$14.84
Beef	$7.09	$80.50	$34.13	$127.65	$68.85
Poultry	$3.93	$24.69	$13.60	$40.71	$25.29
Other meat	$3.34	$22.99	$10.60	$43.22	$23.50

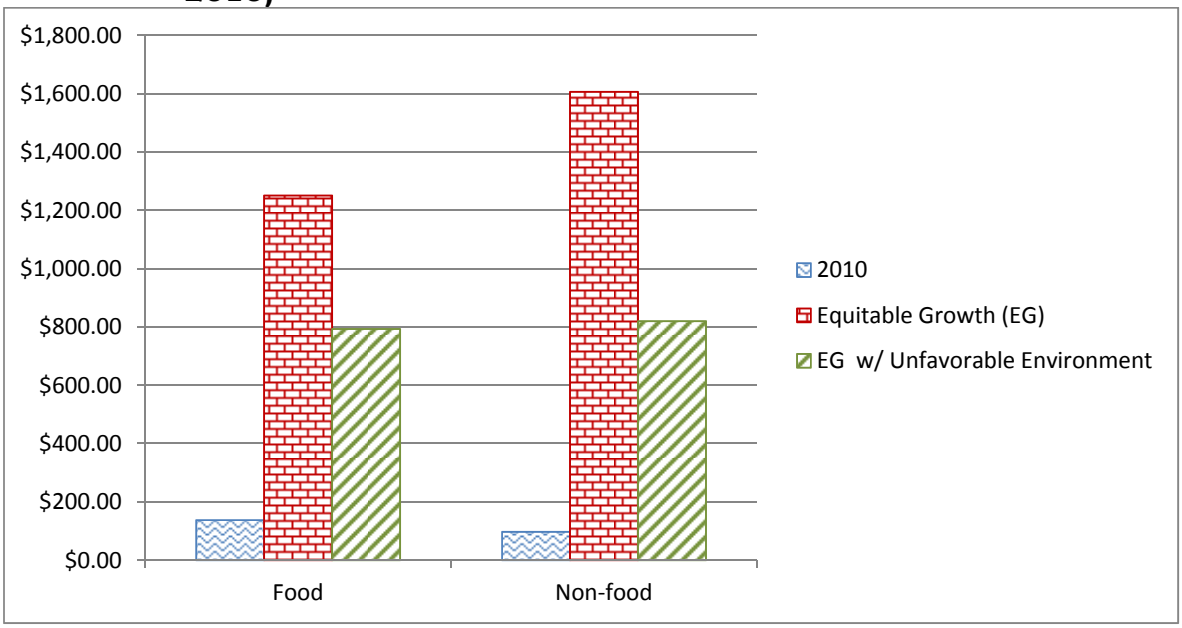
Milk & animal fats	$5.80	$35.17	$18.53	$52.39	$33.25
Eggs	$0.83	$7.34	$3.64	$11.55	$6.75
Fish	$4.89	$37.22	$19.41	$47.38	$31.12
Prepared foods away from home	$6.31	$82.25	$27.76	$146.89	$66.85
Other foods	$3.49	$29.33	$14.38	$33.10	$21.37
By food/non-food					
Food	$137.84	$828.01	$455.79	$1,251.20	$793.65
Non-food	$97.71	$1,322.59	$445.55	$1,606.77	$820.27
Total	$235.54	$2,150.60	$901.34	$2,857.97	$1,613.92

Figure 18. Total expenditure per day on food in the FSZ in 2010 and in 2040 under Business as Usual scenarios ('000'000 PPP USD, 2010)



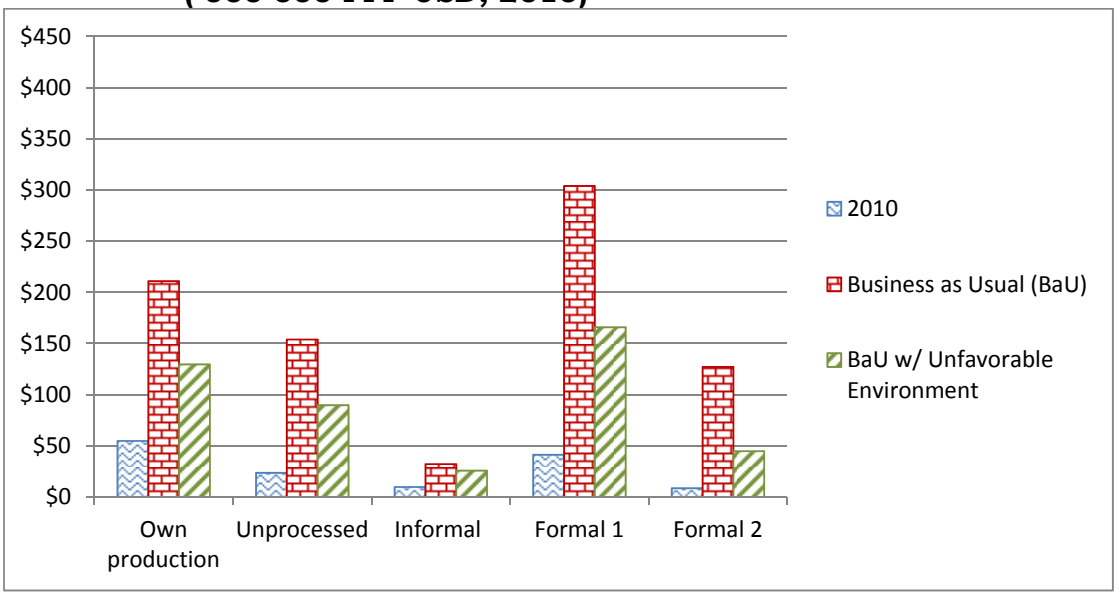
Source: Author calculations from projection model

Figure 19. Total expenditure per day on food in the FSZ in 2010 and in 2040 under Equitable Growth scenarios ('000'000 PPP USD, 2010)



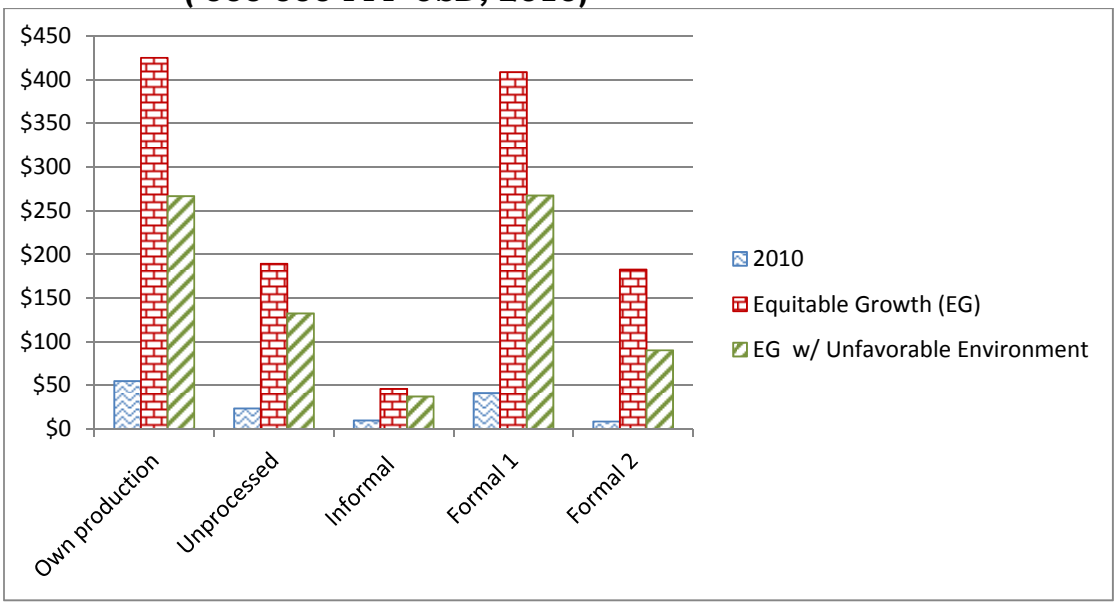
Source: Author calculations from projection model

Figure 20. Total expenditure per day by processing level in the FSZ in 2010 and in 2040 under Business as Usual scenarios ('000'000 PPP USD, 2010)



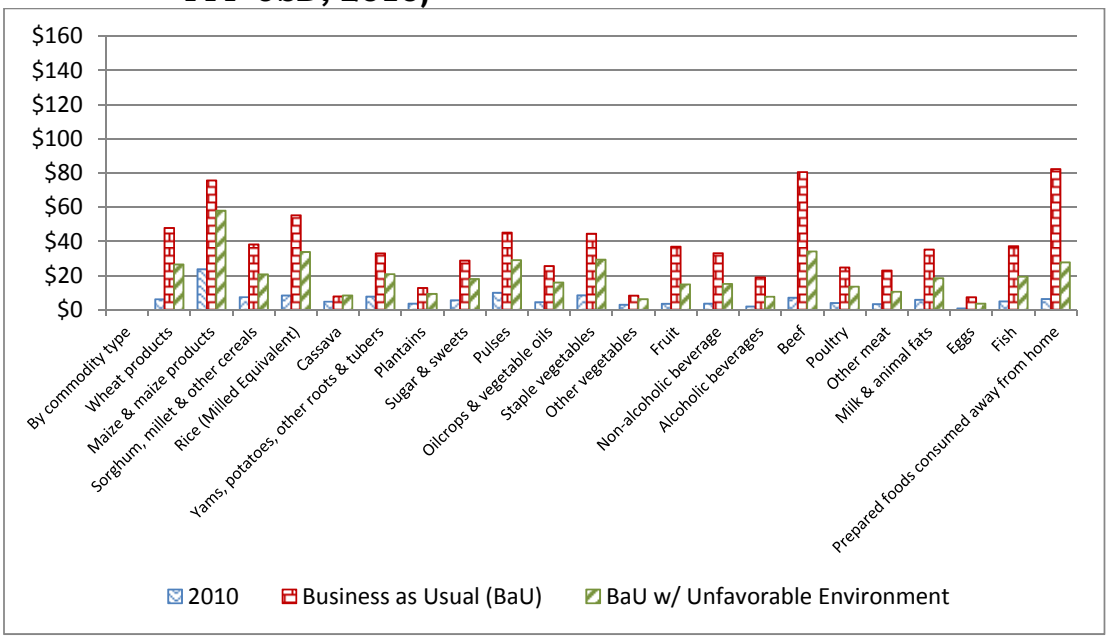
Source: Author calculations from projection model

Figure 21. Total expenditure per day by processing level in the FSZ in 2010 and in 2040 under Equitable Growth scenarios ('000'000 PPP USD, 2010)



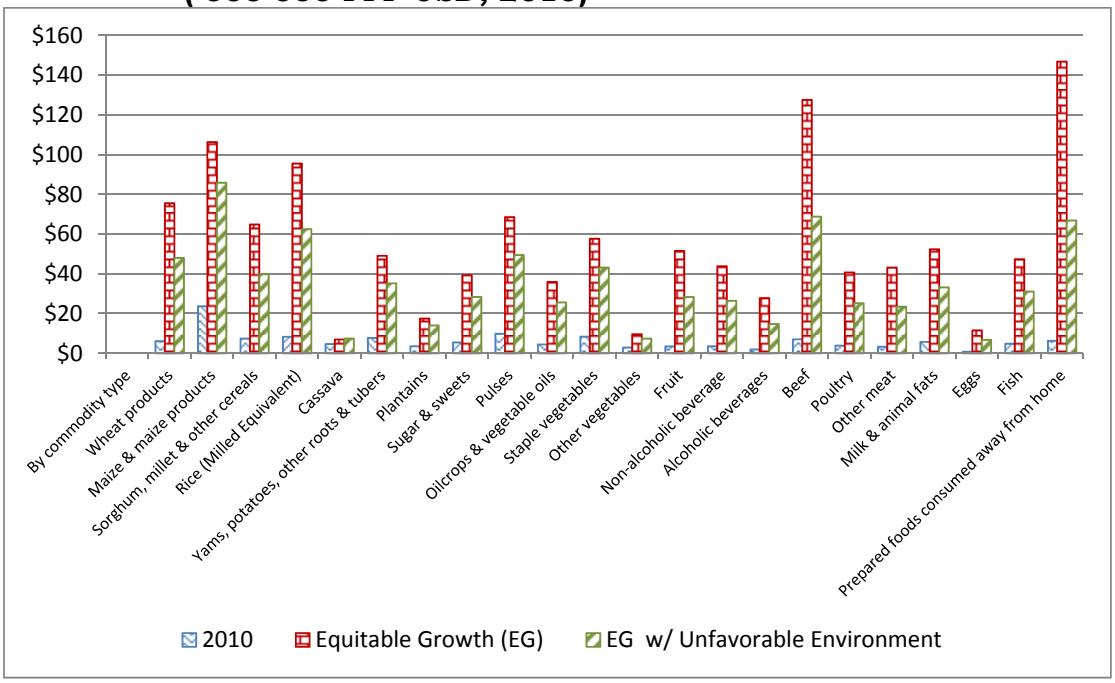
Source: Author calculations from projection model

Figure 22. Total expenditure per day by food group in the FSZ in 2010 and in 2040 under Business as Usual scenarios ('000'000 PPP USD, 2010)



Source: Author calculations from projection model

Figure 23. Total expenditure per day by food group in the FSZ in 2010 and in 2040 under two Equitable Growth scenarios ('000'000 PPP USD, 2010)



Source: Author calculations from projection model

5. Anticipating Qualitative Changes in Demand

Rapid urbanization and sustained income growth at the levels reflected in our projection model lead, in addition to explosive quantitative growth and major shifts towards more highly processed foods and fresh perishable foods, to transformative *qualitative* changes in consumer demand for food over time.

One such change that will be observed over time is rapid rises in demand for value, much of it closely linked to convenience. Urbanization leads to less free time for most people, especially for women, who become more likely to work outside the home, giving them less time and energy to focus on home-prepared foods. Greater packaging, semi-prepared (e.g., sliced- and diced vegetables and fruit) and prepared foods, canned and frozen goods, and fast foods become more common.

The second major qualitative change is that consumers become more concerned about food quality and safety and their conception of what safety means evolves as their incomes and education rise. From simple visual inspection of freshness and cleanliness, consumers eventually come to expect much more sanitary shopping environments and to rely on third-party certifi cations and formal food safety standards to back-up their confidence in the food supply. As Unnevehr and Hirschhorn (2000) state, "food safety interventions build from basic investments and simple interventions to more complex regulatory systems as economies develop." Currently, most African countries have severely limited abilities to design,

maintain, and properly adapt over time these types of complex regulatory structures. Doing so will require far more trained personnel in nutrition, food safety and toxicology, food processing, and the economics of regulation. To be of real use, these trained people will need to be employed in organizational and managerial structures that value knowledge-driven service to the public; promoting such an attitude is a major challenge in any country, and is especially so at this point in nearly all African countries.

It is all but certain that these two qualitative changes will occur to a meaningful extent in Africa over the next 30 years. The difficult question is the rate at which they will occur. Properly anticipating this rate of change is important so that the needed new regulatory structures can keep pace with, and even promote and shape these changes, without getting so far ahead that they become irrelevant or even counter-productive. As one example, insisting that farmers and traders follow sophisticated process standards and meet quantitative requirements for maximum pesticide residues in fresh produce can be counter-productive when well over 90% of the produce comes from farmers with low literacy, moves through badly under-developed traditional marketing structures, and is consumed by very low income consumers who may not even understand such regulations.

Box 1: Will African consumers pay for food safety?

Food safety in developing and emerging countries is receiving increased attention from economists, researchers and policymakers. As urbanization proceeds, and if incomes continue to rise at robust rates, consumers in Africa will become increasingly aware of food safety issues, more demanding of food safety guarantees, and more sophisticated in their approach to food safety. From simple visual inspection of freshness and cleanliness, consumers will come to expect more sanitary shopping environments and to rely on third-party certifications and formal food safety standards to reinforce their confidence in the food supply. As Unnevehr and Hirschhorn (2000) state, "food safety interventions build from basic investments and simple interventions to more complex regulatory systems as economies develop." Yet assuring food safety in modernizing food systems involves significant costs, and current incomes in developing SSA are lower than in Asia. Are consumers in developing SSA willing now to pay for the regulatory structures and private practices that can ensure better food safety? A comprehensive review of the literature by GCFSI highlights three findings:

1. **Overall, consumer awareness of food safety problems in developing SSA is low:** Food safety standards, and systems to ensure them are major issues in export supply chains, especially of fresh produce to Europe. Such systems are essentially non-existent in supply chains serving domestic consumers, who are largely unaware of food safety risks (Probst et al. 2012).
2. **Risk perception by consumers is strongly affected by income:** Several studies show that consumers are willing to pay premia for food safety guarantees, but that these premia are strongly related to income (Probst et al. 2012; Alphonce & Alfnes 2012; Lagerkvist 2013). Lagerkvist et al. (2013) find that consumers shopping in modern retail outlets (who tend to have higher incomes) perceive a lower food safety risk in these channels than in traditional markets.
3. **Knowledge of African consumer willingness to pay for food safety is very limited**: The most up-to-date research on consumer preferences for food safety is skewed towards a focus on several Asian countries and provides an incomplete picture of developing country consumers' preferences, especially in SSA. Research is needed in four areas. First, consumer demand for food safety and how it varies with income level, education, and other socio-demographic variables. Second, how able are current food systems to transmit information about food safety through the supply chain, and what investments and educational programs might improve this performance? Third, a better understanding is needed of producer behavior with regards to safety and quality practices, especially their operation's willingness to bear the costs of improved safety practices. Finally, comparative assessments need to be made of alternative approaches to food safety regulation and practice. Lessons learned from developing Asian countries, in addition to SSA countries, should be included in

Key variables that will drive the rate of change in these qualitative dimensions of demand are per capita income and its distribution, educational levels, and growth of urban relative to rural populations: higher income growth, more equal distribution of that growth, higher levels of education, and greater urbanization will drive more rapid and broad-based increases in demand for the range of quality characteristics we discuss above. Nutrition and food safety awareness campaigns can also influence the rate of change in consumer demand for food quality and safety. Yet the current income levels found in ESA need to be kept firmly in mind. Growing at 4% in real terms per year, mean incomes in ESA will rise by 2040 to levels equivalent only to the four poorest countries of Latin America in 2010 (Honduras, El Salvador, Bolivia, Paraguay). In addition, UN projections call for the urban population share in ESA in 2040, despite the very rapid urbanization forecast for this period, to still be lower than it is at present in Central America. Thus, while the next 30 years will bring substantial change to the structure and quality of demand for fresh produce in the region, one needs to remain anchored in the reality of the region's very low starting point and in patterns observed over time elsewhere in the world, to avoid overestimating the degree of change and designing policies and programs with low or even negative returns.