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The Rise of a Middle Class in East and Southern Africa: Implications for Food System Transformation[1]

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Abstract. We show five points regarding the middle class in developing East and Southern Africa. (1) 55% of the region's middle class – 37% of the "non-vulnerable" middle class – is rural. (2) 61% to 83% of the middle class's food is purchased. (3) Processed food occupies 70-80% of the class's food expenditure, with similar shares in urban and rural areas. (4) Perishable products account for 44% to 55% of the class's expenditure. Policy attention to processing and to food products "beyond-grains" thus needs to be "mainstreamed". (5) The import share of food expenditure does not rise with income in urban areas.

Keywords: Africa, middle class, processed food, food imports, urbanization

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1. INTRODUCTION

Literature on the rise and importance of the middle class in developing countries has grown rapidly in recent years (Easterly, 2001, Banerjee and Duflo, 2008, Birdsall, 2010; Ravallion, 2010). For Africa in particular, the African Development Bank has identified the rapid rise of the middle class as an important trend in the region, "crucial to the continent's economic and political development." (Ncube et al., 2011, 2). They note that by 2010, the middle class rose to 35% of Africa's population, up from 27% in 1980, and nearly tripling in size from 126 million to 350 million over those three decades, at nearly 20% a year faster than population growth. At 350 million it is comparable to the middle class in India in size.

Ncube et al. (2011) emphasize the heterogeneity of the African middle class. They use a broad definition of 2 to 20 dollars a day in purchasing power parity terms, and divide the class into three sub-classes: (1) 60% in the "vulnerable middle", at 2 to 4 dollar per day, just out of poverty and with the potential to slip back; the rest of the middle class is divided into (2) the "lower middle" class, with 4 to 10 dollars a day, and (3) an "upper middle" class, with per capita consumption of 10 to 20 dollars a day.

The literature and debate reflect diverse hopes and fears with respect to the emergence of this African middle class. On the one hand, there is a fear that the middle class has such an import-oriented diet that it is a motor for increases in unsustainable imports, as FAO (Rakotoarisoa et al. 2011) and USDA (2013) posit. And there is a fear that the food habits of the middle class tend toward the highly processed and thus promote obesity and other ills (as posited and explored, although not for Africa, by Popkin 2014, Gomez and Ricketts 2013, and Monteiro et al. 2013[2])).

On the other hand, some harbor hopes that the African middle class, especially in cities, will drive demand for higher-value agricultural products (Badiane 2014) and demand for value-added food products from the processing sector (Reardon et al. 2013), thus creating opportunities for local entrepreneurs and feeding economic growth.

Despite the interest, fears, and hopes generated by the rise of the African middle class, there are several important knowledge gaps, and research questions about them, that are relevant to development strategy in general and agrifood system promotion in particular.

First, will a continuation of the recent pattern of growth (its level and distribution over income strata) in the region drive the rapid emergence of a middle class, or has it been so unequal that it will have little effect on the rise of such a class? This is the question on which most empirical debate has been leveled and we aim to contribute to that debate.

Second, is the African middle class urban? Or is it both urban and rural, and in what proportions? Does this vary over the substrata of the middle class? It seems taken for granted in the literature that it is only or nearly exclusively urban. Ncube et al. (2011) assert that "The vast majority of

[2] Monteiro et al use Euromonitor data to provide information on Cameroon and South Africa, the only African countries out of 79 reviewed.

Africa's middle class is likely not to derive its income from agricultural and rural economic activities…" and "are geographically concentrated in urban areas." But they do not test that hypothesis nor does any other extant study.

Third, is the African middle class diet more diversified (beyond grains and roots/tubers) or more intensive in processed foods than those of other classes? Does this vary over the substrata of the middle class? One might expect at least the diversification, based on Engel's Law. However, there have been no systematic empirical studies of African middle class diets from these two angles. The middle class empirical research noted above does not examine food expenditures. Even studies focusing on middle class expenditures do not study food (such as Chikweche and Fletcher 2014) or do so only partially, as with the work on South Africa by Nieftagodien and Van der Berg (2007), who estimate Engel's curves for the overall food share for the emerging black middle class and compute budget shares by decile for grains and meat, but do not go further on food. We have found no other authors that address middle class food expenditure behavior in Africa.

Fourth, and an extension of the second question, is whether the middle class diet is more intensive in imports than that of other income groups, and whether this varies over the substrata of the middle class?

The aim of this paper is to address the above four knowledge gaps *cum* research questions. We analyze the food consumption patterns of the middle class in East and Southern Africa (ESA). We use this to draw implications regarding likely changes in diets over the next two-three decades.

We focus on (developing) East and Southern Africa for two reasons. First, the broadly comparable consumption patterns within the region, most of which is dominated by maize-based cropping systems, allows aggregation of country data with less concern for loss of local detail than if we were focusing on larger or more heterogeneous zones. Second, as the least urbanized region of the continent, documenting the diet transformations unfolding in this region puts a lower bound on what one might find in other areas of the continent.

The paper proceeds as follows. Section 2 presents definitions, data, and methods. Section 3 presents findings and is structured into subsections corresponding to the four research issues/gaps above. Section 4 concludes with implications for the African agrifood system and policy.

2. DEFINITIONS, DATA, AND METHODS

2.1. Definitions

There is no commonly accepted definition of the middle class across countries. A basic distinction is between relative approaches, e.g. the middle class as all households between 75% and 125% of the median income of a country (e.g., Birdsall et al., 2000), and absolute approaches with fixed lower and upper bounds (e.g., Banerjee and Duflo (2008) and Ravallion (2010)).

We use the "absolute lower and upper bounds" approach and set the lower bound for the middle class at the international poverty line of $2/day in 2005 per capita purchasing power parity terms, as do Ncube et al. (2010), Banerjee and Duflo (2008), and Ravallion (2010). We use the upper bound set out in Ncube et al. of 20 dollars a day.

To capture diversity in behavior across households, we use the strata presented by Ncube et al., that is, up to $2 (the poor), $2 to $4 (the vulnerable middle class); $4-$10 (the lower middle class), $10 to $20 (the upper middle class), and above $20 (the upper class). We expect consumption patterns to differ over the strata of the middle class, as well as between the middle class and the other two classes.

Some criticize a lower bound of $2/day for the middle class because those just above that line are vulnerable to falling back into poverty and are, in part for this reason, unlikely to have the time and energy for the kind of political- and social engagement that many associate with a middle class (Birdsall, 2010). Yet the focus of this paper is on food consumption habits, not political engagement; we accept the $2/day lower bound for the simple reason that being in the vulnerable middle class as opposed to the poor class makes a massive difference, due to the ineluctable operation first of Engel's Law and then of Bennett's Law, in the amount and kind of food that a person can buy. To be specific, a median person in the vulnerable middle class, with $3/day, spends 2.5 times more on food than the median poor person with $1/day[3]. Considering typical retail maize meal prices in ESA and the calorie content of maize meal[4], the median poor person could purchase only about 1,400 kcal/day dedicating *all* her food budget to maize meal purchased at retail; this against an FAO requirement of 2,000 kcal/day. In contrast, the vulnerable middle class person could purchase over 3,500 kcal if she dedicated all her food expenditure to maize meal. This means, of course, that the vulnerable middle class person will, instead, buy some maize meal along with a range of other products (e.g., vegetable oil, fish, meats, dairy products). The result is not only a better nourished individual but also – and this is the focus of this paper – pressure on the food system to provide this larger volume and broader array of food at affordable prices to more people.

We eschew use of the 10 and 13 dollar limits of Banerjee and Duflo (2008), and Ravallion (2010), respectively, for two reasons. First, we wish to look forward 2-3 decades, during which time the currently tiny fraction of the population above this level will likely become far larger, and because by any standard other than that of today's developing world, $20/day hardly makes one "wealthy."

2.2. Data

Data for the paper come from four sources.

[3] The food shares in total expenditure are, respectively, 0.64 for the poor and 0.54 for the vulnerable middle class. (computed from Table 3 below). These people thus spend, respectively, $0.64/day and $1.63/day on food, giving a ratio of 2.52.

[4] The current population-weighted PPP factor for our study countries is 0.37. Typical maize meal prices at retail today are about $0.60/kg, which converts to $1.62 using the PPP factor. Maize meal contains about 3,500 kcal/kg.

First, our household data are from LSMS (Living Standards Measurement Study) data sets across five countries of East and Southern Africa (ESA) (Ethiopia 2004/05, Uganda 2009/10, Tanzania 2010/11, Mozambique 2008/09, and Malawi 2001/11) and from the 2010 Income and Expenditure Survey (IES) data set from South Africa. We use these data to estimate consumption patterns over income classes, and to generate a set of expenditure elasticities that we use to project consumption levels and patterns in the region to 2040[5].

Second, our distributional data (shares of expenditure by 20-tiles) are from the World Bank's PovcalNet database, which uses more than 850 household surveys across 127 developing countries since 1980. We use these data for our six study countries to examine patterns of inequality in the region's growth for use in the baseline scenario of our projection model.

Third, we use the latest (2014) UN data and projections on urban population to establish current rural/urban population shares and as input into the projection model.

Fourth, we use COMTRADE and FAOSTAT trade data linked to a detailed commodity breakdown from the LSMS data sets to estimate gross import shares of food consumption patterns for each of our income strata.

We categorize food items in the LSMS data sets into basic levels of processing (rather than more complex categories related to nutritional content) because our focus is on the link between consumption patterns and likely demands on the African food system for processing and for activities related to perishables (such as cold chain). We use three levels of processing (unprocessed, low value added processed, and high value added processed) and perishable versus non-perishable.

TABLE 1 ABOUT HERE

2.3. Methods

The mapping of products to categories is given in Table 1. Foods are "unprocessed" if they undergo no transformation from their original state beyond removal from the plant and (for non-perishables) drying; examples include pulses, whole grains, and fresh fruit and vegetables. Processed foods are assigned to the "low value added" category if they satisfy only one of the following three conditions: have multiple ingredients; underwent physical change induced by heating, freezing, extrusion, or chemical processes (i.e., more than simple physical transformation); and have packaging more complex than simple paper or plastic. Examples in this "low processed" class include maize meal and milled rice. Foods meeting two of the three categories are classified as high value added processed; examples are breads and other bakery products, industrially packaged vegetable oils, and food away from home.

[5] See Annex A for more detail on the consumption aggregations and the projection model, including how we used South Africa data to ensure proper curvature in elasticities over income levels.

See Annex B for a more comprehensive listing of the top 10 food items (by value) in each of the six categories across all data sets, separately for Ethiopia and the rest of the region[6]. Our commodity breakdown for the import analysis consists of 27 commodity groups. The derivation of the expenditure patterns from the LSMS data and the development of the projection model are described in detail in Annex A.

3. KEY FINDINGS by ISSUE

3.1 Will a continuation of recent growth patterns drive the emergence of a middle class in East and Southern Africa?

Ravallion (2010) shows that the growth of the middle class across the developing world is correlated with GDP growth. Yet the correlation depends on how growth is distributed across households of different income levels. Potts (2013), among others, state that African growth is unequal over income groups, and thus continued growth of this same level and distribution over income strata will not cause the middle class to broaden over time.

To examine the degree of inequality in African growth and thus its potential effect on the growth of the middle class, we use PovcalNet data to compute quantile ratios of total percentage growth in per capita expenditure among the top and bottom 5%, 10%, and 20% of the income distributions in Ethiopia, Uganda, Tanzania, Malawi, Mozambique, and South Africa. The period of analysis is from the late 1990s or early 2000s to the latest available data, with period length ranging from five years (Mozambique) to 13 years (Malawi). We then: (1) calculate the distribution and level of growth from PovcalNet; (2) pair them with UN projections of the growth in rural- and urban populations over the next 30 years; (3) use the LSMS data from all these countries (except South Africa) to estimate rural:urban total expenditure ratios; and (4) project the shares of households in each income class out to 2040. The projection thus reflects a continuation of the patterns of growth, in level and distribution, of the past 15 years[7].

The results are shown in Table 2. The table shows that, under these assumptions, the poor will fall from over 70% of the population to under 20%, the middle class will rise from its current 27% to nearly three-quarters, and the share of the vulnerable middle in the overall middle class will fall by nearly half, from 73% to only 38%. Thus, a continuation of recent growth, as unequal as it may have been, will drive a majority of the population solidly into the middle class by 2040. Of course, declines in the level of growth or sharp increases in its inequality could derail this outcome.[8]

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[6] Our classification scheme maps very closely to that of Monteiro et al. (2010), despite the fact that theirs was developed to highlight the nutritional implications of diet change while our focus was on implications for the structure of the food system. Annex B also contains a mapping of items from Table 2 of Monteiro et al. (2010) into the food item matrix we present in our Table 1.

[7] Per capita expenditure in real PPP USD increased on average 4.5%/year over the period of analysis. Note that our projection assumes 20% more rapid growth in per capita incomes in urban areas compared to rural.

[8] These rates of poverty reduction are not unprecedented. From 1981 to 2011, the 55 countries classified by World Bank as Upper Middle Income saw their share of population living on less

TABLE 2 HERE

3.2 Do the Middle Class Reside in Urban areas only or also rural areas? How important is the class in each area?

Tables 3 and 4 explore the above question. Table 3 shows populations for the vulnerable middle class and the rest of the middle class, overall for ESA and by rural- and urban. It does this for 2010, and for 2040 under three scenarios as outlined in Annex A. *Business as Usual (BaU)* assumes a continuation of the recent level (4.5% per capita per year) and distribution of growth[9]; BaU-High and BaU-Low assume the same distribution of growth but change its level to 6.75%/year and 2.25% per year, respectively. Three patterns stand out. First, the urban middle class in 2010 was only 45% of the population of the total middle class in ESA – fully 55% of the middle class lies in rural areas. Second, rural areas in 2010 have a 37% share in the non-vulnerable middle class; more than one-third of all non-vulnerable middle class households reside in rural areas. Third, projecting forward under *BaU*, the rural share of the non-vulnerable middle class *rises* to 50%; under *BaU-high* it rises to 65%. Only under *BaU-low* does the rural share of the non-vulnerable middle class fall, to 32%. Yet even in this case, one-third of the non-vulnerable middle remains in rural areas. Note also that all three scenarios assume that per capita income growth will be 20% higher in urban areas compared to rural areas; these results do not depend on balanced growth across rural- and urban areas.

TABLES 3 AND 4 HERE

These results are driven by the fact that most of today's population, and especially the poor and vulnerable middle class population, is in rural areas; it is these people that will be rising into the middle class or upwards within the middle class as incomes rise, and there are simply more of them in rural- than in urban areas today and will continue to be over the next 30 years in this region.

We conclude that the middle class today is not simply an urban phenomenon, and that under reasonable scenarios about the future it is not likely to become simply an urban phenomenon.

Table 4 shows that while the overall urban middle class has 52% of the total population of urban areas, it makes 74% of total urban expenditures and 71% of urban food expenditures. Its market presence well exceeds its population share because it has higher incomes than the poor. This disproportion is also manifest in rural areas, where it has but 20% of the population but 37% of the food expenditures (purchases plus own production). The surprising finding for the whole of the region is that the middle class is still only 27% of the population but controls fully 54% of the total expenditures and 48% of the food expenditures.

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than $2/day fall from 68% to 14%; developing East Asia & Pacific, driven by China, saw this share fall from 93% to 23% over the same period. Source: World Bank Indicators, file si.pov.2day_Indicator_en_excel_v2.xls.

[9] This is the scenario that generated the 2040 values in Table 2.

3.3. Does the Middle Class have diets more diversified beyond starchy staples and toward processed and perishable foods than the other consumer classes?

Table 5 shows food budget shares of each of our six categories plus consumed own-production, by income class and by rural versus urban. For ease of interpretation, it also shows the shares for low- and high processed foods summed across perishable and non-perishable, and the shares of perishable and non-perishable summed across processing levels. Note that processed foods and perishable foods overlap, by design, in our classification scheme. Looking on the left side of the table, unprocessed non-perishable foods (largely whole legumes and whole grains; Annex B) have the lowest share among the six categories in both rural and urban areas. Other than own production, this category is the only one whose share falls consistently with income, to well below 1% among the upper class; within the middle class it falls by half from the vulnerable middle to the upper middle. This is consistent with Bennett's Law and expected.

Perishable unprocessed foods have a larger overall share and their share rises by almost half moving from the poor to the upper class; from vulnerable middle to upper middle, their share rises by about 30% (from 10% to 13%). This pattern reflects strong rises in the shares of fresh fruit, fresh fish, and eggs, and a very modest fall in the share of fresh vegetables, from 11% among the poor to 9% among the upper class (data not shown). This pattern of sharply rising consumption of animal proteins and fruit with rising incomes is also expected from Bennett's Law.

The surprising results from this table relate to processed foods. To facilitate interpretation, we also present Table 6, which shows the same data as Table 4 but uses shares of purchased food, not purchased plus consumed own production. Examining the two tables, three results stand out.

First, all processed foods (low- and high together across non-perishable and perishable) constitute over 40% of the entire food budget across all households (right side of Table 5), and 70% of purchased food (Table 6). Even more remarkably, the purchased food share of processed foods in Table 5 rises only modestly with income – the poorest households dedicate nearly as much of their purchased food budget (66%) to processed foods as do the highest income households (86%), while the share within the middle class rises only from 70% to 80%.

Second, the share of processed foods in purchased food does not differ between rural and urban areas. This finding is driven by (a) the importance of maize meal (low value added processed) in rural consumption and (b) the rise of purchased maize meal replacing hand-pounded or custom-milled grain: the share of maize meal in purchased food in rural areas is 8% compared to less than 3% for purchased grain for pounding or grinding into meal. Considering all consumption including own production (Table 5), 30% in rural areas is processed.

Third, highly processed food has more than one-third of the purchased food market (Table 6, final column in Processed) and shows a sharp rise with income in both rural and urban areas. This rise in the share of highly processed food across income classes is driven by sharp rises in nearly every element in this group (Annex B), especially food away from home, milk, and vegetable oils.

Summing across the perishable food sub-categories (final column in each table) shows that these foods also see a sharp rise in their budget shares, from 26% of all food (45% of all purchased food) among the poor to 59% of all food (65% of all purchased) among the upper class. From the bottom- to the top of the middle class, these shares rise from 27% of all food (44% of purchased) to 46% of all food (55% of purchased). As suggested from the previous discussion, it is the processed categories of perishables, and especially highly processed, that rise the fastest, by a factor of more than seven (in overall food) from poor to upper class, and a factor of 2.5 from vulnerable middle to upper middle. Purchased food shares of highly processed perishables nearly quadruple from poor to upper class and increase by 80% from vulnerable middle to upper middle.

TABLES 5 AND 6 HERE

Expenditure elasticities for processed, perishable, and processed-perishable foods are also high (Table 7). In both rural and urban areas, the top three elasticities, all above 1.0, are for (in order) perishable highly processed, perishable low processed, and non-perishable highly processed. This relationship is robust across the income distribution: the same order of elasticities is maintained across all three terciles of total expenditure in both rural and urban areas (data not shown). Also, bottom tercile households have the highest elasticities in every case. Engel's Law predicts that the poorest households would have the highest overall expenditure elasticities for food; the fact that they also have the highest elasticities for highly processed foods must be considered a major surprise.

Using these elasticities and other data and methods as outlined in Annex A, we present in Table 8 three scenarios for the future evolution of demand in our food item categories. *Business as Usual (BaU)* assumes a continuation of the recent level (4.5% per capita per year) and distribution of growth; BaU-High and BaU-Low assume the same distribution of growth but change its level to 6.75%/year and 2.25% per year, respectively.

Five results stand out. First, the share of own production in all food consumption varies hardly at all across the scenarios, falling from 57% in rural areas to within a percentage point of 50% in every case, and to a range of 26% to 29% overall. The table thus focuses on purchased food.

Second, three food categories see little change in their budget shares from 2010 in any of the scenarios: high processed non-perishable, and both unprocessed- and low processed perishable.

Third, high processed perishable shows the greatest change, rising from 14% to 18% even in the low growth scenario, and up to 29% in the high growth scenario. Overall, high processed rises in every scenario while low processed changes little.

Fourth, perishable foods as a group rise in every scenario, from 45% in 2010 to 49% under low growth and 59% under high growth.

Fifth, the overall processed food share is nearly identical in rural- and urban areas under all scenarios, with urban households showing higher shares for high processed than rural

households. Note, however, that in BaU and BaU-High, highly processed food garners a higher share than low processed food even in rural areas.

3.4. Is the Middle Class's diet biased toward imports compared with the other consumer classes?

We estimate the share of imports in total food expenditure by our income classes, separately for rural and urban areas. We do this in several steps. First, we converted COMTRADE and FAOSTAT import data from each country in our analysis to real 2005 PPP terms to be comparable with our expenditure figures. Second, we mapped four- and (when necessary) six-digit COMTRADE codes, and the FAOSTAT codes, into a set of 27 commodity groups from the LSMS data to compute import values for each of these groups. Since the expenditure figures are at retail and imports at CIF, we assumed an average 50% marketing margin from CIF to retail to compare the two[10]. The simple ratio of adjusted import value to estimated expenditure is an estimate of the share of imports in expenditure on each of the 27 groups.

Third, we used these import shares combined with budget shares for each income class on the 27 groups to compute the total value of imports for each income class, and divide by expenditure in that class to get the share of imports in total food expenditure.

Table 9 reports these shares for each income class and for rural versus urban. The key points are as follows. First, FAOSTAT data give higher import shares but identical patterns across income groups and rural versus urban areas. Second, the share of imports in expenditure is 4% (in COMTRADE) to 7% (in FAOSTAT) higher in urban than in rural areas.

Third, and quite surprisingly given common perceptions, import shares in urban areas *do not rise* with income, meaning that the urban middle class imports no more, as a share of their consumption, than the urban poor. This pattern of steady net import shares across income classes among urban consumers is driven by substitution away from (imported) wheat and rice towards meat and other products (as predicted by Bennett's Law) that have lower import shares.

Fourth, because rural population shares are high and import shares rise with income in rural areas, the middle class overall has a higher import share than the poor. Yet this difference is surprisingly small, about 16% on average for the middle class compared to 12% for the poor.

A simple application of these current import shares for each expenditure class to the projected distribution of population across expenditure classes in 2040 (Table 2) suggests only slight rises in the share of imports in consumption over the coming three decades; from 12% to 15% using COMTRADE and from 18% to 21% using FAOSTAT.

[10] Note that assuming a different marketing margin will have no effect on the pattern of import shares in expenditure across income classes, which is the focus of this analysis.

Note also that this scenario is consistent with a sharp rise in per capita food imports in the region. Our projection model indicates that, under the baseline scenario of a continuation of the recent level and distribution of growth in the region, combined with UN projections on population growth and the urban share of population, per capita cash expenditure on food will rise by 3.4 times from 2010 to 2040. Under this scenario, the slight rise in the import share in food consumption would lead to a rise of 4.4 times in net per capita food imports. In other words, per capita food imports can rise quite rapidly while changing very little as a share of food consumption.

This analysis however abstracts from the question (which is beyond the scope of this paper) of whether the production and marketing systems of the region can keep up with the projected dramatic rise in volume and value-added of food demand. This question is urgent in light of slow agricultural productivity growth on the continent. Productivity at farm and post-farm levels will have to increase dramatically to avoid an import surge that goes well beyond what we just discussed.

FIGURE 1 HERE

The possibility of such an import surge can be seen in Figure 1. To generate the figure, we assembled, from FAOSTAT, annual data on the per capita value of net food imports since 1980 from all countries in Latin America, developing Asia (Asia minus Japan, Singapore, and South Korea), and Sub-Saharan Africa. We excluded island nations. We then assembled data from the World Bank WDIs for each country on structural characteristics that should influence the level of imports but not be (strongly or quickly) influenced by those imports. The question to be answered was "does SSA import more food than would be predicted from its observable structural characteristics, independent of behavioral / policy / agricultural investment factors?"

Specific explanatory variables were:

a) Real per capita Gross National Income, in purchasing power parity terms (base = 2010);
b) The country's urban share in total population;
c) The share of the largest city in total urban population, a measure of the centralization of urbanization;
d) Hectares of arable land per person;
e) Whether the country is landlocked or not (1=landlocked, 0=not);
f) Year, to control for secular trends

We then regressed net per capita real food imports on these variables to generate predicted values for each country, aggregated these regionally, and compared predicted to actual imports. The R-Square for the regression was 0.46. The regression left out variables that capture policy and programmatic decisions that influence the productivity of the countries' food systems and thus their ability to produce, process, and distribute the quantity and quality of food demanded by their people. These could include expenditure on agricultural research and extension, and a range of public investment including in post-harvest infrastructure such as roads, the electricity grid, and market places and in education for its workforce. As a result, the difference between predicted and actual imports should reflect differences in performance on these variables;

imports above (below) predicted levels would reflect inferior (superior) performance relative to the average within the overall sample of countries.

We included Latin America in the regression but exclude it from Figure 1 to highlight the difference in performance between developing Asia and developing SSA. Results are striking. They show that predicted per capita net food imports in developing SSA have risen slowly but steadily over the period (somewhat more rapidly since the mid- to late-1990s), driven by the temporal pattern of income gains. Actual net imports have risen at the same pace but have consistently exceeded the predictions based on observed structural characteristics. This pattern is consistent with the continent's low productivity at farm level and throughout its food system. In contrast, Asia's predicted imports (driven by China) grew dramatically over the period and especially since 2000, driven by the region's high income growth. Yet actual imports trended slowly *down* throughout the period, and were far and increasingly below predicted levels through the 2000s, suggesting that some mix of policy, programmatic action, and private investment in the food system drove the system-wide productivity gains needed to avoid such an explosion in imports.

Whether Africa repeats Asia's experience or instead sees imports rise rapidly even as a share of consumption depends on whether it adopts the policies and public- and private investments that will drive increased productivity throughout its food system, a subject beyond the scope of this paper. Rather, what we have established is that any surge would not be the "fault" of the African middle class but of general factors shared by all the consumer classes.

4. CONCLUSIONS

This paper focused on the African middle class, already 350 million strong and growing at 20% a year faster than overall population growth. We show it is likely its growth will continue. The paper presented several empirical surprises, shown in current patterns and magnified by a time-projection analysis, focused on key issues in the region and used survey data from developing East and Southern Africa (ESA).

First, we showed that whereas it is usually thought that the African middle class is concentrated in urban areas, the survey data show it is 45% in urban areas of ESA and 55% in rural areas. The "vulnerable middle class" is important in both the urban middle class (at 60%) and the rural middle class (at 80%). The non-vulnerable middle class is today 37% rural, and this share will decline only if growth falters, but even then will remain at about one-third. The middle class has a much bigger share of national food expenditure than its population implies: whereas it is 27% of overall population, it is 48% of food expenditure. As it is growing relative to the poor class, in the future its consumption habits will determine the majority of the African food markets. This implies that its preferences will drive change in the African food economy.

Second, the data showed that purchased food is already an important share of the overall food economy, and with the rapid growth of the middle class, bound to become increasingly important. Our data showed that for ESA overall (rural and urban), 48% of the poor's food is purchased, versus 61% to 83% over the three substrata of the middle class. As the latter grows, there will be rapidly increasing demand for all market services in these countries – logistics, cold

storage, processing, wholesale markets, retail services. These results show that these supply chain services are not just a niche subject but now should be a key priority of African governments.

Third, the data showed that processed foods are already important in the ESA diet – but that there is not a big difference between the reliance on processed food by the poor versus the middle class. For overall urban plus rural, for all purchased processed food, the share in expenditure was 66% for the poor versus 70-80% for the three substrata of the middle class. The difference was only telling in the high processed foods (31% for the poor versus 38-50% for the middle class). Surprisingly, we found that the processed share in urban areas was just a bit higher than in rural areas – even for the poor and certainly for the middle class. This has two implications. On the one hand, we find that the concern of Popkin (2014) about the health consequences of the high and growing importance of highly processed foods is relevant also in Africa.[11] On the other hand, the results imply that productivity and employment consequences of the processing sector in Africa should pass from a niche theme to a mainstream policy issue and receive consequent research emphasis.

Fourth, perishable products like fruits, vegetables, and meat, emerged in the data as important parts of the purchased diet, as high as 42% of the poor's purchases and 44 to 55% of the three substrata of the middle class, overall, with roughly similar findings in urban areas alone. As the middle class grows, the share of these perishable products in the food economy, and their absolute level of consumption, will grow. This argues for "mainstreaming" the attention to supply chains and productivity of food products "beyond-grains" in Africa. It also argues for greatly increased attention to and public investment in development of cold chains, logistics, and wholesale markets for fresh produce (Tschirley et al. 2011) and meat and fish and dairy.

Fifth, it is usual to hear that the rise of the middle class will spur imports of food. A key finding of this paper is that the urban middle class is in fact not already consuming a higher share (than the urban poor) of its diet as imports – and thus by extension the continuing rise of the urban middle class will not bias the growth path toward more imports. Part of the reason for this is that the middle class's penchant for perishables is met in its great majority by local supply.

REFERENCES

Badiane, O. 2014. "Agriculture and structural transformation in Africa," in W.P. Falcon and R.L. Naylor (editors), *Frontiers in food policy: Perspectives on sub-Saharan Africa*: 1-43.

Banerjee, A. and E. Duflo. 2008. "What is Middle Class about, the Middle Classes around the world?" *Journal of Economic Perspectives* 22(2): 3-28.

Birdsall, N. 2010. *The (Indispensable) Middle Class in Developing Countries; or, the Rich and the Rest, Not the Poor and the Rest*. Working Paper 207. Center for Global Development, Washington, D.C.

Birdsall, N, Graham, C, Pettinato, S. 2000. *Stuck in Tunnel: Is globalization muddling the middle?* Working Paper 14, Washington: Brookings Institution.

[11] At the same time we note that not all these "highly processed foods" are unhealthy, and that an explicitly nutrition-focused analysis is needed to better understand the nutritional implications.

Chikweche, T, Fletcher, R. 2014. Rise of the middle of the pyramid in Africa: theoretical and practical realities for understanding middle class consumer purchase decision making. *Journal of Consumer Marketing* 31(1): 27-38.

Easterly, W. 2001. The Middle Class Consensus and Economic Development. *Journal of Economic Growth* 6: 317-335.

Financial Times. 2013. *Africa's rising food imports*. May 16. http://blogs.ft.com/beyond-brics/2013/05/16/africas-rising-food-imports/.

Gomez, M. and K. Ricketts (2013). "Food value chain transformations in developing countries: Selected hypotheses on nutritional implications." *Food Policy*, 42: 139-150.

Haggblade, S., S. Longabaugh, D. Boughton, N. Dembelé, B. Diallo, J. Staatz, D. Tschirley. 2012. *Staple food market sheds in West Africa*. Food Security International Development Working Papers, No. 121866. East Lansing: Department of Agricultural, Food, and Resource Economics, Michigan State University.

Monteiro, C., R. Levy, R. Claro, I. Ribeira de Castro, and G. Cannon. 2010. "A new classification of foods based on the extent and purpose of their processing," *Cad. Saude Pública* 26(11): 2039-2049.

Monteiro, C.A., J.-C. Moubarac, G. Cannon, S. W. Ng and B. Popkin. 2013. "Ultra-processed products are becoming dominant in the global food system," *Public Health Nutrition* 14(1): 5-13.

Ncube, M., C.L. Lufumpa, and S. Kayizzi-Mugerwa. 2011. *The Middle of the Pyramid: Dynamics of the Middle Class in Africa*. Market Brief, African Development Bank, April.

Nieftagodien, S. and S. Van den Berg. 2007. *Consumption patterns and the black middle class: the role of assets*. Stellenbosch Economic Working Papers: 02/07. Stellenbosch University, Department of Economics and the Bureau for Economic Research.

Popkin, B.M. (2014). "Nutrition, agriculture and the global food system in low and middle income countries." *Food Policy* 47:91-96.

Potts, D. 2013. Urban economies, urban livelihoods and natural resource-based economic growth in sub-Saharan Africa: The constraints of a liberalized world economy. *Local Economy* 28(2): 170-187.

Rakotoarisoa, M.A., M. Iafrate, and M. Paschali. 2011. *Why has Africa become a net food importer? Explaining Africa's agricultural and food trade deficits*. Trade and Markets Division, Food and Agriculture Organization of the UN. Rome.

Ravallion, M. 2010. "The Developing World's Bulging (but Vulnerable) Middle Class," *World Development* 38(4): 445-454.

Reardon, T, Tschirley, D, Haggblade, S, Minten, B, Timmer, CP, Liverpool-Tasie, S. 2013. Five Inter-Linked Transformations in the African Agrifood Economy: Food Security Implications. Paper prepared for "Harnessing Innovation for African Agriculture and Food Systems: Meeting Challenges and Designing for the 21st Century; November 25/26, Addis Ababa, Ethiopia.

Tschirley, D., M. Ayieko, M. Hichaambwa, J. Goeb, and W. Loescher. 2011. "Modernizing Africa's Fresh Produce Supply Chains without Rapid Supermarket Takeover: Towards a Definition of Research and Investment Priorities. Proceedings of "Towards priority actions for market development for African farmers", sponsored by International Livestock Research Institute, Nairobi. May 13-15, 2009.

USDA. 2013. *Agricultural Imports Soar in Sub-Saharan Africa*. International Agricultural Trade Reports. http://www.fas.usda.gov/data/agricultural-imports-soar-sub-saharan-africa.

Table 1. Main food items from LSMS data sets by processing / perishability categories

	Unprocessed	Processed, Low Value Added	Processed, High Value Added
Non-perishable	Legumes Maize grain others	Maize meal Milled Rice Sugar Others	Vegetable oils Breads, biscuits Food away from home Others
Perishable	Fresh vegetables Fresh fish Fresh fruit Others	Butchered beef Other meat (incl. poultry) Dried/packaged fish Others	Food away from home Dairy Others

Table 2. Populations and shares by income class in East and Southern Africa assuming continuation of rate and distribution of recent expenditure growth, 2010 and 2040 by rural and urban

	2010		2040	
Income Class	‘000	Share	‘000	Share
ESA-wide	234,769	100.0%	482,746	100.0%
Poor ($0-$2)	169,826	72.3%	90,033	18.7%
Vulnerable Middle ($2-$4)	**46,985**	**20.0%**	**139,021**	**28.8%**
Lower Middle ($4-$10)	**15,336**	**6.5%**	**165,870**	**34.4%**
Upper Middle ($10-$20)	**2,066**	**0.9%**	**58,493**	**12.1%**
Upper (>$20)	557	0.2%	29,329	6.1%

Source: Authors’ calculations and projections from LSMS household expenditure data, PovcalNet expenditure distribution data, and UN population data

Table 3. Distribution of ESA middle class, over urban and rural

		2040		
	2010	*BaU*	*BaU-high*	*BaU-low*
Overall ESA		------ Population ('000) -------		
Vulnerable Midde Class	46,985	139,021	91,731	155,715
Non-vulnerable Midde Class	17,401	224,363	280,482	119,844
ESA - Rural				
Vulnerable Midde Class	29,135	106,906	73,005	103,330
Non-vulnerable Midde Class	6,458	114,552	183,127	38,918
ESA-Urban				
Vulnerable Midde Class	17,851	32,115	18,726	52,385
Non-vulnerable Midde Class	10,943	109,811	97,355	80,925
		---------- Percent ----------		
Rural share in overall midde cass	55%	61%	69%	52%
Rural share in non-vulnerable midde class	37%	51%	65%	32%
Rural share in vulnerable midde class	62%	77%	80%	66%

Source: Authors' calculations and projections from LSMS household expenditure data, PovcalNet expenditure distribution data, and UN population data

Table 4. Share of Population & Expenditure, within urban, rural and total ESA

	Population (M)		Total Annual Expenditure (Bn USD)		Annual Food Expenditure (Bn USD)	
Urban Poor	25.9	47.0%	$11.0	17.8%	$6.5	23.9%
Urban Middle Class	28.8	52.2%	$45.5	73.5%	$19.3	71.3%
Vulnerable MC	*17.9*	*32.4%*	*$18.5*	*29.8%*	*$9.0*	*33.1%*
Urban Upper Class	0.4	0.8%	$5.4	8.7%	$1.3	4.7%
	55.1	100%	$61.9	100%	$27.1	100%
Rural Poor	143.9	80.1%	$57.3	56.4%	$38.0	62.1%
Rural Middle Class	35.6	19.8%	$42.9	42.2%	$22.7	37.1%
Vulnerable MC	*29.1*	*16.2%*	*$27.9*	*27.5%*	*$15.7*	*25.7%*
Rural Upper Class	0.1	0.1%	$1.4	1.4%	$0.5	0.8%
	179.6	100%	$101.6	100%	$61.2	100%
ESA Poor	169.8	72.3%	$68.3	41.8%	$44.5	50.4%
ESA Middle Class	64.4	27.4%	$88.4	54.0%	$42.0	47.6%
Vulnerable MC	*47.0*	*20.0%*	*$46.4*	*28.4%*	*$24.7*	*28.0%*

ESA Upper Class	0.6	0.2%	$6.8	4.2%	$1.8	2.0%
	234.8	100%	$163.5	100%	$88.3	100%

Source: Authors' calculations and projections from LSMS household expenditure data, PovcalNet expenditure distribution data, and UN population data

Table 5. Food budget shares by processing and perishability classification, income class, and rural/urban (2010)

		Purchased Food Categories										
		Non-Perishable			Perishable			Processed				
Income Class	Own Production	Unpro-cessed	Low Processed	High Processed	Unpro-cessed	Low Processed	High Processed	All	Low	High	Non-perishable	Peris
ESA-wide	42.0%	7.4%	10.7%	13.6%	9.9%	8.3%	8.1%	40.6%	19.0%	21.7%	31.7%	2
Poor ($0-$2)	52.1%	7.7%	9.9%	10.4%	8.7%	6.7%	4.5%	31.5%	16.6%	14.9%	28.0%	1
Vulnerable Middle ($2-$4)	39.1%	8.1%	11.2%	14.7%	10.1%	8.6%	8.1%	42.6%	19.8%	22.9%	34.0%	2
Lower Middle ($4-$10)	25.2%	7.3%	12.6%	18.4%	12.3%	10.8%	13.4%	55.2%	23.4%	31.8%	38.3%	3
Upper Middle ($10-$20)	16.9%	4.0%	11.9%	21.2%	12.9%	12.9%	20.2%	66.2%	24.8%	41.4%	37.1%	4
Upper (>$20)	9.2%	0.2%	7.0%	24.2%	12.4%	14.9%	32.1%	78.2%	21.9%	56.4%	31.4%	5
Rural	56.6%	5.9%	9.1%	9.7%	7.3%	6.8%	4.6%	30.2%	15.9%	14.3%	24.6%	1
Poor ($0-$2)	58.8%	6.6%	8.8%	8.6%	7.5%	6.1%	3.5%	27.1%	14.9%	12.2%	24.0%	1
Vulnerable Middle ($2-$4)	55.6%	5.4%	9.0%	10.5%	7.0%	7.1%	5.3%	32.0%	16.2%	15.8%	24.9%	1
Lower Middle ($4-$10)	49.9%	3.5%	10.5%	12.1%	7.1%	9.1%	7.8%	39.4%	19.6%	19.9%	26.1%	2
Upper Middle ($10-$20)	41.3%	0.9%	11.9%	15.6%	6.9%	11.7%	11.8%	50.9%	23.6%	27.3%	28.3%	3
Upper (>$20)	33.2%	0.0%	12.0%	19.4%	6.3%	13.7%	15.4%	60.5%	25.7%	34.8%	31.3%	3
Urban	9.0%	11.1%	14.3%	22.4%	15.8%	11.6%	15.8%	64.2%	25.9%	38.3%	47.8%	4
Poor ($0-$2)	12.6%	13.9%	16.3%	21.0%	15.9%	10.2%	10.2%	57.7%	26.5%	31.2%	51.2%	3
Vulnerable Middle ($2-$4)	10.3%	12.8%	14.9%	22.1%	15.6%	11.2%	13.1%	61.4%	26.1%	35.2%	49.8%	3
Lower Middle ($4-$10)	7.8%	10.0%	14.0%	22.8%	15.9%	12.0%	17.4%	66.3%	26.1%	40.2%	46.8%	4
Upper Middle ($10-$20)	3.2%	5.7%	11.9%	24.4%	16.2%	13.6%	24.9%	74.8%	25.5%	49.3%	42.1%	5
Upper (>$20)	0.0%	0.3%	5.0%	26.1%	14.6%	15.4%	38.5%	85.0%	20.4%	64.6%	31.5%	6

Source: Authors' calculations from LSMS household data

Table 6. Purchased food budget shares by processing and perishability classification, income class, and rural/urban (2010)

Income Class	Non-Perishable			Perishable			Processed				
	Unpro-cessed	Low Processed	High Processed	Unpro-cessed	Low Processed	High Processed	All	Low	High	Non-perishable	Perishable
ESA-wide	12.8%	18.4%	23.4%	17.1%	14.3%	13.9%	70.1%	32.7%	37.4%	54.7%	45.3%
Poor ($0-$2)	16.1%	20.6%	21.8%	18.1%	14.1%	9.4%	65.8%	34.7%	31.2%	58.4%	41.6%
Vulnerable Middle ($2-$4)	13.3%	18.3%	24.2%	16.7%	14.2%	13.4%	70.1%	32.5%	37.6%	55.8%	44.2%
Lower Middle ($4-$10)	9.8%	16.8%	24.6%	16.5%	14.5%	17.9%	73.8%	31.3%	42.5%	51.2%	48.8%
Upper Middle ($10-$20)	4.8%	14.3%	25.5%	15.5%	15.6%	24.3%	79.7%	29.9%	49.8%	44.7%	55.3%
Upper (>$20)	0.3%	7.7%	26.7%	13.6%	16.4%	35.4%	86.1%	24.1%	62.0%	34.6%	65.4%
Rural	13.5%	20.9%	22.3%	16.8%	15.8%	10.7%	69.7%	36.7%	33.0%	56.7%	43.3%
Poor ($0-$2)	16.1%	21.3%	21.0%	18.1%	14.9%	8.6%	65.8%	36.2%	29.5%	58.4%	41.6%
Vulnerable Middle ($2-$4)	12.1%	20.3%	23.7%	15.9%	16.1%	11.9%	72.0%	36.4%	35.6%	56.1%	43.9%
Lower Middle ($4-$10)	7.0%	21.0%	24.2%	14.3%	18.1%	15.5%	78.7%	39.1%	39.7%	52.2%	47.8%
Upper Middle ($10-$20)	1.5%	20.2%	26.5%	11.7%	20.0%	20.1%	86.8%	40.2%	46.6%	48.2%	51.8%
Upper (>$20)	0.0%	17.9%	29.0%	9.4%	20.6%	23.0%	90.6%	38.5%	52.0%	46.9%	53.1%
Urban	12.2%	15.7%	24.7%	17.3%	12.8%	17.4%	70.5%	28.4%	42.1%	52.5%	47.5%
Poor ($0-$2)	15.9%	18.6%	24.0%	18.1%	11.7%	11.6%	66.0	30.3	35.7	58.6%	41.4%

Vulnerable Middle ($2-$4)	14.2%	16.6%	24.7%	17.4%	12.5%	14.6%		% 68.4 %	% 29.1 %	% 39.3 %	55.5%	44.5%
Lower Middle ($4-$10)	10.8%	15.2%	24.8%	17.3%	13.1%	18.8%		71.9 %	28.3 %	43.6 %	50.8%	49.2%
Upper Middle ($10-$20)	5.9%	12.3%	25.2%	16.8%	14.1%	25.7%		77.3 %	26.4 %	50.9 %	43.5%	56.5%
Upper (>$20)	0.3%	5.0%	26.1%	14.6%	15.4%	38.5%		85.0 %	20.4 %	64.6 %	31.5%	68.5%

Source: Authors' calculations from LSMS household data

Table 7. Expenditure elasticities by food category, rural and urban (East and Southern Africa)

Purchased Food Category	Rural	Urban	ESA-Wide
Non-perishable			
Unprocessed	0.75	0.51	0.69
Processed Low	0.79	0.61	0.75
Processed High	1.07	1.00	1.05
Perishable			
Unprocessed	0.78	0.73	0.77
Processed Low	1.14	1.07	1.12
Processed High	1.54	1.38	1.50

Source: Authors' calculations from LSMS data. Mean of midpoint arc- and Tobit-Engels elasticities

Table 8. Food budget shares in 2010 and 2040 under three scenarios, by food item category, rural, and urban

	Purchased Food Categories										
	Non-Perishable			Perishable			Processed				
Scenario	Unpro-cessed	Low Processed	High Processed	Unpro-cessed	Low Processed	High Processed	All	Low	High	Non-perishable	Perishable
All ESA											
2010	12.8%	18.4%	23.4%	17.1%	14.3%	14.0%	70.0%	32.8%	37.4%	54.7%	45.3%
BaU-Low	9.6%	16.6%	24.8%	16.3%	14.8%	18.0%	74.1%	31.4%	42.8%	50.9%	49.1%
BaU	6.4%	14.1%	25.5%	15.1%	15.9%	23.2%	78.6%	30.0%	48.6%	46.0%	54.1%
BaU-High	3.9%	11.2%	25.3%	13.8%	16.7%	28.7%	82.2%	28.0%	54.2%	40.5%	59.2%
Rural											
2010	13.6%	21.0%	22.4%	16.8%	15.7%	10.6%	69.6%	36.6%	32.9%	56.9%	43.1%
BaU-Low	9.6%	21.7%	24.1%	15.3%	16.7%	12.9%	75.3%	38.4%	36.9%	55.4%	44.8%
BaU	7.1%	20.4%	24.9%	13.5%	17.8%	16.1%	79.4%	38.2%	41.0%	52.4%	47.5%
BaU-High	5.1%	18.8%	25.1%	12.3%	19.2%	19.6%	82.6%	37.8%	44.8%	49.1%	51.1%
Urban											
2010	12.2%	15.7%	24.6%	17.4%	12.7%	17.4%	70.5%	28.5%	42.1%	52.5%	47.5%
BaU-Low	9.6%	13.7%	25.2%	16.8%	13.8%	20.9%	73.4%	27.4%	46.0%	48.5%	51.5%
BaU	6.1%	10.5%	25.6%	15.8%	14.9%	27.1%	78.0%	25.4%	52.7%	42.2%	57.8%
BaU-High	3.3%	7.4%	25.5%	14.7%	15.4%	33.8%	82.1%	22.8%	59.3%	36.2%	63.9%

Table 9. Food imports as a share of total food expenditure in ESA, by income class (2010)

Income Class	COMTRADE	FAOSTAT
Region-wide	13.9%	19.5%
$0-$2	12.4%	17.5%
$2-$4	14.5%	20.6%
$4-$10	16.0%	22.6%
$10-$20	17.1%	23.9%
>$20	17.4%	23.0%
Rural	12.5%	17.4%
$0-$2	11.7%	16.3%
$2-$4	13.1%	18.4%
$4-$10	14.4%	20.1%
$10-$20	16.8%	23.5%
>$20	18.6%	25.2%
Urban	17.0%	24.3%
$0-$2	16.9%	24.5%
$2-$4	17.0%	24.6%
$4-$10	17.1%	24.4%
$10-$20	17.3%	24.1%
>$20	16.9%	22.1%

Source: Authors' calculations based on COMTRADE and FAOSTAT and LSMS data for all countries of the ESA FSZs

Annex A: Consumption aggregations and selected details of the projection model

We use data from the World Bank's PovcalNet data base, from Living Standards Monitoring System (LSMS) Surveys for five countries and seven years, population settlement data from Landscan, and data on cropping patterns and agro-ecological zones to build a food consumption projection model for three Food Staple Zones (FSZs) of ESA. The model projects total value of food demand in these FSZs broken down by two separate food item aggregations, one based on the type of commodity and another based on processing content. The model does these projections separately by income class and rural/urban residence, in five-year increments from 2010 to 2040. This annex explains the data and methods used in developing the model.

Current food and total expenditures by rural and urban areas: To calculate food and total expenditures by rural and urban areas, we used the data sets noted above in the following steps (about which further details are given in Annex A).

a) GIS data were used to create a set of "food staple zones" (FSZ). FSZ included in the analysis were mixed maize, cereal and root crops, and Ethiopian highlands (as a zone unto itself). Results generated from LSMS data from these three FSZ were used to extrapolate to the same FSZs in other countries of the region not covered in our LSMS data sets (Kenya, Rwanda, Botswana, Namibia, Zambia, Zimbabwe);
b) These main FSZ include rural and urban areas; they cover 81% of the population of developing ESA (excluding South Africa); the areas that are excluded include: the pastoral zones, the highland perennial zones, pure root crop zones, and the agro-pastoral millet sorghum zones;
c) We use LSMS data from rural and urban households in the five study countries to calculate current patterns and projections of food expenditure by food category as well as total expenditure by rural versus urban area by food staple zone;
d) We then apply the LSMS results to each total FSZ (extrapolating to all the countries); we aggregate up to ESA level by summing the results over the three FSZ;
e) For per capita results we use a weighted average with weights being the populations of the FSZs.
f) For expenditure strata results, we used the Povcal expenditure distribution data (the 20-tiles data from Povcal); we used Povcal data so that we had more generalizable data for expenditures over the countries for extrapolation.
g) We used the expenditure strata data from Povcal for the countries within ESA and applied that without differentiation to the different FSZ in each country;
h) We calculate the distribution of rural and urban expenditures by combining the FSZ expenditure data in (g) with relative urban:rural expenditure ratios from the LSMS data per FSZ within each country.
i) Applying Lorenz curves to the distribution of expenditures in (h) we estimated the population and mean expenditures by FSZ across rural and urban areas. We thus estimated propensities to consume from total expenditure (as a proxy for income) and the distribution of total expenditure levels between rural and urban areas, by expenditure class from the LSMS data.

Food Item Aggregation and Estimation of Expenditure Elasticities: We used LSMS data sets from five countries to develop two distinct food item aggregations and to compute budget shares and estimated elasticities. South Africa data were used only in the expenditure

elasticity estimates. The two food item aggregations were distinguished by (1) processing level and perishable/non-perishable as explained above and in Annex B, and (2) 27 food groups.

Engel's Law states that expenditure elasticities decline as total expenditure rises. Properly estimating by how much these elasticities decline with income becomes important when projecting consumption patterns out 30 years, during which time projected incomes will rise well beyond current levels. To generate reliable estimates for our purposes, we used LSMS data from all five countries plus South Africa. In summary, the approach took advantage of the wide variation of incomes across the LSMS data sets to estimate log-linear relationships between total expenditure and expenditure elasticities of demand for each food group, separately by income terciles in rural and urban areas in each FSZ. Elasticities for the projections were then selected using these relationships evaluated at mid-point total expenditure from each expenditure class. The essential gains from this approach are that (1) the regression captured the non-linear relationship that typically exists between elasticities and income and (2) it did so over a range of income that, due to the inclusion of South Africa, included the highest projected incomes in the region. Finally, we use LSMS data from the five non-RSA countries to compute food budget shares and total budget shares for each of the categories explained above.

Both mid-point arc elasticities and Tobit-Engel elasticities were estimated. Models were run with each and the models delivered very similar results, with the only meaningful difference in 2040 budget shares emerging for consumed own production: models based on Tobit-Engels elasticities projected larger declines in these items than did the models based on midpoint arc elasticities. Projection results mentioned in the paper are based on the average of model results from each set of elasticities.

Scenarios: This paper uses a *Business as Usual (BaU)* scenario, which incorporates parameters for mean total income growth, and distribution of that growth (a) across income levels and (b) across rural and urban areas. PovcalNet showed an overall growth rate of 4.5% based on annualized rates of real per capita PPP expenditure growth from 2000 to 2010 in the five countries for which we have LSMS data. We used that figure. We based the inequality of growth in the average quantile ratio of total percent change in per capita expenditure over the past 10-15 years between the top- and bottom terciles in the five countries, which was equal to 1.2. We used this ratio, linearly interpolated across all 20-tiles, to model the distribution of growth. Finally, we conservatively assumed an urban bias in growth that results in 20% higher average per capita growth in urban- compared to rural areas.

Annex B: Food item value shares in purchased food, by classification scheme, and correspondence with scheme in Monteiro et al. (2010)

ESA w/o Ethiopia														
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	maize meal	21.8%	legume - grain	57.5%	maize meal	34.4%	breads and biscuits	24.5%	vegetables - fresh	34.6%	beef - butchered	41.1%	food away from home	72.5%
2	vegetables - fresh	8.7%	maize grain	19.6%	milled rice	30.3%	food away from home	23.2%	fish - fresh	17.5%	meat other - butchered	18.9%	milk	14.3%
3	plantains - fresh	7.0%	groundnut - grain	11.4%	sugar - granulated	24.2%	vegetable oil	22.6%	fruit - fresh	10.9%	poultry - butchered	17.8%	fish - canned/cooked	5.9%
4	legume - grain	6.6%	other grains - grain	4.9%	spices / condiments	4.9%	formal alcoholic drink	9.2%	plantains - fresh	9.2%	fish - dried/packaged	13.7%	animal fats	1.4%
5	tuber - fresh	6.0%	sugar cane	2.5%	groundnut - flour	2.0%	soft drinks	6.6%	tuber - fresh	5.8%	cassava - dried/flour	7.5%	drinks	1.4%
6	maize grain	6.0%	wheat grain	1.6%	other grains - flour	1.1%	tea	2.9%	potato - fresh	4.4%	meat other - processed	0.6%	formal alcoholic drink	1.3%
7	cassava - dried/flour	5.7%	raw rice	1.4%	wheat flour	1.1%	oil crop - pressed	2.3%	fish - dried/packaged	4.3%	potato - fresh	0.1%	dairy products	0.7%
8	poultry - butchered	5.2%	nuts - grain	0.7%	tea	0.5%	traditional drink - alcoholic	2.3%	eggs	4.0%	beef - prepared	0.1%	vegetables - processed	0.7%
9	fruit - fresh	4.1%	oil crop - seed	0.2%	legume - prepared	0.4%	sweets	1.5%	cassava - fresh	3.8%	tuber prod used as inputs- non flour	0.1%	traditional drink - alcoholic	0.7%
10	cassava - fresh	4.0%	other	0.0%	groundnut - grain	0.3%	pasta	1.4%	oil crop - seed	3.5%	milk - raw	0.1%	fruit - processed	0.5%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													
ESA w/o Ethiopia - Rural														
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	maize meal	21.4%	legume - grain	53.9%	maize meal	35.3%	vegetable oil	27.6%	vegetables - fresh	36.5%	beef - butchered	35.4%	food away from home	69.2%
2	vegetables - fresh	8.6%	maize grain	23.3%	sugar - granulated	26.5%	food away from home	22.3%	fish - fresh	18.5%	meat other - butchered	24.1%	milk	15.1%
3	plantains - fresh	7.1%	groundnut - grain	9.5%	milled rice	25.8%	breads and biscuits	19.3%	fruit - fresh	11.1%	fish - dried/packaged	17.7%	fish - canned/cooked	9.5%
4	legume - grain	6.9%	other grains - grain	6.2%	spices / condiments	6.4%	formal alcoholic drink	9.7%	plantains - fresh	7.8%	poultry - butchered	11.1%	vegetables - processed	1.3%
5	tuber - fresh	6.1%	sugar cane	3.2%	groundnut - flour	2.1%	soft drinks	6.2%	tuber - fresh	6.8%	cassava - dried/flour	10.9%	animal fats	1.3%
6	cassava - dried/flour	5.9%	wheat grain	1.5%	other grains - flour	1.2%	traditional drink - alcoholic	4.2%	cassava - fresh	4.9%	meat other - processed	0.4%	traditional drink - alcoholic	1.2%
7	maize grain	5.6%	raw rice	1.1%	wheat flour	0.7%	tea	3.6%	fish - dried/packaged	3.5%	tuber prods used as inputs- non flour	0.1%	formal alcoholic drink	1.0%
8	poultry - butchered	5.1%	nuts - grain	0.9%	legume - prepared	0.6%	oil crop - pressed	2.5%	potato - fresh	3.3%	beef - prepared	0.1%	drinks	0.6%
9	fruit - fresh	4.1%	oil crop - seed	0.3%	traditional drink - non-alco	0.4%	sweets	1.0%	eggs	3.0%	milk - raw	0.0%	dairy products	0.3%
10	cassava - fresh	4.1%			groundnut - grain	0.3%	drinks	0.9%	oil crop - seed	2.9%	potato - fresh	0.0%	fruit - processed	0.3%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													
ESA w/o Ethiopia - Urban														
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	maize meal	25.8%	legume - grain	63.3%	milled rice	35.8%	breads and biscuits	28.9%	vegetables - fresh	32.8%	beef - butchered	48.3%	food away from home	74.8%
2	vegetables - fresh	9.6%	groundnut - grain	14.5%	maize meal	33.2%	food away from home	23.9%	fish - fresh	16.6%	poultry - butchered	26.2%	milk	13.8%
3	maize grain	9.3%	maize grain	13.8%	sugar - granulated	21.3%	vegetable oil	18.3%	fruit - fresh	10.8%	meat other - butchered	12.4%	fish - canned/cooked	3.5%
4	poultry - butchered	6.5%	other grains - grain	3.0%	spices / condiments	3.2%	formal alcoholic drink	8.7%	plantains - fresh	10.5%	fish - dried/packaged	8.6%	drinks	1.9%
5	plantains - fresh	6.1%	raw rice	1.9%	groundnut - flour	1.9%	soft drinks	7.0%	potato - fresh	5.3%	cassava - dried/flour	3.1%	animal fats	1.5%
6	tuber - fresh	5.1%	wheat grain	1.6%	wheat flour	1.5%	tea	2.2%	fish - dried/packaged	5.1%	meat other - processed	0.9%	formal alcoholic drink	1.5%
7	fruit - fresh	4.3%	sugar cane	1.4%	other grains - flour	1.0%	oil crop - pressed	2.1%	eggs	5.0%	potato - fresh	0.2%	dairy products	1.0%
8	legume - grain	4.3%	nuts - grain	0.4%	tea	0.9%	pasta	1.9%	tuber - fresh	5.0%	beef - prepared	0.1%	fruit - processed	0.6%
9	cassava - dried/flour	4.1%	oil crop - seed	0.1%	honey	0.3%	sweets	1.9%	oil crop - seed	3.9%	milk - raw	0.1%	soups	0.4%
10	cassava - fresh	3.0%	other	0.0%	groundnut - grain	0.2%	drinks	1.4%	cassava - fresh	2.8%	poultry - prepared	0.1%	traditional drink - alcoholic	0.3%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													

Ethiopia													
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	other grains - grain	34.2%	other grains - grain	43.4%	spices / condiments	50.6%	coffee	25.7%	potato - fresh	40.2%	vegetables - processed	33.4%	food away from home	46.1%
2	maize grain	15.2%	wheat grain	20.6%	sugar - granulated	26.7%	other grain- prepared	20.9%	vegetables - fresh	35.5%	beef - butchered	29.5%	beef - prepared	18.0%
3	wheat grain	10.3%	legume - grain	15.7%	other grain- prepared	5.2%	food away from home	17.9%	tuber - fresh	14.0%	meat other - butchered	28.1%	tuber - prepared	15.2%
4	legume - grain	10.0%	maize grain	13.9%	tea	5.0%	vegetable oil	13.1%	fruit - fresh	7.7%	poultry - butchered	3.8%	milk	8.4%
5	tuber - prepared	6.7%	coffee	3.6%	coffee	3.2%	traditional drink - alcoholic	7.8%	eggs	2.0%	tuber - prepared	3.4%	animal fats	6.0%
6	vegetables - fresh	5.4%	drinks	0.9%	legume - prepared	2.5%	breads and biscuits	7.8%	fish - fresh	0.3%	tuber - flour	1.4%	fruit - processed	2.9%
7	milk	3.5%	sugar cane	0.9%	milled rice	2.1%	soft drinks	1.4%	cassava - fresh	0.1%	fruit - processed	0.3%	dairy products	2.0%
8	beef - butchered	3.1%	oil crop - seed	0.4%	wheat products used as inp	2.1%	formal alcoholic drink	1.4%	poultry - live	0.1%	fish - dried/packaged	0.1%	eggs - prepared	0.7%
9	dairy products	2.0%	pulse - whole	0.2%	honey	1.0%	pasta	1.2%	meat other - live	0.0%	milk - raw	0.1%	vegetables - processed	0.2%
10	animal fats	1.9%	traditional drink - alco	0.1%	water	0.8%	tea	1.1%					formal alcoholic drink	0.2%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													
Ethiopia - Rural														
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	other grains - grain	34.2%	other grains - grain	31.1%	spices / condiments	62.3%	coffee	31.5%	potato - fresh	48.9%	vegetables - processed	45.0%	food away from home	49.2%
2	maize grain	15.3%	wheat grain	25.4%	sugar - granulated	17.4%	food away from home	21.0%	vegetables - fresh	23.6%	meat other - butchered	26.1%	tuber - prepared	18.8%
3	wheat grain	10.3%	maize grain	19.6%	other grain- prepared	6.0%	other grain- prepared	18.7%	tuber - fresh	18.2%	beef - butchered	18.5%	beef - prepared	16.9%
4	legume - grain	10.1%	legume - grain	14.2%	coffee	4.1%	vegetable oil	10.3%	fruit - fresh	8.3%	tuber - prepared	5.9%	milk	6.6%
5	tuber - prepared	6.7%	coffee	5.9%	tea	3.7%	traditional drink - alcoholic	10.2%	eggs	0.6%	tuber - flour	2.2%	fruit - processed	3.4%
6	vegetables - fresh	5.3%	sugar cane	1.3%	legume - prepared	3.1%	breads and biscuits	3.2%	fish - fresh	0.2%	poultry - butchered	1.6%	animal fats	2.4%
7	milk	3.5%	drinks (no alcohol, sof	1.3%	wheat products used as inp	1.1%	tea	1.1%	cassava - fresh	0.2%	fruit - processed	0.5%	dairy products	1.9%
8	beef - butchered	3.1%	oil crop - seed	0.6%	honey	0.8%	soft drinks	0.9%	poultry - live	0.0%	fish - dried/packaged	0.1%	eggs - prepared	0.3%
9	dairy products	1.9%	pulse - whole	0.3%	milled rice	0.5%	formal alcoholic drink	0.9%	meat other - live	0.0%	milk - raw	0.1%	formal alcoholic drink	0.2%
10	animal fats	1.8%	traditional drink - alco	0.2%	drinks (no alcohol, soft drir	0.3%	drinks (no alcohol, soft drink, co	0.8%					spices / condiments	0.2%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													
Ethiopia - Urban														
	Own Production		Non-Perishable Unprocessed		Non-Perishable Processed Low		Non-Perishable Processed High		Perishable Unprocessed		Perishable Processed Low		Perishable Processed High	
1	other grains - grain	33.3%	other grains - grain	62.0%	sugar - granulated	49.8%	other grain- prepared	26.2%	vegetables - fresh	68.0%	beef - butchered	43.1%	food away from home	35.4%
2	wheat grain	10.7%	legume - grain	18.0%	spices / condiments	21.8%	vegetable oil	19.9%	potato - fresh	16.8%	meat other - butchered	30.6%	beef - prepared	22.0%
3	maize grain	8.4%	wheat grain	13.5%	tea	7.9%	breads and biscuits	18.5%	fruit - fresh	6.0%	vegetables - processed	19.1%	animal fats	18.3%
4	legume - grain	7.6%	maize grain	5.4%	milled rice	6.1%	coffee	12.0%	eggs	5.9%	poultry - butchered	6.5%	milk	14.6%
5	vegetables - fresh	6.7%	drinks (no alcohol, sof	0.2%	wheat products used as inp	4.6%	food away from home	10.4%	tuber - fresh	2.7%	tuber - prepared	0.4%	tuber - prepared	2.8%
6	milk	5.3%	sugar cane	0.2%	other grain- prepared	3.2%	pasta	3.2%	fish - fresh	0.5%	tuber - flour	0.3%	eggs - prepared	2.0%
7	beef - butchered	4.8%	oil crop - seed	0.2%	water	2.0%	soft drinks	2.7%	poultry - live	0.1%	fruit - processed	0.1%	dairy products	2.0%
8	tuber - prepared	4.0%	coffee	0.2%	honey	1.4%	formal alcoholic drink	2.5%	meat other - live	0.0%	fish - dried/packaged	0.0%	fruit - processed	1.4%
9	breads and biscuits	3.3%	pulse - whole	0.1%	coffee	1.2%	traditional drink - alcoholic	2.1%	cassava - fresh	0.0%	milk - raw	0.0%	vegetables - processed	0.6%
10	animal fats	3.2%	groundnut - grain	0.1%	legume - prepared	1.0%	tea	1.1%					soups	0.4%
	Note: "drinks" include no no alcohol, soft drink, coffee, or tea													

Annex B, cont'd

Source: Authors' calculations from country LSMS data

Correspondence between food classification scheme in this paper and that in Monteiro et al. (2010)

	Unprocessed	Low Processed		High processed	
Non-perishable	Beans *& other pulses* *Whole grains* *Nuts*	Rice	Sugar Spices Manioc flour Wheat flour Maize meal Other flours	Veg oils Pasta Veg fats	Breads Biscuits Sweets Soft drinks Modern alcoholic drinks
Perishable	Fresh fruits Roots & tubers Fresh vegetables Fresh fish Eggs Raw milk	Butchered mea Dried fish		**Pasteurized milk** Animal fats	Cheeses Processed meats Canned dishes incl fish Sauces including mayonnaise Prepared food away from home Processed, packaged fruits & veg

Note: Monteiro places pasteurized milk in group 1