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Africa's Unfolding Diet Transformation: Implications for Agrifood System Employment

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Structured Abstract: Purpose: To understand how the unfolding diet transformation in East and Southern Africa is likely to influence the evolution of employment within its agrifood system and between that system and the rest of the economy. To briefly consider implications for education and skill acquisition. **Design/methodology/approach:** We link changing diets to employment structure. We then use alternative projections of diet change over 15- and 30-year intervals to develop scenarios on changes in employment structure. **Findings:** As long as incomes in ESA continue to rise at levels near those of the past decade, the transformation of their economies is likely to advance dramatically. Key features will be: sharp decline in the share of the workforce engaged in farming even as absolute numbers rise modestly, sharp increase in the share engaged in non-farm segments of the agrifood system, and an even sharper increase in the share engaged outside the agrifood system. Within the agrifood system, food preparation away from home is likely to grow most rapidly, followed by food manufacturing, and finally by marketing, transport, and other agrifood system services. Resource booms in Mozambique and (potentially) Tanzania are the main factor that may change this pattern. **Research Implications:** Clarifying policy implications requires renewed research given the rapid changes in Africa over the past 15 years. **Program Implications:** Improved quality of education at primary and secondary levels must be the main focus of efforts to build the skills needed to facilitate transformation.

Keywords: Diet transformation, employment, agrifood system, labor productivity, structural transformation

Article Classification: Research Paper (JEL: J2, O40, O14, Q10)

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1. Introduction

The sustained surge in African economic growth over the past 15 years has by now been widely recognized (World Bank 2014; Radelet 2010; Young 2012). Emerging evidence suggests that this income growth has begun to drive far-reaching changes in food demand among African households – a *diet transformation* (Tschirley et al forthcoming). As expected from Bennett's Law, and as documented earlier in Asia by Pingali (2006), this diet transformation involves a relative move away from cereal and tuber staples towards meat, fish, eggs, dairy, fruits and vegetables, and fats. Recent research also shows that the transformation involves a dramatic shift towards processed foods in urban and even rural areas (Dolislager et al forthcoming). Other research on diet transformations in the developing world has focused on the now widely documented *nutrition transition* (Popkin 2009) and on implications for natural resource use and environmental sustainability (Godfray et al 2010).

However, diet change also drives structural changes in labor demand, a critical issue in current African policy debates given the unprecedented wave of youth expected to enter the labor market in coming decades (IFAD 2013). Although Pingali (2006) mentions the employment issue in Asia, he does not explore it empirically. We do so for Africa in this paper, making two contributions to the literature. First, we quantify the size of the *agrifood system* (AFS) – the entire set of actors and activities involved in producing, processing, packaging, and distributing agricultural products to consumers – in total employment. Previous research has identified only farming employment, putting all non-farm employment in categories such as manufacturing, industry, and services. Yet many of these non-farm jobs are linked to the AFS as we have defined it, and so will be affected by diet change. Second, using LSMS data from six countries of East and Southern Africa (ESA), we develop categorization schemes for food- and non-food expenditures, and for jobs, that allow direct linking of the two. We are then able to use projected changes in consumer expenditure across the expenditure categories, combined with scenarios on changes in labor:output ratios, to develop scenarios (a) on the future evolution of employment in the AFS compared to the rest of the economy, and (b) across levels within the AFS.

The employment question is of great currency due to Africa's extremely young population structure, which implies the entry of over 300 million youth into the labor market over the next 15 years and over 700 million over the next three decades. Given the large share of the AFS in African economies – where food occupies more than half of the average African consumer's expenditure – changes in the structure of employment in this system will have major implications for the types of jobs that these youth need to prepare for. Two dynamics are at work. First, in the early stages of structural transformation of an

economy, non-farming sectors tend to be less labor intensive than farming, something we document in this paper. Second, there is concern that non-farming sectors may become even less labor intensive as the economy progresses, driven by larger-scale investment attracted by that very growth. These concerns are especially sharp in resource-rich countries, of which Africa has a growing number. The specter of "jobless growth" thus looms large in Africa: where will the hundreds of millions of youth, many of them born into farming families, find remunerative employment?

We focus on East and Southern Africa (ESA), and in particular on the countries of Ethiopia, Uganda, Tanzania, Mozambique, Malawi, and Zambia. The broadly comparable consumption patterns across these countries – every country has large regions that are 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.

The next section reviews methods and data. Section 3 characterizes the unfolding diet transformation in ESA. We present current patterns of consumption and project them to 2025 and 2040. Section 4 presents employment results: current level and structure of employment in- and out of the region's AFS, our scenarios for changed employment structure to 2025 and 2040, and a discussion of those results in light of available evidence on empirical patterns to date. Section 5 briefly considers the implications of projected structural changes for education and skill needs. We conclude with a brief discussion of the wide-ranging implications of the findings and identification of key research needs.

2. Methods and Data

2.1. Methods

Our measurement of diet change and linked labor demand projections emerges from the following multi-step process. We first list these steps, then explain each in more detail. Additional details are provided in Annex A.

1. Categorize all consumption items into eight standard expenditure categories (*i*) - seven food categories and one non-food category - using the expenditure modules of LSMS data sets for each of the six study countries. Compute 2010 values of total consumer expenditure in each of the eight categories (C_{it}, t=2010).

2. Compute budget shares and estimate expenditure elasticities of demand for each of the eight categories.

3. Identify a plausible range of population and per capita total expenditure growth trajectories from 2010 through 2040.

4. Combine growth rates in expenditure and population (step 3) with expenditure elasticities (step 2) to project growth in aggregate expenditure by category (non-foods and the seven food categories) over two successive 15-year periods: 2010 to 2025, and to 2040 (C_{it}, t=2025 and t=2040). Conduct sensitivity analysis under alternative scenarios on the rate of growth in per capita income.

5. Use the employment modules of these same LSMS data sets to categorize all jobs into five categories (*j*), based on the segment of the economy in which they occur. The first four categories are based on the value chain segments of the AFS: (1) farming (agricultural production, whether by owner-operators or agricultural employees); (2) marketing, transport, and other services; (3) food manufacturing; and (4) food preparation away from home. Jobs outside the AFS constitute the fifth employment category (L_{jt}, j=1-5, t=2010).

6. Estimate the share of total consumer expenditure in each expenditure category (*i*) that is captured by each of the four AFS value chain segments (the *j* without non-AFS):

   S_{jit} = share of each economic segment j in C_{it} for all t

   All non-food expenditure is allocated to the non-AFS segment.

7. Allocate 2010 total consumer expenditure from the eight consumption categories (C_{it}, t=2010; computed in step 1) into the five jobs categories (step 5) using the shares from step 6. Mathematically:

$$C_{jt} = \sum_{i=1}^{8} S_{jit} * C_{it}$$

where C_{jt} is consumption in the five jobs categories during year t. This is the analytical link between the eight expenditure categories *i* and the five jobs categories *j*.

8. Define total output (X) in each of the five jobs categories (non-AFS plus the four AFS value chain segments) as equal to each segment's total consumer expenditure from step 7 (C_j):

$$X_{jt} = C_{jt}$$

9. Compute aggregate labor/output ratios (LX) for each of the five jobs categories *j* using 2010 job totals (Step 5) and total output (steps 1 and 8) for the four AFS value chain segments plus non-AFS.[1]

$$LX_{j,2010} = \frac{L_{j,2010}}{X_{j,2010}}$$

10. Note that labor productivity in each segment is the inverse of that segment's labor/output ratio:

$$XL_{j,2010} = \frac{1}{LX_{j,2010}}$$

11. Define three scenarios for growth in labor productivity (r) from 2010 to 2025 and 2040; the scenarios specify labor productivity growth in all segments (including non-AFS) other than farming.

12. Compute labor/output ratios (LX_j) for 2025 and 2040 as the ratio in 2010 divided by the compounded growth rate in labor productivity:

$$LX_{j,2025} = \frac{LX_{j,2010}}{(1 + r_s)^{15}}$$

[1] Note that LX varies across the five jobs categories *j* but not across the eight consumption categories *i*. Future research could use farm-level budgets (or potentially a linking of jobs and farming modules in the LSMS data sets) to vary LX for farming across perishable and non-perishable categories. Other data would have to be used to differentiate LX for the food manufacturing jobs category across processing categories (high and low perishable, and high and low non-perishable).

$$LX_{j,2040} = \frac{LX_{j,2010}}{(1 + r_s)^{30}}$$

where r_s is the labor productivity growth rate in each scenario *s*.

13. Compute the total number of jobs in each non-farming jobs category for 2025 and 2040 as the product of each job category's total output and its labor/output ratio:

$$L_{j,2025} = X_{j,2025} * LX_{j,2025}$$
$$L_{j,2040} = X_{j,2040} * LX_{j,2040}$$

14. Compute total workforce (W_t) from the LSMS data sets, as all individuals age 15-64 not "out of the job market."

15. Computed jobs in farming as the residual: total workforce minus all jobs in the other four segments of the economy:

$$L_{ft} = W_t - \sum_{j=1}^{4} L_{jt}$$

In step 1, we use LSMS data sets for each of the six study countries to categorize all consumption items into eight groups: non-food, consumed own food production, and six categories for purchased food items, based on three processing levels and a perishable / non-perishable dichotomy. Purchased foods are unprocessed if they undergo no transformation from their original state beyond removal from the plant and (for non-perishables) drying. Processed foods are assigned to the high value added category if they satisfy at least two of the following three conditions: multiple ingredients; physical change induced by heating, freezing, extrusion, or chemical processes (i.e. more than simple physical transformation); and packaging more complex than simple paper or plastic. Foods satisfying one of those criteria are classified as low value added processed. See Annex B for a list of the top ten food items (by value) in each of the six purchased food categories plus consumed own production. Briefly, the groups are dominated by the following in value terms:[2]

[2] These shares refer to our ESA countries minus Ethiopia.

- Group 1 (consumed own production): maize grain or maize meal produced at home 28%; vegetables 9%; plantains and legumes 7% each; fresh tubers and cassava flour 6% each; poultry 5%
- Group 2 (non-perishable unprocessed): legumes, 58% of value
- Group 3 (non-perishable low processed): maize meal 34%; milled rice 30 %
- Group 4 (non-perishable high processed): breads and biscuits 25%; food away from home 23%; vegetable oils 23%
- Group 5 (perishable unprocessed): fresh vegetables 35%; fish 18%; fruit 11 %
- Group 6 (perishable low processed): beef 41%; other meat 19%; poultry 18%; dried/packaged fish 14%
- Group 7 (perishable high processed): food away from home 72%; milk and milk products 14%;

In step 2, budget shares and elasticities for the eight product categories *i* were computed as described in Annex A. Each was computed separately for rural- and urban areas and for terciles of total household expenditure in each. Data from South Africa were used in the elasticity estimates to ensure proper curvature over the range of total expenditures that would be seen during the projection period, as these exceeded the highest values currently seen in the six other countries.

In step 3, rural- and urban population projections for all countries were taken from the 2014 UN revision. Two scenarios were defined for growth in real purchasing power parity (PPP) per capita incomes. A high growth scenario assumes a continuation of growth rates seen over the past 10 years – 4.5% per year based on PovcalNet data for the five countries. The low growth scenario assumes 2%, which would imply policy reversals and other negative shocks to pull growth down sharply from its recent levels.

Step 4 integrates budget shares and expenditure elasticities from step 2, and population projections and total expenditure growth scenarios from step 3, into a consumer expenditure projection model. The model is used to project (under alternative scenarios) growth in demand for non-food and for each of the seven food categories over two successive 15-year periods: 2010 to 2025, and to 2040. We break the 30-year period in two because certain assumptions in our analysis, in particular that workforce participation rates will remain constant, might become less tenable out more than 15 years; the projections for that period remain potentially useful but clearly are subject to more uncertainty.

Step 5 uses the same LSMS data to compute jobs as the total number of full- and part-time jobs in each of the four AFS jobs categories and the single non-AFS category. Recall that the four AFS jobs categories are based on value chain segments – distinct functional levels or activities - in the AFS.

This categorization of jobs based on value chain activities makes it possible, in step six, to estimate the share of total consumer expenditure that accrues to each jobs category. This approach is equivalent to gross margin analysis that estimates the share of the final consumer price that accrues to each successive actor in the chain, from farmer through retailer. For example, 100% of value added in the food category "consumed own production" is from farming. For unprocessed non-perishable food (e.g., legumes or maize grain) purchased by consumers, we assume that 50% of total value added comes from farming and 50% from marketing, transport, and other services, which is equivalent to assuming that prices double from farm gate to consumer. We assume higher margins for perishable foods, with marketing, transport, and other services accounting for 60% of the consumer price, equivalent to a 150% increase from farm gate to consumer. The estimates used in the model are shown in a 5x8 matrix in Table 1. Additional notes on how the shares were established are in Annex C. We report the results of sensitivity analysis on these shares in the results section.

<TABLE 1 ABOUT HERE>

Step 7 analytically links the eight expenditure categories to the five jobs categories by use of these shares. The output from step 7 is the total value of consumer expenditure accruing to each of the five jobs categories / functional levels in the AFS. By defining output in each jobs category as equal to total consumer expenditure accruing to that category (step 8), labor:output ratios can be computed in step 9, and labor productivity in step 10 as the simple inverse. Table 2 shows these values, along with numbers of jobs in each category.

<TABLE 2 ABOUT HERE>

The rate at which labor leaves farm production over the course of development depends on the rate of growth in labor productivity in sectors outside of farming. Very rapid growth in labor productivity in these sectors will, for a given rate of overall economic growth, slow the transition out of agriculture. Slower growth in labor productivity outside agriculture will, conversely, pull more labor out of farm production, again holding overall economic growth constant. Note that labor productivity is driven in large measure by capital intensity: highly capital intensive growth outside of agriculture drives up labor productivity in those sectors and makes it more difficult for labor to leave agriculture.

We return to these issues empirically later in the paper. Here, we use this logic in step 11 to develop three scenarios regarding growth in labor productivity and thus about the rate at which labor will leave agriculture. The general approach and the first two scenarios in particular, follow Timmer (2012). The scenarios specify labor productivity growth for all sectors other than farming, including our single non-AFS sector. Farming is treated as a residual employer in each scenario and its labor productivity is inferred from model results. The scenarios are:

A. "Labor-intensive growth": This scenario assumes no growth in labor productivity outside the AFS, nor in any of the AFS sectors other than farming. As a result, labor is rapidly pulled out of (low productivity) farming into (higher productivity) non-farming activities. Structural transformation is accelerated, the pattern of income growth dramatically decreases inequality between farming and the rest of the economy, and poverty falls rapidly. This is an extreme case and unlikely to occur in practice, but captures elements of Asia's rapid growth in labor-intensive manufacturing over the past several decades.

B. "Capital-intensive growth": In this scenario, labor productivity grows in all non-farming jobs categories at the same rate that total demand in the category grows. Starting- and ending demand in the seven food item categories is mapped into jobs categories as in Table 1 and growth rates in each of these categories are derived. As a result, all non-farming sectors draw no labor out of farming, which must absorb all new labor and thus sees much less growth in labor productivity (incomes) than the other sectors. Structural change thus contributes nothing to growth, which is very unequally distributed across sectors. Like Scenario A, this is an extreme (and likely never seen in practice) scenario but captures elements of the very capital intensive growth outside of agriculture that can be seen in some resource rich countries.

Together, scenarios A and B put upper and lower bounds, respectively, on the amount of structural change in employment that would likely be seen in these economies.

C. "Structural scenario": This scenario is based on a long-term structural relationship estimated between per capita incomes and farming's share in a country's workforce: labor productivity in other sectors grows at a rate that generates farm shares in the workforce in 2025 and 2040 equal to predictions from that model. These shares are 61.0% in 2025 and 47.2% in 2040 under

4.5% growth, and 68.5% in 2025 and 62.3% in 2040 under 2% growth; see section 4 for these results). This scenario represents our "best bet" as to how the employment structure in these countries will evolve over the next 15- and 30 years under alternative growth trajectories.

Each scenario thus generated, based on the assumed rates of growth in labor productivity, labor:output ratios in 2025 (and 2040) for all non-farming sectors (Step 12).

In step 13, end-of-period jobs in each of these sectors – the final objective of this exercise - were computed as the product of these labor:output ratios and total consumer expenditure in the category. After defining the workforce as all individuals age 15-64 not "out of the job market" in step 14[3], jobs in farming were computed in step 15 as the residual (total workforce minus all jobs in other sectors).

The model assumes constant shares of imports in food consumption. Sensitivity analysis of the impact of rising or falling import shares on model results is beyond the scope of this paper. We note, however, that if food demand grows as projected in this paper, the real value of food imports to these countries would have to nearly triple by 2025, and increase by nearly seven times by 2040, just to maintain a constant share in purchased food demand. There is much scope for increasing food imports without affecting the results of these projections. Any decrease in import share would lead to more job creation than this model shows. This could happen, for example, if African agrifood systems successfully respond to increased demand for processed food and drive a decrease in the currently high import share of such food.

2.2. Data

Data come from four sources. First, household survey data for expenditure and jobs came from the latest LSMS data sets from each of the six countries (Ethiopia's 20111/12 ERSS, Malawi's 2010/11 IHS, Mozambique's 2008/09 IOF, Tanzania's 2010/11 National Panel Survey, Uganda's 2011/12 National Panel Survey, and Zambia's 2010 LCMS), from the 2010 Income and Expenditure Survey dataset from South Africa (for expenditure), and from South Africa's third quarter 2010 quarterly Labor Force Survey (for employment).

[3] For most countries, individuals were considered "out of the job market" if they (i) did not have a job listed in any category and (ii) did not look for work and/or try to start a business in the past 4 weeks (or "30 days"). Workforce size was assumed to grow at the same rates as population.

Second, we use the World Bank's PovcalNet database from the six countries above to establish recent patterns in the level and distribution of growth in the region for use in the baseline scenario of our demand projection model. Third, population data come from the latest (2014) United Nations (UN) data and projections. Fourth, we use data from the Groningen Growth and Development Centre (GGDC; see de Vries et al 2014) together with World Bank GNI per capita (real PPP, 2010 base) to quantify the relationship between country per capita incomes and the share of the workforce in farming.

3. Africa's Unfolding Diet Transformation

Tschirley et al (forthcoming), Tschirley et al (2013), and Dolislager et al (forthcoming) document the deep and broad penetration of processed foods in current consumption patterns of ESA. They also estimate very high elasticities – above 1.0 – for three- of the four processed foods categories: high value added perishable, high value added non-perishable, and low value added perishable. These results indicate that more diet change has already occurred than is widely appreciated, and suggest that the pace of change will remain rapid for some time.

Here we summarize the most salient aspects of current consumption patterns and present baseline results of the projection model to 2025 and 2040. These projection results feed into section 4 to project changes in employment structure.

3.1. Current consumption patterns and rates of change

The diet transformation in these countries is characterized by the commercialization of consumption (Dolislager et al, forthcoming) and the rise of processed and perishable foods (Tschirley et al, forthcoming). Two key patterns stand out. First, the transformation has progressed deeply in terms of budget shares and broadly across rural- and urban areas and across the income distribution. Second, diet change is happening most rapidly among the three-quarters of the population that currently lies under the international poverty line of USD2 per capita per day in purchasing power parity terms. This is far earlier in the income distribution than is commonly appreciated, and means that diet change is putting great pressure on the AFS now for structural change to respond to these new demand patterns. The next paragraphs present the empirical basis for these claims.

Table 3 summarizes key food consumption patterns across the six countries as of 2010. We highlight three results. First, purchased food – all food categories other than consumed own production –

accounts for 57% of all food consumption by value. This means that even in ESA, the least urbanized area of Africa, markets now exceed own production as the most important source of food[4]. Market reliance will be higher in other regions. We refer to this as the commercialization of consumption and find that it is not limited to urban elite. For example, households in the bottom tercile of total per capita expenditure rely on markets for 52% of their food, by value; the comparable numbers for all rural households and for rural households in the bottom tercile are 45% and 44%.

Second, processed food (low and high value added together) holds a 39% share of all food expenditure (including consumed own production) and a 68% share of purchased food expenditure. Note also that the share of highly processed foods slightly exceeds that of low processed, at about 36% of purchases compared to 32% (third column).

<TABLE 3 ABOUT HERE>

3.2. Projecting the changing composition of food demand

Table 4 shows the results of food- and non-food demand projections to 2025 and 2040, from a base year of 2010. The top portion shows results under 4.5% annual growth, and the lower portion under 2%. The table captures the combined results of several factors: population growth, an increasing urban share in population, starting budget shares, starting and ending demand elasticities, and income growth consistent with the patterns seen in these countries over the decade leading to 2010. These growth patterns are 4.5% real per capita income growth per year, distributed such that the top tercile of households achieves 1.2 times the percentage growth of the bottom tercile[5].

Under a continuation of recent growth, total expenditure increases by 2.9 times to 2025 and by 7.9 times to 2040. The expenditure rise is led by perishable, high value added processed foods ("Perishable – High Processed"), with growth multiples of nearly four to 2025 (an increase from USD 5.7 billion to USD20.8 billion) and over 11 to 2040 (USD5.7 billion to USD65.5 billion). Food budget shares for this item rise from 7.2% in 2010 to 10.1% in 2025 and 14% in 2040. Non-food is next in line, with growth multiples of 3.3 and 10.4, and total budget shares rising from 45% to 51% in 2025 then to nearly 60% by

[4] Note that consumed own production was valued at the prices consumers would have had to pay to purchase that food, not at farmgate sales prices. This avoids underestimating the share of consumed own production.
[5] These patterns were computed from World Bank PovcalNet data using survey results from each country as close to 2000 and 2010 as possible.

2040. Processed foods as a group increase their food budget share from 39% in 2010 to 44% then 50%; this rise, however, is driven almost entirely by the highly processed group (perishable and non-perishable), whose share rises from 15% to 20% and then up to 25%. Purchased food demand (the final six categories) rises from USD45.5 billion in 2010 to USD125.8 billion in 2025 and USD314.4 billion in 2040, and from 57% of all food consumption to 67% by 2040. Food's share in total expenditure falls from 55% to 49% and finally to 40%.

The pattern of growth across expenditure categories remains the same if per capita expenditure grows only at 2% per year, while total expenditure doubles to 2025 and nearly quadruples to 2040, compared to near tripling and eight-fold increase under the higher growth scenario.

Table 5 shows the expenditure values under each growth scenario mapped into our jobs categories, along with implied annual average growth rates for each category; these growth rates (except for farming) will be used in scenario C of the jobs projection model.

<TABLES 4 AND 5 ABOUT HERE >

4. Implications for Changing Structure of Employment

4.1. The projection model

The current structure of employment provides the starting point for our projections. Table 6 shows, for 2010, the number and shares of jobs in our single non-AFS category and the four AFS categories. Jobs are a simple count of all full- and part-time jobs. Computing jobs as full-time equivalents would reduce the total numbers and reduce the share of farming in those numbers, since it is inherently seasonal. Three patterns stand out. First, the AFS currently dominates employment in this region, accounting for over 80% of all jobs, nearly 90% of all rural jobs, and nearly 60% of all urban jobs. Second, most AFS jobs in the region are in farming (which includes own farming and hired labor), not in the other segments of the value chains: farming accounts for 93% of AFS jobs (81% of all jobs) in rural areas and 64% of AFS jobs (37% of all jobs) in urban areas. Third, jobs outside of farming but within the AFS – food manufacturing, marketing transport and other services, and food preparation away from home - account for 31% of all non-farming jobs overall (8% out of 25%), with little difference in share between rural- and urban areas. Non-farming employment in the AFS is most important for females, at 42% of all non-farming jobs held by females, compared to 24% for males; total non-farm employment of females within the AFS exceeds that of males by 4.2 million compared to 3.6 million, with the greatest gender difference being in food preparation away from home.

<TABLE 6 ABOUT HERE>

4.2. Developing Scenario C

Scenario C in our projections is based on the long-term relationship between a country's per capita incomes and farming's share in its workforce: we set labor productivity in other sectors to grow at a rate that generates farm shares in the workforce in 2025 and 2040 equal to predictions from that relationship. To estimate this long-term relationship we use data from GGDC on agriculture's share in employment from 11 SSA countries (Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, Tanzania, and Zambia) and eight Asian countries (China, India, Indonesia, Japan, Korea, Malaysia, Philippines, and Thailand) from 1960 to 2010.

We pair these data with World Bank data on real per capita income (purchasing power parity, 2010 base) and explore three versions of a simple relationship between agriculture's workforce share and log per capita incomes[6]. All regressions delivered an R-square of about 0.85 and slope coefficients significant at $p<0.01$. The three versions are:

1. Include all 19 SSA and Asian countries. This provided the widest range of incomes and delivered a slope coefficient of -0.208.
2. Exclude Asia and limit the regression to all SSA countries in the GGDC data base with incomes below $5,000. We chose this cutoff because mean incomes in the six ESA countries reach $4600 in 2040 in our high growth projections. This approach resulted in the *lowest* coefficient in absolute terms: -0.163.
3. The same as (2) but excluding resource rich SSA countries (Nigeria and Zambia; Botswana was already excluded in (2) due to high incomes). This approach gave the most negative slope coefficient: -0.226.

The large jump in the absolute value of the slope coefficient between (2) and (3) is striking. It indicates that non-resource rich SSA countries have been experiencing rapid movement of labor out of agriculture – a finding confirmed by independent recent estimates by McMillan and Harttgen (2014) and Fox et al (2013) - and thus highlights the negative impact that resource rents have had on this transformation. We return to the impact of resource rents later in the paper.

[6] Note that Timmer (1988) already demonstrated this general relationship. Our empirical analysis is done to operationalize our employment model.

Results from version 1 are shown in Figure 1; with a slope coefficient about midway between the other two version, we use this in our model. Note that the relationship is steep at low levels of income: growth from low levels (which describes nearly all SSA countries in 2010) results in very rapid declines in the share of farming in a country's workforce. As noted in the description of Scenario C, the farming workforce shares associated with our projected incomes in 2025 and 2040 are 61.0% and 47.2%, respectively under 4.5% growth, and 68.5% and 62.3% under 2% growth [7].

<FIGURE 1 ABOUT HERE>

All three jobs scenarios use demand projection results from Table 5 and the 2010 jobs numbers – total and per $1,000 of final consumer demand - from Table 2. Table 7 shows the labor productivity growth parameters used for each scenario during each period. Parameters for Scenario C were generated by scaling down all non-farming labor productivity growth parameters from Scenario B by the same factor, to generate the needed farm workforce shares.

<TABLE 7 ABOUT HERE>

Results for 2025 are presented in Tables 8 and 9 under the assumption that growth continues as it has over the previous 10 years, at 4.5% per year per capita. Six findings stand out. First, under idealized labor-intensive growth in all sectors outside of farming (Scenario A), the farm workforce declines in absolute numbers by more than 5%, and declines in share from 74.7% to 46.9%. In our "best bet" scenario (C), the farm workforce increases in size but falls in share to 61.0% (identical, as designed, to the level discussed above).

Second, except in Scenario B, where farming is forced to capture *all* job growth due to highly capital intensive growth off the farm, sectors outside of farming account for most growth in jobs: 66% in our structural Scenario C, and over 100% in Scenario A. The latter result is because labor intensive growth in the rest of the economy draws tremendous numbers of people off the farm, driving the absolute fall in farm workforce noted above.

[7] Population-weighted real per capita income in our six countries, from World Bank, was USD1,229 in 2010. Growth of 4.5% (2%) per year delivers declines in the farming workforce share of 13.7 (6.2) percentage points during each 15-year period. We apply these figures to our starting farming share of 74.7% from Tables 2 and 6 to generate the shares in 2025 and 2040.

Third, the rest of the economy outside the AFS captures most job growth except in Scenario B. In Scenario C (best bet) the economy outside of the AFS captures nearly half (48%) of all job growth, farming captures 34%, and non-farm activities within the AFS capture the balance (18%).

Fourth, the rapid rise in demand for processed foods and for food prepared away from home causes total employment in food manufacturing, food preparation, and marketing and transport each to more than double in Scenario C (rises of 115%, 137%, and 103%, respectively). Yet their small starting share in employment means that they contribute relatively little to total job growth over 15 years: 5.4% of total growth comes from food manufacturing, 2.4% from food preparation away from home, and 10.1% (because it started from a higher base) from marketing, transport, and other services.

<TABLES 8 AND 9 ABOUT HERE>

Our fifth result, seen in Table 9, is that Scenario C results in a slightly more equal distribution of incomes across sectors than exists in 2010. Labor incomes in farming nearly double (annual growth rate of 4.5%) while in other sectors they rise by 30% to 40% (annual increases of around 2% in each sector). As a result, labor productivity ratios relative to farming fall in all sectors, with the maximum ratio (in food manufacturing) falling from nearly eight to 5.27. By design, due to its capital intensive growth that does not pull labor out of farming, Scenario B results in large increases in inequality across sectors while Scenario A sharply reduces this inequality. Note that all scenarios result in the same mean labor productivity. In absolute terms, however, incomes remain lowest in farming under all scenarios.

Finally, we see in Scenario C that overall labor productivity rises by 4.5%, nearly identical to that of agriculture and at least double any other sector. Overall labor productivity can grow at such a high rate due to the movement of labor out of low-productivity farming into other sectors with higher productivity; this is the contribution of the structural transformation of the economy to economic growth. In scenario B, which involved no structural transformation (farming absorbed all new labor), overall growth in labor productivity was *lower* than it was in every sector except farming.

Note that changes in the total expenditure shares of Table 1 have tiny effects on the numbers and shares of employment across activities, instead affecting incomes that accrue to each activity. For example, raising the farmer shares on non-perishables to 70% (from 50%) and on perishables to 50% (from 40%) changes the marketing and transport employment shares only from 6.57% to 6.63%, with an equal decline in the farm share. Average farm incomes, however, rise by 11% (from by $1.29/day to $1.43/day), while marketing and transport average incomes fall by 28% (from $4.71/day to $3.41/day).

Dropping growth to 2% per year sharply moderates the move out of farming and thus slows the growth of the non-farm portion of the AFS. Under Scenario C, farming now accounts for 56% of all job growth to 2025 rather than 34%, and the non-farm AFS accounts for 13% rather than 18%. The relative growth of AFS segments remains unchanged, with food preparation away from home growing most in percentage terms, followed by food manufacturing, and finally marketing and transport.

<TABLES 10 AND 11 ABOUT HERE>

Extending the analysis to 2040 shows, first, that Scenario A of highly labor-intensive growth outside of farming becomes untenable under 4.5% growth, generating negative levels of farm employment in the model. What this means in practice is that labor productivity in non-farming sectors of the economy would have to start rising (contrary to the assumption in Scenario A) because farming could not supply enough labor to those sectors; shortages of labor would emerge, driving-up wage rates. Second, over the entire 30 year period and considering only our best bet scenario (C) under 4.5% growth, farming captures only 23% of new jobs, while the non-farm portion of the AFS captures 19%; the remaining 58% comes from (non-farm) jobs outside the AFS. Over this long period of time, dropping growth to 2% generates dramatically different results: farming still accounts for slightly more than half of all new jobs, with the non-farm AFS responsible for 14%.

4.3. Interpreting the model

The model we just presented is driven by assumptions about future trends in labor productivity. Implicitly, it is thus driven by assumptions about the capital intensity of economic growth: more capital intensity raises labor productivity, limits the growth of jobs in the capital intensive sectors, slows transfer of labor out of the labor intensive (and lower productivity) sectors, and drives increased inequality – increased labor income differentials - across sectors of varying capital intensity. Farming is typically the most labor intensive and thus has the lowest labor productivity; we showed this empirically for our six countries in Table 9. Policy makers are thus interested in two things: ensuring an increasingly productive and dynamic agriculture, and moving people out of farming over time and into sectors with higher labor productivity. What the model shows is that neither can happen without the other: broad income growth and poverty reduction requires the structural transformation of the economy.

We suggested that Scenario C, which is based on this long-term structural transformation relationship, is the “best bet” for how the six countries will evolve over the next 15- and 30 years. Recent research on

trends in the share of farming in Africa's workforce broadly supports this contention. For example, McMillan and Harttgen (2014) estimate an Africa-wide decline of 8.8 percentage points in this share between 2000 and 2010, while Fox et al (2013) estimate an even more rapid rate of decline of 5.5 percentage points over 2005 to 2010 (only five years); both estimated declines are somewhat higher than the relationship in Figure 1 would predict, given changes in incomes during that time.

Yet both that relationship and the other recent research admit a great deal of variability across countries. For example, at a per capita income of USD5,000, empirically observed farming shares in the workforce range from about 37% to over 60% (Figure 1). Examining the countries of ESA in the McMillan and Harttgen sample, jobs outside farming captured 92% of all job growth in Kenya but only 46% in Uganda and 32% in Rwanda. In the latter two cases, the farm share in employment fell (as it did in every country in the M&H sample), but only by three- or four percentage points, and from a high base (72% and 79%, respectively); together, these two factors resulted in the absolute number of jobs created in farming exceeding the number created off the farm.

We're left with two questions. First, can we develop more firm expectations regarding how the share of farming in total employment might play out over the coming two- to three decades? Second, can we bring other evidence to bear to evaluate model results on future employment within the AFS (not just farming) compared to the rest of the economy, and across activities within the AFS? To address the first question we return to the GGDC data and examine it on a country-by-country basis. For the second question we consider to what extent South Africa might be a harbinger of emerging patterns in the rest of ESA.

4.3.1. Country variability in farming's share in the workforce

Table 12 shows African and Asian countries from the GGDC database ordered in descending negative value of the coefficient from a country-by-country regression of the same relationship as in Figure 1: farming's share in the workforce against log income per capita between 1990 and 2010. Four results stand out. First, every country in the sample except the resource-rich African countries had a negative and highly statistically significant coefficient on log income. Second, the three African resource-rich countries had the least negative and least significant coefficients; Nigeria in fact had a *positive* but insignificant coefficient. Third, even excluding these resource rich countries, African countries show great variability in this relationship, with coefficients ranging from -0.257 (Tanzania) to -0.688 (Kenya). Finally, and again excluding the resource-rich countries, the coefficients themselves appear to show a

strong positive relationship to income: countries with higher incomes appear to achieve less reduction in farming's workforce share for a given percent increase in income.

Replicating the pooled regression of Figure 1 while adding a variable for the share of natural resource rents in GDP confirms the effect of natural resource dependence: a 10 percentage point increase in the share of natural resource rents in the economy increases farming's share in the workforce by 1.9 percentage points while leaving the coefficient on log income nearly unchanged.[8] The negative effect of natural resource dependence on the movement of labor out of farming is consistent with the highly capital intensive nature of natural resource exploitation – pushing things in the direction of Scenario B in terms of our projections. Mozambique now exports coal, and it and Tanzania have discovered large new natural gas resources. Unless the governments of these countries put in place policies that encourage growth in labor intensive sectors of the economy, these results suggest that both might see slower structural transformation even with high rates of growth.

<TABLE 12 ABOUT HERE>

Further analysis of the factors driving variation across countries in the relationship between income and farming's share of the workforce is beyond the scope of this paper. Summarizing the evidence we've assembled, however, strongly suggests that, unless growth slows sharply, the countries of ESA will, on average, see a substantial shift of labor out of farming, from 75% in 2010 probably to around 60% by 2025 and 50% or below by 2040.

4.3.2. Insights from South Africa's employment structure

Table 13 shows our standard employment breakdown applied to South Africa in 2010. We compare this to actual structures in 2010 and projected structures (under 4.5% growth) in 2025 and 2040 for the six countries in our analysis. In evaluating the table for insights on these countries' future evolution, keep in mind that South Africa's per capita PPP income in 2010 was over USD8,000 compared to an average across the six ESA countries of about USD2,400 in 2025 and USD4,600 in 2040. We would thus expect that the structural transformation projected by our model will not be as far reaching as what is seen today in South Africa. Also, historical factors linked to food and farming policies under apartheid have

[8] Natural resource rents in GDP from World Bank Indicators. Share of natural resource rents in GDP is significant in the regression at p=0.000.

resulted in an extremely large-scale, capital intensive agriculture. This is reflected in the fact that South Africa's farming workforce share (13.6%)[9] is less than half the predicted level from the model in Figure 1 (29.6%). Note also that nearly 12% of that 13.6% is hired farm labor. Largely as a result, the share of AFS jobs in South Africa's economy is low, at only 27.9%.

That said, the structure *within* South Africa's AFS (see the bottom portion of the table) lends support to our projections for the rest of ESA. In particular, following farming, the largest employment sectors in every case are, in order: marketing, transport, and services; food manufacturing; and food preparation away from home. Also, though food preparation away from home remains the smallest AFS sector in South Africa, its employment is *relatively* larger in that country, at two-thirds the size of food manufacturing and about 40% the size of marketing, transport, and other services. The comparable figures in ESA are 40% (0.011/0.028) and 19% (0.011/0.058) in 2010, rising to 45% and 24% by 2040. This too is consistent with the fact that demand and employment in this sector are projected to rise far faster than in the other three AFS sectors.

<TABLE 13 ABOUT HERE>

5. Implications of projected structural changes in the agrifood system for education and skill needs

Before closing we briefly consider the topic at the core of this special issue: the implications of agrifood system transformation for skill acquisition and education. Table 14 shows educational attainment and related variables in the six countries of ESA plus South Africa, broken down by our jobs categorization with one modification: for the education variables we have split farming into own farming and farming labor. Table 15 breaks down educational attainment by level. Four points stand out in the two tables. The first is that levels of education are very low in ESA. Only 2% of the workforce has completed tertiary education, 82% have completed primary or less, and 29% have not completed even a single year of primary school. Thus, the bulk of the workforce now and for some time in these countries will be people with only a primary education. Mass education at tertiary level is a distant dream in these countries.

<TABLES 14 AND 15 ABOUT HERE>

[9] This figure is computed from the 4th quarter 2010 QLFS. GGDC provides a similar figure for 2010, 15%.

Second, the farming workforce is the least educated in ESA, while in South Africa farm *owners* are the *most* educated while farm laborers are the least educated. This pattern reflects the long history of very large-scale farming engaged in almost entirely by white farmers in this country. Note that educational attainment in the six ESA countries is substantially higher in all non-farm segments of the AFS than in farming. This suggests that the returns to education – and the current and future need for it –are higher in these segments. The fact that returns to labor in farming are projected to stay lower than in all other sectors even through 2040 supports this contention.

Third, even in South Africa, typically 90% of workers in the AFS (aside from farmer-owners) have at most a secondary education (Table 15). Fifty- to sixty percent have no more than a middle school education. Fourth, growth rates in labor productivity have major implications for rates of skill and knowledge acquisition. Scenario C requires that farm labor productivity rise by 4.5% per year if overall growth continues at recent rates. Output per person will have to nearly double. Such growth will not be achieved without much greater use of external inputs, including in some cases mechanization. This external input use will have to be paired with greater knowledge and skill among farmers; farming in 2025 and 2040 will have to be a more knowledge intensive activity than it was in 2010. There is little escaping the conclusion that primary- and secondary school is where most effort will have to be made if worker skills are to facilitate rather than hinder the kinds of transformations that are now underway. Enrollments at these levels have risen rapidly in most African countries but quality – actual student achievement – has lagged or even fallen (Filmer and Fox, 2013).

The challenge in other sectors may appear less extreme but may not be so. Labor productivity in those sectors need grow only at half the rate of farming. Yet the farming sector has one benefit in this regard: the vast majority of those who will be farming in 2025 and 2040 will be those who are farming today or those born to families that are farming today. They will have a deep farming background. Meanwhile, the other sectors will be absorbing many people moving out of farming: the overall workforce over the 15 years to 2025 will increase by nearly 50 million but the farming workforce, if recent growth continues, will increase by only 17 million (Table 8). The other 33 million will be moving into other sectors that will require new skills for which these workers may have little background.

6. Summary and Conclusions

The projections in this paper are based on one empirical regularity and reflect two economic laws. The empirical regularity is the robust relationship between a country's per capita income and the share of its

workforce engaged in farming (Timmer, 1988). This relationship formed the basis of Scenario C. The relationship is a manifestation of Engel's Law, which makes it plain that, as incomes grow, expenditure on non-food items will grow more rapidly than expenditure on food, even as both rise in absolute terms. Our empirical results on changing consumption patterns reflect this law. The second economic law at play in our analysis, Bennett's Law, states that consumers will move, in a relative sense, away from staples (in the African case cereals and tubers) as their incomes rise, and towards meat, fish, oils, and fresh produce (Bennett, 1954; Timmer et al, 1983). Our empirical analysis of consumption patterns also reflects this law, while adding the finding that households are also likely to move strongly towards increasingly processed foods as their incomes rise, and indeed have already done so to a degree not widely appreciated.

We conclude that, as long as incomes in ESA continue to rise at some level near what they've done over the past decade, the transformation of their economies that has already begun (McMillan et al 2014) is likely to continue and advance dramatically. The key features of this transformation will be: a sharp decline in the share of the workforce engaged in farming even as absolute numbers rise modestly, a sharp increase in the share engaged in non-farm segments of the AFS, and an even sharper increase in the share engaged outside the AFS. Evidence from South Africa gives credence to our model results suggesting that, within the AFS, food preparation away from home will grow the most rapidly, followed by food manufacturing, and finally by marketing, transport, and other AFS services. Depending on how they're managed, resource booms in Mozambique and Tanzania are the main factor that may change this pattern. Of course, a sharp slowing of economic growth will result in far less transformation of the region's economies.

Our brief consideration of the educational and skill acquisition implications of these changes suggests that improved quality of education at primary and secondary level must be the main focus of educational efforts if the workforce of the future is to have the skills needed to facilitate these economies' structural transformation.

We close by noting that much of the broad-based work on employment in developing countries is about 30 years old (Squire, 1981; Krueger , 1981; Haggblade et al, 1986; Rosenzweig, 1988). Work focused on rural- and urban micro- and small enterprises saw a heyday in the 1990s (Mead and Liedholm, 1998). The more recent work on rural non-farm employment (Haggblade, Hazell, and Reardon 2007) was based on data through the early 2000s. Much new effort is needed to begin understanding the changes taking place since the take-off in African economic growth in the late 1990s.

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Annex A: Selected Methodological Details

Annex A1: Consumption aggregations and selected details of the projection model

This annex provides the outline of methods applied; readers should see Tschirley et al (forthcoming) for further details. We use data from the World Bank's PovcalNet data base, and from Living Standards Monitoring System (LSMS) Surveys for seven countries. Data from the six non-RSA surveys capture two thirds of the population of developing ESA[10]. The model projects total value of food demand in these countries broken-down by two separate food item aggregations, one based on type of commodity and another based on processing content. The model does these projections separately by tercile of total expenditure and rural/urban residence, in five-year increments from 2010 to 2040. This section explains the data and methods used in developing the model.

Food Item Aggregation and Estimation of Budget Shares and Expenditure Elasticities: We used LSMS data sets from seven 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 in this paper and 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 six 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 estimated for each food group, separately by income terciles in rural and urban areas in each country. Elasticities for the projections were then selected using these relationships evaluated at mid-point total expenditure from each total expenditure tercile. 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

[10] We consider only continental ESA and exclude South Africa. Countries of the region are Namibia, Swaziland, Lesotho, Zimbabwe, Mozambique, Zambia, Malawi, Tanzania, Kenya, Uganda, South Sudan, Burundi, Rwanda, and Ethiopia.

highest projected incomes in the region. Finally, we use LSMS data from the six 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 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 this 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.

ESA Aggregation: To create the aggregated ESA estimates we calculated population weighted averages of the non-RSA country level data for all per capita calculations, and all ESA total values were generated by summing the 66.37% of the ESA population that our non-RSA LSMS data represent.

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. To capture the inequality of growth, we first computed average growth rates in each country over the past 10-15 years, by tercile. We then computed the ratio of these figures between top- and bottom terciles, and took the average. This mean tercile ratio of growth rates across the five countries was 1.2, meaning that on average the top tercile enjoyed 20% higher percentage growth than the bottom tercile. We used this ratio, linearly interpolated across all 20-tiles of PovcalNet, to model the distribution of growth. Finally, we assumed an urban bias in growth that results in 20% higher average per capita growth in urban- compared to rural areas. Though data are scarce to empirically estimate such a parameter, both the extensive literature on urban bias in policies, the theory and evidence for economies of agglomeration in urban areas (World Bank 2009), and investigations of the role of migration to urban areas in escape from poverty (Christiaensen et al., 2013) suggest higher income growth rates in urban areas.

Annex B: Food item value shares, by classification scheme

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													

Annex B, cont'd

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, c	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 C. Notes on shares of consumer expenditure across eight categories accruing to each of the five jobs categories

Consumption and jobs categories	Initial Value Added Factors	After adjustment for food away from home	Notes
Non-food			
Non-AFS	100%	100%	
Consumed own production			
Farm production	100%	100%	
Food manufacturing		0%	
Marketing and transport		0%	
Food preparation away from home			
Unprocessed non-perishable			
Farm production	50%	50%	Non-perishable prices double (increase 100%) from farm- to retail
Food manufacturing		0%	
Marketing and transport	50%	50%	
Food preparation away from home			
Unprocessed perishable			
Farm production	40%	40%	Perishable prices increase 150% from farm- to retail
Food manufacturing		0%	
Marketing and transport	60%	60%	Marketing and transport occupy 60% of non-manufacturing costs for perishables
Food preparation away from home			
Low non-perishable			
Farm production	34%	34%	
Food manufacturing	33%	33%	Low processed has 33% manufacturing share
Marketing and transport	34%	34%	Marketing and transport occupy 50% of non-manufacturing costs for non-perishables (same relation as unprocessed)
Food preparation away from home			
Low perishable			
Farm production	27%	27%	
Food manufacturing	33%	33%	Low processed has 33% manufacturing share
Marketing and transport	40%	40%	Marketing and transport occupy 60% of non-manufacturing costs for perishables: (1-0.333)*.60 = 0.40
Food preparation away from home			
High non-perishable			
Farm production	25%	22%	
Food manufacturing	50%	45%	High processed has 50% manufacturing share
Marketing and transport	25%	22%	Marketing and transport occupy 50% of non-manufacturing costs for non-perishables: 0.5*0.5 = 0.25
Food preparation away from home		10%	Food away from home is 20.6% of total value of this category (Annex B). Assume 50% of total value added is from preparation and serving activities: 0.5*0.206 = 0.103. Others allocations scaled down to maintain 100% sum
High perishable			
Farm production	20%	14%	
Food manufacturing	50%	34%	High processed has 50% manufacturing share
Marketing and transport	30%	20%	Marketing and transport occupy 60% of non-manufacturing costs for non-perishables: 0.6*0.5= 0.3
Food preparation away from home		32%	Food away from home is 64.8% of total value of this category (Annex B). Assume 50% of total value added is from preparation and serving activities: 0.5*0.648 = 0.324. Others allocations scaled down to maintain 100% sum

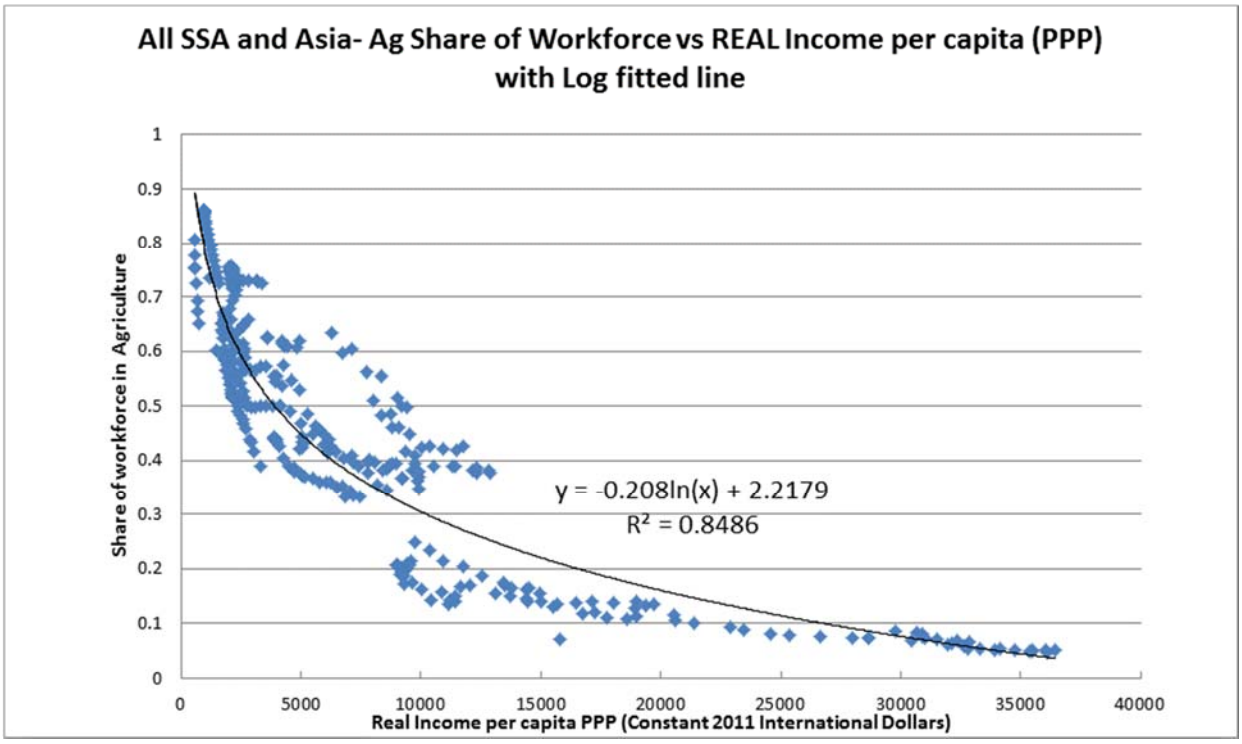
All SSA and Asia- Ag Share of Workforce vs REAL Income per capita (PPP) with Log fitted line
Share of workforce in Agriculture
Real Income per capita PPP (Constant 2011 International Dollars)
y = -0.208ln(x) + 2.2179
R² = 0.8486
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5000
10000
15000
20000
25000
30000
35000
40000

Table 1. Consumer expenditure shares by matrix of 8 expenditure categories and 5 jobs categories

	Jobs Category (value chain segment)				
Product category	Non-AFS	Farm production	Food mfg	Marketing, transport, & other services	Food preparation away from home
Non-food	1.00	0.00	0.00	0.00	0.00
Consumed own production	0.00	1.00	0.00	0.00	0.00
Unprocessed non-perishable	0.00	0.50	0.00	0.50	0.00
Unprocessed perishable	0.00	0.40	0.00	0.60	0.00
Low processed non-perishable	0.00	0.34	0.33	0.34	0.00
Low processed perishable	0.00	0.27	0.33	0.40	0.00
High processed non-perishable	0.00	0.22	0.45	0.22	0.10
High processed perishable	0.00	0.14	0.34	0.20	0.32

Table 2. Total number and share of jobs in six ESA countries in each jobs category, labor:output ratios, and labor productivity, by jobs category

	Jobs in 2010			
Jobs category	**Total ('000)**	**Share**	**Labor:Output ratio (jobs/USD '000)**	**Labor Productivity (USD '000/job)**
Non-AFS	17,090	0.174	0.26	3.84
Farming, own and wage labor	73,396	0.747	1.52	0.66
Food manufacturing	2,237	0.023	0.20	5.13
Marketing and transport	4,704	0.048	0.28	3.62
Food preparation away from home	846	0.009	0.29	3.46

Table 3. Budget shares and market size by expenditure category, six countries of ESA, circa 2010

	Budget shares			Market Size (billion USD) per year
Expenditure Category	Total	Food	Purchased Food	
Non-food	45.2%			65.7
Food				
Own production	23.6%	43.0%		34.3
Non-Perishable - Unprocessed	4.2%	7.7%	13.5%	6.1
Non-Perishable - Low Processed	5.5%	10.1%	17.8%	8.1
Non-Perishable - High Processed	7.2%	13.1%	23.1%	10.5
Perishable - Unprocessed	5.8%	10.6%	18.6%	8.5
Perishable - Low Processed	4.5%	8.2%	14.5%	6.6
Perishable - High Processed	3.9%	7.2%	12.6%	5.7
Total	100.0%	100.0%	100.0%	145.5

Source: Authors' calculations from LSMS data for Ethiopia, Uganda, Tanzania, Mozambique, Malawi, and Zambia

Table 4. Projection results for food- and non-food demand in six countries of ESA, by expenditure categories, 2010 to 2025 and 2040

	2010				2025				2040			
Expenditure Category	Market Size	Total budget share	Food budget share	Purchased food budget share	Market Size	Total budget share	Food budget share	Purchased food budget share	Market Size	Total budget share	Food budget share	Food budget share
					4.5% annual pc growth							
Non-food	65.7	45.2%	---	---	216.9	51.4%	---	---	686.1	59.5%	---	---
Food												
Own production	34.3	23.6%	43.0%		79.3	18.8%	38.7%		152.4	13.2%	32.7%	
Non-Perishable - Unprocessed	6.1	4.2%	7.7%	13.5%	13.8	3.3%	6.7%	10.9%	26.0	2.3%	5.6%	8.3%
Non-Perishable - Low Processed	8.1	5.5%	10.1%	17.8%	20.1	4.8%	9.8%	16.0%	45.2	3.9%	9.7%	14.4%
Non-Perishable - High	10.5	7.2%	13.1%	23.1%	29.0	6.9%	14.1%	23.0%	71.2	6.2%	15.2%	22.6%
Perishable - Unprocessed	8.5	5.8%	10.6%	18.6%	22.1	5.2%	10.8%	17.6%	53.2	4.6%	11.4%	16.9%
Perishable - Low Processed	6.6	4.5%	8.2%	14.5%	20.0	4.7%	9.8%	16.0%	53.4	4.6%	11.4%	16.9%
Perishable - High Processed	5.7	3.9%	7.2%	12.6%	20.8	4.9%	10.1%	16.5%	65.5	5.7%	14.0%	20.8%
Total	145.5	100.0%	100.0%	100.00%	422.0	100.0%	100.0%	100.00%	1,153.0	100.0%	100.0%	100.00%
					2.0% annual pc growth							
Non-food	65.7	45.2%	---	---	141.6	48.3%	---	---	289.4	51.9%	---	---
Food												
Own production	34.3	23.6%	43.0%		59.2	20.2%	39.0%		91.8	16.4%	34.2%	
Non-Perishable - Unprocessed	6.1	4.2%	7.7%	13.5%	11.5	3.9%	7.6%	12.5%	19.7	3.5%	7.3%	11.1%
Non-Perishable - Low Processed	8.1	5.5%	10.1%	17.8%	15.7	5.3%	10.3%	16.9%	28.7	5.1%	10.7%	16.2%
Non-Perishable - High Processed	10.5	7.2%	13.1%	23.1%	21.2	7.2%	14.0%	22.9%	40.1	7.2%	14.9%	22.7%
Perishable - Unprocessed	8.5	5.8%	10.6%	18.6%	16.9	5.8%	11.1%	18.2%	32.0	5.7%	11.9%	18.1%
Perishable - Low Processed	6.6	4.5%	8.2%	14.5%	14.0	4.8%	9.2%	15.1%	27.8	5.0%	10.3%	15.7%
Perishable - High Processed	5.7	3.9%	7.2%	12.6%	13.3	4.5%	8.7%	14.3%	28.7	5.1%	10.7%	16.2%
Total	145.5	100.0%	100.0%	100.00%	293.4	100.0%	100.0%	100.0%	558.0	100.0%	100.0%	100.0%

Note: Market size in billion USD/year. Source: Author calculations as described in text

Table 5. Projection results for food- and non-food demand in six countries of ESA, mapped into jobs categories

Category	Final consumer expenditure (billion USD)			Implied annual growth rates	
	2010	2025	2040	2010-2025	2010-2040
	----------4.5% annual pc growth----------				
Non-AFS	65.7	216.9	687.0	8.3%	8.1%
Farming, own and wage labor	48.4	116.5	241.0	6.0%	5.5%
Food manufacturing	11.5	33.2	86.6	7.4%	7.0%
Marketing and transport	17.0	45.7	110.8	6.8%	6.4%
Food preparation away from home	2.9	9.7	28.5	8.3%	7.9%
Total	145.5	422.0	1153.9	7.4%	7.1%
	----------2.0% annual pc growth----------				
Non-AFS	65.7	141.6	289.4	5.3%	5.1%
Farming, own and wage labor	48.4	87.3	144.3	4.0%	3.7%
Food manufacturing	11.5	23.8	46.3	5.0%	4.8%
Marketing and transport	17.0	34.2	64.6	4.8%	4.5%
Food preparation away from home	2.9	6.5	13.4	5.4%	5.2%
Total	145.5	293.4	558.0	4.8%	4.6%

Source: Authors' calculations from projection model

Table 6. Job structure in six countries of ESA, circa 2010

Jobs category	Female	Male	Rural	Urban	Total
	---------- Number of jobs ('000) ----------				
Agrifood system	41,315	39,868	72,862	8,321	81,183
Farming (own + wage labor)	37,109	36,287	68,011	5,385	73,396
Food Manufacturing	1,390	847	1,697	540	2,237
Marketing, transport, and other services	2,219	2,485	2,751	1,953	4,704
Food preparation away from home	601	245	403	443	846
Non-AFS	5,858	11,225	10,991	6,093	17,083
	---------- Share ----------				
Agrifood system	0.88	0.78	0.87	0.58	0.83
Farming (own + wage labor)	0.79	0.71	0.81	0.37	0.75
Food Manufacturing	0.03	0.02	0.02	0.04	0.02
Marketing, transport, and other services	0.05	0.05	0.03	0.14	0.05
Food preparation away from home	0.01	0.00	0.00	0.03	0.01
Non-AFS	0.12	0.22	0.13	0.42	0.17

Note: numbers reflect total number of jobs (population weighted) captured by LSMS surveys in Ethiopia, Uganda, Tanzania, Mozambique, Malawi, and Zambia; individuals may hold more than one job so job numbers are greater than population numbers. Source: Authors' calculations from LSMS data sets

Table 7. Labor productivity growth parameters used in each employment projection scenario

Category	2010 to 2025			2010 to 2040		
	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	Scenario C
	----------4.5% annual pc growth----------					
Non-AFS	0.000	0.083	0.022	0.000	0.081	0.027
Farming, own and wage labor	------ Computed within employment projection model ------					
Food manufacturing	0.000	0.074	0.019	0.000	0.070	0.023
Marketing and transport	0.000	0.068	0.018	0.000	0.064	0.021
Food preparation away from home	0.000	0.083	0.022	0.000	0.079	0.026
	----------2.0% annual pc growth----------					
Non-AFS	0.000	0.053	0.009	0.26	0.12	0.23
Farming, own and wage labor	------ Computed within employment projection model ------					
Food manufacturing	0.000	0.050	0.008	0.20	0.09	0.17
Marketing and transport	0.000	0.048	0.008	0.28	0.14	0.25
Food preparation away from home	0.000	0.054	0.009	0.29	0.13	0.25

Source: Authors' calculations

Table 8. Scenario results on evolution of job structure in East and Southern Africa, 2010 - 2025, with 4.5% annual income growth (Scenario C bolded as "best bet" projection)

	Jobs in 2010		Jobs in 2025								
			Number ('000)			Share			Contribution to total job growth		
Category	Number ('000)	Share	Scenario A	Scenario B	**Scenario C**	Scenario A	Scenario B	**Scenario C**	Scenario A	Scenario B	**Scenario C**
Non-AFS	17,090	0.174	56,421	17,090	**40,879**	0.383	0.116	**0.277**	0.80	0.00	**0.48**
Farming, own and wage labor	73,396	0.747	69,066	122,534	**89,941**	0.469	0.831	**0.610**	-0.09	1.00	**0.34**
Food manufacturing	2,237	0.023	6,486	2,237	**4,871**	0.044	0.015	**0.033**	0.09	0.00	**0.05**
Marketing and transport	4,704	0.048	12,628	4,704	**9,688**	0.086	0.032	**0.066**	0.16	0.00	**0.10**
Food preparation away from home	846	0.009	2,809	846	**2,032**	0.019	0.006	**0.014**	0.04	0.00	**0.02**
Total	98,273		147,411	147,411	**147,411**	1.00	1.00	**1.00**	1.00	1.00	**1.00**

Table 9. Projected labor productivity by activity, based on three scenarios for evolution of job structure in East and Southern Africa, 2010 – 2025, with 4.5% annual income growth (Scenario C bolded as "best bet" projection)

	Labor productivity,	Implied labor productivity in 2025 ($1,000/yr)			Implied annual growth rates in labor productivity			Labor productivity relative to farming			
Category	2010	Scenario A	Scenario B	**Scenario C**	Scenario A	Scenario B	**Scenario C**	2010	Scenario A	Scenario B	**Scenario C**
Non-AFS	3.84	3.84	12.69	**5.31**	0.000	0.083	**0.022**	5.83	2.28	13.35	**4.10**
Farming, own and wage labor	0.66	1.69	0.95	**1.29**	0.065	0.025	**0.046**	1.00	1.00	1.00	**1.00**
Food manufacturing	5.13	5.13	14.86	**6.82**	0.000	0.073	**0.019**	7.78	3.04	15.63	**5.27**
Marketing and transport	3.62	3.62	9.71	**4.71**	0.000	0.068	**0.018**	5.49	2.14	10.21	**3.64**
Food preparation away from home	3.46	3.46	11.50	**4.79**	0.000	0.083	**0.022**	5.26	2.05	12.09	**3.70**
Total	1.48	2.86	2.86	**2.86**	0.045	0.045	**0.045**	2.25	1.70	3.01	**2.21**

Table 10. Scenario results on evolution of job structure in East and Southern Africa, 2010 – 2025, with 2% annual income growth (Scenario C bolded as "best bet" projection)

	Jobs in 2010		Jobs in 2025								
			Number ('000)			Share			Contribution to total job growth		
Category	Number ('000)	Share	Scenario A	Scenario B	**Scenario C**	Scenario A	Scenario B	**Scenario C**	Scenario A	Scenario B	**Scenario C**
Non-AFS	17,090	0.174	36,835	**17,090**	32,312	0.250	0.116	**0.219**	0.40	0.00	**0.310**
Farming, own and wage labor	73,396	0.747	94,593	**122,534**	100,960	0.642	0.831	**0.685**	0.43	1.00	**0.561**
Food manufacturing	2,237	0.023	4,644	**2,237**	4,100	0.032	0.015	**0.028**	0.05	0.00	**0.038**
Marketing and transport	4,704	0.048	9,466	**4,704**	8,403	0.064	0.032	**0.057**	0.10	0.00	**0.075**
Food preparation away from home	846	0.009	1,873	**846**	1,636	0.013	0.006	**0.011**	0.02	0.00	**0.016**
Total	98,273		147,411	**147,411**	**147,411**	1.00	1.00	**1.00**	1.00	1.00	**1.00**

Table 11. Projected labor productivity by activity, based on three scenarios for evolution of job structure in East and Southern Africa, 2010 – 2025, with 2% annual income growth (Scenario C bolded as "best bet" projection)

	Labor productivity,	Implied labor productivity in 2025 ($1,000/yr)			Implied annual growth rates in labor productivity			Labor productivity relative to farming			
Category	2010	Scenario A	Scenario B	Scenario C	Scenario A	Scenario B	**Scenario C**	2010	Scenario A	Scenario B	**Scenario C**
Non-AFS	3.84	3.84	8.29	4.38	0.000	0.053	**0.009**	5.83	4.16	11.63	**5.07**
Farming, own and wage labor	0.66	0.92	0.71	0.86	0.023	0.005	**0.018**	1.00	1.00	1.00	**1.00**
Food manufacturing	5.13	5.13	10.64	5.80	0.000	0.050	**0.008**	7.78	5.55	14.93	**6.71**
Marketing and transport	3.62	3.62	7.28	4.07	0.000	0.048	**0.008**	5.49	3.92	10.21	**4.71**
Food preparation away from home	3.46	3.46	7.67	3.97	0.000	0.054	**0.009**	5.26	3.75	10.76	**4.59**
Total	1.48	1.99	1.99	1.99	0.02	0.02	**0.02**	2.25	2.16	2.79	**2.30**

Table 12. Coefficients from country level regressions of log per capita income on farming's share in workforce, selected countries of Asia and Africa, 1990-2010

Country	n (obs.)	Real Income per capita in 2010 (PPP, 2011 international dollars)	Coefficient	p-value	Resource Rich?
Kenya	21	2,493	-0.688	0.023	No
Malawi	8	722	-0.629	0.000	No
Senegal	21	2,159	-0.621	0.000	No
Thailand	21	12,270	-0.368	0.000	No
Ghana	5	3,032	-0.344	0.000	No
RSA	21	11,424	-0.283	0.000	No
Tanzania	21	1,526	-0.257	0.000	No
Indonesia	21	7,798	-0.232	0.000	No
Japan	21	35,517	-0.187	0.000	No
Philippines	21	7,478	-0.160	0.000	No
Malaysia	21	19,725	-0.158	0.000	No
India	21	4,589	-0.137	0.000	No
China	21	9,188	-0.121	0.000	No
Korea	21	30,475	-0.105	0.000	No
Botswana	21	12,832	-0.035	0.084	Yes
Zambia	21	3,221	-0.000	0.122	Yes
Nigeria	20	4,825	0.053	0.232	Yes

Note: Dependent variable = farming share of workforce. Source: Authors calculations from GGDC data for farm workforce share, World Bank for incomes.

Table 13. South Africa's current job structure compared to current and projected in other ESA countries

Jobs category	South Africa, 2010	Six countries of ESA		
		2010	Projected 2025	Projected 2040
	---------- Share in total workforce ----------			
Agrifood system	0.279	0.826	0.727	0.621
Farming	0.136	0.747	0.615	0.486
Food Manufacturing	0.044	0.023	0.033	0.040
Marketing, transport, other services	0.072	0.048	0.065	0.077
Food preparation away from home	0.028	0.009	0.014	0.018
Non-AFS	0.721	0.174	0.273	0.379
	---------- Share in AFS workforce ----------			
AFS Only				
Farming	0.487	0.904	0.846	0.783
Food Manufacturing	0.158	0.028	0.045	0.064
Marketing, transport, other services	0.258	0.058	0.089	0.124
Food preparation away from home	0.100	0.011	0.019	0.029

Source: Authors' calculations from South Africa 2010 Q4 Quarterly Labor Survey

Table 14. Educational and related indicators in six countries of ESA plus South Africa, by jobs classification

	Six countries of ESA				South Africa
	Mean years formal education,	Share of workforce		Annual growth in labor productivity,	Mean years formal education,
Jobs category	2010	2010	2025	Scenario C	2010
All jobs	4.3	---	---	---	10.5
Own farming	3.8	0.747	0.616	0.045	11.2
Farm labor	3.8				7.4
Food manufacturing	4.4	0.023	0.033	0.020	10.0
Marketing, Transport, and other services	5.5	0.048	0.065	0.019	9.8
Food preparation away from home	5.5	0.009	0.014	0.023	10.5

Source: Author calculations

Table 15. Shares of the workforce attaining different levels of formal educational attainment, six countries of ESA plus South Africa (2010)

	Formal Educational Attainment						
Job category	**No Primary**	**Some Primary**	**Primary**	**Middle**	**Secondary**	**Tertiary**	**Full workforce**
	---------- Share in each category, six ESA Countries ----------						
All jobs	0.29	0.23	0.30	0.14	0.02	0.02	1.00
Own farming	0.33	0.25	0.28	0.12	0.01	0.01	1.00
Farm labor	0.30	0.27	0.31	0.10	0.01	0.00	1.00
Food manufacturing	0.26	0.26	0.31	0.13	0.02	0.02	1.00
Marketing, Transport, and other services	0.15	0.20	0.43	0.18	0.03	0.02	1.00
Food preparation away from home	0.13	0.18	0.45	0.19	0.03	0.01	1.00
	---------- Share in each category, South Africa ----------						
All jobs	0.03	0.04	0.09	0.33	0.30	0.19	1.00
Own farming	0.05	0.04	0.07	0.17	0.40	0.26	1.00
Farm labor	0.10	0.10	0.23	0.43	0.11	0.01	0.99
Food manufacturing	0.03	0.03	0.10	0.39	0.34	0.10	0.98
Marketing, Transport, and other services	0.03	0.04	0.11	0.40	0.32	0.06	0.97
Food preparation away from home	0.01	0.02	0.07	0.36	0.42	0.10	0.98

Note: shaded areas indicate majority of population. Source: Author calculations from household survey data