The Costs of Consumption Smoothing: Less Schooling and Less Nutrition

Leandro de Magalhaes
Dongya Koh
Raül Santaeulàlia-Llopis

This version: Ferury 2017
(September 2016)

Barcelona GSE Working Paper Series

Working Paper nº 939

The Costs of Consumption Smoothing: Less Schooling and Less Nutrition*

Leandro De Magalhães
University of Bristol

Dongya Koh
University of Arkansas

Raül Santaeulàlia-Llopis
MOVE-UAB and Barcelona GSE

February 3, 2017

Abstract

Using novel micro data, we explore lifecycle consumption in Sub-Saharan Africa (SSA). We find that households' ability to smooth consumption over the lifecycle is large, particularly, in rural areas. Interestingly, consumption in old age is sustained by shifting to self-farmed staple food, as opposed to traditional savings mechanisms or food gifts. This smoothing strategy entails two important costs. First, there is a loss of human capital as children are diverted away from school and into producing self-farmed food. Second, a diet largely concentrated in staple food (e.g., maize in Malawi) in old age results in a loss of nutritional quality for households headed by the elderly.

Keywords: Consumption, Smoothing, Lifecycle, Self-Farming, Schooling, Nutrition, Sub-Saharan Africa
JEL Classification: E21, O11, R20

*We would like to thank Imran Rasul and Jon Temple for their comments. We would also like to thank seminar participants at the World Bank LSMS group, participants at the Oxford CSAE meetings in 2016 and at the European Winter Meeting of the Econometric Society in Edinburgh, and the research assistance of Parker Chang, Jonas Jin and Ardina Hasanbasri. Raül Santaeulàlia-Llopis acknowledges financial support from the Spanish Ministry of Economy and Competitiveness, through the Severo Ochoa Programme for Centres of Excellence in R&D (SEV-2015-0563)

1 Introduction

In economies where large populations live on less than one dollar per day, how much can households smooth consumption over the lifecycle? While a lot of attention has been drawn to the testing of the informal arrangements that preserve consumption in response to income shocks (i.e., unanticipated income changes) in poor countries (Townsend, 1994, Attanasio and Ríos-Rull, 2000, Kinnan, 2014), less is known about the ability to smooth consumption against anticipated changes in income such as the arrival of old age. This is particularly important for poor countries because the lack of pension income and the presence of savings constraints (Dupas and Robinson, 2013a,b, Brune et al., 2015) can limit the ability to sustain consumption in old age. To assess this question, we draw on the new waves of the Integrated Surveys on Agriculture under the Living Standards Measurement Study (LSMS-ISA) in Sub-Saharan Africa (SSA).[1] We focus on some of the world poorest countries in SSA, mainly Malawi, where lifecycle consumption smoothing can be a strong challenge.[2] Three main empirical findings emerge from our analysis.

Our first finding is that the household's ability to smooth consumption over the lifecycle is large in SSA, particularly, in rural areas. Household expenditure displays a hump shape over the lifecycle in both urban and rural areas, but the hump is much less pronounced in rural areas. This difference between urban and rural expenditure profiles also holds once we control for household structure. Precisely, the size of the adult-equivalent expenditure hump for urban areas is roughly double that for rural areas. Further, disaggregating lifecycle expenditure we find that food expenditure is twice smoother over the lifecycle than nonfood expenditure which, given the larger share of food in household expenditure in rural areas, partly explains the flatter profile of household expenditure in rural areas than in urban areas.[3]

The presence of a hump in lifecycle expenditure in SSA is consistent with previous evidence from rich and middle-income countries (Deaton and Paxson, 1994, Attanasio et al., 1999, Storesletten et al., 2004, Fernández-Villaverde and Krueger, 2007). Interestingly, the size of the

[1] For a detailed analysis on the LSMS-ISA improvements on previous LSMS data sets see Carletto et al. (2010) and Beegle et al. (2012). The ISA data is available for several countries in SSA.

[2] We mainly focus on Malawi in the main text, the country with perhaps the highest quality of data in the LSMS-ISA group (De Magalhães and Santaeulàlia-Llopis, 2015). We show robustness of our results for Uganda and Nigeria in the appendix. Malawi's average income per capita of 850, Uganda is closer to the middle of the income distribution with an income per capita of 1,230, and Nigeria is somewhat richer with an income per capita of 2,160. These values are in purchasing power parity for 2010 as provided by the World Bank. Using US current dollars (USD), rural households in Malawi and Uganda have income per capita levels of less than 250USD.

[3] Recent studies suggest that food is less subject to measurement error than other consumption items, in large part because it is surveyed with less recall (Attanasio et al., 2014). At the same time, a focus on food is interesting in our context because food represents the largest item of the consumption basket in SSA. In Malawi, for example, food expenditure represents more than 60% of total household expenditure (De Magalhães and Santaeulàlia-Llopis, 2015).

hump in household expenditure in the urban areas of SSA is comparable to the U.S. This implies that there is a larger ability to smooth lifecycle consumption in the rural areas of SSA, where the vast majority of the population lives, than in the U.S.[4]

Our second finding after investigating food expenditure by source of origin is that the smoothing of food expenditure is driven by substituting into self-farmed staple food (e.g., maize in Malawi) and away from purchased food in old age.[5] Food gifts play a minor role in lifecycle smoothing as they are flat throughout. These findings imply that we are able to empirically discard two alternative explanations of how consumption smoothing is achieved in old age for the poor countries that we study. The first is that lifecycle consumption smoothing is not achieved through buffer savings or borrowing as we show that purchased food declines in old age. In this sense, this paper speaks to a literature that has identified savings constraints among the poorest and studies how they attempt to smooth consumption in spite of the constraints (Dupas and Robinson, 2013a,b, Brune et al., 2015). The second is that, despite the important role of informal arrangements in managing consumption insurance against unanticipated changes in income in poor countries (Kinnan, 2014), food gifts do not contribute to lifecycle smoothing.[6]

An important aspect of lifecycle smoothing is potential differences between food expenditure and consumption (measured in caloric intake) (Aguiar and Hurst, 2005). This is particularly relevant in the poor countries where food is the largest item of the consumption basket. In addition, price levels might differ across space even within rural and urban areas (Deaton and Dupriez, 2011, Gaddis, 2015).[7] To abstract from prices and investigate differences between expenditure and consumption we study the lifecycle behavior of total caloric intake. We find that the lifecycle profile of caloric intake is considerably smoother than the lifecycle profile of food expenditure. Household caloric intake practically shows no hump over the lifecycle in SSA despite there being a hump in food expenditure. This result is closely related to the findings in Aguiar and Hurst (2005) for the U.S. and Hicks (2015) for Mexico. These authors show that food consumption remains stable with age as retired households substitute away from eating out and spend more time shopping and preparing food at home. In contrast to these authors, the smoothing strategy by which consumption remains stable in old age in SSA is by substituting away purchased food for self-farmed food.

[4]More than 80% of the population in Malawi and Uganda lives in rural areas. In Nigeria, this figure is 68%.

[5]Maize consumption in Malawi is the most important contributor to total household caloric intake, 65% in rural areas and 45% in urban areas.

[6]There is evidence of larger transfers in South Africa, a country several times richer than the ones we study where state pensions are available (Case and Deaton, 1998). The study of smoothing against anticipated changes in income has been studied in the context of more developed countries (Browning and Collado, 2001, Berg, 2013).

[7]Note that to transform nominal prices to real we use CPI measures that differ across rural and urban areas, but these CPI measures do not differ within areas.

Our third finding is that this smoothing strategy has two costly consequences. The first is that school-age children in households headed by the elderly work more hours and are less likely to attend school. Precisely, we show that children in a household with an elderly head are 41% less likely to attend school when compared to children in households with young heads. While the household head and spouse decrease the number of hours worked in old age, the hours their cohabiting adult children and school-age children work on self-farming increase by approximately 30% over the lifecycle of the household head.[8] The second cost is a decrease in the nutritional quality of the household food intake as the head reaches old age. Maize consumption in Malawi, for example, rises over the lifecycle and provides calories and iron, but not much more. There is a household level decrease in the intake of micro nutrients such as vitamin A, B12, C and D and macro nutrients such as sugar and fat.[9] On top of working more hours with less schooling, a less nutritious diet can diminish the ability of school-age children to acquire human capital (Schultz, 1999, Behrman, 2009, Maluccio et al., 2009) and cognitive skills (Feyrer et al., 2013).[10] Thus, the young children bear a double burden from the main consumption smoothing strategy in SSA. Further, the struggle to smooth caloric intake in old age by turning into self-farming directly speaks to the literature on the "Food Problem" (Schultz, 1953, Timmer, 2002) which can have long-term implications for aggregate development (Gollin et al., 2007). In particular, in order to meet subsistence needs, adult children cohabiting with elderly heads focus on self-farming instead of looking for alternative occupations in more productive sectors (Gollin et al., 2014).

The rest of the paper proceeds as follows. Section 2 describes our data and dicusses the construction of household consumption and expenditure. In Section 3, we specify our empirical strategy based on a simple lifecycle model with two consumption goods. Our main empirical results are discussed in Section 4. We conclude in Section 5.

[8] More generally, the role of children as old-age support has been studied in Boldrin and Jones (2002) and Banerjee et al. (2014), and the role of consumption in the interaction between children and parents has been studied in, among others, Hayashi et al. (1996), Bethencourt and Ríos-Rull (2009) and Akin and Leukhina (2015). In Malawi, we find that 56% of elderly households (head aged 55 or more) have at least one cohabiting adult child and 66% has at least one school-age child. This is consistent with results for China where 32% of elderly households cohabit with an adult child (Oliveira, 2015).

[9] This result holds for Malawi and Uganda. In Nigeria, a richer country, nutrient intake is as stable in old age as caloric intake, suggesting the nutritional loss in old age might depend on the stage of economic development.

[10] The loss of nutritional intake in old age is also potentially linked to the deterioration in cognitive health and skills of the elderly in Africa recently reported in Payne et al. (2013, 2016), a relation that we think deserves further exploration. This is relevant for policy as SSA is aging (Payne et al., 2013) and an older and less healthy population can represent an important burden for economic growth (Weil, 2014).

2 Data and Measurement Issues

We work with the Integrated Surveys of Agriculture (ISA) recently collected under the umbrella of the Living Standard Measurement Surveys (LSMS) of the World Bank. The ISAs are seen as a clear improvement on previous LSMS rounds (Carletto et al., 2010) and they are unique in the level of detail on nondurable and durable consumption (Beegle et al., 2012).[11] We focus the discussion on Malawi because it has the most detailed ISA questionnaire and the largest sample size with two cross-sectional waves of approximately 12,000 households each, 2004-05 and 2010-11, and an additional panel wave between 2010 and 2013 of roughly 3,500 households.[12] The surveys in Uganda and Nigeria have a smaller sample, respectively 3,000 and 5,000 households per wave. There are three waves for Uganda (2005-06, 2009-10, 2010-11, 2011-2012) and two for Nigeria (2010-11 and 2012-2013). Parallel results for Uganda and Nigeria in the online appendix.

The ISAs are particularly detailed in capturing food consumption. Food consumed is recorded by origin including purchases, self-farmed production and received gifts. To construct food expenditure we attach consumption prices to the quantities of self-farmed food and food gifts, see (De Magalhães and Santaeulàlia-Llopis, 2015). This way, our measure of food expenditure includes not only food purchases but also self-farmed food and food gifts. This is essential for the SSA countries that we study because the value of self-farmed food represents close to 50% of the total value of household food expenditure, and the total value of food expenditure is roughly 60% of total expenditure (De Magalhães and Santaeulàlia-Llopis, 2015).

Seasonality is an important aspect of consumption in SSA that deserve further discussion. This is particularly relevant for food consumption, which is reported with a 7-day recall (other consumption items are usually reported with longer recalls). Given the short recall period, food consumption may exhibit monthly patterns (Paxson, 1993). Since the Malawi surveys in 2004/05 and 2010/11 are rolled out across the year from March to March, we can control for seasonality with monthly dummies.[13] For this reason, the monetary value of in-kind food consumption (self-farmed production and gifts) is assigned using season- and region-specific prices.[14] This way, our

[11] A large part of the ISA improvements draw on Grosh and Glewwe (2000) that include specific issues on consumption measurement (Grosh and Deaton, 2000).

[12] The Malawi ISA is also labeled as the Integrated Household Survey (IHS). The current ISA versions that we study are a considerable improvement on the first IHS1 wave available for 1997-1998. So much so that we believe it is best to restrain our attention to the last three waves, as the IHS1 data may not be directly comparable.

[13] The 2013 Malawi ISA survey is rolled over six months. The Nigeria surveys take place in two different points in time: pre and post harvest. At each visit a 7-day recall food consumption questionnaire is applied. This double visit allows us to account for seasonality in Nigeria. The annualized food expenditure/consumption is the average of the pre and post harvest answers. In Uganda the surveys are not rolled out throughout the year, but across all waves there are data for all months and we are able to deseasonalize the data in a similar manner to Malawi.

[14] To transform nominal variables into real we use official CPI measures from the National Statistics Office

measure of food expenditure is the sum of food purchases and the monetary value of self-farmed food and received food gifts.

Direct measures of food consumption, i.e., the intake of calories and other micro and/or macro nutrients, help circumvent problems of measurement relating to prices. In this direction, the ISAs allow us to isolate the effects of prices and distinguish between consumption and expenditure because the quantity of food consumed is also carefully recorded. These quantities are reported in units that must be converted to kilograms.[15] The survey for Malawi allows for 135 separate food items to be reported and includes any items consumed outside the home. With such level of detail the food basket of Malawian household can be accurately recovered.[16] We use the Food Composition Tables from the United States Department of Agriculture (USDA) National Nutrient Database to compute the nutritional intake of each and all of the food items consumed. In our analysis we include calories and other macro-nutrients (fat and sugar), minerals (iron and zinc), and vitamins (A, B12, C and D); see our discussion in Section 4.2.[17]

Nondurable expenditure other than food (62% of average household consumption in Malawi) are classified under alcohol and tobacco (negligible), clothing (3%), health (i.e., prevention, treatment, hospitalization, and traditional healers — 2%), education (2%), utilities (15%), housing (i.e, mostly self-reported rental value of dwelling or rent — 2%), transportation (1%) and other nondurables[18] (13%). This level of detail is similar in the Nigeria and Uganda surveys.

3 Theory and Empirical Strategy

We present a lifecycle model à la Attanasio et al. (1999) to guide our empirical analysis in Section 3.1. Importantly, we distinguish between food and nonfood consumption. We discuss

(NSO) in Malawi that differ across rural and urban areas. Spatial differences in prices might introduce additional biases in the comparison of expenditure across households within rural and urban areas, although this is more of a concern for larger countries (Deaton and Dupriez, 2011, Gaddis, 2015).

[15] De Magalhães and Santaeulàlia-Llopis (2015) discuss in detail the price method we use to generate conversion rates. This conversion is also performed for Nigeria. The Uganda data is already available in kilograms.

[16] The Uganda survey lists 60 different food items and Nigeria 89. Unlike Malawi and Uganda, the Nigeria survey does not provide a list of food items consumed outside the home, only their overall monetary value. This difference in the level of detail in food consumption is another reason for our focus on Malawi. Note that the objective of the paper is not to estimate the precise level of caloric intake, but to estimate the lifecycle behavior in consumption. For this purpose the number of items present in the Uganda and Nigeria are more than sufficient as they include all staple foods and more.

[17] The use of nutrient intake for consumption comparisons across households is not straight-forward as the need for different types of nutrients might differ across persons, regions, and time (Behrman and Deolalikar, 1990, Alderman et al., 2008, Pitt et al., 2012). See Eli and Li (2015) for a pioneering treatment of some these concerns.

[18] For example: fuel, newspaper and paper products, milling fees, hygiene and cleaning products, cooking and cleaning utensils, repair costs, cell phones, carpets and rugs, mats and linen, mosquito nets, rubber, plastics, construction and repair materials, mortgage payments, marriage and funeral costs and bridewealth costs.

household structure in Section 3.2 and our empirical strategy in Section 3.3.

3.1 A Lifecycle Model of Two Consumption Goods: Food and Nonfood

A household lives for a finite number of periods until age J. Each household maximizes lifetime utility by choosing age profiles of household food consumption, $c_{a,j}$, and household nonfood consumption, $c_{m,j}$, as follows:

$$\max_{\{c_{a,j},c_{m,j}\}_{j=0}^{J}} \sum_{j=0}^{J} \beta^j \left[u(c_{a,j})\exp(\theta_a' z_j) + \kappa v(c_{m,j})\exp(\theta_m' z_j)\right],$$

subject to a budget constraint $p_a c_{a,j} + c_{m,j} + a_{j+1} = y_j + (1+r)a_j$, where p_a is the relative price of food in terms of nonfood consumption good, y_j is labor income, and a_j is a risk-free asset with a constant return r. We assume additive separability of the utility function across consumption goods as is standard in the structural transformation literature (Gollin et al., 2002, 2007). In our preferences we have a time discount factor β and a set of household characteristics that may affect each consumption good differently. We denote the household characteristics as vector z_j, namely household structure. Since household structure may have different effects across consumption goods, through the vectors θ_a and θ_m, each household member may potentially have a different share per consumption good (Aguiar and Hurst, 2014). For example, children might require a higher share of food consumption than of other consumption goods.

We assume a constant relative risk aversion (CRRA) utility function separately for food and for nonfood consumption with, respectively, coefficients η_a and η_m. Isolating $c_{m,j}$ from the budget constraint and plugging into the utility function we can compute the first order conditions of a_{j+1} and $c_{a,j}$. The first order conditions imply, after taking logs, that

$$\ln c_{i,j+1} - \ln c_{i,j} = \text{cons.} + \frac{1}{\eta_i}\,\theta_i'\,(z_{j+1} - z_j) \tag{1}$$

for $i = \{a, m\}$ and the constant is $\frac{1}{\eta}\ln\beta(1+r)$.[19] In this simple formulation, the lifecycle behavior of food and nonfood consumption is driven by changes in household structure z_j. We

[19] This follows from the separability of u and v. First, note that the intertemporal Euler equation, or first order condition of a_{j+1} is,

$$v_{c_{m,j}}\exp(\theta_m z_j) = \beta(1+r)v_{c_{m,j+1}}\exp(\theta_m z_{j+1}). \tag{2}$$

Second, we plug the first order condition for $c_{a,j}$, i.e., $u_{c_{a,j}}\exp(\theta_a z_j) = p_a\kappa v_{c_{m,j}}\exp(\theta_m z_j)$, into (2) to find,

$$u_{c_{a,j}}\exp(\theta_a z_j) = \beta(1+r)u_{c_{a,j+1}}\exp(\theta_a z_{j+1}). \tag{3}$$

This way, assuming a CRRA shape for u and v and taking logs, we can write (2) and (3) as (1).

empirically test this hypothesis separately for rural and urban areas.

3.2 Household Structure Over the Lifecycle

We document the behavior of household structure by household heads' age groups separately for rural and urban areas for Malawi.[20] The average age of household heads is larger in rural areas, 43, than in urban areas 39. Heads aged between 15-44 account for 60% of the heads population in rural areas and for 73% in urban areas (panel A1 and B1, Table 1). This rural-urban gap is largely driven by the heads aged between 25 and 34 that account for 29% of the heads population in rural areas and 40% in urban areas. The complement is that the number of heads who are older than 55 is almost twice larger in rural areas (24%) than in urban areas (13%), a feature that is also present for heads above 65.

Household heads in both rural and urban areas are predominantly married with 70% of heads having a cohabiting spouse in rural areas and 71% in urban areas. In rural areas, 70% of heads aged 15-24 have a cohabiting spouse, a figure that increases to roughly 80% for heads aged 25-44 and slowly decreases thereafter to reach 50% for heads aged more than 65 (panel A2, Table 1). Urban areas follow a similar pattern starting with a lower figure of 50% of heads aged 15-24 having a cohabiting spouse, reaching 80% for heads aged 35-44, and decreasing thereafter (panel B2, Table 1).[21]

In terms of children (household members below the age of 18), household heads in the age group 15-24 have on average 1.5 children in rural areas. This number increases to 3.7 children for heads in the age group 35-44, and decreases gradually to 1.5 for heads aged above 65. For heads in old age, household members below 18 represent, mostly, grandchildren. A less prominent hump is present in urban areas starting with 1.1 children for heads aged 15-24, increasing to 2.8 for heads aged 35-44, and declining thereafter to 2.1 for heads above 65. Finally, the number of adult offspring, which includes mostly head's children (and nephews/nieces, or grandchildren) above the age of 18, mostly increases over the lifecycle. In rural areas, the size of adult offspring rises from 0.1 for the youngest heads to peak at 0.8 for heads aged 55-64, and then drops to 0.5 for heads above 65. In urban areas, the peak occurs at 1.5 for heads aged 55-64 and remains high at 1.2 for heads above 65. As we will see below, a substitution away from purchased food towards home produced foods is a key mechanism to smooth consumption in old age. The

[20] ISAs' household roster provides demographic information about each and all members of the household. In particular, the relationship between each member and the household head is identified. Relatives who are members of the household include children (i.e., son/daughter-in-law, niece/nephew, grandchildren), wife/husband, father/mother, father/mother-in-law, brother/sister, brother/sister-in-law, and grandfather/grandmother. Non-relatives who are members of the household include servants and lodgers living in the household.

[21] This is a reminiscent of lower age at first marriage in rural areas (Palamuleni, 2011).

number of adult children living with elderly parents (and helping with home production) may be an important channel through which households maintain their level of household consumption when the head reaches old age. The presence of adults who are not head's children is negligible in rural and urban areas.

Overall, household size shows a clear lifecycle hump in both rural and urban areas. In rural areas the household of the youngest heads, aged 15-24, have 3.0 members, a number that peaks at 5.7 for heads aged 35-44, and declines to 4.5 for heads aged 55-64 and to 3.4 for ages 65 and above. In urban areas, heads aged 15-24 have a household size of 2.7, peaking for heads aged 45-54 at 5.6, and declining to 4.8 for heads above 65.

3.3 Empirical Strategy

We investigate mean lifecycle profiles of expenditure in two different ways. First, we estimate the lifecycle profiles with the following regression that controls for time and cohort effects:

$$\ln C_{it}^k = \beta_0^k + f(a_{it};\Theta) + \mathbf{1}_t\beta_t^k t + \mathbf{1}_b\beta_b^k b + \epsilon_{it}^k, \tag{4}$$

where C_{it}^k is the household expenditure of household i during period t on expenditure category k (e.g., food and nonfood), a_{it} is the age of the household head (for ages 26-65) $f(a;\Theta)$ represents a cubic polynomial in age, and we additionally control for time dummies t for each household survey (e.g., Malawi ISA 2004/05, 2010/11, and 2013) and cohort dummies b.[22] We run the regression for urban and rural households separately.

Time effects play a key role and must be controlled for. For example, Malawi faced a famine the year before the 2004-5 survey and by 2010-11 the economy had not only recovered fully but a program of widespread fertilizer subsidy had been implemented. However, we find that the shape of the lifecycle profiles we estimate are robust to whether we control for cohort effects or not. That is, our estimates are robust to a more parsimonious specification that does not impose any restriction on the functional form between age and consumption. This more parsimonious specification estimates age dummies controlling only for time effects. In the main text, we present results from this more parsimonious specification. We refer the reader to the online appendix for the estimates of our more general specification that additionally controls for cohort dummies specified in equations 4 and 5.

[22] If we represent the function $f(a_{it},\Theta)$ with a full set of age dummies, i.e., $\mathbf{1}_a\beta_a^k a_{it}$, then age, time, and cohort effects are not linearly independent from each other (i.e., $b = t - a$) and only two of the three dummy controls can be operative. See a detailed discussion in Heathcote et al. (2005). Assuming a polynomial form as we do, a cubic in age, avoids this multicollinearity issue. We find that adding more degrees to the polynomial does not improve the fit and settle with the cubic specification.

Second, we additionally control for household structure,

$$\ln C_{it}^{k} = \beta_0^k + f(a_{it}; \Theta) + \mathbf{1}_t \beta_t^k t + \mathbf{1}_b \beta_b^k b + \theta_{it}^k X_{it} + \epsilon_{it}^k, \tag{5}$$

with an additional vector of household structure characteristics, X_{it}, that includes dummy variables for marital status, household size, and the number of male and female children in age categories 1-2, 3-5, 6-13, and 14-18. This implies that we take the equivalence scales (and household structure) as exogenous, as in Aguiar and Hurst (2014) although we allow for the gender of the child and a thinner set of age categories of children defined as individuals under 15.[23] To examine the lifecycle effect of household structure on different types of consumption, we compare the estimated coefficients of age dummies, β_a, from these two models in the Section 4.

4 Empirical Results

First, we focus on lifecycle expenditure. We emphasize the differential behavior of rural and urban areas, food and nonfood expenditure, and the role of self-farming (Section 4.1). Second, we investigate the lifecycle behavior of consumption in terms of caloric intake and maize consumption (in Kg.) (Section 4.2). Third, we examine the consequences of lifecycle smoothing for child investments and nutrient intake (Section 4.3). Unless otherwise noted, our results focus on Malawi with more details on other SSA countries in the appendix.

4.1 Lifecycle Expenditure

We show the age profile of household-level nondurable expenditure (in logs) in Figure 1 using our more parsimonious specification described in Section 3.3. The age profiles are normalized to 0 (in logs) at age 25 and we plot a cubic polynomial on age as well as the estimated age dummies. Before dissecting the lifecycle behavior of household expenditure in poor countries, we contextualize it with respect to the U.S. (panel (a), Figure 1). Nationwide, household expenditure in Malawi increase by 0.25 log points between the age of 25 and its peak in early 40s, while household expenditure in the US increases by roughly twice as much, 0.42 log points, between the ages of 25 and its peak, somewhat later than Malawi, in the late 40s. That is, there is a clear lifecycle hump in nondurable expenditure in both countries but it is twice as prominent in the U.S. as in Malawi.

The Rural-Urban Divide. A potential explanation behind the nationwide differentials across countries is the rural-urban composition of the population. In Malawi, roughly 85% of the

[23]In Aguiar and Hurst (2014) children are household members up to the age of 21.

population lives in rural areas, while this figure is less than 1% in the U.S. We explore the lifecycle behavior of household expenditure separately for rural and urban Malawi (panel (b), Figure 1). In rural areas, the peak in nondurable expenditure is reached at 0.23 log points in the early 40s with respect to age 25. The nondurable expenditure in urban areas peaks at 0.46 log points in the late 40s with respect to age 25. Beyond the peak, nondurable expenditure reaches back the initial level at age 60 in rural areas with log deviation of -0.11 at age 65, while it remains always above the initial level in urban areas with a log deviation of 0.20 at age 65. This implies that the total range of household expenditure from its peak to its minimum is 0.34 in rural areas and 0.46 in urban areas, suggesting more lifecycle consumption smoothing in rural areas by 0.46/0.34-1=0.35. In summary, nondurable expenditure shows a lifecycle hump that is 0.35 larger in urban areas than in rural areas. The hump is also more prolonged for urban than for rural households. Overall, the rural-urban divide largely accounts for the nationwide behavior of nondurable expenditure over the lifecycle: nationwide expenditure follows the behavior of rural areas. Interestingly, lifecycle expenditure in urban Malawi closely follows its U.S. counterpart (panel (b), Figure 1).

The excess sensitivity of consumption to anticipated income changes throughout the lifecycle can be partially explained by household structure (Attanasio et al., 1999). When we control for household structure separately for rural and urban areas, we find the adult-equivalent profiles in Figure 2. Adult-equivalent expenditure shows a hump that peaks lower and at an earlier age over the lifecycle than its household-level counterpart. In rural areas, adult-equivalent expenditure increases by 0.06 log points from age 25 to its peak age, while this figure is 0.23 at the household-level. That is, household structure accounts for more than 2/3 of the lifecycle hump in expenditure. In urban areas, adult-equivalent expenditure increases by 0.30 log points from age 25 to its peak age, while this figure is 0.46 for households. This implies that household structure accounts for roughly 1/3 of the lifecycle hump in expenditure. It is also interesting to note that adult-equivalent expenditure peaks roughly 8 years earlier than its household-level counterpart in both rural (early 30s) and urban areas (late 30s), and declines by twice as much in urban areas than in rural areas. Precisely, adult-equivalent nondurable expenditure drops back to the age-25 expenditure levels by age 45 in rural areas and by age 57 in urban households. By age 65 the log deviation from age 25 is -0.17 in rural areas and -.09 in urban areas. This implies that total range of adult-equivalent nondurable expenditure from its peak to its minimum at age 65 is 0.23 in rural areas and 0.39 in urban areas, suggesting about twice more consumption smoothing in rural areas than in urban areas.

Food and Nonfood Expenditure To examine the source of the hump in adult-equivalent nondurable expenditure, we decompose the lifecycle profiles into food and nonfood. Food expenditure (panel (a), Figure 3) is smoother than nonfood expenditure (panel (b), Figure 3). In rural areas, food expenditure and nonfood expenditure peak in the early 30s at a similar level with respect to age 25, a deviation of 0.06 log points, but the decline after the peak is starker for nonfood expenditure reaching a deviation of -0.31 log points at age 65 that is larger than for food expenditure, -0.13 log points. In urban areas, nonfood expenditure peaks at a larger level than food expenditure, respectively, by a deviation of 0.33 and 0.23 log points in the late 30s with respect to age 25. As it was the case in rural areas, the decline after the peak is starker for nonfood expenditure reaching a deviation of -0.17 log points at age 65 that is roughly three times larger than for food expenditure, -0.06 log points, in urban areas. The total range of food expenditure is 0.19 in rural areas and 0.29 in urban areas, while the range in nonfood expenditure is 0.36 in rural areas and 0.49 in urban areas suggesting more lifecycle smoothing in food than in nonfood expenditure. Food expenditure largely drives the behavior of nondurable expenditure, which is consistent with food expenditure representing respectively roughly 70% and 60% of non-durable expenditure in rural and urban Malawi.[24] These shares are stable through the lifecycle (panel (c), Figure 3).

The Role of Self-Farmed Food. Given the role of food in explaining the smoothing of total expenditure, we now investigate food expenditure in more detail. In particular, we break down expenditure by origin. We deconstruct adult-equivalent lifecycle behavior of food into purchases, the monetary value of self-farmed food and received food gifts.[25] First, the only category that goes up over the lifecycle is self-farmed food (left axis, panel (a), Figure 4). In rural areas the monetary value of self-farmed food is 0.10 log points higher at age 40 and 0.22 log points higher at age 65 compared to age 25. The increase in urban areas is more pronounced in old age and the monetary value of self-farmed food is 0.52 log points higher by age 65 than by age 25. The share of self-farmed food also increases during the lifecycle: from 38% to 48% in rural areas and from 4% to 17% in urban areas (right axis, panel (a), Figure 4). Second, food purchases show a hump that decreases substantially after peaking around ages 30-40 (left axis, panel (b), Figure 4). The hump in food purchases is larger than that of total nondurable expenditure. The decrease is particularly strong in rural areas where the level of purchased food is below that of age 25 by age 40, and by age 65 the level is lower than at age 25 by -0.51 log points. In urban areas the level of purchased food by age 65 is below that of age 25 by -0.31 log points. The share of purchased food also decreases during the lifecycle: from 52% to 40% in rural areas and from 92% to 78% in urban areas (right axis, panel (b), Figure 4). This decrease in purchased food rules out savings as a smoothing mechanism for old age. Third, the level of food expenditure

[24] In the US, food represents less than 35% of nondurable expenditure (Aguiar and Hurst, 2014).

[25] Recall that we value self-farmed food consumed and food received as gifts consumed using prices constructed from food purchases (Section 2).

from gifted consumption in rural areas is relatively flat throughout the lifecycle (panel (c)). In urban areas, we observe a hump shape peaking at age 45 and attaining the same level at 65 as that of age 25. In neither urban and rural areas does the share of received food gifts increase in old age which remains relatively stable at 10% in rural areas and 4% in urban areas. This stability of food gifts throughout the lifecycle rules out social insurance arrangements as a consumption smoothing mechanism for old age. To reiterate, it is self-farmed food that helps mitigate the hump from food purchases and hence smooth household food expenditure.

To sum up, we find that rural households smooth adult-equivalent expenditure roughly twice more than urban households over the lifecycle. Deconstructing lifecycle expenditure, we show that households smooth food expenditure twice more than nonfood expenditure in both rural and urban areas. Our decomposition of food expenditure suggests that the main mechanism to smooth food expenditure in old age is the substitution away from purchased food and into self-farmed food.[26] This result rules out two alternative traditional explanations of lifecycle smoothing. First, the decline in food purchases over the lifecycle suggests that lifecycle savings play a minor role in financing the smoothing of lifecycle expenditure in old age. Indeed, the major asset in household wealth in SSA is land which increases roughly by 40% over the lifecycle and is largely devoted to self-farming (De Magalhães and Santaeulàlia-Llopis, 2015).[27] Second, the stability of food gifts over the lifecycle, without increases in old age, suggests that informal risk-sharing arrangements are important against unanticipated shocks (Kinnan, 2014) do not contribute to smooth the anticipated changes in income over the lifecycle.

4.2 Lifecycle Consumption

An important aspect of lifecycle smoothing are potential differences between food expenditure and consumption measured in caloric intake (Aguiar and Hurst, 2005). This is particularly relevant in poor countries because food is the largest item of the consumption basket. To abstract from prices, we study the lifecycle behavior of total caloric intake and the quantity consumed (in kilogram) of the main staple food (maize) in Malawi.

Food consumption, measured in terms of caloric intake, is more stable over the lifecycle than expenditure. In rural areas, caloric intake peaks in the early 30s with a deviation of 0.03 log points with respect to age 25, i.e., half the peak of food expenditure (panel (a), Figure 5). The decline after the peak is also less pronounced for caloric intake reaching a deviation of -0.04 log

[26] This occurs in both rural and urban areas of Malawi and Uganda. In Nigeria, the substitution away from purchased food and into self-farmed food is also present but less pronounced. See our online appendix.

[27] Moreover, land accumulation as a form of savings is limited by lack of land markets (Restuccia and Santaeulàlia-Llopis, 2017). The presence of savings constraints in SSA is also emphasized in Dupas and Robinson (2013a,b), Karlan et al. (2014), Brune et al. (2015).

points at age 65 that is half that of food expenditure. In urban areas, caloric intake peaks in the late 30s with a deviation of 0.09 log points with respect to age 25, i.e., less than half the peak of food expenditure (panel (b), Figure 5). The decline of caloric intake after the peak is about the same as that of food expenditure, reaching a deviation of -0.06 log points at age 65. This implies that the total range of caloric intake over the lifecycle is 0.07 log points in rural areas and 0.15 log points in urban areas. Recall that for food expenditure these figures are respectively 0.19 for rural areas and 0.29 for urban areas. That is, households smooth caloric intake twice more than food expenditure in both rural and urban areas. This way, the rural-urban divide persists with consumption. The ability to smooth consumption is twice larger for rural than for urban areas.

Maize is by far the most important staple food in Malawi and represents 61% of the total household caloric intake (65% in rural are and 46% in urban areas). Such a specialization in both production and consumption in Malawi provides us with a natural and direct way to compare consumption and expenditure. We find that household maize consumption (measured in kilograms) steadily grows throughout the lifecycle, both in rural and urban areas (respectively, panel (a) and (b), Figure 5). Indeed, Malawian households increase lifecycle maize consumption substituting away from other forms of food (panel (c), Figure 5). This implies that the consumption of maize largely drives the smoothing of caloric intake over the lifecycle. We now turn to what happens to the quality of food consumption.[28]

To sum up, households are capable of smoothing consumption through the lifecycle to a much larger extent than what measures of food expenditure suggest. This result echoes the results for the U.S. in Aguiar and Hurst (2005) and for Mexico in Hicks (2015) that find a stable caloric intake in old age, despite a decline of food expenditure in old age. In the case of Malawi, the consumption of self-farmed maize largely drives the smoothing of caloric intake over the lifecycle but at the expense of everything else. This potentially implies negative consequences for the quality of the food consumed in households headed by the elderly. We turn to these issues next.

4.3 The Costs of Smoothing

In the previous section, we have showed a substantial ability to smooth lifecycle consumption and expenditure in Malawi. This smoothing is characterized by an increase in self-farmed food consumption, mainly, maize. We now examine two costly consequences of this smoothing strategy.

[28] Nigeria and Uganda have considerably more diverse diets and agricultural diversification than Malawi. We show the lifecycle caloric and nutrient intake for these countries in our online appendix.

4.3.1 More Farm Work and Less Schooling

To study how the rise of self-farmed food is sustained over the lifecycle, we explore the behavior of household hours employed in self-farming, i.e., farm work conducted on the plots cultivated by the household. We focus in rural areas, where 85% of the population lives and 77% of the rural heads engage in self-farming. Household heads work an average of 26 hours per week and spend 61% of their working hours self-farming.[29] Spouses and cohabiting adult children work, respectively, 22 and 17 hours per week self-farming which implies that they spend an even higher percentage of their own working time in the household farm, respectively 93% and 89%.[30]. School-age children do (on average) farm work for 8 hours a week which represents 97% of their total hours worked.[31]

Consistent with self-farmed food consumption, we find that household's hours worked on self-farming grow roughly by 0.22 log points from ages 25 to 65 (panel (a), Figure 6). Interestingly, a decomposition of household hours worked on self-farming shows that household heads (and their spouses) increase these hours by almost only 0.1 log points from age 25 to 50, and decrease them thereafter. That is, the work of heads (and spouses) falls short in explaining the increase in household farm work. The increase in farm work is sustained by the hours that cohabiting children—both adult and school-age children—employ in self-farming which increase with the age of the household head to reach roughly 0.35 log points at age 65 (panel (b), Figure 6). In other words, households increasingly divert labor resources into self-farming over the lifecycle, a feature that is sustained by increasing the hours worked by children.

This smoothing strategy has direct and costly consequences for children. We find that school-age children work more hours in households headed by the elderly and are less likely to attend school (panel (c), Figure 6).[32] To be precise, in households headed by a 65 year-old, school-age children spend (on average) 30% more hours self-farming than school-age children living in households with a 35 year-old head.[33] Further, more farm work conducted by school-age children is associated with less schooling. We find that the percentage of school-age children in a rural household *not* attending school increases from 17% in households with a head aged 35 to 24% for

[29] Regarding total hours per worker, we find a country average of 29 hours per week for household heads which is consistent with what Bick et al. (2016) find for Sub-Saharan countries.

[30] These numbers are for rural and conditional on there being a working spouse or adult child

[31] These numbers are conditional on having a child that works. Unconditionally, the average amount of hours that school-age children work self-farming is 5.3, which implies 95% of the total hours worked for this sample.

[32] Children aged 6 to 17 are classified as school-age. In panel (c), Figure 6 we normalize the average log hours worked by school-age children to be 0 when the head is aged 35. This is so because the count of children for households with very young heads is imprecise as we allow school-age children to include siblings, nephews and grand-children.

[33] Note that these profiles control for household composition and number of children of different age groups as described in Section 3.3.

households with a head aged 65, i.e., an increase of 41%. Therefore, there is a substantial loss of human capital for future generations associated with consumption smoothing achieved through self-farming. The burden of consumption smoothing for the aggregate economy is also channeled through adult children who cohabit and self-farm for their parents. These adult children do not work in more productive nonagricultural sectors of the economy (Gollin et al., 2014).

4.3.2 Nutritional Loss

A consumption smoothing strategy by which elderly households divert resources into self-farmed foods, mainly, maize, is likely to have negative consequences on the quality of food intake. We find that this is the case. Consistent with a diet where maize is the staple food, households are able to smooth iron and zinc in both rural and urban areas, respectively, in panel (a) and (b) of Figure 7. In contrast, a look to vitamins shows a very different story. In rural areas, the consumption of vitamin A, B12, C and D show a similar but even larger hump and range over the lifecycle than food expenditure. In particular, there is a substantial nutrient loss in terms of all vitamins consumption at age 65 with log deviations of -0.10 for vitamin C, -0.13 for vitamin A, -0.18 for vitamin D and -0.19 for vitamin B12 compared with age 25 consumption (panel (c), Figure 7). This loss in vitamins consumption is between two and five times that of caloric intake that is barely -0.04 log points at age 65. For the 15% of the population that lives in urban areas, the nutritional loss in old age is particularly stark for vitamin B12 and vitamin D with log deviations of, respectively, -0.37 and -0.20 compared with age 25 consumption (panel (d), Figure 7). Interestingly, vitamin A and C grow and smooth better over the lifecycle in urban areas. Finally, macro nutrients such as fat and sugar intake also drop in both rural and urban areas below the levels at age 25 (panel (e) and (f), Figure 7). Overall, there is a clear reduction in the quality of household food intake in households with an elderly head. This is consistent with a substitution of most food items toward the consumption of the staple food, maize. Maize provides calories and iron, but not much more.[34]

Our findings contrast with previous results for a richer countries such as the US where food quality remains stable in old age (Aguiar and Hurst, 2005), suggesting that these results can depend on the aggregate stage of economic development. Smoothing in old age that is achieved through (dis)savings or social security systems that provide pension income (which are features of more developed economies) are likely to affect diet variety much less than smoothing strategies that rely on increasing self-farming staple food in old age.

[34] We find a similar drop in nutrition quality in Uganda, and less so for Nigeria, a richer economy; see our online appendix.

5 Conclusion

The incentives to smooth consumption over the lifecycle are powerful. Our investigation shows that households in some of the world poorest countries are able to smooth consumption (caloric intake) throughout the lifecycle. The smoothing strategy is characterized by the substitution away from purchased food and into self-farmed staple food (e.g., maize in Malawi) in old age. This contrasts with traditional lifecycle smoothing mechanisms built on food transfers across generations or savings, which can be inaccessible to the SSA populations that we study.

The lifecycle shift toward self-farmed food has two important costly consequences. First, school-age children are diverted away from school and toward cultivation of self-farmed food, thus lowering education attainment and human capital accumulation. Second, the nutritional quality of household's food consumption is substantially reduced. For example, in Malawi, a diet in which the importance of maize consumption increases over the lifecycle provides iron and zinc for individuals living with elderly heads, but not much more. Moreover, these two costs are intertwined as poor nutrition can generate lower education attainment (Behrman, 2009).

Ultimately, our results suggest that consumption smoothing based on self-farming can provide a breeding ground for aggregate stagnation with low schooling and poor nutrition. The choice of this consumption smoothing strategy despite its costs suggests that the incentives for smoothing overpower the incentives to generate economic growth in the poor countries that we study.[35] An argument that we think deserves further exploration. In this direction, the provision of alternative mechanisms to smooth consumption in old age (e.g., a higher ability to save) is likely to help kick-start economic growth. We leave all these interesting questions for future research.

References

Aguiar, M. and Hurst, E. (2005). Consumption versus Expenditure. *Journal of Political Economy*, 113(5):919–948.

Aguiar, M. and Hurst, E. (2014). Deconstructing Lifecycle Expenditure. *Journal of Political Economy*. Forthcoming.

Akin, S. N. and Leukhina, O. (2015). Risk-sharing within Families: Evidence from the Health and Retirement Study. *Journal of Economic Dynamics and Control*, 52(C):270–284.

Alderman, H., Behrman, J. R., and Hoddinott, J. (2008). Health and Nutrition and Economic Development. In *International Handbook of Development Economics, Volumes 1 & 2*, Chapters, chapter 25. Edward Elgar Publishing.

[35] This discussion echoes the trade-off between consumption insurance and economic growth recently documented in Santaeulàlia-Llopis and Zheng (2016).

Attanasio, O., Banks, J., Meghir, C., and Weber, G. (1999). Humps and Bumps in Lifetime Consumption. *Journal of Business and Economics*, 17:22–35.

Attanasio, O., Hurst, E., and Pistaferri, L. (2014). The Evolution of Income, Consumption, and Leisure Inequality in the US, 1980-2010. In *Improving the Measurement of Consumer Expenditures*, NBER Chapters. National Bureau of Economic Research, Inc.

Attanasio, O. and Ríos-Rull, J.-V. (2000). Consumption Smoothing in Island Economies: Can Public Insurance Reduce Welfare? *European Economic Review*, 44:1225–1258.

Banerjee, A., Meng, X., Porzio, T., and Qian, N. (2014). Aggregate Fertility and Household Savings: A General Equilibrium Analysis using Micro Data. NBER Working Papers 20050, National Bureau of Economic Research, Inc.

Beegle, K., De Weerdt, J., Friedman, J., and Gibson, J. (2012). Methods of Household Consumption Measurement through Surveys: Experimental Results from Tanzania. *Journal of Development Economics*, 98(1):3–18.

Behrman, J. R. (2009). *Health and Growth*, volume 6, chapter Early Life Nutrition and Subsequent Education, Health, Wage, and Intergenerational Effects, pages 167–183. Washington, DC: Commission on Growth and Development and the World Bank.

Behrman, J. R. and Deolalikar, A. B. (1990). The Intrahousehold Demand for Nutrients in Rural South India: Individual Estimates, Fixed Effects, and Permanent Income. *Journal of Human Resources*, 25(4):665–696.

Berg, E. (2013). Are Poor People Credit-Constrained or Myopic? Evidence from a South African Panel. *Journal of Development Economics*, 101:195–205.

Bethencourt, C. and Ríos-Rull, J.-V. (2009). On The Living Arrangements Of Elderly Widows. *International Economic Review*, 50(3):773–801.

Bick, A., Fuchs-Schündeln, N., and Lagakos, D. (2016). How do Average Hours Worked Vary with Development? Cross-Country Evidence and Implications. Technical report, National Bureau of Economic Research WP No. 21874.

Boldrin, M. and Jones, L. E. (2002). Mortality, Fertility, and Saving in a Malthusian Economy. *Review of Economic Dynamics*, 5(4):775–814.

Browning, M. and Collado, M. D. (2001). The Response of Expenditures to Anticipated Income Changes: Panel Data Estimates. *The American Economic Review*, 91(3):681–692.

Brune, L., Giné, X., Goldberg, J., and Yang, D. (2015). Facilitating Savings for Agriculture: Field Experimental Evidence from Malawi. Technical report, National Bureau of Economic Research.

Carletto, G., Beegle, K., Himelein, K., Kilic, T., Murray, S., Oseni, M., Scott, K., and Steele, D. (2010). Improving the Availability, Quality and Policy-Relevance of Agricultural Data: The Living Standards Measurement Study-Integrated Surveys on Agriculture. In *Third Wye City Group Global Conference on Agricultural and Rural Household Statistic. Washington, DC*, pages 24–25.

Case, A. and Deaton, A. (1998). Large Cash Transfers to the Elderly in South Africa. *The Economic Journal*, 108(450):1330–1361.

De Magalhães, L. and Santaeulàlia-Llopis, R. (2015). The Consumption, Income, and Wealth of the Poorest: Cross-Sectional Facts of Rural and Urban Sub-Saharan Africa for Macroeconomists. World Bank Policy Research Working Paper No. 7337.

Deaton, A. and Dupriez, O. (2011). Spatial Price Differences within Large Countries. Working Papers 1321, Princeton University, Woodrow Wilson School of Public and International Affairs, Research Program in Development Studies.

Deaton, A. and Paxson, C. (1994). Intertemporal Choice and Inequality. *Journal of Political Economy*, 102(3):437–467.

Dupas, P. and Robinson, J. (2013a). Saving Constraints and Microenterprise Development: Evidence from a Field Experiment in Kenya. *American Economic Journal: Aplied Economics*, 5(1):163–192.

Dupas, P. and Robinson, J. (2013b). Why Don't the Poor Save More? Evidence from Health Savings Experiments. *American Economic Review*, 103(4):1138–71.

Eli, S. and Li, N. (2015). Caloric Requirements and Food Consumption Patterns of the Poor. Working Paper 21697, National Bureau of Economic Research.

Fernández-Villaverde, J. and Krueger, D. (2007). Consumption over the Life Cycle: Facts from Consumer Expenditure Survey Data. *Review of Economics and Statistics*, 89(3):552–565.

Feyrer, J., Politi, D., and Weil, D. N. (2013). The Cognitive Effects of Micronutrient Deficiency: Evidence from Salt Iodization in the United States. NBER Working Papers 19233, National Bureau of Economic Research, Inc.

Gaddis, I. (2015). Prices for Poverty Analysis in Africa. World Bank, Policy Research Working Paper 7652.

Gollin, D., Lagakos, D., and Waugh, M. E. (2014). Agricultural Productivity Differences Across Countries. *The American Economic Review*, 104(5):165–170.

Gollin, D., Parente, S. L., and Rogerson, R. (2002). The Role of Agriculture in Development. *American Economic Review*, 92(2):160–164.

Gollin, D., Parente, S. L., and Rogerson, R. (2007). The Food Problem and the Evolution of International Income Levels. *Journal of Monetary Economics*, 54(4):1230–850.

Grosh, M. and Deaton, A. (2000). *Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 Years of the Living Standards Measurement Study*, volume 17, chapter Consumption. Washington, DC: World Bank.

Grosh, M. and Glewwe, P. (2000). *Designing Household Survey Questionnaires for Developing Countries: Lessons from 15 Years of the Living Standards Measurement Study, Volume 2*. Washington, DC: World Bank.

Hayashi, F., Altonji, J., and Kotlikoff, L. (1996). Risk-Sharing between and within Families. *Econometrica*, 64(2):261–94.

Heathcote, J., Storesletten, K., and Violante, G. (2005). Two Views of Inequality over the Life Cycle. *Journal of the European Economic Association*, 3(2-3):765–775.

Hicks, D. L. (2015). Consumption Volatility, Marketization, and Expenditure in an Emerging Market Economy. *American Economic Journal: Macroeconomics*, 7(2):95–123.

Karlan, D., Ratan, A. L., and Zinman, J. (2014). Savings by and for the Poor: A Research Review and Agenda. *Review of Income and Wealth*, 60(1):36–78.

Kinnan, C. (2014). Distinguishing Barriers to Insurance in Thai Villages. Working Paper, Northwestern.

Maluccio, J. A., Hoddinott, J., Behrman, J. R., Martorell, R., Quisumbing, A. R., and Stein, A. D. (2009). The Impact of Improving Nutrition During Early Childhood on Education among Guatemalan Adults. *Economic Journal*, 119(537):734–763.

Oliveira, J. (2015). The Value of Children: Inter-Generational Support, Fertility, and Human Capital. *Journal of Development Economics*.

Palamuleni, M. E. (2011). Socioeconomic Determinants of Age at Marriage in Malawi. *International Journal of Sociology and Anthropology*, 3(7):224.

Paxson, C. H. (1993). Consumption and Income Seasonality in Thailand. *Journal of Political Economy*, 101(1):39–72.

Payne, C., Mkandawire, J., and Kohler, H.-P. (2013). Disability Transitions and Health Expectancies Among Adults 45 Years and Older in Malawi: A Cohort Modeling Approach. *PLOS Medicine*, 10(5):e1001435.

Payne, C. F., Kohler, I. V., Bandawe, C., and Kohler, H.-P. (2016). Cognitive Health among Older Adults: Evidence from Rural Sub-Saharan Africa. University of Pennsylvania Population Center Working Paper (PSC/PARC) WP2016-3.

Pitt, M. M., Rosenzweig, M. R., and Hassan, M. N. (2012). Human Capital Investment and the Gender Division of Labor in a Brawn-Based Economy. *American Economic Review*, 102(7):3531–60.

Restuccia, D. and Santaeulàlia-Llopis, R. (2017). Land Misallocation and Productivity. Barcelona GSE Working Paper.

Santaeulàlia-Llopis, R. and Zheng, Y. (2016). The Price of Growth: Consumption Insurance in China 1989-2009. Barcelona GSE Working Paper.

Schultz, T. P. (1999). Health and schooling investments in africa. *The Journal of Economic Perspectives*, 13(3):67–88.

Schultz, T. W. (1953). *The Economic Organization of Agriculture*. McGraw-Hill, New York.

Storesletten, K., Telmer, C. I., and Yaron, A. (2004). Consumption and Risk Sharing over the Life Cycle. *Journal of Monetary Economics*, 51:609–633.

Timmer, C. P. (2002). Agriculture and Economic Development. *Handbook of agricultural economics*, 2:1487–1546.

Townsend, R. M. (1994). Risk and Insurance in Village India. *Econometrica*, 62(3):539–91.

Weil, D. N. (2014). Health and Economic Growth. In *Handbook of Economic Growth*, volume 2 of *Handbook of Economic Growth*, chapter 3, pages 623–682. Elsevier.

Table 1: Household Structure (Malawi ISA 2010/11)

(A) Rural Residency

(A1) Population Shares (%) by Age Group

	15-24	25-34	35-44	45-54	55-64	65+
Population 2010	9	29	22	15	11	13

(A2) Household Structure by Age Group

	15-24	25-34	35-44	45-54	55-64	65+
Spouse	0.7	0.8	0.8	0.7	0.6	0.5
Children (<6)	1.0	1.3	1.2	0.8	0.4	0.2
Children (6-18)	0.5	1.1	2.5	2.5	1.8	1.3
Adults (offspring) ($>$18)	0.1	0.1	0.3	0.7	0.8	0.5
Adults (other) ($>$18)	0.0	0.0	0.0	0.0	0.0	0.0
Household Size	3.0	4.3	5.7	5.6	4.6	3.5

(B) Urban Residency

(B1) Population Shares (%) by Age Group

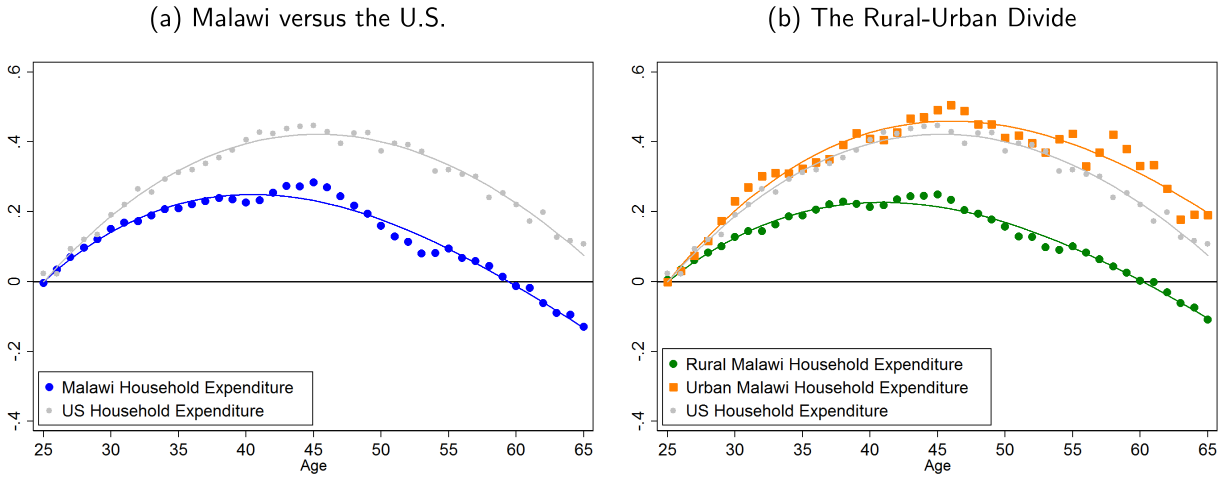
	15-24	25-34	35-44	45-54	55-64	65+
Population 2010	8	40	25	13	7	6

(B2) Household Structure by Age Group

	15-24	25-34	35-44	45-54	55-64	65+
Spouse	0.5	0.7	0.8	0.7	0.6	0.6
Children (<6)	0.5	0.9	0.8	0.5	0.5	0.4
Children (6-18)	0.6	0.9	2.0	2.2	1.8	1.7
Adults (offspring) ($>$18)	0.1	0.2	0.4	1.2	1.5	1.2
Adults (other) (>18)	0.2	0.1	0.1	0.1	0.1	0.0
Household Size	2.7	3.8	5.1	5.6	5.3	4.8

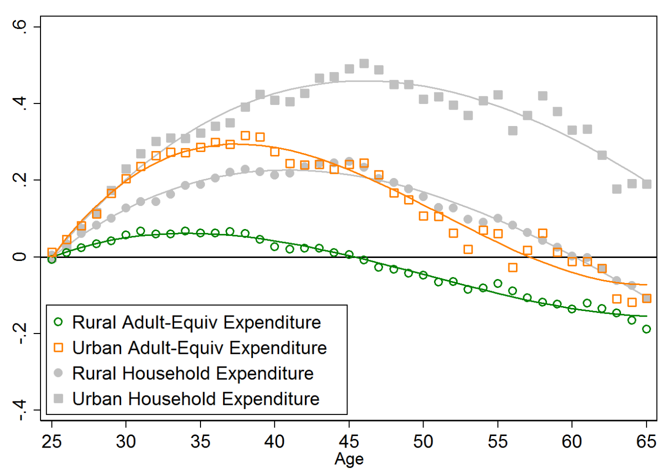
Notes: The data refer to the Malawi ISA 2010/11. We obtain similar insights for the alternative Malawi ISA surveys in 2004/05 and 2013. Children refer to household members age less than 19. Offspring adults refer to the household's head sons and daughters aged 19 or above. The relationship between each member of the household and the household head is collected in the household roster that includes relatives and non-relatives (e.g. servants and lodgers) living in the household at least 9 months in the last year.

Figure 1: Lifecycle Household Expenditure: Malawi, the U.S. and the Rural-Urban Divide



Notes: Panel (a) shows household nondurable expenditure over the lifecycle in Malawi and in the US. Nondurable expenditure is defined in Section 2 and our empirical strategy in Section 3.3. The US profile is taken directly from Aguiar and Hurst (2014). Panel (b) additionally decomposes household nondurable expenditure over the lifecycle in the rural and urban areas of Malawi. See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials.

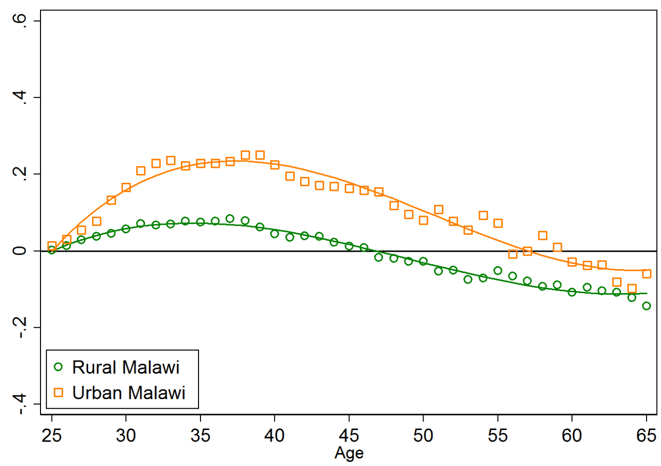
Figure 2: The Role of Household Structure



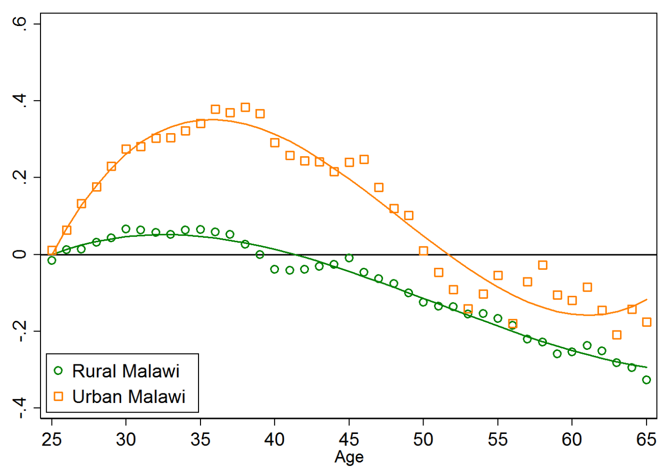
Notes: The adult-equivalent expenditure is defined in Section 3.3. To show the role of household structure we overlay adult-equivalent expenditure with the urban and rural household expenditure profiles from panel (b) of Figure 1 (gray lines). See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials.

Figure 3: Lifecycle Food and Nonfood Expenditure

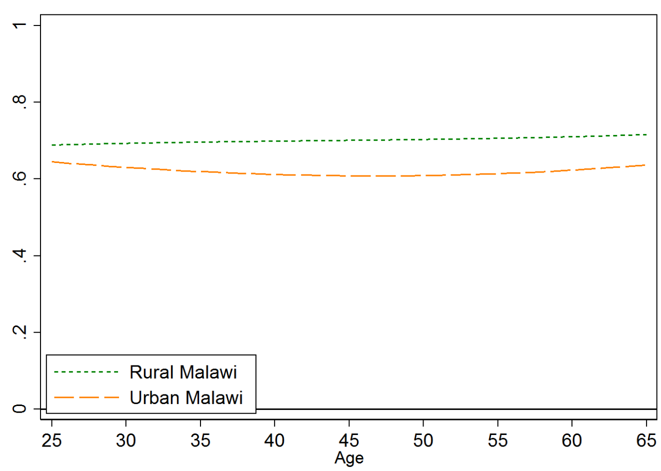
(a) Food expenditure



(b) Nonfood expenditure

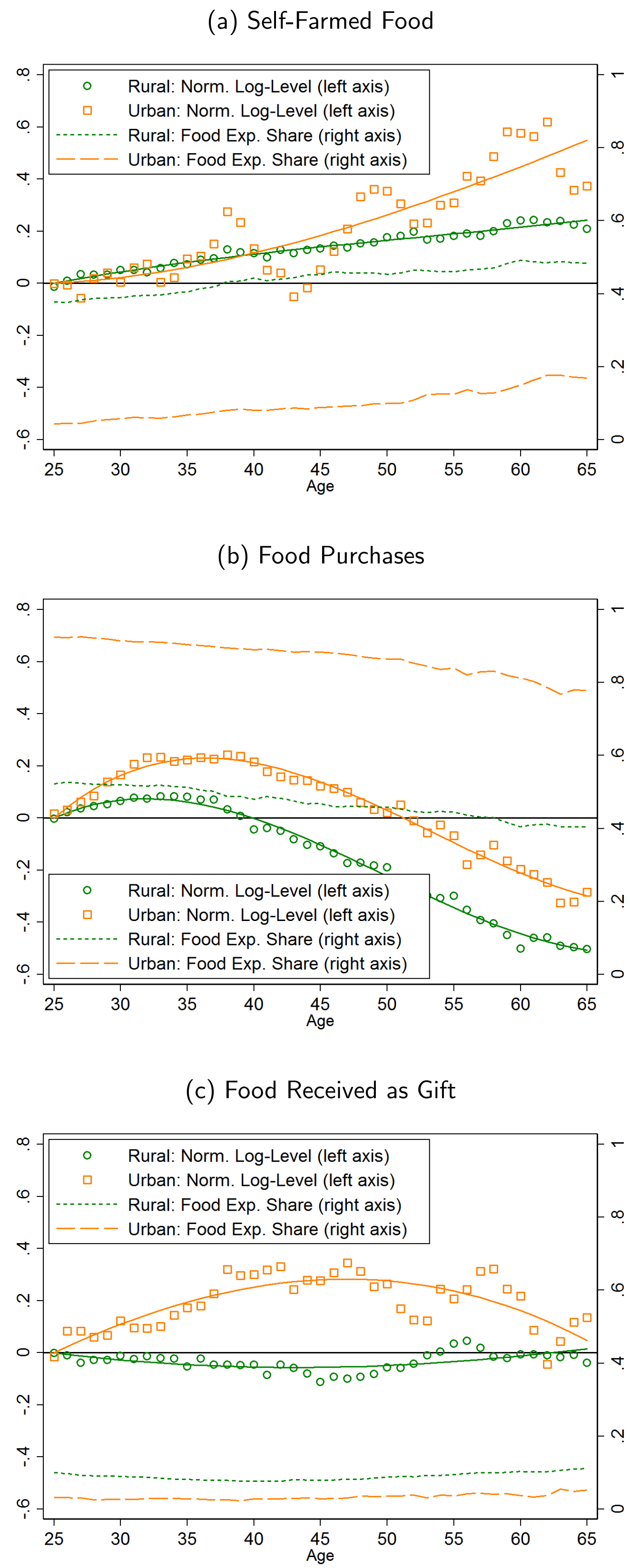


(c) Food Share of Total Expenditure



Notes: The expenditure profiles in rural and urban Malawi are decomposed into food and nonfood expenditure in respectively panel (a) and (b).We plot the food share of total nondurable expenditure in panel (c). See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials. All profiles are plotted in adult-equivalent terms.

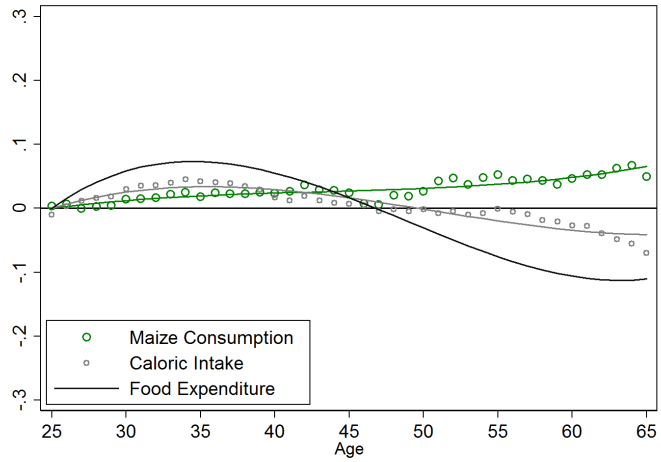
Figure 4: Deconstructing Lifecycle Food Expenditure



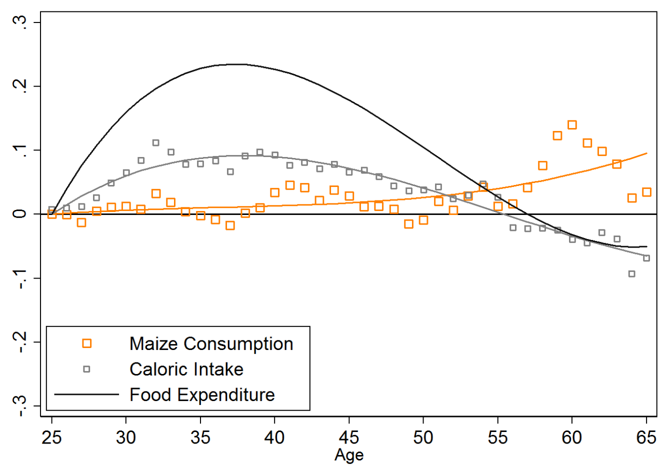
Notes: We break down food expenditure by its origin (left axis): self-farmed food in panel (a), food purchases in panel (b), and food received as gift in panel (c). In each panel we overlay the lifecycle profiles with the expenditure share out of total food expenditure (right axis). See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials. All profiles are plotted in adult-equivalent terms.

Figure 5: Lifecycle Consumption vs. Expenditure

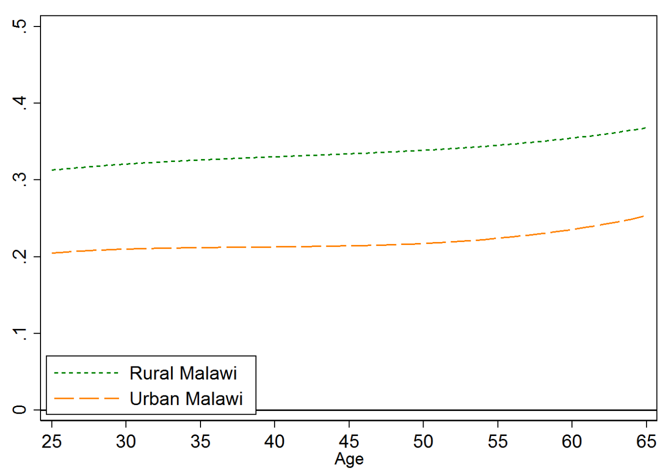
(a) Rural Malawi



(b) Urban Malawi

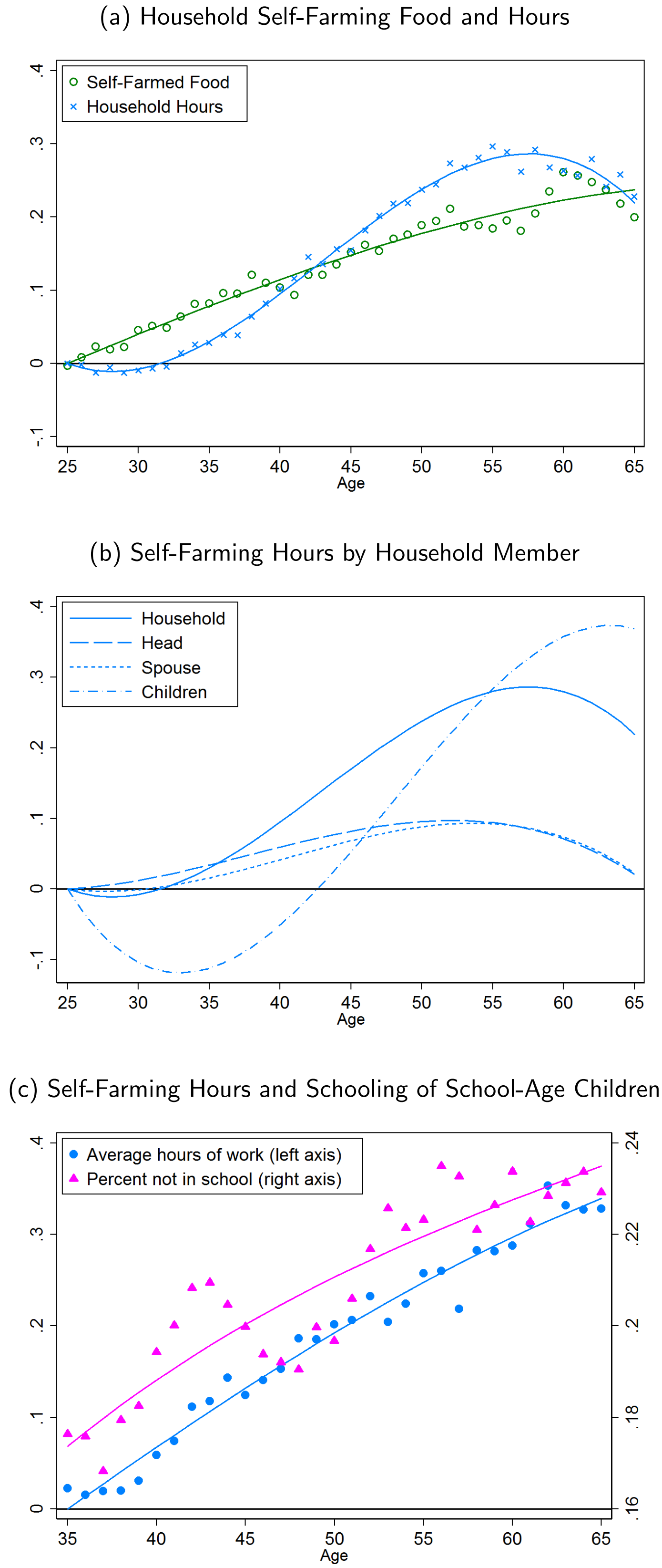


(c) Maize Share



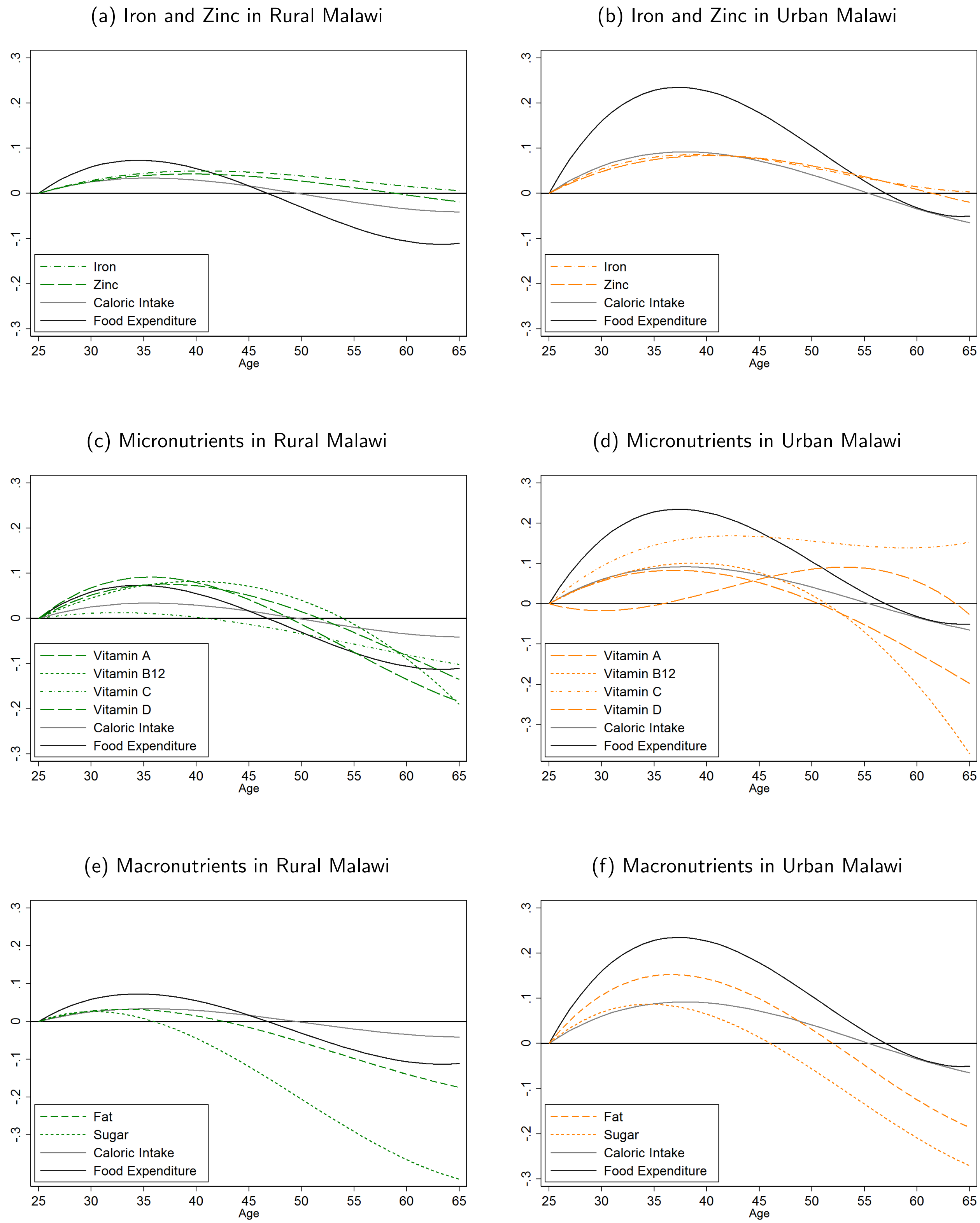
Notes: Consumption profiles are measured in terms of caloric intake and the quantity (Kilograms) of maize consumed in rural and urban Malawi, respectively panel (a) and panel (b). In each panel, we overlay consumption with food expenditure profiles from panel (a) in Figure 3. In panel (c), we plot the expenditure share of maize out of total food expenditure. See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials. All profiles are plotted in adult-equivalent terms.

Figure 6: Self-Farming Hours and Schooling



Notes: Panel (a) shows the adult-equivalent self-farmed food expenditure and adult-equivalent working hours employed in self-farming. Panel (b) breaks down the household hours employed in self-farming by household members: head, spouse, and children. In the case of children, hours are in per capita terms, i.e., we divide total children hours by total number of children. The age profiles are normalized to 0 (in logs) at age 25. Panel (c) focuses on school age children (6-18); we normalize hours in per capita terms to 0 at age 35 and show the percentage of school age children currently not attending school.

Figure 7: Quality of Lifecycle Consumption



Notes: We plot consumption profiles of nutrient intake by minerals (iron and zinc) in the top panels, micro nutrients (vitamins A, B12, C and D) in the center panels, and macro nutrients (fat and sugar) in the bottom panels. The left panels refer to rural areas, and the right panels refer to urban areas. In each panel, we overlay nutrient intake with calories and food expenditure profiles from Figure 5. See our discussion in Section 4. The age profiles are normalized to 0 (in logs) at age 25. The graphs show estimated age dummies (marked with dots) and associated cubic polynomials. All profiles are plotted in adult-equivalent terms.