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Income elasticities for food, calories and nutrients across Africa: A meta-analysis

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ABSTRACT

This paper aims to provide a better understanding of the relationship between income and the demand for different types of food, nutrients, and calories in Africa by conducting a meta-analysis of income elasticity estimates. We build a meta-sample consisting of 1523 food-income elasticities, 369 nutrient-income elasticities, and 123 calorie-income elasticities extracted from 66 primary studies covering 48 African countries. The sample displays a large heterogeneity in income elasticity estimates, which our meta-analysis aims to explain by looking into attributes of the primary studies and characteristics of the countries considered. There are significant differences in the size of the income elasticities across food and nutrient groups. Foods that make up basic diets tend to have lower income elasticities, while elasticities are considerably higher for less basic and more aspirational foods. The role of methodological attributes of the primary studies in explaining heterogeneity is found to be small. Overall, our results confirm that although income growth in Africa will increase food consumption and lead to more nutritionally diverse diets, it is also associated with excessive intakes of fats and sugars, raising concerns about over-, in addition to undernutrition. This suggests that income-based policies can still play a role in the fight against hunger, but that targeted programs are needed to promote nutritionally valuable and healthy diets.

1. Introduction

Official estimations indicate that over 200 million people in Africa are hungry (FAO, IFAD & WFP, 2015). The share of undernourished people in SSA has declined substantially over the past decades (from 27.6% in 1990–1992 to 20.7% in 2010–2012), but at a considerably slower pace than in the rest of the developing world (World Bank, 2016). Given that the population of Sub-Saharan Africa (SSA) is expected to double by 2050 (UNPD, 2015), feeding the poor will remain an enormous challenge. Not only will the demand for food continue to rise, also the composition of food demand will change with rising incomes. Demand for food may shift towards more expensive, but not necessarily more nutritional food items as incomes increase (Behrman and Deolalikar, 1987), and also growing urbanisation will contribute to changes in the nutritional composition of diets with not only undernutrition, but also overnutrition becoming a concern (Popkin, 1994).

By and large, the existing literature on income and food demand has focused on the relationship between income and calorie consumption (i.e. calorie-income elasticities), while relatively few studies have considered the diet or nutrient composition (e.g. fats, proteins, carbohydrates) (Salois et al., 2012). The distinction is important because many African countries face specific nutrient deficiencies (e.g. proteins, vitamins), despite normal, or close to normal, levels of calorie intake. Moreover, concerns arise in the context of the 'nutrition transition', the shift in caloric intake towards fat-rich and sugar-rich diets as incomes grow. Haddad et al. (2003) have estimated in how far income growth can reduce underweight among children. Yet, deeper insights are needed on how income growth relates to the composition of diets in terms of nutrients and type of goods, in order to understand how to fight problems of under- but also overnutrition. In this paper we therefore study in detail the income elasticity of intake of different types of food, calorific intake and nutrient intake for Africa.

Generally, food demand is income inelastic (elasticities are less than one), reflecting Engel's law that food budget shares decline when

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income rises.[1] Studies have shown that the relationship between income and calorie consumption is not linear and that the increase in the demand for calories as a result of income growth becomes smaller as income levels become higher (i.e. income elasticities are not constant). This is thought to result from the reaching of a saturation point in calorie consumption (e.g. Skoufias et al., 2011; Salois et al., 2012). Studies have also found evidence that increased income leads to a preference for higher quality foods and more diversified diets, which may result in fewer calories (per unit of cost) than basic staple food diets (e.g. Skoufias et al., 2011) while delivering better nutrition. Evidence for developed countries (and increasingly also for developing countries), however, suggests that, overall, rising country income levels can lead to calorie overconsumption (leading to obesity), while the nutritional value of diets does not necessarily improve. In some developing countries, especially in their largest cities, the two realities of undernutrition and overnutrition often coexist, reflecting the "nutrition paradox" (Caballero, 2005). However, as Fabiosa (2011) notes, underlying these general trends, countries at similar stages of economic development have very different dietary patterns. This might be due to a variety of different factors including food supply structures, degree of urbanisation and, more generally, different cultures and food consumption habits. It follows that projections on future food demand, and the effectiveness of income-based policy mechanisms in addressing food and nutrition security may vary across regions including across Africa.

In this paper we examine the relation between income and food, calorie and nutrient demand in Africa through a systematic review of the existing literature. We carry out a meta-analysis to explain the large heterogeneity in income elasticities across the African continent The paper draws on several recent review studies, including other meta-analyses of food demand (e.g. Bouis and Haddad, 1992, Salois et al., 2012, Ogundari and Abdulai, 2013, Zhou and Yu, 2014), which are summarized in Table A.1 in Appendix. Our study builds on previous studies in three ways. First, most review studies focused on the relation between income and calorie consumption. This study provides evidence for income elasticities associated with different types of food and nutrients, besides calories, in order to improve our understanding of the relationship between income, diet composition and nutrition. The exception is the study by Salois et al. (2012) which considered different nutrient-income elasticities (including carbohydrates, proteins and fats), yet based on a smaller sample and without controlling for methodological attributes which may influence the results. Second, we consider a comprehensive list of potential sources of variation in income elasticities, relating to the attributes of the primary studies as well as the countries they refer to. Previous reviews and meta-analyses have mostly focused either on the data and methodological attributes of the primary studies (Bouis and Haddad, 1992; Ogundari and Abdulai, 2013), or on country income levels (Zhou and Yu, 2014; Salois et al. 2012), but not on both at the same time. Chen et al. (2015) do control for both sources of variation simultaneously, but focus on China only. Moreover, we also include urbanisation rates and geographical controls, which were not considered in previous studies. Thirdly, none of the previous meta-analyses provides specific evidence for Africa. Teklu (1996) does provide a qualitative review of food demand studies for Sub-Saharan Africa, and also Bouis and Haddad (1992) include a few African studies in their overview. Yet, given the large number of new studies estimating the food-income relation in Africa since then, an update of the literature and a systematic approach are appropriate. As such, this study provides the first meta-analysis of income elasticities of food demand for Africa.

The remainder of the paper is organised as follows. Section 2 provides a summary of the meta-sample construction and research methods used. Section 3 presents the key descriptive statistics of the meta-sample, the results from the meta-regression models and sensitivity tests, while Section 4 discusses the key implications from our findings, and section 5 concludes.

2. Data and research methods

2.1. Selection of primary studies and construction of the meta-sample

To identify the candidate primary studies to be included in the meta-sample, a search was carried out using a combination of terms including: "nutrition and income elasticity", "food and income elasticity", "calorie-income elasticity" and the combination of "income elasticity" and "demand elasticity" with a list of keywords such as "developing countries", "Africa", "food", "calorie", "nutrition", type of food (e.g. "eggs", "dairy", "milk", "cereal", "fruit", "vegetable", "fish", "meat").[2] The search was carried out across various online databases including both published peer-reviewed literature (e.g. journal articles) and 'grey' literature (e.g. working papers, reports) in the economics, medical and nutrition disciplines. Database searches were performed between October 2014 and February 2015. The databases searched were: ISI Web of Knowledge, ScienceDirect, EconLit, PubMed, AJOL (African Journals Online), World Bank, AgEcon, USAID (US Agency for International Development), FAO (UN Food and Agriculture Organisation), IFPRI (International Food Policy Research Institute), RePEc (Research Papers in Economics), and Google Scholar. In addition, we also considered the references of primary studies included in previous review studies of food demand (e.g. Bouis and Haddad, 1992; Salois et al., 2012; Green et al., 2013[3]; Ogundari and Abdulai, 2013; Zhou and Yu, 2014). No time frame regarding the publication date of primary studies was imposed. In total 89 candidate studies were identified, of which 27 had already been included in earlier review studies, while the remaining 62 concern new records, the majority of them identified through AJOL.

A further selection was made based on the relevance of the abstract to the research objectives, i.e. whether the abstract mentioned a combination of the words "food", "calorie", "nutrient", "income", and "elasticity" and whether the region of the study concerned Africa. At this stage a number of records were also excluded when a full text was not available. This screening left us with 75 articles. Next, to avoid problems of comparability between income elasticity estimates, we only maintained studies providing unit-free elasticity estimates of food demand with respect to income. This reduced the final sample to 66 studies. Fig. A.1 illustrates the selection process of primary studies and Appendix B lists the primary studies included in the meta-sample. Once a study was selected, a process of data extraction was initiated following a specific protocol about the attributes of the primary study and elasticity estimates to be gathered[4] (see Table 1). Where a study produced multiple income elasticities (e.g. for different food/nutrient groups, for urban and rural samples separately, using different estimation models), all estimates were included in the meta-sample,

[1] We use 'food' as a composite term for the three aspects we consider i.e. food types, calories and nutrients. In more specific instances however (e.g. in discussing results), we are explicit in differentiating food, calorie and nutrients.

[2] Given the focus on developing countries in Africa, we also specified the search terms in Portuguese, French and Spanish, besides English, although, in the event, none were located.

[3] Green et al. (2013) is not a review on income elasticities, but provides a meta-analysis of food-price elasticities. Since primary studies may estimate both price and income elasticities, we also screened the primary studies considered in this paper.

[4] It should be noted that a number of potential attributes (including demographic controls, conditional vs. unconditional elasticities, single- vs. multi-stage budgeting, type of estimator) were not considered either because many of the papers concerned did not provide sufficient details or because there was little variation across studies. For example, the presence of upward bias through indirect calorie and nutrition elasticity estimation linked to changes in quality of food consumed (Behrman and Deolalikar, 1987), was tested, but not found to be significantly different from zero. Yet, little variation (the largest part of studies using the direct method) and high multicollinearity with other study attributes, did not allow to include this attribute in the final regressions.