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Composition of Household Income and Child Nutrition Outcomes Evidence from Uganda

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Summary. — This study targets the empirical space between cross-country analyses exploring links between income and nutrition without insights on micro-level determinants, and relevant microeconomic studies hindered by small sample size and/or incomplete data. We use the rural samples of the three waves of the Uganda National Panel Survey, and estimate panel regressions of child height-for-age *z*-scores (HAZ) controlling for time-invariant child-level heterogeneity. On the whole, we find no impact of short-term changes in total gross income on HAZ but document small positive correlations for younger children. Sector-differentiated analyses indicate that compared to wage earnings, only share of income from non-farm self-employment correlates positively with HAZ. Within agriculture, shares of income from consumption of own crop production and from low-protein crop production underlie the negative effect of share of income from crop production. While we cannot claim causal relationships, our findings suggest the possibility of "stickiness" of crop production to own consumption.

Key words — child nutrition, household income, agriculture, nutrition-sensitive agricultural production, Uganda, Sub-Saharan Africa

1. INTRODUCTION

In the quest for widespread and sustainable welfare gains, not all income may have equal effects. Growth within some sectors or accruing to certain individuals within a population may be relatively more effective at reducing poverty and improving specific welfare outcomes in developing countries. Child under-nutrition, targeted directly by the first of the Millennium Development Goals and related to others, is an aspect of poverty that is often argued to be sensitive to growth in the agricultural sector, with potential for both gains and losses. In recent years, there has been a growing movement to pull together evidence on the links among agriculture, income, nutrition, and health for the design of multi-sectoral interventions that target nutritional deficiencies. [1]

All income has the potential to benefit children's nutrition, and if household consumption choices depend on production outcomes only via total earnings, income from any source or sector will be equally beneficial. Empirically observed deviations from this theoretical case may originate from multiple sources: distribution of poverty across sectors, relative food production and consumption prices due to markups and transaction costs, risk preferences, and intra-household bargaining outcomes, to name a few. If such deviations occur, the direction and relative weights of these channels of impact would lead to very different prescriptions for policymaking and allocation of scarce resources meant to boost nutrition-supporting growth. Empirically, however, validation of the claims regarding whether and how household sectoral involvement and gains in productivity can contribute to changes in nutritional status and health has been hindered by data limitations and by methodological concerns.

A large collection of microeconomic studies attempting to determine the income links to nutrition through specific mechanisms provide mixed and often conflicting results. The investigated mechanisms include (i) commercialization (reviewed by DeWalt, 1993; Kennedy, Bouis, & von Braun, 1992; Von Braun & Kennedy, 1994), (ii) gender dynamics (reviewed by Kurz & Johnson-Welch, 2007; Peña, Webb, & Haddad, 1996; Quisumbing, Brown, Feldstein, Haddad, & Peña, 1995; Quisumbing & Maluccio, 2000), and (iii) nutrition-sensitive production and education interventions (reviewed by Berti, Krasevec, & Fitzgerald, 2004; Gillespie & Mason, 1994; Leroy & Frongillo, 2007; Masset, Haddad, Cornelius, & Isaza-Castro, 2011 [2]; Ruel, 2001; Soleri, Cleveland, & Frankenberger, 1991). While some differences could be due to context-specific dynamics, numerous reviews in recent years express concerns regarding (i) the validity of the empirical methods used for impact estimation, and (ii) the inconsistency in the types of data used across studies which often lack information on income and have information on only consumption or anthropometry but not both (Arimond *et al.*, 2011; Leroy, Ruel, Verhofstadt, & Olney D., 2008; World Bank, 2007).

Despite these challenges, the sheer number of studies conducted over the last few decades speaks to the long-standing and urgent demand for insights into how to effectively leverage growth for nutritional improvement. While researchers and key policy players overwhelmingly assert that there is a strong potential for agricultural development to support nutrition and health, they also lament the lack of insight into the specific conditions necessary and sufficient to achieve improved nutritional outcomes efficiently and at broad scale. Herforth (2013) synthesizes the current state of knowledge cites general consensus on many best practices for improving nutrition through agriculture but highlights two questions that are yet to be settled: (i) what are the relative nutritional impacts of agricultural

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production for own consumption *vis-à-vis* agricultural production for sales and (ii) what agricultural products households should focus on, for example staple crops vs. animal-source foods? To this list, we add a third, overarching question that stems from the literature: Even if agricultural growth can be leveraged effectively for nutrition, is it more effective than non-agricultural growth at micro level?

With these questions in mind, we take advantage of the three waves of the household survey data from the Uganda National Panel Survey in an attempt to fill the knowledge gap between the cross-country analyses that explore the links between income and nutrition but cannot explore determinants at a micro level and the numerous smaller microeconomic studies that point to mechanisms of impact but are often hindered by some combination of sample size, data incompleteness, and other methodological considerations. We start by looking at how child nutritional outcomes correlate with *short-term* changes (1–2 years) in household income regardless of source. Subsequently, we explore heterogeneity by source of income, first between crop cultivation[3] and non-crop sources and then further within type of agriculture, according to the priorities set previously in the literature.

There are three key findings. First, we document no detectable impact of short-term changes in total gross income on height-for-age overall, though there may be a very small gain for the youngest children. Second, sector-differentiated analyses indicate that only the share of income originating from self-employment exerts positive and statistically significant effects on height relative to other sectors. Third, the income shares pertaining to (i) a household's consumption of own crop production and (ii) low-protein crop production, rather than crop production alone, appear to be driving the negative effect of the share of income originating from crop production. All of these relationships are small relative to typical year-on-year changes in income composition.

The remainder of the paper is structured as follows. Section 2 discusses the theoretical mechanisms through which income growth and sector and subsector of growth can influence nutrition in the context of the existing body literature. Sections 3 describes our data sources; Section 4, empirical strategy and results. Section 5 concludes.

2. LINKING INCOME AND AGRICULTURE TO NUTRITION: THEORY AND LITERATURE

The factors that are commonly understood to interact to that hinder nutrition are (1) household food insecurity, which encompasses food availability as well as quality, (2) inadequate care, and (3) unhealthy environment (Behrman & Deolalikar, 1988; UNICEF, 1990).[4] The direction of these biologically based impacts is well established in the literature, and we take them as given: any positive or negative impacts of agriculture on nutrition must act through these channels. Descriptively, we offer a health production function for nutritional outcomes:

$$H_i = H(f_i, n_i, s_i, X_i),$$

which over time accumulate as:

$$H_{it} = H(f_{it}, n_{it}, s_{it}, X_i, H_{it-1})$$

where time t-indexed food consumption f_{it}, care/nurturing n_{it}, and sanitary environment s_{it} as well as a vector of individual or household characteristics X_i and previous nutritional health outcomes H_{it-1}. Lack of any factor, such as food, care, sanitation, may be sufficient to induce under-nutrition, and the provision of each is expected to complement the others in producing health (while competing through the budget constraint), so we would expect the true production function will contain interactions of these terms, likely with non-linearities and minimal subsistence terms.

Connecting the dots conceptually from income to nutrition, households may value health directly or may value consuming inputs that contribute to health (food, care, sanitation) as well as other consumption c_{it} and leisure l_{it}, according to household characteristics X_{it}:

$$U_{it} = U(f_{it}, n_{it}, s_{it}, c_{it}, l_{it}, X_{it}).$$

The household wants to maximize utility subject to a budget constraint such as

$$p_f f_{it} + p_s s_{it} + p_c c_{it} - w(n_{it} + l_{it}) \leqslant I_{it}$$

where p_f, p_s, p_c, w are the prices of food, sanitation, other consumption, and the wage rate; and income I_{it} comprises farm profits, non-agricultural enterprise profits, and the value of household labor and land endowments.[5]

Under basic household models, income only affects these nutrition-inducing consumption choices by setting the budget constraint, with no other characteristic of income having influence. By relaxing the budget constraint, increases in income from any source may lead to greater food consumption; nutritional gains may be further facilitated by higher marginal consumption of food among the poor (Engel's Law) especially in terms of consumption of calories and essential micronutrients (Skoufias, Tiwari, & Zaman, 2012; Strauss & Thomas, 1995; Subramanian & Deaton, 1996). At the same time, income gains enable greater consumption of complementary health inputs such as sanitation improvements and healthcare services, and the income elasticity of health and sanitation expenditures can remain quite high throughout the income distribution (Von Braun, de Hean, & Blanken, 1991). Income can be used for childcare services or otherwise improve the quality of care given as well. For example, higher expenditure on education allocated to girls as a result of increased income eventually translates into higher maternal education, shown to improve child nutritional outcomes (Behrman & Wolfe, 1984; Umapathi, 2008; Webb & Block, 2004), though this can take years or decades to materialize.

Empirical studies using pooled cross-sectional data provide evidence that nutritional outcomes do improve alongside long-run, aggregate economic growth (Cole, 2003; Haddad & Smith, 2002; Headey, 2013[6]; Webb & Block, 2010). Yet this relationship is not guaranteed, depending on duration and distribution of growth. Under the permanent income hypothesis and consumption smoothing, short-term income fluctuations may be less likely to induce consumption of food or sanitation when compared to longer term gains (Hall & Mishkin, 1982). Clearly, a household must be able to participate when there is aggregate growth in order to benefit from it. Looking at "nutritional episodes" with an average duration of 4.7 years, Heltberg (2009) looks at income growth across countries but finds less improvement in child stunting rates compared to longer term studies, with less nutrition improvement in more unequal societies. Relatedly, Webb and Block (2010), with data largely drawn from Sub-Saharan Africa, find that growth from structural transformation fails to support nutrition for the rural poor in the short run but point to agriculture effectively lowering stunting by reaching the rural poor. Headey (2013) finds that once India is excluded in cross-country regressions, agricultural growth corresponds to a stronger reduction in stunting than non-agricultural growth in the medium term. Again, even if a household is able to participate in

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