Considering Health and Nutrition in Agricultural Production Decisions:
Evidence from Tanzania

Extended Abstract

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Motivation

One of the three pillars of food security, as defined by the World Health Organization, is that households should have access to foods for a nutritious diet.[1] In many developing countries, households access food not just through the local market but also through home agricultural production. The broad objective of this project is to investigate whether health and nutrition affect household agricultural production decisions in developing countries. To study this relationship, we examine how household demand for nutrients is determined by on-farm agricultural production.

In Africa and Asia over 80% of cropland is used directly for food crops, and households purchase a smaller share of their food items on the local market than households in more developed countries (Foley, 2011). In Tanzania, the focus of this research project, two of the main cash crops are coffee and tobacco, which have little to no nutritional benefits. Maize is the dominant food crop, but large amounts of maize consumption can lead to niacin deficit and, in extreme cases, pellagra. If households decide to produce maize, coffee, or tobacco crops based on market incentives, then households may have very little access to key vitamins and minerals. Thus, unlike in many developed countries, household agricultural production in Africa and Asia has to fulfill two main purposes: ensure food (and nutritional) security and generate revenue (for example, see a collection of studies in Fan et al., 2012).

Given the widespread popularity of agriculture-focused development programs, it is important that policy-makers understand the potential adverse effects that these interventions may have on rural households. For example, Feed the Future, the U.S. Government's Global Food Security and Hunger Initiative, focuses primarily on increasing production for the market.[2] Additionally, Malawi's 2005 Agricultural Input Subsidy Program subsidized fertilizer purchase for the production of maize (Dugger, 2007). Neither of these two programs considered the potential adverse affects that market-oriented agricultural production may have on household health and nutrition. Our research project will provide evidence on the tradeoffs households face, in terms of household nutritional health, between market-oriented and household-oriented agricultural production.

Research question:

We wish to understand whether or not households make crop choice and agricultural production decisions in order to satisfy household food demand and nutrient needs. A large literature has shown that health and nutrition are crucial inputs into the accumulation of human capital (especially education), productivity on the labor market, and overall individual welfare and economic growth in developing countries (Strauss and Thomas, 1998; Deolalikar, 1988) but few studies have considered the source of these nutrients.

Households will produce food to meet nutrient needs if they are unable to obtain certain nutrients on the local food markets due to food, labor, or land market failures (de Janvry, 1991). For example, if food markets are fully functioning, then households are indifferent between

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[1] http://www.who.int/trade/glossary/story028/en/
[2] http://www.feedthefuture.gov

growing food for consumption and purchasing food on the market because any food item that the household wants to consume is readily available in the local market. If food markets are not fully functioning, however, a household is limited in what food products it consumes by what is available in the market and by the food that the household produces at home.

This research project will be one of the first studies to estimate household demand for nutrients as a function of household agricultural production. Ecker and Qaim (2011) estimate nutrient demand in Malawi but do not explicitly consider how agricultural production influences this demand. If households produce crops for own consumption, then their agricultural production is a key determinant of household nutrient consumption, and consequently household health.

Methodology:

To answer this question, we adopt an innovative interdisciplinary approach that lies at the intersection of applied economics and nutrition science by combining econometric methods with nutrition decomposition methods. To estimate nutrient demand we rely on well-known econometric demand system estimation methods that incorporate panel data techniques. We estimate nutrient demand both at the level of individual foods (i.e. maize), food groups (i.e. staple foods), and across time.

To measure nutrient consumption, we construct two different measures of household nutrient consumption. The first measure is the household dietary diversity score (HDDS), an approach that is increasingly used in food policy research. The HDDS is the number of food groups consumed by the household in the last week. Foods are aggregated into 10 different groups including staples, roots and tubers, vegetables, and fruits (oils, sweets, and beverage consumption are not included in the HDDS). The HDDS takes advantage of the fact that a more diverse household diet is strongly correlated with household health and nutritional status (Ruel, 2003*)*.

The second measure decomposes the consumed foods into energy (kilocalories), macronutrients (protein), vitamins (vitamin A, riboflavin, folate, vitamin B_{12}, and vitamin C) and minerals (iron and zinc). We use nutrient conversion charts available from the UN Food and Agriculture Organization (FAO) to derive the level of household nutrients obtained from both food groups (staple foods, pulses, fruits and vegetables, animal products, and meal complements) and from specific food items (i.e. maize). We then estimate per capita nutrient consumption that takes into account individual-specific nutrient requirements based on an individual's age, gender, weight, and height. Detailed nutrient data are very rarely used in traditional economic analyses, which is an innovation of this study. Thus, our analysis takes advantage of detailed household-level consumption and agricultural production data and individual-level anthropometric data.

Data:

We use the 2008-2009 and 2010-2011 rounds of the Tanzania Living Standards Measurement Survey, which was collected by the Tanzanian National Bureau of Labor Statistics. Each round of the survey contains observations on approximately 3,300 households (16,000 individuals) and produces nationally representative estimates of agricultural production and poverty for the country. With two years of household data, we control for any time-invariant unobserved household characteristics that influence micronutrient demand, which allows for a more accurate estimation of the relationship between household agricultural production and household nutrient demand.

These data are well suited for this project because of the detailed level of information contained in the agriculture, consumption, and anthropometric questionnaires. The agriculture questionnaire contains both crop- and plot-level information on the crops planted, amounts harvested, and inputs used in production. The consumption questionnaire asks households, for each of 59 distinct foods, how much of the food they have consumed in the last seven days and whether these foods were purchased, produced at home, or gifted to the household. From this consumption survey we construct the two measures of household nutrient consumption mentioned above. Finally, the anthropometric questionnaire records the age, gender, weight and height for each household member. This information is used to create individual-level required and recommended nutrient levels.

Preliminary results from our dataset show that, on average, the household dietary diversity score is approximately 6 (out of 10 possible food groups) in both 2008-2009 and 2010-2011. This score means that there is significant room for households to increase the diversity in their diet. In fact, the four least consumed food groups are eggs, poultry, red meat, and fruits and vegetables (in order from least to most consumed).

Table 1 presents a simple breakdown of per capita household food consumption by source for five food groups using the 2010-2011 round of our data. We can see that, on average, roughly half of household food consumption comes from staple crops, which include maize, rice, cassava, and yams, with vegetables and fruits being the second largest food group consumed. In total, approximately one-third of the food consumed by households is produced within the household. The large variance in the source of food consumed by households, however, points to a significant difference across households in terms of what foods they are eating and where they are obtaining these foods.

Table 1: Per capita household food consumption by source (2010-2011)

	Purchased[a]	Home produced[a]	Gifted[a]	Total[a]
Staple foods	233.06 (208.32)	215.06 (276.99)	28.90 (88.81)	476.47 (230.19)
Pulses	20.30 (25.43)	12.48 (29.38)	2.38 (12.57)	35.14 (34.13)
Vegetables and fruits	89.97 (101.40)	34.68 (79.04)	13.90 (50.10)	138.64 (121.47)
Animal products	91.32 (201.67)	43.68 (133.56)	9.50 (56.98)	86.83 (116.32)
Meal complements	52.44 (91.87)	2.89 (38.63)	1.93 (24.19)	56.85 (102.01)
Total	571.15 (467.23)	324.22 (385.94)	64.64 (144.75)	901.54 (367.31)
Observations	3225	3225	3225	3225

[a] All amounts reported in grams. Standard deviations in parentheses
Source: Tanzania Living Standards Measurement Survey (2010-2011)

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