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Rising food prices and undernourishment: A cross-country inquiry

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ABSTRACT

Households' welfare in developing countries has been hit by dramatic food prices increases which occurred between 2005 and 2008. In this paper, we adopt a partial equilibrium approach to analyze the short-time effects of a staple food price increase on nutritional attainments, as a measure of welfare. The analysis consists of first approximating complete food-demand systems and then performing household level micro-simulations. Instead of focusing on a single country profile, we provide a more complete snapshot by comparing the evidence through a cross-country assessment made possible by the use of nationally representative household surveys. Comparability is assured by the adoption of the same methodological choices in the treatment of the micro data. We find that food price spikes not only reduce the mean consumption of dietary energy, but also worsen the distribution of food calories, further deteriorating the nutritional status of populations. We also discovered that access to agricultural land plays a significant role in ensuring adequate nutritional attainments in rural areas, and surprisingly, even in urban areas.

Introduction

The main objective of this paper is to assess the household-level food security impact of tradable staple food price increases in developing countries. We adopt a partial equilibrium approach by simulating the food demand response of households to a price shock, thus considering mainly short-term effects or direct effects on consumers and producers.

The motivation for this paper stems from the recent upward trends in global food prices, concerning overall many staple commodities between 2005 and 2008.[1] Although by early 2009, most food prices had fallen from their peaks, they remained well above 2005 levels. In this context, the major source of concern is clearly related to the possible reduction of consumption levels: households may be forced to reduce both their food consumption, in response to the price surge, and other longer-term expenditures, such as education, in order to meet basic needs. However, the impact of soaring food prices on welfare is likely to be very diverse, depending upon which commodity prices change and the structure of the economy. Governments may play an important role by setting specific market and trade policies with the aim of protecting domestic markets and calming down the internal effects of price fluctuations.[2] This may come at the risk of increasing international volatility. Further, the overall effect of price increases on poverty depends also on the distribution of net buyers and net sellers of food among low-income households, i.e. it depends on whether the gains to poor net producers offset the adverse effects on poor consumers (Aksoy and Izik-Dikmelik, 2008).

In this kind of study, the monetary value of food consumption or total expenditure is generally used as a measure of living standards. Ul-Haq et al. (2008) and Brambila et al. (2009), for example, estimate an Almost Ideal Demand System (AIDS), which serves as a basis for their simulation exercise respectively for Pakistan and Zambia. Ivanic and Martin (2008) use an expenditure function to characterize household consumption and factor supply behavior and a profit function to represent household production activities in ten low-income countries; this yields an expression for the welfare impacts of small price changes.

This paper instead focuses on food security for several reasons: (a) from an academic point of view, nutrition is of particular interest as a proximate determinant of human growth, which may have functional consequences for health, labor productivity, cognitive development and personality, which in turn may influence socio-economic conditions (Steckel, 1995); (b) as shown below, poverty and undernourishment do not exactly correlate, and therefore have different determinants; and (c) from an institutional point of view, eradication of extreme hunger together with poverty are among the targets of the first Millennium Development Goal.

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[1] For example, the price of maize rose by 80% between 2005 and 2007, wheat by 70%, and rice by about 25%.

[2] There is a broad literature covering this topic. We refer for instance to Ravalion and Walle (1991), Jensen and Manrique (1996), and Ravallion and Lokshin (2004).

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The nutritional analysis we undertake is commonly considered as part of the food security literature, which has become increasingly relevant to policy makers. Food security is essentially a three-dimensional concept: it embodies availability (food supply), access (the economic capacity to attain food), and utilization (food safety, micro-nutrient sufficiency, etc.). These dimensions are hierarchical, with the first concept of availability necessary but not sufficient for the other two. All countries considered here are food-secure with respect to availability (average dietary energy supply is well above minimum dietary energy requirements[3]), which justifies this paper's focus on access; measured here through undernourishment (specifically dietary energy deficiency) as the indicator. Most household-level food security indicators are relatively simple indicators of diet quantity and/or diet quality.[4] In this study, a household is defined as undernourished if its dietary energy consumption (caloric intake) falls below its minimum dietary energy requirement (MDER). For exposition purposes, in this paper we interchangeably use the concepts of undernourishment and food insecurity, while acknowledging that the latter encompasses the former.

The analysis presented below is similar to the more common poverty analysis present in the literature. Both ask similar questions (who are the poor/food insecure? what are the causes and consequences of their poverty/food insecurity?); both share the same approach, requiring a measure of welfare to compare households/individuals (expenditure vs. dietary energy consumption) and a threshold by means of which households can be classified (poverty line vs. energy requirements). The main difference regards the way how the caloric threshold is measured. We estimate energy requirements accounting for both household composition in terms of age, sex and presence of pregnant women; and the country-specific biometric distribution. The other significant difference is that given the relative size of the poverty and food security literature, we know a much more about the former.

Our contribution to the empirical food security literature lies first in the usage of household-specific energy thresholds, which blends into the micro-analysis of undernourishment the best available guidelines regarding dietary energy requirements, FAO (2004). Also, we offer a novel cross-country assessment made possible by using national living standards household surveys. Instead of focusing on a single country profile, by first computing a food demand system and then performing a micro-simulation, we provide a more complete snapshot, comparing the evidence over an extended set of countries. In order to accomplish this task and keep consistency, we adopt the same methodological choices in the treatment of the micro data. Further, instead of using food demand elasticities from different non-comparable studies, we decided to use demand parameters from the cross-country study of Seale et al. (2003), which provides comparable, "conservative" estimates, while consistent with what is found in the literature. We further complemented the available own-price elasticities with computed cross-price elasticities consistent with consumer theory, following the technique suggested by Beghin et al. (2003), to account for mitigating substitution effects.

The paper is organized as follows. Section 2 describes the use of household surveys for food security analysis and the main methodological choices taken. In Section 3 we discuss our food price simulation approach, while in Section 4 we present the food security profile of eight selected countries. We proceed by presenting simulation results and a study of the determinants of food security. Finally, we provide some conclusions.

Methodology

The total dietary energy consumed by individuals depends on the quantity of food consumed and its caloric content:

$$E = \sum_j c_j \cdot x_j(\mathbf{p}, \mathbf{y}) \tag{1}$$

Food consumption is usually measured at the household level, so we define x_j as the per-capita demand of food item j, c_j is the energy content of the edible part of food item j, and E is the total dietary energy intake, measured in kilocalories per capita per day. As the energy conversion factors are fixed, as they depend on the nutritional content of food, the changes in dietary energy consumption are given by the changes in food consumption

$$dE = \sum_j c_j \cdot dx_j(\mathbf{p}, \mathbf{y}) \tag{2}$$

Food consumption will change as a result of food price variations, due to both a change in real income, and indirectly by changing nominal household income if the household is a producer of food

$$dx_j = \frac{\partial x_j(\mathbf{p}, \mathbf{y})}{\partial p_i} \cdot dp_i + \frac{\partial x_j(\mathbf{p}, \mathbf{y})}{\partial y} \cdot \frac{\partial y}{\partial p_i} \cdot dp_i, \tag{3}$$

In (3) income y is the sum of the different goods and services (including labor supplied) produced by the household, valued at their market prices, that is, $y = \sum_i p_i y_i$, and hence $\partial y / \partial p_i = y_i$. We can multiply and divide terms to re-write Eq. (3) as:

$$d \ln x_j(\mathbf{p}, \mathbf{y}) = [\varepsilon_{\mathbf{ji}} + \gamma_{\mathbf{i}} \cdot \eta_{\mathbf{j}}] \cdot \mathbf{d} \ln \mathbf{p_i},$$

which shows that as a result of a price change of food item i, the percentage change in each food item j consumed will vary proportionally to the percentage change in the price food item i multiplied by the cross (or own) price demand elasticity (ε_{ji}) and the income demand elasticity η_j of food item j multiplied by the share in disposable income of the value of the production of the food item i, $\gamma_i = p_i y_i / y$.

The change in total dietary energy consumed, as a result of an increase in the price of food item i will be given by:

$$\frac{dE}{E} = \frac{dp_i}{p_i} \sum_i \beta_j \cdot [\varepsilon_{ji} + \gamma_i \cdot \eta_j], \tag{4}$$

where β_j is the share of good j in total dietary energy consumption: $c_i x_j(p, y) / \sum_i c_i x_i(p, y)$. Eq. (4) presents a key relationship; in it, the economics given by (3) get limited by the nutritional constraints given by (1). For example, for countries with a less diverse diet, where the staple accounts for a large share of food consumption, the bulk of the change in dietary energy consumption will be given by the changes in the consumption of the staple foods, which account for a larger share of dietary energy intake. Even if some food items suffer large proportional changes, their impact on dietary energy will be lower than smaller proportional changes in the consumption of the staple.

Many choices have to be made in order to arrive to an empirical estimate of household and individual level dietary energy intake. These choices include: how to deal with outliers, which food composition table to use, how to add the energy equivalent of expenditures on food eaten away from home, etc. It is beyond the scope of this paper to explain these in detail, but we refer the reader to Smith and Subandoro (2007), which constitutes an excellent handbook on how to use household surveys to obtain food security indicators; Sibrián et al. (2008), which is our reference manual on how

[3] Dietary energy supply, available at http://faostat.fao.org/, measures the dietary energy available per capita after accounting production, net of exports and imports, and subtracting non-food uses of crops (like seeds and feedstock).

[4] See (Smith and Subandoro, 2007) for a more detailed illustration of the main household-level food security indicators.