

# Demand side drivers of global food security <sup>☆, ☆ ☆</sup>



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## ABSTRACT

Drawing upon a series of cross-country demand analyses conducted using International Comparison Program (ICP) data from 1980, 1996 and 2005, this paper highlights how consumer preferences for food evolve over time. Income and price elasticities were estimated for an increasing number of countries, reaching 144 in the 2005 ICP analysis. Consumers in lower income countries spend a higher share of income on food, are most responsive to income and price changes, and are increasingly diversifying their diets toward more protein and fat containing foods such as meats and fish. Consumers, in general, also make larger adjustments to non-food expenditures when food prices change than they do to food expenditures when the price of non-food items change.

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## 1. Introduction

The challenge of feeding the world's population, estimated to exceed 9 billion by 2050 (United Nations, 2011), in the face of changing diets, increasing non-food demand for agricultural products, declining growth in agricultural productivity, and uncertainties stemming from changing weather patterns has received a lot of attention lately. Much of the discourse has focused on supply-side issues of declining productivity growth and sustainably increasing agricultural productivity. Understanding those factors that govern future food supply capacity is an important component of strategic planning to reduce food insecurity. However, it is equally important to improve our collective understanding of the demand-side drivers. Examination of food demand patterns over time and how these patterns adjust to rising incomes and changing prices enables better projection of food needs, provides an insight into the kinds of food consumers are likely to seek in the future, allows identification of at-risk populations, and improves predictions about how the food industry may be structured to meet the evolving trends in global demand.

Food demand research has traditionally occurred at the country or regional level where comparable food expenditure data are readily available (Zheng and Henneberry, 2009; Abdulai and Aubert, 2004). The availability of consistent and comprehensive data sets across countries, however, has enabled cross-country

demand analysis which allows the examination of food demand trends at the global level. Drawing upon a series of cross-country demand analyses conducted using data from 1980, 1996 and 2005 this paper highlights how consumer preferences for food evolve over time. The paper starts with a brief snapshot of the prevailing food consumption patterns across countries at different levels of economic development. This is followed by a description of the data and the models used for demand analysis. Next, a discussion of key results is provided. We conclude by highlighting some implications for global food security and strategic planning.

## 2. Food consumption patterns vary by income group

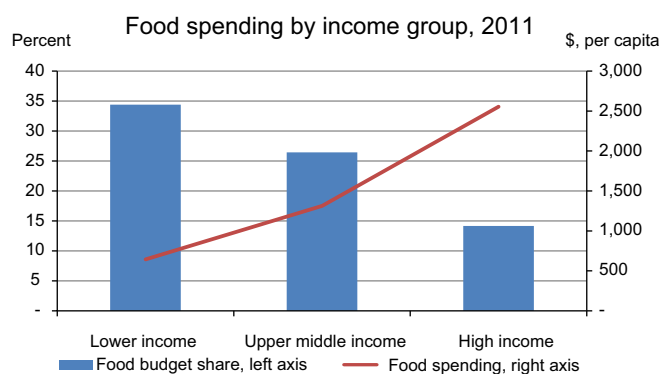
The share of income or private consumption expenditure (PCE) spent on food is often used as an indicator for the relative well-being of a country. The difference between income and PCE is that income includes household savings. Over time, PCE is more stable than income. In many demand analyses, PCE is used as a proxy for household income. Household spending on food tends to increase as income levels increase, but the proportion of total income devoted to food declines (Fig. 1). This phenomenon is known as Engel's Law, after the 19th century German statistician Ernst Engel. The intuition behind Engel's Law might be described as a "food first" budget allocation. Even low-income households must devote at least a minimum amount to meet the basic need for food. As income increases, households may spend some of that additional income on food, but will allocate proportionately more than before on other, nonfood items. For a given gain in income, the increase in food spending is larger at lower income levels than at higher income levels. This explains why, as incomes rise in lower income countries, their food expenditures grow and consumption patterns

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Source: Authors' calculations based on data from Euromonitor International, 2012.

**Fig. 1.** While small in value, consumers in low-income countries spend a larger share of their total budget on food.

appear to seek to catch up to the levels and composition of those of higher income countries (Regmi et al., 2008).

Most high-income countries are approaching a food consumption level close to saturation, with average daily per capita consumption around 3500 kcal (Food and Agriculture Organization, 2013). With consumption at such high levels, additional income does not result in further increases in calories consumed, but may rather result in additional spending going toward diet diversification, improved quality, convenience, or for food which satisfies consumer values such as organic, fair trade, and animal welfare.

Consumption in low-income countries, on the other hand, is about 2400 kcal per capita per day and consists predominantly of cereals, roots and tubers, although protein and fat containing food products such as meats, dairy products and vegetable oils are becoming more important. Low-income consumers spend a large share of their PCE on food, leaving less income for other essential items such as health care, housing, education, and fuel. In contrast, households in high-income countries have relatively small food budget shares, leaving sufficient income for other essentials, as well as recreational and cultural activities. In the US, for example, at-home food spending accounts for less than 10% of PCE, compared with Cameroon, where it accounts for 47% (ERS, 2012). Cameroon's food spending share has not changed much over the last 10 years, but absolute food spending has almost doubled (Euromonitor International, 2012) and per capita food consumption as measured in calories per capita per day has increased 15% between 2000 and 2009 (Food and Agriculture Organization, 2013).

While examination of consumption patterns provides a snapshot for a given point in time, estimation of demand elasticities (consumer responsiveness to income and price changes) enables projections of how demand patterns are likely to change in the future as incomes change. The income elasticity at the household level of a given consumption item measures the percent change in its demand with a 1% change in household income. Over time, as countries and households generally become more affluent, the income elasticity measure becomes a valuable tool which can provide some insight regarding the likely future demand for different consumption items. Similar to the income elasticity of demand, consumer reaction to price fluctuations is measured by price elasticities. The own-price elasticity of a good is the percent change in demand for that good with a 1% change in its price. Likewise, a cross-price elasticity measures the change in demand of a good when there is a 1% change in the price of another good.

### 3. Data needs for cross-country demand analysis

Data requirements for analyzing international consumption patterns for a large number of countries and commodities are demanding

and stringent (Seale and Regmi, 2006). The data need to be transitive, that is, they must allow consistent comparison across countries. Data have to be additive which means that the lower levels of aggregation for expenditure categories (such as meat, dairy and others food groups) must sum to the broad consumption category (such as food). Finally, data have to be measured in a single unit, a particular challenge since expenditures for countries are generally available in local currency units. Using exchange rates to convert expenditures into a single currency is not desirable as they do not take into consideration non-traded goods and services, leading to an understatement of purchasing power and thus an overstatement of poverty of low-income countries.

The International Comparison Program (ICP), which implements expenditure surveys using a special methodology that maintains transitivity and additivity at various levels of aggregation, provides data suitable for cross-country demand analyses. The data available from ICP can be considered as being representative for an average household for a given country. ICP uses the purchasing power parity (PPP) approach to calculate and express expenditures in a single currency, international dollars. PPP is the number of national currency units required to buy equivalent goods as purchased with one unit of base-country currency. For example, if the United States is the base country, the estimated PPP for a country would reflect the number of its national currency units required to purchase the same amount of a given good (say food) as purchased with \$1 (or a given amount) in the United States.

The ICP started as a joint venture between the United Nations and the University of Pennsylvania, with the overall purpose of providing comparable Gross Domestic Product (GDP) data for a large number of consumption items across countries (Diewert, 2010; Kravis et al., 1975). It is currently maintained by the International Comparison Program Development Data Group of the World Bank. Over the years, data collected by the ICP increased from 10 countries in Phase I (1970), 60 countries in Phase IV (1980), 115 countries in 1996, to 146 in 2005 (Table 1). These 146 economies in 2005 account for more than 95% of the world's population and 98% of the world's nominal GDP (World Bank, 2008). As part of its improved survey methodology, the 2005 ICP divided the world into five geographic regions (i.e., Africa (48 countries); Asia Pacific (24 countries); West Asia (10 countries); South America (10 countries); and the Commonwealth of Independent States (CIS) (10 countries)) and the OECD, other European countries, Israel and Russia (46 countries). Israel was included in both the West Asia and the OECD surveys and Russia was included in both the CIS and OECD surveys, giving a total of 146 countries. Of the 146 countries, information was missing for Greece and Comoros leaving data of 144 countries available for demand analysis.

### 4. Methodology used in demand analysis

This paper draws on several studies which use the same model (Florida model, Theil et al., 1989) and three sets of ICP data collected during three different periods (1980, 1996 and 2005). Fitting a cross-country demand system to a large number of goods is made possible via multistage budgeting (Barten, 1977). This strategy categorizes goods into a manageable number of groupings so that econometric estimation is feasible. In the first stage, all consumers in each country are postulated to allocate their total expenditures among broadly defined categories of goods such as food and transportation. In the second stage, consumers allocate each group's expenditure among categories of goods within each group. For example, consumers allocate total food expenditure among categories such as meat, dairy, vegetables and others. The cross country demand analyses conducted with the ICP data have all divided total consumer expenditures into nine consumption

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