Food Policy 45 (2014) 45–56

Contents lists available at ScienceDirect

Food Policy

journal homepage: www.elsevier.com/locate/foodpol

Food price volatility in sub-Saharan Africa: Has it really increased?

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ARTICLE INFO

Article history:
Received 18 January 2013
Received in revised form 27 November 2013
Accepted 30 December 2013

Keywords:
Food prices
Africa
Volatility
Food crisis
Price stabilization
Maize marketing

ABSTRACT

The food price crisis of 2007–2008 and recent resurgence of food prices have focused increasing attention on the causes and consequences of food price volatility in international food markets and the developing world, particularly in sub-Saharan Africa. In this paper, we examine the patterns and trends in food price volatility using an unusually rich database of African staple food prices. We find that international grain prices have become more volatile in recent years (2007–2010) but no evidence that food price volatility has increased in the region. This contrasts with the widespread view that food prices have become more volatile in the region since the global food crisis of 2007–2008. In addition, the results suggest that price volatility is lower for processed and tradable food than for nontradable food, that volatility is lower in the major cities than in secondary cities, and that maize price volatility is actually higher in countries with the most active intervention to stabilize maize prices. These findings suggest that greater attention should be given to the (high) level of food prices in the region rather than volatility per se, that regional and international trade can play a useful role in reducing food price volatility, and that traditional food price stabilization efforts may be counterproductive.

Introduction

Background

As a result of the global food crisis of 2007–2008 and the resurgence of food prices in 2010, there is unprecedented interest in high and volatile food prices. *The 2011 State of Food Insecurity in the World*, jointly published by the Food and Agriculture Organization (FAO), the International Fund for Agricultural Development, and the World Food Programme, concentrates on the impact of volatile food prices on food security in developing countries (FAO et al., 2011a,b). *Agricultural Outlook 2010–2011*, produced by the Organization for Economic Cooperation and Development (OECD) and the FAO, also focuses on the issue of food price volatility (OECD and FAO, 2011). The 2011 *Global Hunger Index*, prepared by the International Food Policy Research Institute (IFPRI) adopts food price volatility as the special theme for 2011 (IFPRI, 2011). In October 2010, the United National Committee on World Food Security commissioned a study of food price volatility, which resulted in a report published in October 2011 (HLPE, 2011). And in June 2011, the ministers of agriculture of the G20 countries prepared an action plan to address food price volatility (G20, 2011).

The reasons for the interest in the topic are clear. Instability in the price of staple foods is an important source of risk in developing countries. This is particularly true for poor households in sub-Saharan Africa. Three factors contribute to the strong link between food price volatility and risk for poor African households. First, the variation in staple food prices tends to be higher in Africa than in other regions (Minot, 2011). Second, poor households allocate a large share, often more than 60%, of their budgets to food, so a given variability in food prices has a large effect on purchasing power (FAO et al., 2011a,b, 14). Third, the share of the population that depends on agriculture for its livelihood is generally larger in Africa than in other regions. Within rural areas, semi-subsistence farmers are partially insulated from the effect of fluctuations in staple food prices, while cash-crop farmers, commercial grain producers, wage laborers, and those with nonfarm enterprises are more vulnerable (Benson et al., 2008).

Although food prices have increased substantially since 2006, the evidence of food price volatility is mixed. Gilbert and Morgan (2010) examine long-term trends in international food prices and find that volatility has been lower since 1990 than during the 1970–1989 period. They also test the difference in volatility between the 2007–2009 period and previous years. Of the 19 commodities tested, only 3 showed a statistically significant increase in price volatility (soybeans, soybean oil, and groundnut oil).

The OECD and FAO (2011) report states that there is no long-term trends toward increased volatility but notes that the "implied

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http://dx.doi.org/10.1016/j.foodpol.2013.12.008
0306-9192/

volatility" associated with futures prices of wheat, maize, and soybeans has been rising steadily since 1990.[1] FAO et al. (2011a,b, 8) note that there is little or no evidence of a long-term increase in the volatility of international food prices but argue that "there is no doubt that the period since 2006 has been one of extraordinary volatility."

However, volatility in international prices affects households and businesses only to the extent that it is transmitted to domestic markets. It is almost universally accepted that food prices in Africa have become more volatile in recent years (see Gerard et al., 2011 and G20, 2011). However, few if any empirical studies have examined the trends and patterns in food price volatility in the region using recent data. FAO et al. (2011, 22) provide a graph showing that the average volatility of the prices of wheat, maize, and rice rose in 2008 before falling again in 2009; however, their report does not test the statistical significance of the change, nor does it report estimates of volatility before 2007.

The issue of changes in food price volatility has important implications for policy. The trends in food prices since 2007 have revived interest in regulating food markets in SSA. As Gerard et al. (2010, 11) note that "after the food crisis in 2008, the need for market regulation and the necessity of fighting price instability have been accepted by a growing percentage of experts and decision-makers."

A number of countries are increasing the size of their food reserves, and the topic of international food reserves is again under discussion (Murphy, 2009; von Braun and Torero, 2009). Gerard et al. (2011) argues that the high and volatile prices of food strengthen the case for government intervention to stabilize food prices in developing countries, in spite of the practical difficulties of doing so.

Objectives

The goal of this paper is to examine the patterns and trends in food price volatility in Africa. In particular, we are interested in testing the widely held belief that food prices have become more volatile since the global food crisis of 2007–2008.

The remainder of paper is organized as follows: Section 2 describes the definition and measurement of food price volatility, the data used in this analysis, and the method for statistically testing differences in volatility. Section 3 provides the results of the analysis. To provide some context, we first examine volatility in international grain prices. Then the patterns and trends in food price volatility in Africa are explored, including changes in volatility in recent years. Finally, Section 4 summarizes the results and discusses their implications.

Data and methods

Defining and measuring food price instability

Food price instability refers to variation over time in the price of food. In this report, we focus primarily on instability in the price of maize, rice, wheat, and other staple foods in Africa. Although cassava and other root crops are important staples in many countries in the region, these cannot be stored long after harvest and, for this reason, are not the focus of government efforts to stabilize food prices. Cassava does play an important role in helping households adapt to grain price instability (Dorosh et al., 2009; Prudencio and Al-Hassan, 1994).

Variation is sometimes measured using the coefficient of variation (CV), defined as $CV = s/\mu$, where s is the standard deviation of the variable of interest over a given time period and μ is the mean value over that period. However, this measure has a disadvantage when used to measure price instability. Prices are often non-stationary, exhibiting a unit-root or random-walk behavior. Under these conditions, the variance and standard deviation approach infinity as the time period approaches infinity. In practical terms, this means that the estimate of variability depends on the length of time covered by the sample.

Another measure of variability, often used in financial market analysis, is the standard deviation of returns, where the return is defined as the proportional change in price from one period to the next. The return is generally measured as the difference in the logarithm of prices from one period to the next. This concept, called unconditional volatility, can be expressed as follows:

$$\text{Unconditional volatility} = \text{stdev}(r)\left[\sum \frac{1}{N-1}(r_t - \bar{r})^2\right]^{0.5} \quad (1)$$

where

$$r_t = \ln(p_t) - \ln(p_{t-1})$$

$$\bar{r} = \sum \frac{1}{N} r_t$$

If prices follow a unit-root process with a multiplicative error term, then r will be stationary and its standard deviation will not depend on the size of the sample. This concept is unconditional in that it does not take into account any prior information and is based only on observed variation in returns.

An alternative approach is to test the conditional variance of returns using a generalized autoregressive conditional heteroskedasticity (GARCH) model (Engle, 1982; Bollerslev, 1986). A GARCH(p,q) model can be expressed as follows:

$$r_t = \mu + \varepsilon_t$$

$$var(\varepsilon_t) = \sigma_t^2 = \gamma + \sum_{i=1}^{q} \alpha_i^2 e_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2$$

The GARCH model has the advantage of allowing the variance of returns (and hence volatility) to change over time as a function of lagged squared residuals (e_{t-i}^2) and lagged variance (σ_{t-j}^2). Conditional volatility is the estimated value of σ_t. This approach has been used by Gilbert and Morgan (2010) and others to study changes in (conditional) volatility in food prices.

Volatility in food prices can be measured at the producer, wholesale, or retail level. In Africa, most data on food prices are at the wholesale or retail level. If margins between producer, wholesale, and retail prices are a constant proportion of the price, then measuring the volatility at any of the three levels will give the same result. However, if margins are fixed, then producer prices will be the most volatile and retail prices the least, with the volatility of wholesale prices falling in between. In practice, however, other factors influence the marketing margins such as the degree of competition at each level in the channel, the availability of information, changes in road quality or congestion, and the volume of trade between markets. Instability can also be measured at different time scales, using daily, monthly, or annual price data.

Data sources

This analysis uses data on international grain prices and on staple food prices in Africa. Data on international grain prices were obtained from the International Monetary Fund (IMF). In particular, we use the prices of maize (No. 2 yellow maize free-on-board (FOB) Gulf of Mexico), rice (5% broken milled white rice FOB Bangkok), and wheat (No. 1 hard red winter wheat, ordinary protein, FOB Gulf of Mexico) from the IMF database (IMF, 2011).

[1] Implied volatility is derived from the futures market price of a commodity, the risk-free interest rate, and a theoretical model of how asset prices should be formed in the face of price volatility. As such, it is different from the actual volatility of the price.