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## Food Policy

journal homepage: [www.elsevier.com/locate/foodpol](http://www.elsevier.com/locate/foodpol)Drivers and triggers of international food price spikes and volatility<sup>☆</sup>Getaw Tadesse<sup>a,\*</sup>, Bernardina Algieri<sup>b,1</sup>, Matthias Kalkuhl<sup>c,2</sup>, Joachim von Braun<sup>c,3</sup><sup>a</sup> Eastern and Southern Africa Regional office, International Food Policy Research Institute (IFPRI), P.O. Box 5689, Addis Ababa, Ethiopia<sup>b</sup> Dipartimento di Economia e Statistica, Università della Calabria, I-87036 Arcavacata di Rende (CS), Italy<sup>c</sup> Department of Economic and Technological Change, Center for Development Research (ZEF), University of Bonn, Walter-Flex-Str. 3, D-53113 Bonn, Germany

## ARTICLE INFO

## Article history:

Available online xxx

## Keywords:

Commodity markets

Food price volatility

Price spikes

Speculation

## ABSTRACT

The objective of this study is to explore empirical evidence on the quantitative importance of supply, demand, and market shocks for price changes in international food commodity markets. To this end, it distinguishes between root, conditional, and internal drivers of price changes using three empirical models: (1) a price spike model where monthly food price returns (spikes) are estimated against oil prices, supply and demand shocks, and excessive speculative activity; (2) a volatility model where annualized monthly variability of food prices is estimated against the same set of variables plus a financial crises index; and (3) a trigger model that estimates extreme values of price spikes and volatility using quantile regressions. The results point to the increasing linkages among food, energy, and financial markets, which explain much of the observed food price spikes and volatility. While financial speculation amplifies short-term price spikes, oil price volatility intensifies medium-term price volatility.

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## Introduction

The global food system recently showed exceptional international commodity price developments. In 2007–2008, the nominal prices of almost all food commodities increased by more than 50%. Three years after the 2007–2008 global food price spikes, food prices surged again in 2010–2011 (Fig. 1). Though the two events were different in terms of affected commodities,<sup>4</sup> a strong correlation among most food prices was registered. More important, prices of all food commodities soared above the long-term average, with an adverse impact on poor people in poor countries (Conforti, 2004; Dawe, 2008; Dorosh et al., 2009; Hernandez et al., 2011). Indeed, the sudden increase in international food prices and its transmission to domestic prices led to rising inflation rates, which mainly hurt the

poor, who spend large shares of their income on staple foods. Volatility causes economic uncertainty and may result in lower investment, especially in small businesses lacking access to credit. Although on global markets food grains are viewed mainly as commodities, they constitute the basic food of the poor and the “currency” of the poorest 2 billion people.

Faced with rising food insecurity, social unrest, and accelerated inflation driven by food prices, developing and advanced countries as well as international governmental and nongovernmental organizations began to respond with a new sense of urgency. For instance, the G20 agenda of 2011 addressed food security. Nonetheless, although the price crises of 2007–2008 and 2010–2011 have led to some policy changes, the sense of urgency about preventing human suffering has not yet translated into comprehensive actions related to world food supply and demand.

Unstable food prices at national and regional levels are not a new phenomenon. Some consider the 2007–2008 price spike part of normal price instability caused by temporary shocks (Díaz-Bonilla and Ron, 2010). In fact, average price volatility did not differ significantly between the 1970s and the late 2000s, but the nature of the volatility and its causes are different. Traditional market fundamentals—that is, demand and supply factors—were found inadequate to explain the extreme price spikes in 2007–2008 and 2010–2011.

In the past few years, many studies have been carried out to investigate the causes of and solutions to soaring food prices (Abbott et al., 2009, 2011; Gilbert, 2010; Roache, 2010). They have identified a set of drivers of food price upsurges including biofuel

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<sup>4</sup> The sugar price index was lower than its historical average during the first food price crisis (2007–08) but reached a historic high in 2010–11. Rice prices were the highest during the first high price episode but were lower than most other cereals during the second crisis.

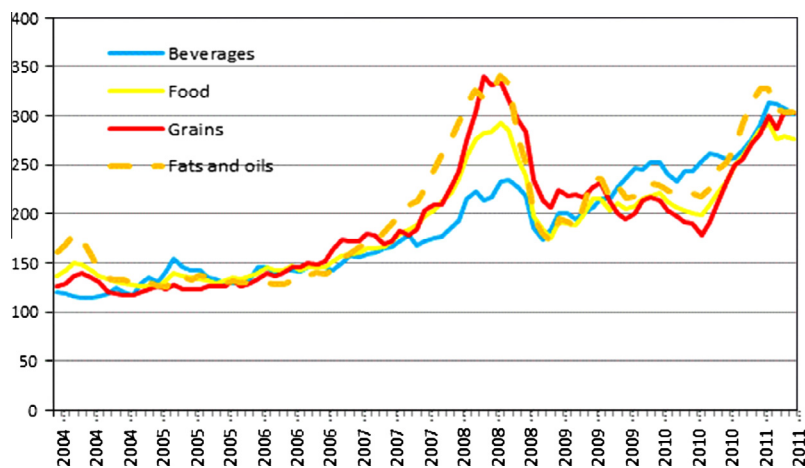


Fig. 1. FAO food price indices from January 2004 to November 2011. Source: FAO (2011).

demand, speculation in commodity futures markets, countries' aggressive stockpiling policies, trade restrictions, macroeconomic shocks to money supply, exchange rates, and economic growth. The relative importance and actual impact of these causes have been widely discussed. While there is a certain consensus regarding the effects of weather, biofuel production, and export restrictions on food commodity markets, the dispute surrounding speculation is far from settled. Most of the empirical studies focus primarily on Granger causality tests to explain the role of speculation in price returns or volatility (Irwin et al., 2009; Robles et al., 2009; Gilbert, 2010). Another strand of research seeks to identify bubble behavior—that is, explosive increases in prices—in commodity markets during 2007–2008 (Gilbert, 2009; Phillips and Yu, 2011; Shi and Arora, 2012). Granger causality tests, however, are criticized for presuming a time-lag structure that might be too long to allow for observing any reaction of liquid financial markets (Gilbert and Pfuderer, 2012; Grosche, 2012). Analysis of bubbles can identify abnormal price behavior but does not explain the causes of the observed price increases.

This study goes a step further by examining the impact of speculation and agricultural fundamentals on price spikes and volatility, where price spikes are the short-term ups and downs of prices following short-term shocks and volatility is the variability of price around its trend. The distinction between price spikes and volatility is more important from a welfare perspective than trends in overall price levels because price spikes and volatility are the primary indicators of food crises.<sup>5</sup> Furthermore, this distinction is also essential to differentiate among factors that generate risks for poor consumers to cope, and uncertainties for agricultural investors to plan. We argue that a food crisis is more closely related to extreme price spikes, while long-term volatility is more strongly connected to general price risks.

In particular, this study provides empirical evidence on the quantitative importance of widely discussed determinants of commodity prices. In our empirical analysis, we consider agricultural supply shocks, stock-to-use ratios, demand shocks (energy prices and gross domestic product [GDP]), and futures market shocks (speculative activity in commodity futures trading and financial crises). The empirical analysis is carried out using three models: (1) a price spike model where monthly food price returns (spikes) are estimated against oil prices, supply shocks, stock-to-use ratios,

demand shocks, and volume of speculative futures trading; (2) a volatility model where annualized monthly variability of food prices is estimated against yearly observable variables such as supply shocks, stock-to-use ratios, economic growth, volume of speculative futures trading, oil price volatility, and a financial crises index; and (3) a trigger model that estimates extreme values of price spikes and volatility using quantile regressions. The adopted methodology will allow us to shed light on the formation of price spikes and price risks rather than simply so-called “high food prices.” The food commodity prices under investigation are for wheat, maize, and soybeans.<sup>6</sup> The rest of the paper is organized as follows: Section ‘Conceptual framework’ presents the conceptual framework of the approach. Sections ‘Estimation methods’ and ‘Data’ describe the setup of the adopted models and the variables included in the empirical analysis. Section ‘Results and discussion’ discusses the econometric results. Section ‘Conclusion’ concludes.

### Conceptual framework

The recent literature identifies the determinants of food price hikes as biofuel demand, speculation in commodity futures markets, and macroeconomic shocks. These determinants represent the demand and supply side of the world food equation. In an attempt to distinguish how different factors affect price changes, three groups of potential causes have been singled out: exogenous shocks, also called “root” causes; “conditional” causes; and “internal” drivers (Fig. 2). Root causes, such as extreme weather events, oil price shocks, production shocks, and demand shocks, are independent core factors affecting food price fluctuations. They are exogenous because the possibility of a causal relationship going from the agricultural sector to root causes is minimal. The exogenous shocks are expected to generate food price spikes and volatility, and the magnitude of their impacts depends partly on the political and economic environment of a given country. In other words, a second group of factors related to specific political and economic conditions – labeled here as conditional drivers—can dampen or exacerbate the exogenous shocks. Some of these factors (such as a high concentration of production or low transparency in commodity markets) are rather time-invariant and difficult to measure; they are therefore not considered in the empirical analysis of this article. The third group of causes consists of factors that are triggered by the same price dynamics, and these internal causes are endogenous shock-amplifiers and include discretionary

<sup>5</sup> Although there is no universally agreed-on definition of “food crisis,” here it is understood as an abrupt and unanticipated change that affects people severely and negatively.

<sup>6</sup> We do not include rice because of its different international market patterns.

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