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Persistencia de volatilidad y efecto de inventario en los mercados de futuros de granos: evidencia de un modelo recursivo

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Abstract

The purpose of this paper is to investigate the volatility persistence and the inventory effect in grain futures markets during the period of 1959–2014. The innovative nature of this study lies in the evaluation of rolling estimates, using a recursive univariate TARCH(1,1)-in-mean volatility model. The daily evolution of volatility persistence and the inventory effect on corn and soybean futures contracts is analyzed using a rolling window of 1008 observations over four years. In general, the results suggest that the conditional volatility in both markets is highly persistent. There is also evidence of inventory, time-to-maturity, and seasonality effects on the volatility dynamics of corn and soybeans. In addition, the findings point to a lower short-run volatility persistence in recent years, which caused a slight decrease in long-run volatility persistence and the half-life period in both markets.
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Keywords: Price volatility; Volatility persistence; Inventory effect; Grain futures markets

Resumo

Neste artigo, os autores procuraram investigar a persistência da volatilidade e *inventory effect* nos mercados futuros de grãos no período entre 1959 e 2014. A inovação do estudo consistiu na aplicação de um modelo de volatilidade recursivo TARCH(1,1) com rolagem das estimativas a partir de uma janela de tempo de quatro anos. Os resultados apontaram para uma alta persistência da volatilidade condicional nos mercados de milho e soja. Além disso, observou-se a presença dos efeitos sazonalidade, *inventory* e *time-to-maturity* na dinâmica de volatilidade dos preços de

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ambos mercados. Verificou-se ainda uma queda na persistência de curto-prazo no período recente, o que levou a uma diminuição da persistência de longo-prazo e da meia-vida nos mercados em estudo.

Resumen

El objetivo en este estudio es investigar la persistencia de la volatilidad y el efecto de inventario en los mercados de futuros de granos en el período de 1959 a 2014. La innovación del trabajo consiste en la aplicación de un modelo de volatilidad recursivo TARCH(1,1) por estimación, en un período de cuatro años. Los resultados indican una alta persistencia de la volatilidad condicional en el mercado de maíz y soja. Además, hay evidencia de efectos de inventario, tiempo hasta la expiración y estacionalidad en la dinámica de la volatilidad de los precios de ambos mercados. También se ha verificado una baja persistencia de la volatilidad a corto plazo en los últimos años, lo que ha causado una caída de la persistencia de la volatilidad a largo plazo.

Palavras-chave: Volatilidade; Persistência da volatilidade; Inventory effect; Mercado futuro de grãos

Palabras clave: Volatilidad; Persistencia de la volatilidad; Efecto de inventario; Mercado futuro de granos

Introduction

The analysis of price volatility in agricultural markets plays an important role in the decision-making process. Price variation influences decision-making in the case of production, marketing, and risk management in agriculture. High price fluctuations affect producer's profitability, even when production is very efficient. These events also affect policy makers, especially in developing countries, since price and volatility levels impact food security, balance of trade, inflation rate, tax revenue, employment, GDP, and business cycles. Additionally, in financial markets, price oscillations are relevant in portfolio allocation and derivatives pricing (Ghoshray, 2013; Naylor & Falcon, 2010).

During the 2000s, many agricultural commodities experienced a sharp and rapid rise in price. While over the second half of the 1970s and 1990s, in particular in the 1980s, the inflation-adjusted World Bank agriculture index decreased 58%, a sharp price spike of around 40% occurred during 2005–2008. Agricultural commodities, such as corn, wheat, and soybeans exhibited a price increase of more than 60% over this period.

Previous studies have investigated the factors underlying this scenario. Several explanations were given, such as an increasing demand for biofuel from grains and oilseeds, rising oil prices, a growth in demand for commodities (especially in the BRICS countries – Brazil, Russia, India, China, and South Africa), a reduction in subsidies for European farmers, adverse weather conditions, low inventory levels, depreciation of the U.S. dollar, and an increase in speculative transactions in commodities futures markets (Gilbert, 2010; Headey & Fan, 2008; Sumner, 2009).

Recent studies have explored the price fluctuations of agricultural commodities in order to verify the existence of volatility breaks in the first decade of the 2000s (Calvo-Gonzalez, Shankar, & Trezzi, 2010; Gilbert & Morgan, 2010; Huchet-Bourdon, 2011; Sumner, 2009; Vivian & Wohar, 2012). In general, no clear

evidence was found to support the idea that the recent price variability was unparalleled. However, two important issues have received relatively little attention, namely the persistence of price volatility and the leverage effect (also known as the "inventory effect", in the case of commodities). Even if agricultural markets are not experiencing unprecedented levels of volatility, it is still crucial to understand how long it takes volatility to revert to its previous level after a shock. In addition, it is important to verify the asymmetry in the volatility process. In agricultural markets, in contrast to equity markets, positive price shocks ("bad news") tend to have a larger impact on conditional variance than negative price shocks ("good news"). This phenomenon is known as the inventory effect (Carpantier, 2010) and can be explained by the storage model.[1] Volatility persistence and inventory effects affect agricultural producers', buyers', and traders' exposure to risk, thus influencing risk management operations (Carpantier & Samkharadze, 2013). More broadly, these issues are relevant for countries that rely heavily on exports and imports of agricultural commodities, as well as to evaluate inflationary processes and formulate price stabilization programs (Ghoshray, 2013; Vivian & Wohar, 2012).

This paper explores the volatility persistence and inventory effect on grain futures markets over the last decades. The research uses daily futures prices of two commodities (corn and soybeans). A recursive univariate TARCH(1,1)-in-mean volatility model is applied to compute the daily evolution of the volatility persistence and the inventory effect in terms of rolling estimates. Thus, the study investigates whether there have been changes in these two measures over time and their implications for agricultural markets. The study also analyzes

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[1] A decrease in the commodity inventory levels, originating from a scenario of supply shortages and/or demand expansion related to this commodity, tend to cause an increase in its price. The inventory effect considers that the reaction to commodity returns is higher for positive price shocks than to negative shocks (Hasan, Akhter, & Rabbi, 2013; Stigler and Prakash, 2011).