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Adaptive market efficiency of agricultural commodity futures contracts

Eficiencia del mercado adaptativo en los contratos futuros de productos agrícolas

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Abstract

In this paper we investigate the adaptive market efficiency of the agricultural commodity futures market, using a sample of eight futures contracts. Using a battery of nonlinear tests, we uncover the nonlinear serial dependence in the returns series. We run the Hinich portmanteau bicorrelation test to uncover the moments in which the nonlinear serial dependence, and therefore adaptive market efficiency, occurs for our sample.

Keywords: Efficient markets; Nonlinearity; Adaptive market hypothesis; Agricultural commodities; Futures market

Resumen

En este documento se investiga la eficiencia del mercado adaptativo del mercado de futuros de productos básicos agrícolas, utilizando una muestra de ocho contratos de futuros. Se utiliza una batería de pruebas no lineales para descubrir la dependencia no lineal en la serie de retornos. Aplica-

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mos el estadístico Hinich portmanteau bicorrelación para descubrir los momentos de dependencia no lineal en las series, y por lo tanto se encuentra que cuatro productos del mercado tienen adaptable eficiencia.

Palabras clave: Mercados eficientes; No linealidad; Hipótesis de mercados adaptativos; Productos agrícolas; Mercado de futuros

Introduction

The weak-form efficient market hypothesis (EMH) is a financial theory that has attracted lots of attention from researchers for over four decades. A market is efficient when prices always fully reflect available information (Fama, 1970). However, despite such a large body of research on EMH, there is no consensus on whether markets are efficient or not. Thus, according to Campbell, Lo, and MacKinlay (1997), the notion of relative efficiency may be a more useful concept than the all-or-nothing view taken by the conventional efficiency studies. They suggest relative efficiency because measuring efficiency provides more insights than testing it, *i.e.*, it may be more useful to know the differences in the degree of inefficiency across markets than knowing that a market is inefficient *per se*.

Traditionally, the weak-form EMH has been tested in empirical studies through the unpredictability of returns from past returns criterion (or conventional efficiency studies). Some of these tools are: the serial autocorrelation test using the Ljung and Box (1978) portmanteau Q statistic, the runs test (Shiller & Perron, 1985) and the variance ratio test (Al-Khazali, Ding, & Pyun, 2007; Chow & Denning, 1993; Lo & MacKinlay, 1988), amongst others. However, these short-horizon return predictability studies have been criticized for their focus on linear correlations of price changes. According to Hong and Lee (2005), an alternative approach would be to remove all linear serial autocorrelation from the sample and determine whether returns still contain predictable nonlinearities. Furthermore, since a white noise process does not necessarily imply efficiency as returns series can be linearly uncorrelated and at the same time nonlinearly dependent (Granger, 2001; Granger & Andersen, 1978), there is a need for the utilization of nonlinear techniques to uncover hidden nonlinear serial dependency structures in time series, *cf.* (Hinich & Patterson, 1985; Hsieh, 1991; Panagiotidis & Pelloni, 2007; Patterson & Ashley, 2000). Amongst the vast number of nonlinear tests, there is the McLeod and Li (1983) Test, Tsay (1986) Test, ARCH-LM Test (Engle, 1982) and the BDS Test (Broock, Scheinkman, Dechert, & LeBaron, 1996). All these tests can be used to detect the presence of nonlinear dependence in a time series and therefore market inefficiency.

An alternative to the EMH from a behavioral perspective, the adaptive market hypothesis (AMH), proposed by Lo (2004), states that markets are adaptable and switch between efficiency and inefficiency at different epochs. In this theory (Lo, 2005), the degree of