Economic Modelling 36 (2014) 541–546

Contents lists available at ScienceDirect

Economic Modelling

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

Volatility transmission in agricultural futures markets☆

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ARTICLE INFO

JEL classification:
C32
G13
G14
Q14

Keywords:
Agriculture
Commodities
Futures markets
GARCH-in-mean VAR
Volatility

ABSTRACT

After the huge rise and fall of agricultural commodity spot and futures prices between 2007 and 2008, the potential reasons for and the impact of the strong rise in volatility provoked an intensive debate in the media as well as in the academic literature. However, owing to the increasing interdependence of global markets, an isolated examination of single futures markets does not seem to be appropriate. Therefore, the aim of this study is to investigate the volatility spillover between various agricultural futures markets from a new perspective. To do this, we use data for the prices of first nearby futures contracts for corn, cotton, and wheat and estimate GARCH-in-mean VAR models in the tradition of Elder (2003). Our results provide evidence in favor of an existing short-run volatility transmission process in agricultural futures markets.

1. Introduction and literature overview

Since agricultural commodity prices began to exhibit large swings between 2007 and 2008, the evolution of these has attracted considerable attention in the media and in academia. The FAO (Food and Agriculture Organization of the United Nations), which held a ministerial meeting on food price volatility on October 16, 2012 in Rome concerning this development, expects the increase in volatility to continue in the medium-term. This pattern does not appear solely in cash markets, but also in futures markets for agricultural products (Beckmann and Czudaj, forthcoming). To mention just one example, the price of the first nearby futures contract of soft red wheat traded at the Chicago Board of Trade (CBOT) increased by almost 200% from April 2007 to March 2008 and had decreased by 63% by December 2008 (see Fig. 1). Other agricultural commodity prices experienced a similar pattern. Thus, the role of futures markets is also discussed controversially when it comes to whether the potential engagement of speculative capital introduces volatility and price movements unrelated to demand and supply effects such as changes in the world population, economic growth or agricultural production (Piesse and Thirtle, 2009; Wright, 2011). Generally speaking, futures markets can offer the possibility of gaining arbitrage revenues and thus exhibit speculation, while they may also form the mechanism by which new information is incorporated into prices if markets are efficient. These markets allow for the transfer of risk from commercial traders, who are exposed to futures price movements, to non-commercial traders, who are frequently labeled speculators and take short (long) futures positions in the hope of yielding a capital gain from the fall (rise) in prices.

Against this background, this paper analyzes the futures markets of agricultural commodities from a new perspective. While previous studies have mostly examined either futures or spot markets separately or the link between them, we focus on spillover effects between various futures markets. The question of spillover effects is important for several reasons: firstly, general causality patterns can be identified. Secondly, co-movements of futures markets are a crucial issue for both investors and policymakers: on the one hand, the possibility of cross-market hedging can be affected. On the other hand, co-movements or cross-sectional volatility might be a result of a systematic influence stemming from a particular group of participants. However, it is worth mentioning that a direct evaluation of speculative pressure is beyond the scope of this study. As outlined further below, it is hard to judge whether speculation has the predominate role in increasing volatility. Nevertheless, it is important to shed some light on the general discussion regarding this issue in the following in order to put our findings in a general context.

An implication of standard theory is that futures prices should follow a random walk with price innovations introducing new information and

☆ Thanks for valuable comments are due to two anonymous reviewers and the participants of the 11th EEFS Annual Conference, Koç University, Istanbul, Turkey. We are also grateful for the efficient handling of our submission by the Guest Editor John Hunter.

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0264-9993/$ – see front matter
http://dx.doi.org/10.1016/j.econmod.2013.09.036

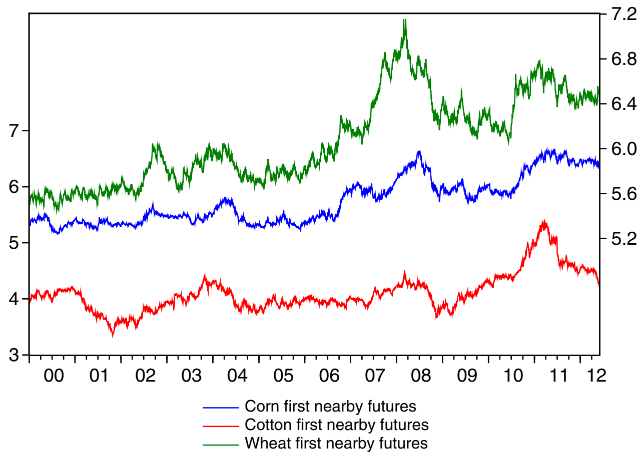

Fig. 1. Logarithms of different agricultural futures price series.

mostly uninformed traders or speculators trying to follow informed market participants. In this vein, a suggestive distinction between informed and uninformed traders is that informed traders will trigger a return to a fundamental value through trading if uninformed traders have previously moved a market away from its fundamental value (Gilbert, 2010a). With regard to agricultural markets, a related argument is that a limited number of traders, who previously supported investment and stabilized futures prices, were generally engaged before the group of futures investors or futures speculators, who regard agricultural futures as an asset, entered the market (Gilbert, 2010a). A popular line of reasoning is that these actors have no intention of selling in the real market, with their purchasing potential introducing volatility as well as upward or downward pressure or speculative bubbles on prices (Pace et al., 2008). In this context, Masters (2008), Masters and White (2008), and Gensler (2009) argue that extensive buy-side pressure from index funds has recently created a speculative bubble in commodity prices, with the consequence that prices heavily exceeded their fundamental values at the highest level.[2]

However, despite this popular line of reasoning, there is little clear-cut evidence that speculative trading affects the prices and volatility of commodities (Brunetti et al., 2011). The U.S. Commodity Futures Trading Commission (CFTC) argues that the percentage level of speculation in agricultural commodity markets has remained relatively constant as prices have risen (CFTC, 2008). Testing the hypothesis of an impact from speculation provided by Masters (2008) and Masters and White (2008), Irwin et al. (2009), Irwin and Sanders (2011, 2012), Sanders and Irwin (2010, 2011a, 2011b), and Bohl et al. (2013) also conclude that index investors have no impact on agricultural futures prices. On the other hand, futures price volatility should be positively influenced by the volume traded, according to various theoretical models which rely on traders with asymmetric information (Copeland, 1976; Epps and Epps, 1976) or divergent beliefs (Harris and Raviv, 1993; Shalen, 1993). Empirically, this pattern has been confirmed by previous studies which have found that increased trading volume is accompanied by increased futures price volatility, measured by absolute or squared returns (Chen and Lin, 2004; Ciner, 2002; Clark, 1973; Cornell, 1981; Kocagil and Shachmurove, 1998; Moosa and Silvapulle, 2000; Wang and Yau, 2000). However, since futures trading in commodity markets is conducted by both hedgers and speculators, we cannot simply conclude which type of trader affects futures price volatility (Bohl et al., 2013).

As mentioned above, we are interested in the role of volatility in agricultural futures, and one strand of the literature argues that a causal link exists between volatility and speculation. However, no enhancing influence of speculators is found by Brorsen and Irwin (1987) for six agricultural commodities and copper (1978–1984) or by Irwin and Yoshimaru (1999) for 23 agricultural, energy, and metal commodities (1988–1989). Both studies cover periods prior to the intensive financialization process of raw material markets. Focusing on the latter, the same result is obtained by Bryant et al. (2006) for three agricultural commodities, crude oil, and gold (1995–2003); Haigh et al. (2007) for crude oil and natural gas (2003–2004); and Brunetti et al. (2011) for corn, crude oil, and natural gas (2005–2009). By contrast, analyzing prices for corn, gold, and soybeans (1983–1990), Chang et al. (1997) detect that the positive effect of speculators' trading volume on volatility is much stronger than that of other traders. Finally, drawing on nine agricultural, energy, and metal commodities (1994), Irwin and Holt (2004) also conclude that speculative trading increases futures price volatility, but explain this relationship by valuable private information instead of noise trading. Cooke and Robles (2009) focus on international prices of corn, wheat, rice, and soybeans (2002–2009) and show that the observed change in food prices may be explained by financial activity in futures markets and different proxies for speculation.[3]

Detached from any reasoning about speculation, one sensible argument is that the complexity of agricultural futures markets has increased significantly for producers in recent times. In this vein, it is not surprising that an increasing number of empirical studies have put those markets under closer scrutiny. From a general perspective, analyzing the relationship between spot and futures prices for commodities to evaluate the price discovery role of futures markets, which may help reduce uncertainty, is a well-established research subject (Hernandez and Torero, 2010). It is often stated that, under the joint assumption of risk neutrality and rationality, the current futures price should be an unbiased estimator of the expected future spot price if changes in futures prices are uncorrelated with changes in other asset prices (Beckmann and Czudaj, 2013, forthcoming).

More related to our research topic, volatility spillover effects are about to become a popular line of research. In an early study, Buguk et al. (2003) examine the price volatility spillover in U.S. catfish markets based on monthly data running from 1980 to 2000. They conduct a univariate exponential generalized autoregressive conditional heteroscedasticity (EGARCH) model and conclude that a strong volatility spillover from feeding material to catfish prices can be observed. More recently, Von Ledebur et al. (2009) analyze by means of a multivariate GARCH whether and to what extent the volatility of agricultural commodity prices at different market places were transferred during the dramatic price changes of 2008. They use a daily sample period from March 27, 2007 to March 5, 2008 and argue in favor of an operating volatility transmission.

In this vein, the aim of the present study is to analyze the volatility spillover between different agricultural futures markets from a new perspective. In so doing, we use data for prices of first nearby futures contracts for corn, cotton, and wheat and estimate a GARCH-in-mean VAR model in the tradition of Elder (2003). Although we are not able to measure the influence of speculation directly, this may provide some insight into the issue if we follow the literature, which assumes a causality

[2] More specifically, Gutierrez (2013) has actually tested the hypothesis of a speculative bubble in agricultural commodity markets and has identified explosive processes and collapsing bubbles for the prices of wheat, corn, and rough rice, while the evidence appears to be weak in the case of prices for soybeans. From a policy point of view, Von Braun and Torero (2008, 2009) have suggested the specification of a price band which would be a signal (threat) to speculators on food markets in the sense that a market assessment based on virtual reserve is likely to occur when futures prices exceed the upper limit of this band.

[3] However, Irwin et al. (2009) state that the hypothesis of a speculative bubble in commodity markets does not withstand close scrutiny, and provide four main reasons for this: firstly, they point out that arguments in favor of a speculative bubble are often conceptually flawed and reflect fundamental and basic misunderstandings of the functioning of commodity futures markets. Secondly, they see a number of facts related to the situation in commodity markets that appear to be inconsistent with the existence of a speculative bubble in commodity prices. Thirdly, in their view, statistical evidence suggests that neither position for any group in commodity futures markets, including long-only index funds, actually triggers futures price changes. Finally, they emphasize that there is a historical pattern of attacks upon speculation during periods of high volatility.