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Causality between market liquidity and depth for energy and grains ☆

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ABSTRACT

This paper examines the roles of futures prices of crude oil, gasoline, ethanol, corn, soybeans and sugar in the energy–grain nexus. It also investigates the own- and cross-market impacts for the lagged grain trading volume and the open interest in the energy and grain markets. According to the results, the conventional view, for which the impacts are from oil to gasoline to ethanol to grains in the energy–grain nexus, does not hold well in the long run because the oil price is influenced by gasoline, soybeans and oil. Moreover, gasoline is preceded by only the oil price, and ethanol is not foreshadowed by any of the prices. However, in the short run, a two-way feedback in both directions exists in all markets. The grain trading volume effect across oil and gasoline is more pronounced in the short-run than in the long-run, satisfying both the overconfidence/disposition and the new information hypotheses across markets. The results for the ethanol open interest show that money flows out of this market in both the short- and long-run, but no results suggest across market inflows or outflows to the other grain markets.

1. Introduction

Food prices, particularly grain prices, have risen significantly in the last few years and led to political protests in developing countries. The prevailing view considers carnivores in countries like China and India, droughts in Russia and Eastern Europe, or heavy rain in North America, as the culprits behind the rising trend in grain prices. The countervailing view considers the real culprits to be increases in consumption of ethanol and other bio-fuels which, through the derived demand, have led to increases in prices of these goods in the supply chain, in reaction to higher oil prices. Some analysts view the use of commodities by financial investors (the so-called "financialization of commodities") as partly responsible for the recent price spike (Baffes and Haniotis, 2010). Such a view gives an important role to hedgers and speculators.

The direction of the underlying price causality in the countervailing view emanates first from high crude oil, which is then filtered through gasoline to increases in the price of ethanol. As ethanol in the USA is derived from corn, higher ethanol prices cause spikes in corn prices which, in turn, through plant acreage sharing, influences the prices of soybeans and sugar (Lin and Riley, 1998). This is the conventional energy route to grains. However, is it possible that spikes in grain prices, particularly corn, could lead to surges in ethanol prices, gasoline and crude oil? These are all commodities and are influenced by macro-economic variables. Additionally, there is complementarity and/or substitutability between corn and soybeans and between corn and sugar, all of which share the planted acreage (Tokgoz et al., 2008). Moreover, corn-based ethanol is a substitute for gasoline and can serve as the link in the causation between petroleum and grains. In fact, some agricultural economists consider ethanol as the catalyst that closely links energy and agricultural products since the ethanol boom that started in 2006 (Tyner, 2008).

These possible causal relationships, regardless of where they might start and end, are affected by the financialization of commodities. Financial investors can affect not only the direction of causality but also

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the number and intensity of such interrelationships. Market tradability and depth (Kyle, 1985), as reflected in the sizes of trading volumes and open interest decided by hedgers, speculators and arbitrageurs, can play a role in such interrelationships (Dahlgran 2009; Franken and Parcell, 2003). Trading volume is important in improving forecasts of changes in futures prices. The price-trading volume, or open interest relation, is important for several reasons, as it: provides insights as to the structure of markets (such as the dominance of speculators and the presence of hedging and arbitrage activity; is used in event studies; shows the importance of private and public information in determining investor demand (Admati and Pfleiderer, 1988); and is crucial to the debate regarding the distribution of speculative prices.

Some markets, such as that for ethanol, are known to be thin, and hence are avoided by hedgers and speculators. For this reason, it will be interesting to explore and compare the trading volume and open interest of these markets on own- and cross-returns.

The objectives of this paper are four-fold, namely to: (1) discern the forcing variables that affect the long-run relationships among the futures prices of crude oil, gasoline, ethanol, corn, soybeans and sugar; (2) determine if ethanol plays a linkage role between petroleum and grain products; (3) analyze the long- and short-run relationships between these products; and (4) examine the roles that the grain trading volume and open interest play in the petroleum–grain interrelationships.

The paper is organized as follows. Section 2 provides a review of the literature, Section 3 presents the data and descriptive statistics of the 12 series used in the empirical analysis, Section 4 presents the models and empirical results, and Section 5 gives some concluding comments.

2. Review of the literature

The early literature has investigated the cointegrating relationships between spot and futures prices for most of commodities considered in this paper. Garbade and Silber (1983) examined the price movements and price discovery function in the spot and futures markets for seven storable commodities, including corn, wheat, oats, orange juice, copper, gold and silver. Their findings indicated that, in general, futures dominate spot price changes for most of these commodities. Their evidence suggested that, for 70% of new information, the futures market dominates the spot markets for corn, wheat and orange juice. The authors obtained a similar result for gold, but the pricing power for silver, oats and copper was more divided between the spot and futures market. These authors did not account for any roles that the trading volumes (liquidity) and the open interest (depth) might play in affecting pricing efficiency and hedging capability. Instead, they used risk transfer through futures contracts to draw implications on hedging and price discovery as a mechanism for pricing.

Yang et al. (2001) examined the price discovery function for storable (namely, corn, oats, soybeans, wheat, cotton and pork bellies) and non-storable (namely, hogs, live cattle, feeder cattle) commodities. They analyzed any differentiating impact that storable commodities might have played in the price discovery function of futures prices compared to non-storable commodities. They found that although, in general, storability does not affect the futures price discovery function, futures contracts can be used as a price discovery tool in all of these markets. They also found that large differences in the trading volumes of these commodities had little effect on the predictive power of futures prices. This result is different from the finding in this paper. Yang et al. (2001) did not account for any role for the open interest (depth) or a catalyst.

Within a framework for a large developing country with a strong government intervention and with an interest in price discovery, Wang and Ke (2002) assessed the long- and short-run efficiency of six Chinese commodities, including wheat and soybean futures and spot prices, with different maturities for the futures contracts. Their findings implied that there existed a long-run relationship between futures and spot prices for soybean in China, while the short-run lead/lag relationship was weak. However, wheat futures contracts were found to be inefficient, possibly due to government interventions and over speculation in the wheat market. Wang and Ke (2002) did not consider the impact of liquidity and depth of markets on pricing and hedging as they concentrated on pricing efficiency in these unconventional markets.

In another developing market, Zapato et al. (2003, 2005) examined cointegration between the New York futures price and the Dominican Republic spot price for sugar. Their empirical evidence suggested that the World Futures Sugar (WFS) price has predictive power for the spot price of a small sugar-producing country. It was found that, in general, futures prices appeared to play a dominant role in the price discovery mechanism. However, there appeared to be neither long-run relationships nor short-run leads in these tightly traded markets. Zapato et al. (2003, 2005) did not consider the objectives addressed in this paper.

Regarding the major ethanol-producing country that has thinly traded markets, Mattos and Garica (2004) investigated the relationships between spot and futures prices in six Brazilian agricultural markets (namely, Arabic coffee, corn, cotton, live cattle, soybeans and sugar), but this set of commodities does not include ethanol. All of these markets are considered to be thinly traded in terms of trading volume, compared with those in the United States. Mattos and Garica (2004) has two surprising results relative to those of the US markets: (1) the thinly traded sugar futures contracts showed evidence of some degree of long-run relationships (cointegration), with the futures price playing the dominant role; and (2) the highly traded corn contracts showed almost no interrelations between the futures and cash prices. However, both the Brazilian sugar and corn markets have peculiarities that may account for these surprising results. The paper may have some relevance to our analysis as ethanol has a thinly traded market which may hinder its depth and trading capability.

Recent research shares greater overlap with this paper. Tyner (2010) explored the integration of energy and agricultural markets, and addressed the evolving relationships among the prices of crude oil, gasoline, ethanol and corn. It was found that there is little correlation between these prices before 2005. However, a strong link emerged between oil, gasoline and corn in the ethanol boom period of 2006–2008, but with no relationship between the prices of ethanol and corn. However, the relationship between the prices of ethanol and corn strengthened in late-2008 and 2009 as ethanol production came under severe pressure, leading to a causal relationship originating from corn to ethanol prices. Although the paper considered ethanol, it did not account directly for the liquidity and depth of these markets and any of the hypotheses related to them.

Balcombe and Rapsomanikis (2008) developed a range of generalized bivariate error-correction models to explore the nonlinear long-run price relationships in the sugar–ethanol–oil nexus. The models were estimated using the Bayesian Monte Carlo Markov Chain method. The estimates suggested that the long-run drivers of the Brazilian sugar prices were oil prices. The price adjustments were non-linear and causal from oil prices to sugar and ethanol prices, but were linear between ethanol and sugar prices. That paper is different from the current paper in that we directly address the enforcing drivers in a multivariate model and explicitly account for the impacts of commodity properties on the price efficiency function.

Grains are known to have the property of adding diversification benefits to portfolios by reducing risk instead of contributing to speculators' profitability. Therefore they are favored by risk-averse investors. Gohin and Treguer (2010) developed a partial equilibrium model, focusing on ethanol production with downside risk-averse corn farmers. The objective was to assess the impact of ethanol production on agricultural volatility, particularly corn. The empirical results showed substantial ethanol impact on the distribution of corn prices. Risk-adverse corn farmers can still benefit due to the higher mean price effect, despite increases in the corn price variance.