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Crude oil–corn–ethanol – nexus: A contextual approach

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HIGHLIGHTS

- Strong relationship between crude oil–corn and crude oil–ethanol.
- Corn–ethanol connected through a by-pass of crude oil markets.
- Ethanol market has no direct impact on the price levels of corn.
- Corn markets became more prone to volatility due to ethanol production.

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ABSTRACT

This paper offers a holistic study on the complex relationships between crude oil, corn and ethanol during a turbulent period between 2006 and end of 2011. Through a holistic mapping of the current market situation and a contextual analytical design we show that there exists a strong relationship between crude oil and corn markets on one side, and crude oil and ethanol on the other. However, the price relationship between corn and ethanol was revealed to be less straightforward, and is driven by the US government fuel policy. Furthermore the study indicates that corn markets have became more prone to volatility due to ethanol production, especially when the demand for corn is high and/or the crude oil prices are high enough to create a competitive market for ethanol.

1. Introduction

The production of ethanol has seen a brisk increase from early 2000. Since 2006 the United States is the largest producer of ethanol with over 50% of the global production. The incentives for ethanol production were mainly driven by government support policy, such as budgetary support measures, blending or mandatory use, and trade barriers. Refraining from an in-depth analysis on the reasons behind the political decisions concerning ethanol production we may speculate that factors such as the high, and still growing demand for energy; the need for reductions of greenhouse gas (GHG) emissions; crude oil dependency – and thus a reliance on oil producing countries implying a prospective geopolitical instability – are the main drivers for the government support measures.

Current technologies to produce biofuels are mainly based on commodities such as cereals, sugar, and oilseeds. This implies that in conjunction with the growing demand for biofuels an even higher increase in demand for these crops can be expected. The limited amount of arable land and the rising global demand for food are important inhibitors for the production of first generation biofuels. Second generation biofuels are now being developed. Biofuels derived from cellulosic plant material could provide a possible means to tackle the limitations of first generation biofuels. However, there is still no large scale production of second generation biofuels, mainly due to their high production cost.

Due to the tight linkage between feedstock and first generation biofuels, the cost of production is directly dependent on the feedstock prices which, in turn, have risen due to high world market demand. However, the tale of linkage is far more intricate. The US tax credits for ethanol production are fixed and therefore do not adjust to market conditions. These fixed cash in-flows into ethanol production create a stable demand for corn and consequently (in theory) helps to stabilize corn prices. In addition, policies such as *corn-for-ethanol* magnify this effect. For an extensive analysis of this issue we refer to previous work (Natanelov et al., 2011), where we have shown that the US ethanol production, contrary to general belief, stabilized corn prices in relation to crude oil prices – until crude oil prices breach a threshold value of 75 USD/barrel.

Furthermore, when discussing the issue of price linkages it is crucial to take on a holistic view and consider certain external

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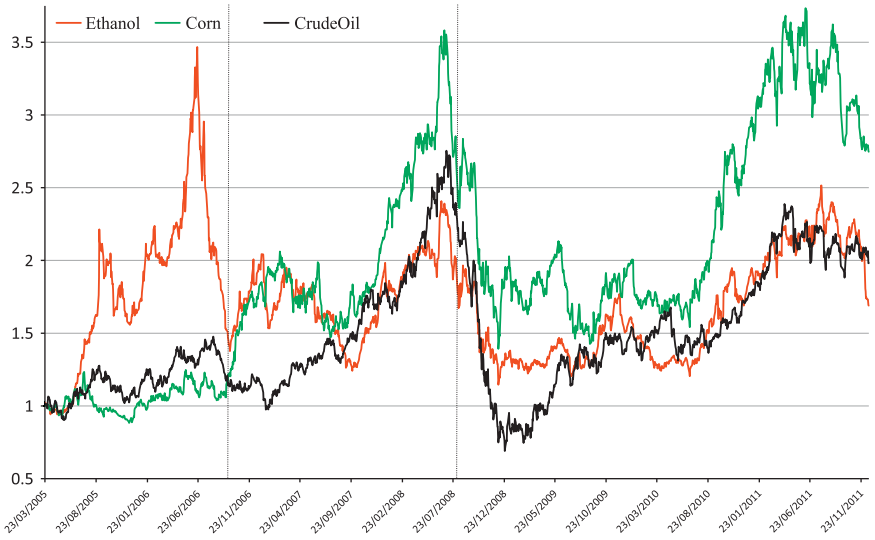

Fig. 1. Indexed price evolution between 23 March 2005 and 15 December 2011.

shocks to the markets. To exemplify, Fig. 1, clearly presents a huge peak in ethanol prices in 2006. Closer examination of adjacent markets shows that because of health concerns, due to problems with contamination of drinking water by methyl tert-butyl ether (MTBE), the US has drastically reduced its production of MTBE and banned it as a fuel additive in 2006.

In previous work (Natanelov et al., 2011) we have indicated that the linkages between energy and agricultural markets are much more intricate and nuanced than considered by most. In this paper, we analyze deeper the specific linkages between corn, ethanol and crude oil prices. We shall attempt – within a broad context – to zoom into the most recent period, which is marked by crises; unprecedented price jumps of agricultural commodities; and higher levels of volatility and speculation. Within this context, we shall analyze the dynamic relationships between corn, crude oil and ethanol prices. Through our results, logic, contextual and holistic approach we hope to be able to shed some light on the characteristics of these markets in the current environment and provide a logical and intuitive explanation for the change in relationships through time.

The paper is structured in the following manner. In the literature review an overview of previous research is presented. In the methodology section we discuss the technique used in our analysis. In the subsequent section we present and discuss the results. In the final part concluding remarks and recommendations are offered.

2. Literature review

Dynamic price relationships between commodity and energy markets have been widely discussed in recent literature. Zhang et al. (2009, 2010) support the derived demand theory for ethanol, corn, and soybean relationships with oil and gasoline. The authors highlight the role of agricultural commodity prices as market signals enabling commodity markets to restore their equilibriums after a demand or supply shock. Market shocks may in the short-run increase agricultural commodity prices, however decentralized freely operating markets, such as futures markets, will mitigate the persistence of these shocks. Furthermore, their results did not reveal long-run relationships between fuel (ethanol, oil and gasoline) prices and agricultural commodity (corn and soybean) prices. Similarly, Lewis and Tonsor (2011) analyze the impact of ethanol production on spatial corn markets in the US using cointegration. Their results suggest that spatial corn prices operated in a long-run equilibrium between 1998 and 2008 and that ethanol production has not altered these spatial price relationships. Du and Hayes (2009) analyze the impact of ethanol production on US and regional gasoline prices. Their analysis indicates that the gasoline prices are lower due to the ethanol production. The Midwest region has the highest reduction of gasoline prices due to ethanol, which is not all that surprising given the high concentration of ethanol production plants in that region. Due to its high policy relevance the authors recommend a thorough study of the linkages between the energy and agricultural sectors.

In contrast, Anderson and Coble (2010) investigate the impact of renewable fuels standard ethanol mandates on corn prices and corn production levels. The focus of the study is on the mandates' influence on market participants' expectations. Their results indicate that through the stochastic nature of supply and demand shocks, a nonbinding mandate can have substantial impact on corn prices and volumes due to the price-responsiveness of demand from the US ethanol sector instigated by the mandate. They note that the ethanol production levels are on a similar level as the mandates resulting in market participants believing that any reduction in corn supply will be met by a relatively inelastic demand – or large price – response from the ethanol sector. In a similar study, McPhail and Babcock (2012) support the results of Anderson and Coble (2010), and find that the mandates reduce price elasticity of demand for corn and gasoline, which in turn increases price variability when supply shocks hit the markets. A recent study (Serra et al., 2011) analyzed monthly prices of ethanol, corn, oil, and gasoline between 1990 and 2008. The authors indicate that the four commodity prices are related in the long run, with an especially strong link between corn and energy markets. This link between corn and energy markets is attributed to price responses in ethanol market. Gohin and Chantret (2010) measure the long-run impact of energy prices on world agricultural markets including macro-economic linkages. By incorporating a general equilibrium (GE) model they find a significant relationship. Besides identifying a positive relationship due to the cost push effect, they find that the introduction of the real income effect may imply a negative relationship between world food and energy prices. In an analogous study, Gohin and Treguer (2010) indicate that to the farmers' downside risk aversion in combination with the reduced variation of corn prices due to biofuels dampens the quantity effect of biofuels. The third column