THE EFFECT OF BIOFUELS ON THE LINK BETWEEN OIL AND AGRICULTURAL COMMODITY PRICES: A SMOOTH COINTEGRATION APPROACH

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Overview

The aim of this paper is to study the effect of oil prices on corn, soybean, sunflower, rapeseed and wheat prices, both in the short- and long-term. We go further than the previous literature by paying particular attention to the effect of biofuel production development on the long-term link. This effect is highly controversial because it has indeed never been proven.

The sharp rise in oil prices from 2004-2006 resulted in a small increase in agricultural commodities prices compared with those from 2007-2008. In both cases, the oil price has been multiplied by approximately 2.5, whereas the respective multiplication factors of agricultural commodity prices were 1.3 and 1.7. Thus, the correlation between the price variations has accentuated since 2006, corresponding to an acceleration phase of US biofuel production. In addition, Campiche et al. (2007) and Harri et al. (2009) determined the apparition of a cointegration relationship between some agricultural commodity and oil prices in 2006. Biofuels constitute energy sources developed to replace fossil fuels. However, biofuels are produced from agricultural commodities, and this utilization of agricultural commodities competes with their food use. This competition is the main cause of the "food versus fuel" debate, according to which biofuel production accentuates the food insecurity situation in some countries, particularly in the developing ones. In addition, a key characteristic of the biofuels market is governmental support, for example in the majority of OECD countries. Thus, if this new market has indeed contributed to the price rise of agricultural commodities, producer country governments would primarily be responsible.

Methods

We use various methods from nonlinear time series econometrics, including smooth transition cointegration regression (Terasvirta 1994) and the Shin (1994) and Choi and Saikkonen (2010) tests for nonlinear cointegration. These methods allow us to estimate the oil-agricultural commodity price nexus in the long-term, depending on the level of biofuel production. With a nonlinear approach, we are able to determine the existence of different regimes in the oil-price effect and to verify the role of biofuel development in alternating between these regimes. In addition, we use the Error Correction Model (ECM) to examine the oil-price effect in the short-term.

Our empirical analysis relies on five agricultural commodities. Three are directly linked to biofuel production as inputs: corn and soybean for US production and rapeseed oil for European production. Additionally, we use wheat and sunflower oil prices to examine whether biofuels affected previous commodities substitutes. The oil price that we consider is the West Texas Intermediate (WTI) spot price. All these spot prices are daily and log transformed, the corresponding estimated coefficients thus representing elasticity between prices. For biofuels, we use the US monthly production, and we turn it into daily data by quadratic interpolation. Moreover, we account for economic activity by integrating the composite Standard & Poor's (SP500) index. Our period ranges from 01/02/1986 to 11/28/2014; with the exception of sunflower and rapeseed oils for which the period begins on 12/04/2001 due to a lack of data.

Results

Our main findings can be summarized as follows.

First, there is a positive effect of biofuel production on agricultural prices through an increase in the long-term oil-price effect. This effect confirms that biofuel production has been one of the key causes of agricultural price increases since 2006. For example, as long as the daily biofuel production was less than approximately 350,000 barrels, the long-term elasticity between soybean and oil prices was 0.024. This elasticity reached its maximum, i.e. 0.424, at a daily production of nearly 1.1 million barrels. For rapeseed oil, the elasticity with oil price increased from 0.452 to 0.817.

Second, the biofuels effect is not confined to agricultural commodities used in its production; rather, it is transmitted to other agricultural markets through the substitution effect, with a diversion of food consumption and crop production. For example, the long-term elasticity between sunflower oil and oil prices increased from 0 to 0.885.

Third, in the absence of biofuel production, there is a long-term positive oil-price effect, with a low magnitude, on soybean and wheat prices. The long-term elasticity between wheat and oil prices was 0.098, before the development of biofuels.

Fourth, without biofuels production, corn prices are characterized by a long-term negative oil-price effect, with a price elasticity of -0.113, through the income channel, due to the oil-price effect on the economic activity. This elasticity reached 0.817 at a daily production of nearly 1.4 million barrels.

Finally, there is a weak positive short-term oil-price effect on agricultural prices, with a break during the economic crisis from 2007-2009. For example, the short-term oil-price elasticities for corn and soybean are 0.087 and 0.075, respectively.

Conclusions

Our results have important policy implications. They suggest that it is urgent to reduce first-generation biofuel production by accelerating the introduction of second-generation biofuels. Such acceleration should have no effect on agricultural commodities prices because the production of second-generation biofuels only uses agricultural crop residuals and non-food crops.

References

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