

## Keywords

ethanol market, motor fuel market, oil crop market, convergence test

## Overview

In 2005, the United States has passed the Energy Policy Act (EPA). This law mandates for gasoline to include a minimum requirement level of renewable fuel by 2012 (Farrel et al., 2006). Thus it is expected that the use of ethanol as a motor fuel will increase in the United States. As more and more ethanol began to be used as alternative fuel source for the motor fuel, it is probable that the inter-relationship between the ethanol and the existing motor fuel market to become stronger. It is also likely that demand on oil crops will grow in order to produce more biofuel, and hence, the linkage between the oil crop and ethanol markets will be strengthened. To test if market interdependence persists among the ethanol, motor fuel, and oil crop markets, this study investigates the convergence and integration among the ethanol, diesel, gasoline, corn, and soybean markets. The paper expects that the ethanol, motor fuel, and oil crop markets are integrated and show convergence in their price trends if the ethanaol market is depedent and share price information with the motor fuel and oil crop markets. On the other hand, if the ethanol market has indepedent price movement with the motor fuel and oil crop markets, it will imply that market inter-relationships are small among these markets.

Previous studies testing for price relationships among the ethanol, motor fuel, and oil crop markets (Zhang et al., 2010; Zhang et al., 2009; Higgins et al., 2006) only perform cointegration tests to test if these markets are integrated but this research performs the convergence test and measure if these markets move towards a long-run growth path or to some common trend over the test period.

## Methods

The study use the convergence test developed by Phillips and Sul (PS)(2007). This method is used because this method does not rely on any particular assumptions on trend stationarity or stochastic non-stationarity. The PS test first examines the overall convergence among the whole price series investigated in this study. Then the PS method allows to identify groups of integrated markets that converge to different equilibrium among the price series studied in the research. After the subconvergence groups are identified by the PS method, I test the price linkage among the prices within the subconvergence groups by performing the Johansen (1991) and Phillips-Ouliaris (1990) cointegration tests. For testing the stationarity of the price series used for the cointegration tests, I conduct the Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests.

The term of the price series used in this study is the Jan. 2005 – Oct. 2011 period. The study uses the monthly price provided by the United States Department of Agriculture (USDA) Iowa Ethanol Plant Report for the ethanol price. For the diesel and gasoline price, the study used the monthly price based on the U.S. Energy Information Administration survey report. Finally I used the monthly prices of corn and soybean prices available at the USDA National Agricultural Statistics Service.

## Results

The result of the PS test indicated that the ethanol, diesel, gasoline, corn, and soybean prices do not have overall convergence implying that these markets cannot be considered as one integrated market. The PS test to identify the subconvergence group revealed that corn and soybean markets form the first convergence group, and diesel and gasoline markets build the second convergence group. The test suggested that ethanol market does not belong to any subconvergence group and that the ethanol price moves independently from the motor fuel and the oil crop prices. The cointegration tests conducted within the subconvergence groups suggested that there are no cointegration relationships among the price series within the subgroups. This could be that although the prices were converging within the subconvergence groups, the levels of price convergence or market integration were

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## Is the ethanol market independent from the existing motor fuel and oil crop markets?

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not strong or fast enough for the price series to be cointegrated.

## Conclusions

After the U.S. issued the EPA on 2005, it can be expected that the use of ethanol as an alternative fuel for the motor fuel such as diesel and gasoline to increase and the ethanol market will have more inter-relationships with these markets. It was also anticipated that as the demand on ethanol grows, more oil crops such as corn and soybean will be used for producing biofuel and that the ethanol market will have interdependence with the oil crop markets. To find out if these empirical thoughts will appear in the market relationships among the ethanol, motor fuel, and oil crop markets, the paper conducted the convergence test among the ethanol, diesel, gasoline, corn, and soybean prices.

The results of the study revealed that there is no overall convergence among these prices although diesel and gasoline markets, and corn and soybean markets converge to subconvergence groups. The ethanol price did not belong to any subconvergence group which indicates that the ethanol market is independent from the existing motor fuel and oil crop markets. This implies that although the use of ethanol is growing in the U.S. and more oil crops are harvested to produce ethanol, we are still at the stage where ethanol market does not play a major role to influence or be affected from the existing motor fuel and the oil crop markets.

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