

# Cointegration and Causality of Energy and Grain Prices

Daniel Armeanu\*

Department of Finance Academy, Economic Studies Bucharest, Bucharest, Romania

## Abstract

Oil, natural gas, and/or coal have historically been linked to grain markets because they are used as inputs for fertiliser production or transportation costs. The recent rise in energy prices in response to significant events such as the COVID-19 pandemic and the Russia-Ukraine conflict has refocused researchers' attention. The goal of this paper is to use time series models to assess any changes in the relationships between crude oil, natural gas and grain prices, which will contribute to a review of the fuel-food relationship. Several techniques (Zivot-Andrews and Clemente, Montaés, Reyes unit root tests, Johansen's cointegration test, Toda-Yamamoto time domain causality test with time dummy variables for structural breaks and Hatemi-J asymmetric causality test) are used to account for structural breaks and regime shifts data spanning the years January 1982 to September 2022. The main conclusion is that, in light of recent developments in the respective markets, the neutrality hypothesis remains valid.

**Keywords:** Cointegration • Crude oil price • Natural gas price

## Introduction

Tracing the causal links between the prices of agricultural commodities and energy market prices is one method of evaluating these relationships. The literature that was consulted identifies two groups of authors. There is no causal connection between them because the neutrality hypothesis has been put forth by numerous researchers. Yu et al investigated the long-run linkage between several edible oil prices among them and crude oil prices for the period from January to March they discovered no discernible correlation between crude oil prices and edible oil prices using time series analysis. The study by Zhang et al. focused on how Chinese corn, soy meal and pork prices were impacted by crude oil prices. Crude oil price influence on the other variables Gilbert emphasised the importance of oil prices in driving up food prices and connected them to the rise in demand for food crops for biofuel production.

## Description

Agricultural commodities and oil. Using monthly data from January to March and the Engle-Granger two-stage estimation method, Hameed and Arshad discovered that there was a long-term, unidirectional causal relationship between the price of petroleum and the price of vegetable oils. Using monthly data for the prices of corn, wheat, rice and soybeans for the years 2002 through, first difference models and Granger causality tests, Cooke and Robles found that the oil price Granger causes the prices of corn and soybeans. The relationship between energy and food prices was examined by Taghizadeh-Hesary et al. using a panel model and taking into account eight Asian economies, confirming that the price of oil has had a significant impact. Sizable impact on food prices between during the study period. They claimed that the fluctuation in oil prices poses a threat to both food security and energy consumption and that diversifying this industry will benefit both energy and

**\*Address for Correspondence:** Daniel Armeanu, Department of Finance Academy, Economic Studies Bucharest, Bucharest, Romania, E-mail: danielarmeanu45@edu.in

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food security it directly affects various economic sectors, such as agriculture, as it is a crucial input for the production of goods and services Roman et AL paper. ' investigated the connection between crude oil and food price indexes, including meat, oils, cereals, sugar and dairy and also stated the impact's direction. The authors found short-term links between crude oil prices and the prices of food, cereal and vegetable oils as well as cointegration relationships between crude oil and meat prices using various econometric techniques for the period from as essential for life, food products are considered in several articles regarding the relationship between food prices and crude oil prices. The three primary agricultural products chosen for this work are the grain category, such as wheat, corn and soybeans, as well as their connection to the cost of crude oil and natural gas, which is examined in terms of causality and counteraction [1-3].

The connections between energy market prices and the prices of agricultural commodities were examined in this article. For the period of September monthly data on the prices of wheat, corn, soybeans, crude oil and natural gas were used to examine any potential cointegrating relationships between the variables. Since counteraction was detected, an analysis was carried out to initially formalise the variables' historical relationships using equations. The Haemic-J asymmetric causality test and the Toda-Yamamoto time domain causality test were carried out to complete the analysis and determine the causal relationship between grain, crude oil and natural gas prices. The decision to use causality tests is driven by the desire to investigate asymmetrical as well as linear relationships between variables. Two-rank cointegration of the variables was discovered. The Johansen's trace test was empirically used to discover the existence of long-term relationships between variables. We can learn useful information from this result about long-term relationships between grain, oil and natural gas prices. Peaks in the price of the energy market make the co-movement between the series more obvious [4,5].

## Conclusion

Some error correction terms that were discovered to be statistically significant and negative using the method revealed long-term causality relationships in the corresponding equations. No causal relationships between the prices of grains and the energy market were discovered using the TY time domain causality test.

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## Conflict of Interest

None.

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