

## Original Research

### Effects of crude oil prices on copper and maize prices

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#### ABSTRACT:

**Background:** Within the last few decades, the extended use of biodiesel and bioethanol has established interlinkages between energy markets and agricultural commodity markets. The effect of crude oil prices on copper and maize prices were analysed. **Materials & methods:** Crude oil price data in this study consist of monthly averages of three crude oil prices—representative of world prices. These are the Brent crude oil price, Dubai crude oil price and the West Texas Intermediate (WTI) crude oil price. Descriptive analysis was conducted. Descriptive statistics included kurtosis, skewness, mean and standard deviation. **Results:** All the variables were positively skewed implying that the markets for maize, copper and crude oil have potential for small frequent losses and large infrequent gains. **Conclusion:** There shows the existence of a long-run relationship between the two mineral prices (crude oil and copper) on the one hand and maize prices on the other.

**Keywords:** crude oil, maize, copper.

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#### INTRODUCTION

Commodity futures has become increasingly popular as a financial instrument to hedge against risks in financial markets. Its further integration into the global financial system is strengthened due to the financialization process in commodity markets.<sup>1</sup> According to Tang and Xiong (2012), the total value of the market transactions of institutional investors increases on a large scale, and a large amount of funds flow into commodity market, giving commodity prices clearly new features.<sup>2</sup> Traditionally, commodity prices are determined by global imbalances of demand and supply.<sup>3</sup> The recent trend, especially after the 2008 global financial crisis, has revealed a very different scenario. Extreme price dynamics, higher short-term volatility, and increasing level of co-movement in commodity prices are far beyond the explanatory power of the standard demand and supply framework. As a consequence, factors that may affect commodity price movement have becoming more complicated.

Crude oil, copper and maize are essential to both poor and rich nations. Maize for example is a staple food in vast parts of Sub-Sahara Africa (SSA) and accounts for 40% of all cereals production in that region.<sup>4</sup> It is also a staple food for several countries in Latin America. Copper is used in electronic public defense

and military equipment as well as industrial and domestic electronic equipment.<sup>5</sup> Crude oil, sometimes called the 'black gold,' is arguably the most significant of the three. It is a basic input in industrial production and is used to fuel cars and planes for transportation and generate electricity for use in production of goods and services. A change in the price of oil is therefore likely to affect several aspects of an economy. The energy–agricultural market interlinkages have become a subject of extended study within the last decade. The global food crises in 2007/08 and 2010/11, as well as negative environmental and social impacts of promoting biofuels, have given governments second thoughts regarding the promotion of biofuels. Since the outbreaks of biofuels industry, an abundance of manuscripts have focused on dependency between fossil fuel, biofuel, and feedstock prices.<sup>6-8</sup> In a few papers and due to data availability issues, the biofuel prices are ignored.<sup>9</sup> In those studies, ignoring biofuel prices generally relies on the hypothesis that a change in the food–fuel price relationship post the outbreak of the biofuels industry is related to the impact of biofuels. Hence, this study was conducted to analyse the effect of crude oil prices on copper and maize prices.

## MATERIALS & METHODS

Crude oil price data in this study consist of monthly averages of three crude oil prices—representative of world prices. These are the Brent crude oil price, Dubai crude oil price and the West Texas Intermediate (WTI) crude oil price. Maize prices are those of yellow maize. These are the closest proxies for world commodity prices for the respective commodities that could be found in the WB dataset. Descriptive analysis was conducted. Descriptive statistics included kurtosis, skewness, mean and standard deviation.

## RESULTS

The skewness and kurtosis figures all fall within the range of  $\pm 3$ . This indicates that residuals are approximately normally distributed. Normality is a desirable characteristic for the data analysis required. All the variables were positively skewed implying that the markets for maize, copper and crude oil have potential for small frequent losses and large infrequent gains.

**Table 1: Maize, copper and crude oil price trends**

|          | Logmaize | Log_copper | Log_crudeoil |
|----------|----------|------------|--------------|
| Mean     | 4.225    | 7.822      | 3.325        |
| Median   | 4.125    | 7.720      | 3.102        |
| Maximum  | 5.624    | 8.925      | 4.520        |
| Minimum  | 3.852    | 7.026      | 2.367        |
| Skewness | 0.521    | 0.210      | 0.284        |
| Kurtosis | 2.961    | 1.452      | 1.985        |

## DISCUSSION

Modern agriculture and mining use products from oil to fuel machinery in farms and mining plants, respectively. They also use them to fuel transportation of output from the production centers to the markets. For this reason, high and volatile crude oil prices are of concern in the mining and agriculture sectors of the economy. Several studies have attempted to explain the effects of crude oil prices on metal prices and food prices.<sup>10,11</sup> However, at the moment, no single theory explains the effects of crude oil prices on commodities in general.<sup>12</sup> Hence, this study was conducted to analyse the effect of crude oil prices on copper and maize prices.

In the present study, the skewness and kurtosis figures all fall within the range of  $\pm 3$ . This indicates that residuals are approximately normally distributed. A study by Kaul B et al, the effects of crude oil prices on copper and maize prices. Vector autoregressive and vector error correction models are used to study the relationship between oil prices and prices of copper and maize. The commodity price data used consist of average monthly prices of each of the commodities: crude oil, copper and maize for the months January 1982 to June 2021. For robustness, the analysis was also run on a sample of the same data for the period January 2000 to June 2021. A long-run

relationship was found between crude oil and copper prices on the one hand and maize prices on the other for the 1982 to 2021 period at the 5% significance level. The same was not true for the shorter sample (2000 to 2021). Granger causality flowing from crude oil prices alone to copper and maize prices was not found. Recommendations that are useful for energy, mining, agriculture and general development policy and practice are made. The findings are also useful for bilateral and multilateral aid discussions. The limitations of the study and recommendations for future scholarship are also made.<sup>13</sup>

In the present study, normality is a desirable characteristic for the data analysis required. All the variables were positively skewed implying that the markets for maize, copper and crude oil have potential for small frequent losses and large infrequent gains. Another study by Kaushik investigates the effects of global crude oil prices on metal prices in India. Dynamic conditional correlation generalized autoregressive conditional heteroskedasticity modeling was applied on data from June 1, 2006, to March 31, 2017. While several other metals were studied, the price of copper was found to have a weak positive correlation with the crude oil price. The authors posit that the same global economic factors that drive crude oil prices also drive copper prices.<sup>14</sup> Zhang and Tu studied the effects that global oil price shocks have on China's metal markets with a focus on copper and aluminum. Autoregressive conditional jump intensity (ARJI) and model, combining with the generalized conditional heteroskedasticity models, was used for data analysis. Crude oil price shocks were found to have significant symmetric impacts on the metal markets.<sup>15</sup> Nwoko et al. who found a long-run relationship between crude oil prices and food price volatility. The long-run relationship was found to be positive, confirming the Dutch disease theory and economic growth theory. The higher the prices of minerals (copper and crude oil), the higher the price of agriculture produce (maize in this case). A slow speed of adjustment (5.72%) to long-run equilibrium was found. This suggests that copper and crude oil prices are relatively weak policy instruments for influencing maize prices. Granger causality results also backed this up. No causal relationship was found between crude oil prices and maize prices.<sup>16</sup> This is in line with Nazlioglu and Soytas who also found no evidence of causality.<sup>17</sup> The lack of Granger causality could be because of high labor intensity in maize production. The finding is however in contrast with Jiang et al. who found that crude oil prices transmit volatility to maize prices. Variance decomposition showed that over a 24-month horizon, changes in copper prices and crude oil prices accounted for a total of about 30% of changes in maize prices. This confirms the asymmetric effect theory of mineral prices, that is, mineral prices have varying effects on food price volatility in varying contexts.<sup>18</sup>

## CONCLUSION

The contribution to food security literature in the context of both the bottom of the pyramid (BoP) nations as well as the top ones. Existence of a long-run relationship between the two mineral prices (crude oil and copper) on the one hand and maize prices on the other.

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