Research Paper

Investigation of the Spillover Effects in the Base Metals Market with an Emphasis on Technological Changes

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Abstract: In the basic metals market, copper and aluminum are among the most popular metals in manufacturing and construction industries due to their uses in various industries. Given Iran's favorable rank in the production and export of copper and aluminum in the region, this study had investigated the factors affecting on their global prices in the short and long-term. Therefore, in the current research, an attempt has been made to investigate the short-term (with emphasis on the spillover effect) and long-term influencing factors on the prices of these two important metals using DECO-GARCH and NARDL models. According to the results of the DECO-GARCH model, in the short term, the price of oil, parallel metal markets such as nickel, alumina, and the dollar index with the stock index have a significant effect on the global prices of copper and aluminum. Also the existence of the spillover effect among them was confirmed. According to the results of the short-term model, the existence of the spillover effect in the models was confirmed. In fact, any fluctuation in any of the variables instantly affects the fluctuations of other variables. According to the results of the long-term model, oil price, economic growth, technological changes, industrial production index, prices of metals such as nickel and alumina, stock index, and automobile production index have a significant effect on the global prices of copper and aluminum.

Keywords: Aluminum, Copper, Spillover Effect, DECO-GARCH, NARDL.

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INTRODUCTION

In the literature of microeconomics, inputs and intermediate goods play an important role in the production and economic growth of countries. In the real world, one of the most important inputs for the production of goods, including intermediate durable goods (such as machinery) and consumer goods (such as cars and buildings) is basic metals. In a country like Iran, after oil and oil products, the export of mineral products has an important position. Therefore, the investigation of short-term and long-term influencing factors on the global prices of aluminum and copper is the main subject of this research. This research examines what factors affect the daily price or return of copper and aluminum. On the other hand, in the long-term (annual) horizon, it seeks to identify and investigate the effect of annual variables (some statistics are presented only annually, such as gross domestic production (GDP)) on the price behaviors of the two mentioned metals. By reviewing the research literature, the factors affecting the prices of basic metals include three groups: 1) the macroeconomic variables at the global level such as GDP, technology, industrial production, exchange rate, 2) the commodities prices in other markets, including the energy market, precious metals and other non-ferrous metal and mineral products and 3) finally, some intra-industry factors such as the amount of metal reserves and the internal developments of the major exporting and importing countries of these commodities.

The hypotheses of this research are: (i) In the short term (daily time frame), energy price, dollar index, prices of parallel metal markets such as nickel and alumina, and stock index have a significant effect on the global prices of copper and aluminum. (ii) In the long term, energy price, economic growth, technological changes, industrial production index, prices of parallel metal markets such as nickel and alumina, stock index and car production have a significant effect on the global prices of copper and aluminum.

METHODS

In the econometrics literature, structural time series models such as the GARCH family are most widely used for short-term modeling (and investigating the effects of contagion and transferability) among variables. Therefore, in this research, the developed DECO-GARCH model is used to investigate short-term effects and the NARDL model is used to investigate long-term relationships among variables. The DECO-GARCH model sets the average conditional correlation equal to all pairwise correlations to reduce the burden of calculating large-scale correlation matrices. In fact, this model uses the same structure to build the covariance matrix as in the DCC-GARCH model [1]. However, the conditional correlation matrix is different due to averaging the conditional correlations.

One of the attractions of the NARDL approach is that it reveals differences in response to positive and negative changes, and also shows how these change in the short and longer term [2]. The adoption of the bounds test also means that it can capture relationships between both stationary and non-stationary variables.

FINDINGS

The results of DECO-GARCH model

In this research, the multivariate DECO-GARCH model was used in order to investigate short-term relationships. Therefore, two separate models were estimated separately for copper and aluminum. According to the results, the first step is the univariate GARCH expression. At this step, ARCH and GARCH coefficients are significant for all variables. The sum of the coefficients of ARCH and GARCH is very close to one, which indicates that the volatility in the markets has a high persistence and is continuous. The second step is to estimate the DECO-GARCH model. At this stage, the average correlation coefficient is significant, which indicates the transfer of fluctuations among markets. parameter in the second model is positive and significant, which indicates the importance of the shock in the market. The significance of parameter in both models also means the existence of fluctuations in the market, that is, the correlations are highly dependent on the past correlations. In both models, there is an overflow or spillover effect, and this effect is mostly in the beta parameter. That is, the spillover effect is in the variance of their changes. In fact, any fluctuation in any of the variables instantly affects the fluctuations of other variables.

The results of NARDL model for aluminum:

• The positive shock of the car production index has a significant negative effect on aluminum price.

- The negative shock of the car production index has a positive and significant effect on aluminum price.
- Positive and negative shocks of global economic growth both have a negative and significant effect on aluminum price.
- The positive shock of the S&P500 index has a positive and significant effect on the price of aluminum.
- The negative shock of the technology index has a negative and significant effect on the price of aluminum.
- The positive and negative shocks of the oil price have significant positive and negative effects on the price of aluminum, respectively.

The results of NARDL model for copper:
- The general effect of industrial production index shocks on copper price is positive.
- The negative shock of the price of nickel has a positive and significant effect on the price of copper.
- The negative shock of the S&P500 index has a negative and significant effect on the price of copper.
- The negative shock of the global economic growth has a negative and significant effect on copper price.
- Positive and negative technology index shocks have a negative and significant effect on the price of copper.
- A positive oil price shock has a limited positive effect on copper price.

CONCLUSIONS

In the current research, an attempt was made to investigate the impact of the effecting factors on the global prices of copper and aluminum by using the short-term developed models that emphasize the transferability of prices in markets (DECO-GARCH model) and long-term models that emphasize the asymmetric, non-linear and different effects of positive and negative shocks (non-linear ARDL model). The results of the DECO-GARCH model estimation showed that in the short term, the price of oil, the dollar index, the prices of parallel metal markets such as nickel and alumina, and the stock index have a significant effect on the global prices of copper and aluminum, and the existence of the spillover effect was also confirmed; In such a way that the fluctuation in the price of each market instantly affects the fluctuations of other markets. Also, based on the results of the NARDL model, oil price, economic growth, technological changes, industrial production index, prices of parallel metal markets such as nickel and alumina, stock index, and automobile production index have a significant effect on the global prices of copper and aluminum in the long term. Therefore, the second hypothesis of the research is also confirmed.

REFERENCES

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