Investigating the Relationship between Exchange Rates and Oil Prices on Iranian Steel Exports to China with Emphasis on Sanctions: A wavelet and multivariate-GARCH approach

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Abstract

Considering Iran's potential in steel production and exports, attention to its exports contributes to reducing the country's dependence on oil revenues. Various studies show that oil prices and exchange rates can affect the world trade of oil-exporting countries. Hence, the purpose of this study is to investigate the effect of exchange rate and oil prices on Iran's steel exports to China in the period between February 2008 and March 2019 using the wavelet and multivariate-GARCH approaches. The results of the wavelet model showed that increasing in sanctions in the early 2010s and their intensification during 2018 and 2019 has intensified the impact of exchange rate on Iran's steel exports to China. Also, during the period 2013 to 2015, with the prolongation of the negotiation process and changes in world oil prices, the correlation between world oil prices and Iran's steel exports to China has intensified in the long run. The results of multivariate GARCH show that the correlation between the real exchange rate and Iran's steel exports to China has been negative for most of the period. Moreover, the correlation between the real exchange rate and oil prices has been positive for most of the period under study. Therefore, it can be said that steel is one of Iran's export commodities which increases its non-oil export revenues as oil prices and revenues increase.

Keywords: Exports, Steel, Iran, Wavelet, Multivariate-GARCH.

1. Introduction

Numerous studies have examined exports in different countries showing that export diversification is essential for sustainable growth and economic development [1-2]. Al-Marhubi[3] showed that export diversification along with higher investment contributes to economic growth. Also, Arip et al. [4] found that export diversification can have a positive effect on the economic growth of a country. knowing that Iran is one of the largest steel exporters in the world and that its economy has aimed at reducing dependence on oil revenues and implementing non-oil export-based growth policies, the main question is how the key factors affecting Iran's steel exports influence Iran's economic growth. In the context of the theoretical literature, exchange rates affect exports, including steel exports. In the international economy, it has been acknowledged that the lack of proper exchange rate management can lead to severe imbalances in the economy and the correction of economic variables, including the trade balance, is dependent on demand management policies as well as exchange rate managementv[5]. The basic premise is that increasing exchange rate fluctuations brings about uncertainty and can have a negative impact on the trade flows of the countries[6]. However, there is no precise consensus regarding the effect of exchange rates and exchange rate fluctuations on trade[7]. Therefore, pay-

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ing attention to empirical studies along with the analysis of their findings is especially useful for Iran and helps reach a strong consensus on policy-making and planning. In exporting and importing countries, the price of oil is considered an important variable with different effects on non-oil production and exports[8]. Changes in oil prices in importing countries lead to changes in production costs, including changes in the production and trade of energy-consuming industries, including steel[5]. Therefore, the impact of oil prices on steel trade varies according to the economic structure of the given country. In oil-importing countries, rising oil prices lead to increase production costs, and in oil-exporting countries, they increase wealth.

Whereas Iran has faced various oil price and exchange rate shocks in the last decade, this study is an attempt to examine the impact of exchange rate and oil price on Iran's steel exports to China using the continuous wavelet approach. With regard to the fact that many studies in the country have employed time-series econometric approaches to examine the relationship between exchange rates and oil prices from one hand and steel exports from the other, this paper has novelty in that it employs the wavelet approach to investigate the relationship between the variables under study in two dimensions of time and frequency. In addition, in order to ensure the results of the wavelet model and to examine more precisely the relationship between the variables of the model, the uncertainty relationship of the studied variables has been investigated using the GARCH multivariate approach. For this purpose, the article is organized in five sections. After the introduction, in the second section, a review of the literature including theoretical foundations and research background is presented. Section Three is dedicated to presenting the research method. In Section Four, the model will be specified and estimated and in the final section, the conclusion will be presented.

2. Review of the literature

Exchange rate management and its impact on cross-border trade is one of the most important issues in the field of international trade and has been of great attention to many economists, especially in developing countries. The importance of this issue stems from the fact that the exchange rate, viewed from any school, is not only an important relative price that connects the domestic and global markets for goods and other services, but also shows the strength of the exchange competition of a country with other countries in global markets. Hence, the exchange rate is seen as an anchor that supports the balance of stable domestic and foreign economies in medium and long terms[9]. Accordingly, policymakers in open economies use exchange rate management both to implement monetary policies and to optimally choose the exchange rate regime[10]. After the collapse of the Bretton Woods system and changing the fixed exchange rate to the floating exchange rate, exchange rates were subject to various fluctuations. Although the exchange rate typically fluctuates beyond normal conditions, macroeconomic forces, market structure, global shocks, speculations, and the like also affect the exchange rate[11]. Exchange rate fluctuations will potentially lead to market uncertainty, traders' profit fluctuations, increased risk, unrealistic balances in foreign trade, and changes in production and transaction costs[12]. These factors, relative to the risk-taking behavior of companies, alter production and exports at different levels because companies are generally less risk-taking and are less likely to put themselves at risk[13].

There is a view in the literature of international economics that exchange rate fluctuations affect the volume of international trade and reduce it by increasing the risk of international trade since risk-averse traders replace low-risk activities with high-risk activities[14]. Risk-Portfolio theory, on the other hand, argues that higher risk leads to higher returns. Therefore, increasing the risk of exchange rate fluctuations can increase the volume of foreign trade[15]. Studies on partial equilibrium analysis under risk aversion[16-17] have shown that there is an inverse relationship between trade and exchange rate uncertainty. There are studies that show this relationship can be positive, negative or ambiguous depending on the economic conditions and the structure of countries[17]. These factors include market conditions related to derivative assets and the replacement of foreign direct investment[18-20].

Clark[17] and Thursby and Thursby[21] showed that exchange rate fluctuations have significant negative effects on countries' exports. However, Klein[22] in his research points to the positive effect of exchange rate fluctuations on the trade flow of countries. Frankel and Wei[23] show in their paper that although exchange rate fluctuations have a negative effect on the trade flows of a country, the effect is small. Using the GARCH-in-mean model, Kroner and Lastrapes[24] examined exchange rate fluctuations and showed that there is significant evidence of a negative (positive) relationship between US and Germany exports. Bacchetta and van Wincoop[25] used the general equilibrium method and the purchasing power parity argument to argue that international trade does not necessarily increase under constant exchange rates. Grier and Smallwood[26], by studying the effect of exchange rate shock on trade using the multivariate GARCH-M approach, showed that there is little evidence of a negative impact of exchange rate uncertainty on multilateral exports among developing countries. Tenreyro [27] used the gravitational model for the developed and developing countries to show that an exact relationship between exchange rate fluctuations and trade could not be established. Using the exchange rate uncertainty index, Bredin and Cotter[28] showed that there is a positive and significant relationship between fluctuations and

bilateral exports. In another study, Fang et al.[29] examined the impact of real exchange rate risk on the bilateral exports of eight Asian countries to the United States. The results showed that real exchange rate risk had a significant negative or positive effect on exports during the recession and boom. Rahman and Serletis[30], using estimations of the bivariate GARCH model, showed that there is a negative relationship between exchange rate fluctuations and exports. Using data from developing countries, Baum and Caglayan[31] showed that in only 30 of the 143 countries was there a significant relationship between exchange rate fluctuations and exports. Arip et al.[4] examined the relationship between export diversity and economic growth in Malaysia. The results showed that export diversity plays an important role in Malaysia's economic growth. Todshki and Ranjbaraki[8] showed that global oil prices have a significant positive impact on steel trade. Hassan and Zaman[32] showed that rising oil prices have a negative impact on Pakistan's trade balance. They showed that there is a one-way causal relationship from oil prices towards the current level. Grier and Smallwood[33] in a study entitled Exchange Rate and Trade Shocks: The Multivariate GARCH-M Approach showed that real exchange rate uncertainty has a negative effect on trade in less developed countries. Bouoiyour and Selmi[34] in their study examined the effect of exchange rate fluctuations on Egyptian exports using the wavelet and GARCH approaches. The results of their research show that the degree of dependence between these two variables is frequency-dependent such that at lower frequencies the impact of exchange rate fluctuations on exports is greater. Smallwood[10], examining the relationship between exchange rate uncertainty and bilateral export growth in China, measured exchange rate fluctuations using the DCC-GARCH multivariate model in an attempt to analyze the effect of exchange rate uncertainty on bilateral export growth for ten large export market. This study showed that exchange rate uncertainty has no effect on trade with the United States whereas it has had a negative effect on trade with almost all other countries. Kilian and Rebucci[35] examined the relationship between oil prices and the trade balance of oil-exporting countries and found that rising oil prices improved the current account as well as the oil trade balance and worsened the non-oil trade balance. A local study by Mashhadi Mohammadi et al[36] examined the effect of deviation of the real exchange rate from its equilibrium path on the export of Iran's steel industry in the period 1992-2012. For this purpose, Isfahan Mobarakeh Steel Company was selected as a sample and steel exports were considered as a function of three variables of real exchange rate, deviation of real exchange rate from its equilibrium path, and steel production. The results showed that steel exports depend on the exchange rate in the short run, but the impact of steel production on exports is not significant.

3. Methodology

3.1. Wavelet transform

Continuous wavelet transform is defined as follows:

$$W_X(u,s) = \int_{-\infty}^{\infty} \frac{1}{\sqrt{s}} \psi\left(\frac{t-u}{s}\right) dt \qquad \text{Eq. (1)}$$

Where $\frac{1}{\sqrt{s}}$ is the normalizing agent. W_X (u,s) is obtained by designing a special wavelet ψ (.) on the time series x (t). Coherence, which is considered as a local linear correlation between two constant time series, is similar to the correlation coefficient in linear regression, except that it takes place in the frequency space. Wavelet coherence is defined as relation (2):

$$R_t^2(s) = \frac{\left|s\left(s^{-1}W_t^{AB}(s)\right)\right|^2}{s\left|s^{-1}\left|W_t^A(s)\right|^2\right| s\left|s^{-1}\left|W_t^B(s)\right|\right|^2} \qquad \text{Eq. (2)}$$

In this case, S is a smoothing agent. One of the most important advantages of wavelet transform over fourier transform is its high strength in conditions where the data have rapid rupture and jump. Therefore, at high scales, the wavelet focuses on short-term details and phenomena, and at low scales, it focuses on the description of long-term phenomena[37].

3.2. Multivariate GARCH method

Most studies have used two-step methods to investigate the effect of exchange rate fluctuations on trade so that in the first stage the exchange rate fluctuations are calculated using different methods. Then, by considering this variable in time series or data panel models, the effect of exchange rate fluctuations on trade is analyzed. This method can lead to regression problems and cause inefficient results[33].

Taking into account the studies by Smallwood[10] and Grier and Smallwood[33], this work will use the multivariate GARCH method to investigate the fluctuations and the relationships between the variables of the study. The multivariate GARCH model is used to model the variability of two or more variables simultaneously. In the multivariate GARCH method, all parameters are simultaneously estimated in one model. Therefore, the problems of estimating the effect of exchange rate fluctuations on exports in two stages are minimized. For this reason, Grier and Smallwood[33] examined exchange rate and trade shocks using a dynamic conditional correlation (DCC) model.

In order to use the GARCH method, model (3) is usually used as follows, where y_t represents a vector with dimensions N × 1 of the observations and f_{t-1} represents the data set of the period T-1. In this model, it is assumed that y_t, using the p-order vector autoregression process, a vector of invisible observations f_t and a multivariate

GARCH process for y_t are plotted. Hence, the GARCH approach in the present study is MGARCH-in-Mean. Assuming that f_t is a k-order vector autoregression process and e_t is part of the error in the VAR equation, we can write:

The H_t matrix is an MGARCH process that is estimated using the Dynamic Conditional Correlation (DCC) approach[38-39].

4. Data and model estimation

4.1. Data and static study of variables

To investigate the relationship between exchange rate and steel trade, the two variables of real exchange rate and the quantity of Iran's steel exports to China have been used from February 2008 to March 2019. Since Iran is an oil exporter and the government's budget is highly dependent on oil, changes in oil prices can affect non-oil exports, including the steel trade. The Augmented

$$Ay_t = Bf_t + \Gamma(L_p)y_{t-1} + \Lambda_1 h_t + e_t$$
$$f_t = \mu + \Phi(L_k)f_{t-1} + Ge_t \qquad \text{Eq. (3)}$$

Dickey-Fuller (ADF) test is used to study stationary of variables in time series. The stationary results of the variables of the model are presented in the table below.

Given that some of the research variables are I(1), in order to investigate the effect of exchange rates and global oil prices on Iran's steel exports, the difference between the logarithm of the real exchange rate, oil prices and Iran's steel exports to China have been used.

4.2. Wavelet coherence

In this section, using the wavelet coherence approach, the correlation between the variables is investigated in pairs. Figure (1) has the three dimensions of time, time scale, and coherence intensity. The horizontal axis shows the time dimension. The vertical axis, which shows numbers 4 to 32, represents the time scale. Given that data used is monthly, the number 4 indicates the time scale of 4 months and 32 indicates the 32-month scale, which represent the short-term and long-term periods, respectively. Therefore, moving from the top of the chart to the bottom of the chart indicates moving from the short-term to the medium-term and long-term time horizons. The intensity of the coherence is determined by different colors in the figure. According to the bar chart next to the figure, the spectrum in blue shows the least amount of coherence and the spectrum in orange shows the highest amount of coherence. Another important point in wavelet coherence analysis is that although it shows the correlation in different time scales, it is not possible to determine the positive and negative correlation from its diagram because all the sentences are considered as squared. Phase difference analysis is used to find the reason for changes in variables and direction of correlations such that angled arrows show the phase direction and the cause of changes in time series. The arrows shown as → and ←indicate that the series under study is either co-phased and not, respectively. Also, arrows ↗ and ↙ indicate that the first time series is the cause of the formation of the second time series, and arrows ↖ and ↘ indicate that the second time series is the cause of the formation of the first time series.

Figure (1) shows the intensity of the correlation between the exchange rate and steel exports to China.

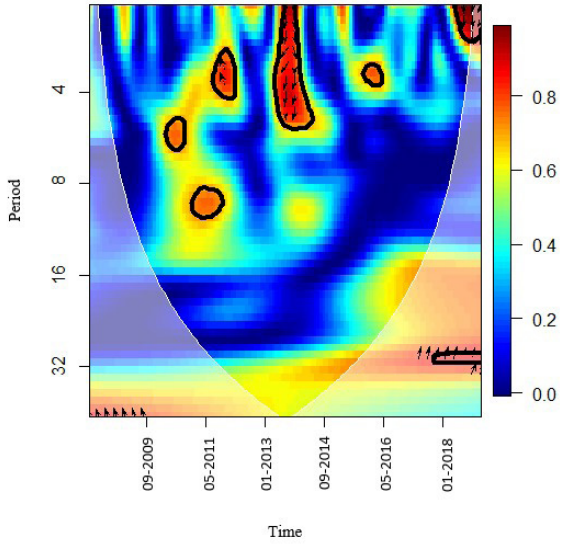

Fig. 1. Correlation between exchange rate and Iran's steel exports to China (Source: research results).

Table 1. stationary test of research variables.

Variable	Level		First difference		
	Intercept	Trend and Intercept	Intercept	Trend and Intercept	
Logarithm of Iran's steel exports to China	-3.62***	-3.48***	-	-	I(0)
Logarithm of real exchange rate	-4.80***	-4.85***	-	-	I(0)
Logarithm of oil prices	-1.26	-2.48	-8.13***	-8.39***	I(1)

Figure (1) shows that from the early -2011 to the mid-2012, in the short-term and medium-term time horizons, the correlation between the exchange rate and steel exports to China intensified.

Also, the results of phase difference analysis show that, during this period, changes in steel exports to China affect changes in exchange rate. This finding shows that in this period, which coincides with the intensification of oil sanctions and the decrease in foreign exchange income, the increase in steel exports has led to an increase in the country's foreign exchange income as well as greater control of the exchange rate by the government. From the beginning of 2013 to the end of 2014, the correlation between the exchange rate and Iran's steel exports to China has increased. The results also indicate that from 2018 to the end of the period under study, the correlation between these two markets has been intensified in the short run. The results of phase difference analysis show that in this period, changes in exchange rate have affected changes in steel exports. Therefore, it can be said that the increase in the exchange rate in this period is a factor influencing the increase of steel exports. During the years 2011 to 2015, in the long-term time horizon, a correlation of more than 50% is observed (the yellow spectrum). These results show that by increasing sanctions in the early 2010s and the expectation of the intensification of sanctions during 2018 and 2019, the correlation between the exchange rate and Iran's steel exports to China has been intensified. Figure (2) shows the correlation between world oil prices and Iran's steel exports to China.

According to Figure (2), the correlation between these two variables is evident in most of the period under study in the short-term and medium-term horizons. Also, in the period 2013 to 2015, the correlation between oil prices and Iran's steel exports to China has been intensified in the long run. The results of phase difference analysis show that the two time series of changes related to oil prices and Iranian steel exports to China are co-phased.

4.3. Multivariate GARCH estimation

The fact that there are small and large errors in predicting exchange rate and oil price variables is one of the reasons for using ARCH models in this study. Given that the exchange rate and oil price series have behaved differently during different periods, it is expected that during the random process of these series, the variance has not been constant but a function of error series. Therefore, GARCH models are used to evaluate the uncertainty and instability in exchange rate and oil price variables. As mentioned earlier, this model has been used because of the properties of the multivariate GARCH model, such as the ability to model the simultaneous variability of two or more variables. Using the ARCH test, the effects of the ARCH on the variables are examined. Table (2) shows the test results of the ARCH effects of each of the research variables. The results show that the effects of ARCH are present in all variables, so GARCH models can be used to investigate the effect of fluctuations of the variables.

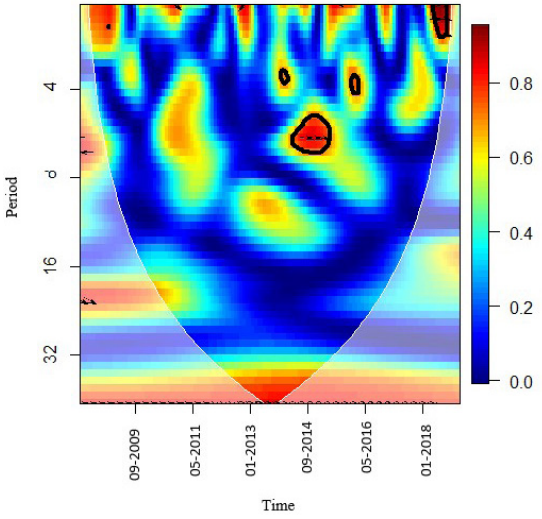

Fig. 2. Correlation between oil prices and Iran's steel exports to China (Source: research results).

Table 2. Test of ARCH effects (Source: Research Results).

Variables	Coefficients
Logarithmic difference of Iran's steel exports to China	16.94^{***}
Logarithmic difference of real exchange rate	11.82^{***}
Logarithmic difference of oil price	22.54^{***}

In order to estimate the MGARCH-in-Mean model, the serial correlation of errors should not be large. Therefore, according to Schwartz and Akaik's criteria, the first interval is selected for the VAR model. The results of model estimation are shown in Table (3).

Based on the results provided in Table (3), the parameters α and β are non-negative and the condition α + β <1 is met. This condition ensures that the conditional correlation of the previous period affects the conditional correlation of the current period. The positive of the parameters indicates that following the shock in the series of logarithmic differences of the variables, we expect the conditional correlation to increase in the next period. The beta parameter in this model indicates the effect of the conditional correlation of the previous period on the conditional correlation of the current period. The larger this value is and the closer it is to one, it is expected that (for the estimated correlation) the conditional correlation of the current period will be close to the conditional correlation of the previous period. Figures (3) and (4) respectively show the trend of dynamic conditional correlation between the logarithmic differences of Iran's steel exports to China and the real exchange rate and the logarithmic difference of Iran's steel exports to China and oil price.

According to Figure (3), the dynamic conditional correlation between the difference in the logarithm of Iran's steel exports to China and the real exchange rate fluctuates between -0.3557 and 0.24312. The average fluctuations related to correlation in the period under study is -0.05638. This correlation is negative for most of the years. According to Figure (3), between the years mid-2012 to 2014 and also at the end of 2018 and early-2019, the correlation between these two variables has increased. This shows that as the result of an increase in the price of currency, which is generally due to the increase in the severity of sanctions in this period, the correlation between these two variables has moved towards positive values. In other words, by increasing sanctions, rising exchange rates, and declining oil revenues in the country, attention to steel exports has increased. This confirms the estimation results given by the wavelet model.

Table 3. Estimation of MGARCH-in-Mean model (Source: research results).

statistic	Logarithmic difference of Iran's steel exports to China	Logarithmic difference of real exchange rate	Logarithmic difference of oil price
α	0.168**	0.3544***	0.5606***
β	0.623***	0.6445***	0.3264***
DCC1=0.0767**			
DCC2=0.7532***			

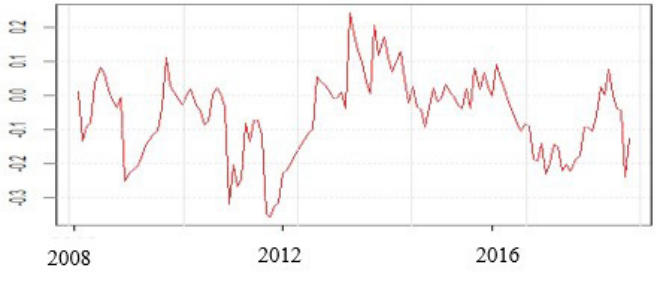

Fig. 3. Dynamic conditional correlation between the difference in the logarithm of Iran's steel exports to China and the real exchange rate (Source: research results).

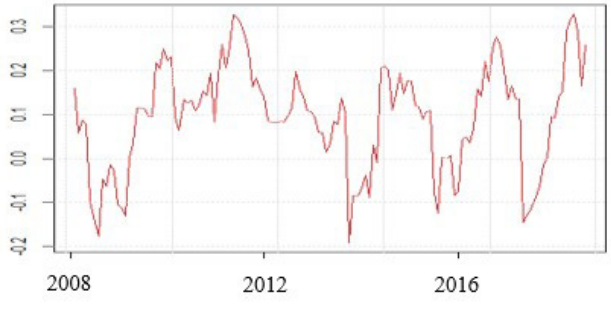

Fig. 4. Dynamic conditional correlation between the logarithmic differences of oil prices and Iran's steel exports to China (Source: research results).

Figure (4) shows the dynamic conditional correlation between the logarithmic differences of Iran's steel exports to China and oil prices. Accordingly, the average fluctuations related to correlation in the period under study is equal to 0.096. The maximum and minimum correlations between these two variables are 0.327 and -0.1916, respectively. Figure (4) shows that by increasing world oil prices in the early 2010s, Iran's steel exports to China have increased and, therefore, there is a positive correlation between these two variables. This indicates that as the result of increase in world oil prices and the economic growth of countries, the demand for steel has increased and, consequently, Iran's steel exports has increased as well.

The results of wavelet analysis and MGARCH analysis showed that in the period 2012-2014 and also at the end of 2018 and 2019, the correlation between these two variables has increased. In other words, the increase in the price of currency has led to an increase in the correlation between these two variables. Also, the average conditional correlation between the time series of oil prices and steel exports to Iran is positive. Wavelet analysis also showed that in the period 2013-2015, the correlation between world oil prices and Iran's steel exports to China has intensified in the long run. Also, the results of phase difference analysis in the wavelet approach show that the above two series are co-phased. This period coincides with an increase in oil prices in the world's markets, which originated from economic prosperity in some countries, especially China. Thus, despite the fact that Iran's non-oil exports as an oil exporter are expected to decline as oil prices rise, Iran's steel exports to China have increased, thereby increasing Iran's non-oil revenues.

5. Conclusions and suggestions

Iran has always had a relatively good status in the production and exports of steel in the region. However, few if any economic studies have dealt with the relationship between economic factors and steel exports. The purpose of this study is to investigate the relationship between exchange rates and oil prices, and Iran's steel exports. Since more than 80% of Iran's steel is exported to China, this study examines the relationship between exchange rates and oil prices on one hand and Iran's steel exports to China on the other. For this purpose, the two approaches of multivariate wavelet and GARCH have been used. The main merit of the wavelet approach is that in addition to time, it also takes into account the time scale. The results of wavelet estimation show that during the years 2011 to 2015, the correlation between the exchange rate and Iran's steel exports to China has increased in the long run. Also, together with an increase in sanctions in the early 2010s and the expectation of the intensification of sanctions during 2018 and 2019, the correlation between the exchange rate and Iran's steel exports to China has been intensified. The correlation between world oil prices and Iran's steel exports to China is evident in the short-term and medium-term horizons for most of the period under study. Also, in the period 2013 to 2015, the correlation between world oil prices and Iran's steel exports to China has been intensified in the long run. On the other hand, the second approach used in the present study is the multivariate GARCH approach. Numerous studies have examined the effect of exchange rate fluctuations on the trade of various products. As can be seen in the literature, most of these studies have used a two-step approach for this purpose. Put differently, they first calculate exchange rate fluctuations using various models, including univariate GARCH, and then examine the effect of these fluctuations on trade using linear or nonlinear models. The distinguishing feature of the current study as compared to other studies is its one-step approach in investigating the impact of exchange rate fluctuations on Iran's steel exports to China. In this study, the effect of exchange rate fluctuations on Iran's steel exports to China is simultaneously investigated and, for this purpose, the multivariate GARCH-in mean approach is used. The results of this study show that the conditional correlation of exchange rate and Iran's steel exports to China is negative. Therefore, it can be concluded that exchange rate fluctuations decrease the profit of exporting and importing companies by increasing the risk in business activities, and thus reduce the volume of trade. On the other hand, during the years 2012 to 2014 and also at the end of 2018 and 2019, the correlation between these two variables has increased. This shows that as currency prices increase, which is generally due to the increase in sanctions in this period, the correlation between these two variables moves towards positive values, which confirms the results of the wavelet approach in this regard. Afshari and Siavashi[40] showed that exchange rate can be increased the diversity of non-oil exports. The results reveal that, the increase in oil price have a positive effect on Iran's steel exports to China. This means that the increase in oil prices, which indicates an improvement in the global economy, can lead to more consumption of steel in the world and thus increase steel exports. This result is consistent with Todshki and Ranjbaraki[8] study.

Given that China is one of Iran's main trading partners, the results of this study could help expand Iran's steel exports to China. Also, the government and the Central Bank of Iran should use appropriate exchange rate policies to prevent exchange rate fluctuations to improve the trade balance of the country's steel sector. Finally, due to the lack of studies on the relationship between economic variables and the production and exports of steel, it is suggested that researchers in this field pay special attention to the steel sector in their studies.

References

[1] K. Munir, Z. Javed: J. Bus. Stud. Q., 7 (2018): 225.

[2] O. Raveh, A. Reshef: J. Dev. Econ., 118 (2016): 183.
[3] F. Al-Marhubi: Appl. Econ. Lett., 9 (2000): 559.
[4] M. F. Arip, L. S. Yee, B. Abdul Karim: MPRA., (2010).
[5] D. Salvatore: International Economics (International Finance), Ninth Edition, Ney Publications, (2007), 1.
[6] M. Bahmani-Oskooee, A. Usman, S. Ullah: Eurasian Econ. Rev., 10 (2020): 163.
[7] K. Grier, A. Smallwood: JMCB., 39 (2007): 965.
[8] N. E. Todshki, A. Ranjbaraki: Procedia Econ. Financ., 36 (2016): 390.
[9] H. Umaru, A.A. Niyi, N.O. Davies: IJAAFMR., 8 (2018): 131.
[10] A. D. Smallwood: Econ. Model., 82 (2019): 332.
[11] M. Auboin, M. Ruta: World Trade Rev., 12 (2013): 577.
[12] S. M. Juhro, D. H. B. Phan: BMEB., 21 (2018): 1.
[13] P. B. Clark, N. Tamirisa, S. J. Wei, A Sadikov, L. Zeng: IMF., 235 (2019).
[14] M. McKenzie: J. Econ. Surv., 13 (1999): 71.
[15] G. P. De: IMF Staff Pap., 35 (1988): 63.
[16] W. Ethier: Am Econ Rev., 63 (1973): 494.
[17] P. B. Clark: West. J. Agric. Econ., 11 (1973): 302.
[18] G. Franke: J Int Money Finance., 10 (1991): 292.
[19] J. M. Viaene, C. de Vries: Eur. Econ. Rev., 36 (1992): 1311.
[20] P. Sercu, C. Vanhulle: J Bank Financ., 16 (1992): 155.
[21] J. G. Thursby, M. C. Thursby: Rev Econ Stat., 69 (1987): 488.
[22] M. W. Klein: J Int Money Finance., 9 (1990): 299.
[23] J. A. Frankel, S. J. Wei: IMF., 4335 (1993): 111.
[24] K. Kroner, W. Lastrapes: J Int Money Finance., 12 (1993): 298.
[25] P. Bacchetta, E. van Wincoop: Am Econ Rev., 90 (2000): 1093.
[26] K. Grier, A. Smallwood: J Money Credit Bank., 39 (2007): 965.
[27] S. Tenreyro: J. Dev. Econ., 82 (2007): 485.
[28] D. Bredin, J. Cotter: Econ. Inq., 46 (2008): 540.
[29] W. Fang, Y. Lai, S. Miller: J Int Money Finance., 28 (2009): 215.
[30] S. Rahman, A. Serletis: J. Macroecon., 31 (2009): 500.
[31] C. F. Baum, M Caglayan: J Int Money Finance., 29 (2010): 79.
[32] S. A. Hassan, K. Zaman: Econ. Model., 29 (2012): 2125.
[33] K. Grier, A. Smallwood: J Int Money Finance., 37 (2013): 282.
[34] J. Bouoiyour, R. Selmi: J Int Trade Econ Dev., 24 (2015): 201.
[35] L. Kilian., A. Rebucci: J. Int. Econ., 77 (2007): 181.
[36] H. Mashhadi Mohammadi, A. Shakeri, M. Mahmoudzadeh: Quarterly Journal of Financial Economics., 8 (2014): 15.
[37] S. Moshiri, k. Pakizeh, M. Dabirian, A. Jafari: Iranian Journal of Economic Research, 14 (2010): 74.
[38] R. Engle: J. Bus. Econ. Stat., 20 (2002): 339.
[39] Y. K. Tse, A. K. C. Tsui: J. Bus. Econ. Stat., 20 (2002): 351.
[40] Z. Afshari, M. Siavoshi Zangiani: J. Econ. Dev. Pol, 7(2019), 9-33.