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RESEARCH PAPER

Real Exchange Rate Shocks and Export-Oriented Businesses in Iran: An Empirical Analysis Using NARDL Model

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Abstract
In this paper by applying the NARDL approach, we revisit the "fear of appreciation" hypothesis in the case of Iran by analyzing the effects of exchange rate shocks (both appreciations and depreciations) on the various export-oriented industries in the Tehran Stock Exchange. To this aim, the data used include monthly data of both main variables, i.e. real exchange rate, different stock market indexes (which include Petrochemical, Basic Metal, and Mining industries indexes), and control variables, i.e. inflation, OPEC oil price, and international sanctions. Our findings illustrate that not only have exchange rate shocks significant effects on different stock indexes but also these relationships are asymmetric and nonlinear. Moreover, our results have confirmed the fear of depreciations hypothesis in the export-oriented industries in the Tehran Stock Exchange.
Keywords: Exchange Rate Shocks, Export-Oriented Industries, Fear of Depreciation, NARDL Model.
JEL Classification: C58, F31, E44, G32.

Introduction

Exchange rate shock and its significant impacts on various indicators of an economy is not, generally, an emerging phenomenon in the economic literature, and there are a variety of examples in the global economy (Erdoğan et al., 2020; Chen and Lin, 2019; Ho and Huang, 2015). In the case of Iran and, more specifically, after the Islamic Republic Revolution of 1979 until mid-2020, the foreign exchange rate, i.e. the United States Dollar or USD, has experienced extraordinary increases, around two thousand and five hundred times, from 80 IRR to up to approximately 200000 IRR (See the Statistical Center of Iran webpage). This dramatic increase has not occurred through a constant or uniform trend. To be more precise, it has taken place over different unpredicted shocks and high volatile periods. On this basis, the issue that has always attracted particular attention in the realms of macroeconomic policy debates and also business analysis has not been the growth of the exchange rate, but the sudden and unexpected rise in this index. A phenomenon sometimes is called "exchange rate shock" in economic literature (Babajani Baboli et al., 2018). Based on this stylized fact, the primary concern of this paper includes analyzing the impacts of exchange rate shocks on different export-oriented businesses in Tehran stock Exchange, TSE[1]

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1. The main stock market in Iran.

To illustrate the crucial role of stock market in developing countries like Iran, it should be noted that stock market, generally, is one of the essential markets that play a significant role in establishing and maintain the long-run and stable equilibrium in an economy. To be more precise, as a subsector of the financial market, share markets can lead the economy to more capital formation and GDP growth through raising capitals and channelizing the investments into various private or governmental projects or business plans, redistributing of total income and wealth, improving corporate governance[1] (Erdoğan et al., 2020; Heidari et al., 2019). Depending on the nature, economic infrastructure and strength, production capacity, and the ratio of trade growth to GDP growth, the role of the stock market in an economy depends on several factors and the reaction of market agents to different exogenous shocks that threaten their profitability. In line with this, as empirical studies related to the economy of Iran demonstrate, the most significant threats in this stock market can be classified into two groups: (i) global risks include international sanctions, oil price shocks, and exchange rate fluctuations; (ii) domestic risks like significant movements in the indicators of competitive and alternative financial markets, economic growth, and inflation (Heidari et al., 2019; Haeri Nasab and Sohaili, 2019; Kordlouie et al., 2018). As it is clear from the real evidence of Iran's economy (especially after 2012, 2018, and 2020 rapid decline in Iranian Rial) and also based on the results of Heidari et al., 2019; Zamanian et al., 2017; Jahangiri and Hoseini Ebrahimabad, 2017 studies, among all these effective factors, the role of exchange rate shocks seems to be more decisive, especially in recent decades.

Relying on the arguments of Zarei (2020); Babajani Baboli et al. (2018); Zamanian et al. (2017), the crucial effects of exchange rate shocks on stock market can be supported from two assorted views, theoretically and empirically. In this regard, in these two researches, why does exchange rate shocks play an undeniable role in the spread of instability in the economy of Iran has been addressed. They, moreover, unanimously emphasis that the primary sources of instability and imbalance in the single-product economy of Iran come from a vicious cycle. Regardless of Iran's foreign exchange market’s fundamental problems like lack of the central bank independence, the exchange rate misalignment and the existence of multiple exchange rate systems2 (Zarei, 2020), he roots of this vicious cycle stem, on the one hand, from the remarkable reliance of government budget and supply-side of foreign exchange market to the income comes from oil exports; from the volatile nature of the oil market. Consequently, the increased inflation leads to a considerable decrease in the power purchasing parity of domestic currency or a noteworthy enhancement in the foreign exchange rate; again, the increased exchange rate would raise inflation. Generally, exchange rate appreciation, as a relative export advantage, may lead to a significant economic growth. However, due to reasons like (i) the small share of the non-oil economy; conversely, the significant dependence of Iran's single-product economy on oil exports, (ii) weak infrastructure and lack of suitable platforms to increase Gross Domestic Products, and most importantly, (iii) the existence of international sanctions, exchange rate appreciation cannot necessarily lead to increased exports and the strengthening of the domestic currency, and in some cases, it can even exacerbate the situation and raise the exchange rate again.

This cycle will continue with decreasing magnitude of effects. In response, central bank of Iran has adopted a managed floating exchange rate regime to control the ramifications of such a vicious cycle, manage the significant pass-through from exchange rates into inflation, prevent imbalances and inefficiencies in the financial markets, and keep the exchange rate on a long-term equilibrium path. This policy, which known as a "leaning-against-the-wind" policy, is a type of intervention in the exchange market that implements through selling home currency

1. Through enhancing managerial efficiency and standards to catch the eyes of shareholders
2. That exacerbate the instability in different sectors of the economy.

during the period of appreciation and, conversely, buying the domestic currency while it is depreciating (Chen and Lin, 2019). Under such circumstances, the responses of various sectors of an economy to exchange rate appreciations and depreciation would be unequal and asymmetric. As a result, statistically investigating of various industries' reactions to different types of exchange rate shocks is the primary concern of this study. Hence, the main hypotheses of this paper are:

Hypothesis 1: Various export-oriented industries in the Tehran stock market produce an asymmetrical and different reaction to exchange rate appreciations and depreciation.

Hypothesis 2: The effects of real exchange rate shocks on export-oriented businesses follows a nonlinear and asymmetric behavior.

Accordingly, through these hypotheses we can formally test the idea of whether export-oriented companies in Iran response asymmetrically to exchange rate appreciation and depreciation. In other words, we are going to test the "fear of appreciation" hypothesis in the behavior of export-oriented businesses in the TSE.

To be more precise, the rationale behind this hypothesis is that since central banks, generally, tend to intervene in the foreign exchange market to defend competition in the export-oriented businesses, they usually try to limit exchange rate appreciations rather than depreciations (Zamanian et al., 2017). It is important to say that, to measure the exchange rate appreciation and depreciation, the exchange rate shocks will be decomposed into the negative and positive components, respectively (See Adeniyi and Kumeka, 2019; Chen and Lin, 2019; Komijani et al., 2013). Therefore, by achieving the time series data of exchange rate appreciation and depreciation, it would be possible to test whether the effects of exchange rate appreciations on the export-oriented businesses (the fear of appreciation hypothesis) is statistically significant[1]. Simultaneously, we can examine whether the mentioned relationship follows a nonlinear and asymmetric behavior.

Ultimately, in this study, the asymmetric and nonlinear effects of exchange rate shocks on some selected export-oriented businesses in the TSE (which are petrochemical, metal, and Mine stock index) examines. To this aim, in addition to using a NARDL[2] model, which can analyze the asymmetrical relationship between different variables, the monthly standardized logarithmic time series data from 2012:01 to 2020:01 will be used. The data include the selected industries and foreign exchange rate (Dollar to Rials) as the main variables of the study and also some applicable control variables like inflation, OPEC oil price, and international sanctions imposed on Iran. The rationale behind choosing control variables comes from reasons such as confirmation of theoretical and empirical evidence, stylized facts of Iranian economy, data availability, and the frequency of the available time series data.

Theoretical Framework

Export-Oriented Businesses in the TSE

To address the main concerns of this study, we must, first, determine the answer of these questions that are: what export-oriented industries consider in this study and why? Answering this question requires an overview of the TSE's role and position in the economy of Iran and, also, the industries active in this market.

With more than half a century of experience, Tehran Stock Exchange has been one of the most important stock markets in Iran, while there are also three other types of active stock markets

1. The same applies for testing the fear of depreciation hypothesis.
2. Nonlinear Auto Regressive Distributed Lags

such as Iran's OTC[1] market known as Iran Fara Bourse (IFB), Iran Mercantile Exchange (IME), and Iran Energy Exchange (IRENEX). In Iran, there is no foreign currency exchange market for transactions, exchanges or investment of foreign currencies in the traditional global form.

Various industries are operating in the TSE that the most important of which are: investment industries, petrochemical industries, basic metals industry, mining industries, banks and credit institutions, telecommunications, automobile and parts manufacturing, cement industry, etc (See Securities and Exchange Organization). Examining the performance, stability, profitability, trading volume and market share of the top 50 companies active in the stock market support the idea that either their field of specialization or investment portfolio components can be categorized in the export-oriented businesses (Except for some companies that operate entirely domestically).

The fundamental question here is; what factors have led to the economic prosperity of export-oriented companies in Iran? To answer, it should be noted that the decisive factors cause the expansion of export-oriented businesses are the financial situation, revealed comparative advantages, development strategies, long-run perspective of the economy in which they act (Zamanian et al., 2017). Accordingly, the economic authorities of Iran have recently prioritized various programs to reduce the share of oil incomes from the government budget and rely more on non-oil exports. This policy has led the country to choose and pursue the export promotion (vs import substitution) development strategies as its main executive goal. For instance, as stated in Iran's 20-year National Vision (by the end of 2025), achieving first ranked country in the region by exports and also diversifying and expanding the non-oil exports in the industrial, mining and trade sectors, are the primary missions of the industry, mine, and trade ministry. In line with this, according to the Sixth Five-Year National Development Plan (for 2016–2021), the country's non-oil exports should grow by 21.7 percent annually (should reach $ 120 billion in 2025). Thus, Iran's strategic policies in its long-run roadmap have led to significant profitability growth in those joint-stock companies that international trade makes up a significant portion of their activities; such as Esfahan's Mobarakeh Steel Company; Persian Gulf Petrochemical Industries Company; National Iranian Copper Industry Company; Ghadir Investment Company; Iran Khodro Automaker company; Esfahan Steel Company; Investment Banks like Saderat, Pasargad, and Mellat, etc. The common and main features of these companies are (i) most of them are mainly operating (directly or indirectly through investing) in the fields of petrochemical, basic metal, and mining industries in which the Iranian economy has revealed relative advantages; (ii) a significant share of their total income came from international trade. All in all, due to the importance and status of the petrochemical, basic metal, and mining industries, the functional framework of this study concentrates on these export-oriented businesses in the TSE. Selected Industries are Petrochemical, Metal, and Mining Industries. In what follows, a brief overview of the selected export-oriented businesses, i.e. the petrochemical, metal, and mining industries, will respectively be provided to support why these indexes are among the most demanding stocks (even during the sanctions).

The Petrochemical Industry Stock Index

As the most critical industries in Iran and Tehran stock market, the petrochemical industry has been an attractive investment destination for many domestic and international investors Moreover, the foreign exchange earnings of this industry have been the highest among the non-oil exporting industries, especially in recent years. Furthermore, another most exciting point about such industries is that the demand for the products of these companies is so high that despite the international sanctions on Iran's economy, many of them continue to export in

1. Over-The-Counter

various ways (Zarei, 2020). Besides, the petrochemical companies in the TSE have recorded the most positive records like profitability, trading volume, liquidity, demand for purchases, etc. On top of that, its vital position in the economy of Iran can be proved by the significant number of (over 30%) petrochemical companies among the top 50 companies by early 2020, the total volume of investment in this industry which is far more than each of other competing areas, and the remarkable daily value of traded shares of this industry in comparison with the other traded shares in the TSE; therefore, this industry has always been able to overcome a significant number of obstacles about financing, taxes, infrastructural, and policies-making problems (Khosrowzadeh et al., 2020). Therefore, the information about this industry nicely show the reasons behind the popularity of petrochemical stock index in the TSE.

The Basic Metal Industry Stock Index

After the petrochemical industry, the basic metals industry is, generally, in the second place of the top exporting industries in the country. As reviewing the official news of the TSE show, this average ranking (based on the trading volumes in the TSE) has even saved, approximately, during the first semi-year 2020. Besides, whether it is expected from the companies act in the basic metal industry to have profitability growth, business prosperity, and strong position in the future is a decisive question about the future of this strategic industry in Iran. The convincing reasons that can lead us to expect such a thriving future in that industry include: the growing demand for the industry's products in the world, the stable, in average, trend of high volume transactions in most top stock exchange in the world, and significant profitability of the widely used by-products in international trade, as well as Iran's significant comparative advantage in the production and export of final products and even raw materials such as zinc metal, lead, and copper (Argha et al., 2020).

The Mining Industry Stock Index

Remarkable revealed comparative advantage in the Iranian economy together with extensive actual export capacity have made the mining industry a profitable and stable industry. Precisely, the reasons that helped such companies to become much more lucrative than many other competitors in the TSE are: the diversity of Iran's underground resources, the existence of considerable actual export targets, huge profits and high added value of final manufactured products, high employment rate and export-oriented nature and, finally, becoming an advantage as well as an inflationary shield for shareholders during various exchange rate shocks. More interestingly, as Zolfaghari and Shahabi (2015) claim, Iran's unique capacity for a mass of strategic mineral reserves along with its achievable and feasible export incomes have the potential to be replaced by the total oil revenues in the administration of such a single-product country.

Asymmetric and Nonlinear Effects of Exchange Rate Shocks

Theoretically, both exchange rate appreciation and depreciation can affect domestic prices, economic growth, stock indexes, and other economic indicators through different channels that are the “marginal cost channel” (through changing the costs of imported inputs, especially for those firms which provide their inputs from international suppliers), “inflationary expectations (with the help of future price adjustments) or markup channel” (by changing the value of imported goods and services due to exchange rate appreciation or depreciation, the domestic suppliers should adapt their prices to maintain their market shares even if they have nothing directly to do with international trade.), and "macroeconomic policies channel"; Significant exchange rate movements that culminates in different macroeconomic policies, can change the flow of aggregate supply and demand.(Khosrowzadeh et al., 2020; Erdoğan et al., 2020; Chen and Lin, 2019). In response to these shocks, economic authorities, private investors as well as business owners try to assess and manage the consequences of these shocks. The monetary authorities and governments, on the one hand, make some policies to manage the high level of exchange rates pass-through to domestic inflation, encourage export competitiveness among different firms and businesses, promote economic growth, reduce the likelihood of exchange rate volatility, expand the long-run balance in other markets and consequently the whole economy (Heidari et al., 2019; Jahangiri and Hoseini Ebrahimabad, 2017). Business owners and investors, on the other hand, do not follow public-benefit oriented strategies. They, speculatively, adopt and implement decisions through which they can maximize their own profits while the exchange rate is fluctuating (Muller and Verschoor, 2006).

In line with this, almost all recent studies in the effects of exchange rate shocks on different economic indicators can be classified into two groups, if the small percentage of interdisciplinary studies is ignored: (i) Macroeconomic-center studies which have concentrated more on the impacts of the shocks on macroeconomic variables like GDP, inflation, unemployment, total private-sector consumption, monetary and fiscal policies, and so forth (See Warshaw, 2020; Dieci and Westerhoff, 2013; Chkili et al., 2012; Fang et al., 2009) (ii) business-oriented researches which have focused on various subsectors or industries of different economies, like banks, agriculture, healthcare, international trade, stock market, etc. (See Khosrowzadeh et al., 2020; Zolfaghari and Sahabi, 2015).

Moreover, another interesting point is the existence of a common feature or assumption among most of the studies indicates the impacts of exchange rate shocks on economic variables (e.g. stock exchange index) are symmetric. For example, if currency appreciation causes a decrease in the stock index, it is assumed that depreciation would have the opposite effects (Bahmani-Oskooee and Saha, 2015). To clarify this issue, Miller and Reuer (1998) argue that, generally, when firms use real options to hedge against fluctuations of the exchange rate, no matter do they active in domestic or international business, their pricing and managerial reactions to the exchange rate appreciation would be different compared to depreciation. This difference in their reactions, support the significance of asymmetric hedging. In the same way, Koutmos and Martin, in 2003, applied and support the idea of asymmetric impacts of exchange rate through measuring exchange rate depreciations and appreciations by decomposing them. Using the partial sum concept and standard methods in different sectors of the U.S., Japan, Germany, and the U.K., they support the significance of asymmetric exchange rate exposure.

Furthermore, the research literature confirms the coexistence of asymmetric relationships and nonlinearity between different economic variables. As the financial theory supports, the reason behind this type of relationship is related to uncertainties caused by some significant high volatile variables like exchange rate. In this regard, while uncertainties spread as a result of exchange rate shocks, the cooperate cash flows will nonlinearly be a function of the exchange rate; the market shares of different firms will be reshaped because of adjusting their price and supply volume; the default risks of companies will change due to the increase in the cost of transactions (Bartram, 2004). Accordingly, studies of Xie et al., 2020; Sikhosana and Aye, 2018; Krapl, 2017; Dieci and Westerhoff, 2013; Fang et al., 2009; Muller and Verschoor, 2006) provide further empirical supports for the existence asymmetric and nonlinearity of the relationship between exchange rate fluctuation and stock price in different case studies. The same will be valid even about the effects of exchange rate volatility on stock index supported by Erdoğan et al., 2020; Warshaw, 2020; Tian and Hamori, 2016; Chkili et al., 2012. They confirm the existence of an asymmetric and nonlinear relationship between exchange rate volatility and stock market index.

Exchange rate Shocks and Export-Oriented Industries

As one of the influential market-based factors, the exchange rate would be influenced by not only some domestic economic policies but also some international economic and political events (Khosrowzadeh et al., 2020). The unstable nature of this variable causes many remarkable changes both in macro- and micro-level indexes. Variables like total exports and imports, balance-of-payments, relative competitive advantage, investment, Inflation rate, and GDP as macroeconomic variables, and also input prices, profitability, productivity and the performance of different businesses as micro-level indicators (Babajani Baboli et al., 2018). In this respect, most businesses operating in an economy are directly or indirectly affected by movements in the foreign exchange market. The extent of this effect depends on several decisive factors, such as: the country's economic power, level of development, manufacturing infrastructure, natural resources and other comparative advantages, financial markets role in channeling investors funds from investors to different corporations, and so forth. Industries dealing with international trade are among the first directly affected sectors by exchange rate shocks. To be more precise, exchange rate movements can significantly affect the production costs, firms' output, out-of-pocket expenses (like supply costs), the international competitive advantage of all domestic productions, total exports and profits of the companies (Dornbusch and Fischer, 1980); consequently, their shares in the stock markets. The businesses that act completely in domestic markets would indirectly be affected by the fluctuations in the exchange rate due to the likely changes in the imported inputs' costs, inflationary expectations, or profit margin. In this regard, many studies support the effects of exchange rate shocks on the performance of different industries (See Argha et al., 2020; Zarei, 2020; Khosrowzadeh et al., 2020; Heidari et al., 2019; Zolfaghari and Sahabi, 2015).

Finally, to achieve the most efficient and significant modelling results, choosing and applying the most appropriate control variables would be valuable and decisive. In harmony with this, despite the remarkable role of exchange rate shocks in explaining the behavior of different export-oriented industries indexes, there are other compelling challenges that have caused significant changes in the production and, subsequently, export process of such industries (Zolfaghari and Sahabi, 2015; Fang et al., 2009). As reviewing the stylized facts of economy of Iran demonstrate, the most critical challenges for export-oriented businesses in such a single-product economy would be international sanctions, different economic uncertainties, lack of both domestic and Foreign Direct Investments, i.e. FDI, the inefficiency of the transportation system, cumbersome and inefficient tax system, lack of competition as well as the government management of all these industries. All these challenges can be classified into three groups include (i) fundamental obstacles (like inefficient transportation system that is rooted in the economic structure of country); (ii) policy-making issues (such as international sanctions or inflation that represent the results of macroeconomic and political policies can be observed in the changes of such variables); (iii) market-oriented shocks (like exchange rate shocks). Although investigating the fundamental obstacles are not considered in this paper, the main concentration is on one of the major market-oriented concerns in Iran, i.e. exchange rate shocks. In addition to these shocks, some control variables such as the international sanctions, oil price movements, and inflation rate are considered as representative of the policy-making issues.

Empirical Results

Based on the vital role of the foreign exchange market in the long-run equilibrium of an economy, like Iran, understanding the extent to which exchange rate's positive and negative shocks affect different sectors of the economy seems essential for both macro and micro decision-makers. Regarding this primary research purpose, together with applying the NARDL model, the monthly standardized logarithmic data of metal stock index (LMTI), mine stock index (LMI), petrochemical stock index (LPCI), the real exchange rate inflation (LINF), OPEC oil price (LOIL), and international sanctions imposed on Iran (S), from 2012:01 to 2020:01, have been used.

In line with this, to demonstrate the features of the data, it should be stated that, firstly, the mentioned data gathered from the official websites of Iran's statistic center, Tehran stock exchange, OPEC, and the Islamic Republic Iran's central bank. Secondly, as theoretical and experimental evidence indicate, in some cases, the effects of positive and negative exchange rate shocks on various economic variables such as stock market indices are significantly distinctive (or is there a significant difference between “fear of appreciation” and “fear of depreciation”). Consequently, in this paper, the exchange rate data has been decomposed into positive and negative time series, respectively ($LEXR^{+}$) and ($LEXR^{-}$), based on Ullah et al. (2020) survey. Finally, the (S) variable is a dummy one so that the data were one when nuclear sanctions imposed on Iran and the data were zero when the sanctions were either lifted or suspended. To be more precise, during the investigation period, there were to group of “One” in dummy variable data to show the periods in which the international sanctions had been imposed. The first one started at 21st march 2012 to 17th December 2015, on which some of these sanctions were lifted. The next one started at 8th may 2017 when the United States announced its withdrawal from the Joint Comprehensive Plan of Action (JCPOA) and prolonged until the end of the study period.

According to the mentioned data, in the following, various stages will be done to estimate the empirical results. In this regard, a statistically accurate estimation needs some pre-modelling tests. One of the essential pre-modelling tests, especially in using time series data, is a unit root test that helps to eliminate the possibility of spurious regression. In line with this, the ADF stationary test, introduced by Dicky and Fuller (1979), has been exerted on the research variables, as follows:

Table 1. The Unit-Root Tests

	At Level			At First difference	
	None	**Intercept**	**Intercept and Trend**	**None**	**Result**
LPCI	2.626 (0.998)	-0.909 (0.781)	-1.353 (0.868)	-8.465 (0.000)	I(1)
LMI	-1.182 (0.214)	-2.127 (0.234)	-1.189 (0.907)	-7.511 (0.000)	I(1)
LMTI	-0.815 (0.359)	-2.153 (0.225)	-1.621 (0.777)	-6.574 (0.000)	I(1)
$LEXR^{+}$	2.186 (0.993)	0.032 (0.958)	-1.212 (0.902)	-4.961 (0.000)	I(1)
$LEXR^{-}$	4.452 (1.000)	0.998 (0.996)	-0.309 (0.989)	-3.593 (0.000)	I(1)
LINF	0.599 (0.844)	-0.813 (0.811)	-0.107 (0.994)	-2.035 (0.041)	I(1)
LOIL	-1.689 (0.086)	-1.752 (0.402)	-2.441 (0.356)	-7.313 (0.000)	I(1)
S	-9.695 (0.000)	-	-	-	I(0)

Source: Research finding.

Table 1 demonstrates that all research variables, except S, which is stationary at level, are first difference integrated, i.e. I(1). Thus, if there is, at least, a long term co-integrated relationship among the non-stationary variables, the concern of spurious regression would be left behind. Therefore, in the table below, the co-integration among three groups of non-stationary variables will be tested by the Johansen- Juelius method, proposed in 1990.

The results of table 2, based on Trace and Max-Eigenvalue criteria, corroborate that at least one co-integration relationship, are existence among the variables. Therefore, using the NARDL model to evaluate the relationship between the research variables is cogent.

Table 2. The Co-Integration Tests

Variables: LPCI, LEXR+, LEXR-, LINF, LOIL & Constant: C and S					
Data Trend	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	1	1	2	2
Maximum Eigenvalue	1	1	1	1	1
Variables: LMI, LEXR+, LEXR-, LINF, LOIL & Constant: C and S					
Data Trend	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	1	1	1	1
Maximum Eigenvalue	1	1	1	1	1
Variables: LMTI, LEXR+, LEXR-, LINF, LOIL & Constant: C and S					
Data Trend	**None**	**None**	**Linear**	**Linear**	**Quadratic**
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	1	1	1	1
Maximum Eigenvalue	1	1	1	1	1

Source: Research finding.

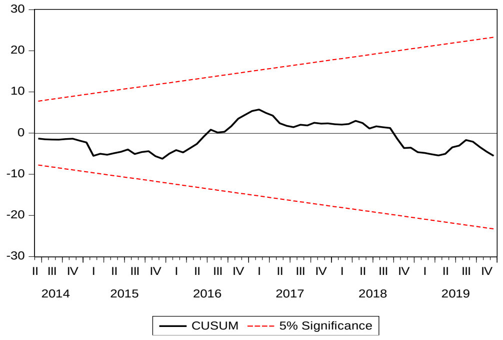
Table 3. The Long-Run Equations of the NARDL Model

Coefficient Name in the Equation	**The Dependent Variable: LPCI**		**The Dependent Variable: LMI**		**The Dependent Variable: LMTI**	
	Independent Variables	**Coefficient**	**Independent Variables**	**Coefficient**	**Independent Variables**	**Coefficient**
C(1)	C	7.82*	C	0.56***	C	4.39**
C(2)	$LEXR^{+}_{t}$	1.93*	$LEXR^{+}_{t}$	1.62**	$LEXR^{+}_{t}$	1.18*
C(3)	$LEXR^{-}_{t}$	-1.54*	$LEXR^{-}_{t}$	-2.15*	$LEXR^{-}_{t}$	-2.07*
C(4)	$LINF_t$	0.68**	$LINF_t$	0.39*	$LINF_t$	0.45**
C(5)	$LOIL_t$	-1.09*	$LOIL_t$	-0.47**	$LOIL_t$	-0.21*
F-Bound	4/01*		5/46*		4/53*	

Source: Research finding.
Note: *, **, and ***, respectively, represent 99%, 95%, and 90% significance level.

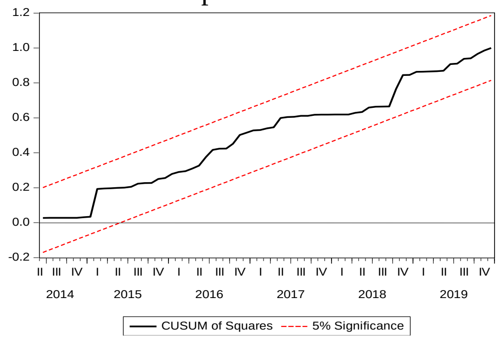
There are three long-run equations among the different dependent (LPCI, LMI, and MLTI) and independent ($LEXR^{+}_{t}$, $LEXR^{-}_{t}$, LINF, and LOIL) variables presented in various columns of Table3. On this basis, results of F-Bound test (as a criterion of the Johansen-Juelius test) demonstrates that the co-integrated (long-run) relationships among each group of variables are statistically certified. In harmony with this, except for the constant variable of LMI, all the coefficients of long-run NARDL models are significant at the 95%, or more, confidence level. Furthermore, while the coefficients of $LEXR^{+}$, and LINF in all long-run equations have been positive and significant, the effects of $LEXR^{-}$, and LOIL have been negative on all three research dependent variables. In addition to the F-bound test, there are other post-modelling (diagnostic) tests that can prove the reliability and significance of such estimated models that CUSUM and CUSUM-Square tests are among the most widely used and reliable. These graphical tests are presented in Figures 3 to 8:

Figure 3. The NARDL Cusum test Graph of dLPCI



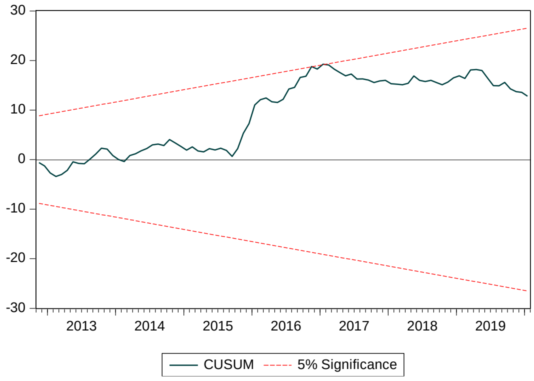
Source: Research finding

Figure 4. The NtARDL Cusum Square test Graph of dLPCI



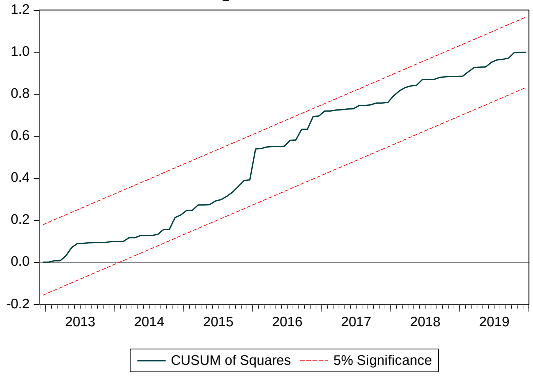
Source: Research finding.

Figure 5. The NARDL Cusum test Graph of dLMI



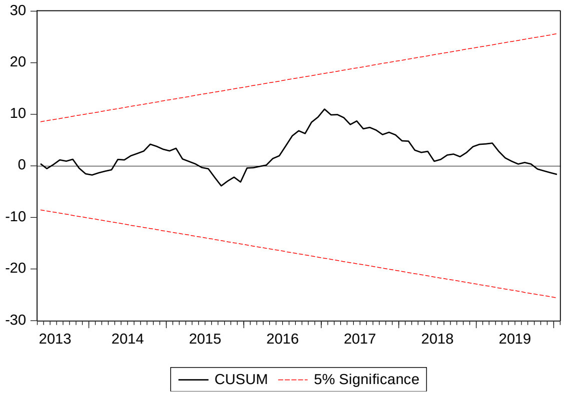
Source: Research finding

Figure 6. The NARDL Cusum Square test Graph of dLMI



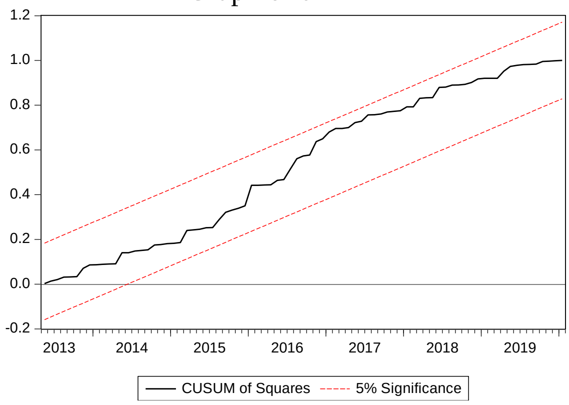
Source: Research finding.

Figure 7. The NARDL Cusum test Graph of dLMTI



Source: Research finding.

Figure 8. The NARDL Cusum Square test Graph of dLMTI



Source: Research finding.

As can be seen in the above graphs, in each figure, the models' residuals are located in the threshold bounds. Theoretically, this means that the standard errors and squared standard errors of the estimated model are low enough to trust in their results. Therefore, the results of CUSUM and CUSUM Square graphical tests verify the existence of stability in all of three estimated models. On this basis, after calculating the accurate long-run relationships by NARDL model, evaluating the short-run equation are required to figure out the dynamic relationships among these three groups of the research variables.

Table 4. The Short-Run Equations of NARDL Model

Coefficient Name in the Equation	The Dependent Variable: dLPCI		The Dependent Variable: dLMI		The Dependent Variable: dLMTI	
	Independent Variables	Coefficient	Independent Variables	Coefficient	Independent Variables	Coefficient
C(6)	LPI_{t-1}	-0.801*	LMI_{t-1}	-0.799*	$LMTI_{t-1}$	-0.819*
C(7)	$LEXR^{+}_{t-1}$	0.281**	$LEXR^{+}_{t-1}$	0.243*	$LEXR^{+}_{t-1}$	0.196*
C(8)	$LEXR^{-}_{t-1}$	-0.217*	$LEXR^{-}_{t-1}$	-0.465**	$LEXR^{-}_{t-1}$	-0.386*
C(9)	$LINF_{t-1}$	0.078***	$LINF_{t-1}$	0.063*	$LINF_{t-1}$	0.076**
C(10)	$LOIL_{t-1}$	-0.140**	$LOIL_{t-1}$	-0.067**	$LOIL_{t-1}$	-0.038***
C(11)	$dLPI_{t-1}$	0.47*	$dLMI_{t-1}$	0.61*	$dLMTI_{t-1}$	0.49*
C(12)	$dLPI_{t-2}$	0.23***	$dLMI_{t-2}$	0.30**	$dLMTI_{t-2}$	0.27**
C(13)	$dLPI_{t-3}$	0.16*	$dLEXR^{+}_{t}$	0.42***	$dLEXR^{+}_{t}$	0.49*
C(14)	$dLEXR^{+}_{t}$	0.27**	$dLEXR^{+}_{t-1}$	0.11**	$dLEXR^{-}_{t}$	-0.52**
C(15)	$dLEXR^{+}_{t-1}$	0.36*	$dLEXR^{-}_{t}$	-0.47*	$dLEXR^{-}_{t-1}$	-0.31***
C(16)	$dLEXR^{+}_{t-2}$	0.14***	$dLEXR^{-}_{t-1}$	-0.31***	$dLINF_{t}$	0.17*
C(17)	$dLEXR^{-}_{t}$	-0.30*	$dLEXR^{-}_{t-2}$	-0.20*	$dLINF_{t-1}$	0.14*
C(18)	$dLEXR^{-}_{t-1}$	-0.18*	$dLINF_{t}$	0.25*	$dLINF_{t-2}$	0.06***
C(19)	$dLINF_{t}$	0.23*	$dLINF_{t-1}$	0.10*	$dLOIL_{t}$	-0.16*
C(20)	$dLINF_{t-1}$	0.19***	$dLOIL_{t}$	-0.36*	S	0.478*
C(21)	$dLOIL_{t}$	-0.29*	S	0.378*	C	0.152***
C(22)	$dLOIL_{t-1}$	-0.15***	C	-0.114***	-	-
C(23)	S	-0.156*	-	-	-	-
C(24)	C	0.927*	-	-	-	-
Diagnostic criteria						
Adjusted R-squared	0.96		0.93		0.98	
F-statistics	295.826		112.197		930.385	
F-Probability	(0.000)		(0.000)		(0.000)	
Ljung-Box (1)	0.736		0.008		0.079	
Q-Probability	(0.392)		(0.932)		(0. 778)	
ARCH (1)	0.829		0.351		1.236	
ARCH-Probability	(0.362)		(0.554)		(0.267)	
DW statistics	2.0168		1.9879		1.9715	

Source: Research finding.

Before illustrating the dynamic short-run NARDL model results, it should be noted that both long-run and dynamic short-run (Error Correction model, ECM) estimate as a system modelling. In this study, however, to convey the results more clearly and accurately, we have decided to separate present the long- and short-run results, respectively, in table 3 and 4. This means that diagnostic criteria of NARDL models are pertinent to both tables. In this regard, the adjusted R-squared and F-statistics results confirm the significance and authenticity of three distinctive models. To be more precise, adjusted R-squared for LPCI, LMI, and LMTI are, in order, 96, 93, and 98 percent which means the independent variables of each model could explain approximately more than 90 percent of changes in the dependent variables' behaviors. Besides, the statistics and possibility of the Q (Ljung-Box) test, like Durbin Watson statistics, prove that there is no sign of serial correlations in the residuals of the models. Moreover, the results of the ARCH test show that there is no heteroscedasticity in the residuals of the models. Furthermore, the results confirm that the coefficients of variables are not only significant at 90 percent confidence level but also consistent with the economic theories as well as the evidence of Iran's stylized facts. Based on these statistical diagnostic tests, it concludes that the result of the estimated NARDL model is significant and reliable.

In analyzing the coefficients, it should be noted that the C(6) to C(10) coefficients in each of three NARDL estimations are related to Error Correction Terms, ECT, while C(11) to C(24), if exists, are relevant to dynamic short-run equations. In terms of the dLPCI estimated model, three lags of the dependent variable (AR)[1] significantly affect dLPCI, respectively, with coefficients of 0.47, 0.23. 0.16. In addition, the cumulative impacts of $dLEXR^+$ and $dLEXR^-$ are the most effective variables on dLPCI, i.e. 0.77 and -0.48, respectively. In other words, if the exchange rate increases by one percent, the dLPCI would be augmented 0.77 percent and, similarly, if exchange rate decreases one percent, the dLPCI would be fell down 0.48 percent. Moreover, the dLINF and dLOIL have, successively, effects of 0.42 and -0.44 on the dLPCI. Furthermore, each period that sanctions las longer, the dLPCI recline by 0.156 unit.

When it comes to the dLMI, the cumulative coefficients of $dLEXR^+$ and $dLEXR^-$ are 0.53 and -0.78, whereas those of dLINF and dLOIL are 0.35 and -0.36 respectively. In this equation, the two lags of dependent variables are significant and, more interestingly, the sanctions positively affect the dLMI. In other words, prolonging the international sanctions bring about an enhancement by 0.378 in the mine stock index, which is more than such condition in the case of petrochemical stock index. Additionally, considering the dLMTI, the cumulative influences of $dLEXR^+$ and $dLEXR^-$ are 0.49 and -0.83, while the cumulative effects of dLINF and dLOIL are 0.37 and 0.16 successively. Moreover, there are two significant autoregressive variables in the model and, more interestingly, prolonging sanctions cause to an increase in the amounts of both LMTI and LMI changes.

Comparing the results of three different estimated NARDL models, the longest-lasting coefficient in the dLPCI, dLMI, and dLMTI is, respectively, $dLEXR^+$, $dLEXR^-$, and dLINF. Besides, the most effective independent variable in the dLPCI, dLMI, and dLMTI is, successively, $dLEXR^+$, dLEXR, and $dLEXR^-$. Moreover, although the dLINF and LOIL have, in order, positive and negative impacts on the the independent variables. Besides, international sanctions cause to increase in both dLMI and dLMTI, while it makes a decrease in the dLPCI during the investigation period.

Although in the ARDL model, the error correction term estimates as the coefficient of long-run residual's first lag, in the NARDL model, ECT (or m_h) calculates through the separately estimated coefficients. The ratio of the independent variables first lag coefficient to dependent variable first lag coefficient, in dynamic short-run equation. This way of evaluating the ECT can give more accurate sights to more meticulously analyzing the relationships among variables than the other ECMs, like ECM, ARDL, CECM, TAR, MTAR, and so forth (Zarei, 2020). In this regard, in table 5, the formulas for calculating each ECT and its longevity are presented. More precisely, ECT coefficient which shows the dynamic relationship in the estimated model, indicates if an exogenous shock from each independent variable makes the model lose its long-term equilibrium path, the impact of this shock (i.e. its longevity) will be disappeared or neutralized after how many periods. Based on these concepts, the longevity of any independent

1. Auto-Regressive variables

shocks will be measured by dividing one by the ECT coefficient, i.e. $\frac{1}{ECT}$ (Zarei, 2020).

Table 5. Calculating the ECT of NARDL Model

The Dependent Variable	dLPCI		dLMI		dLMTI	
The evaluated Criterion	**ECT**	**Longevity**	**ECT**	**Longevity**	**ECT**	**Longevity**
$m_{h_1}^{+}=\sum_{r=0}^{h}\frac{\partial Y_{t+r}}{\partial LEXR_{t+r}^{+}}=-\left\|\frac{C(7)}{C(6)}\right\|$	-0.3508	2.85	-0.3043	3.29	-0.2389	4.18
$m_{h_1}^{-}=\sum_{r=0}^{h}\frac{\partial Y_{t+r}}{\partial LEXR_{t+r}^{-}}=-\left\|\frac{C(8)}{C(6)}\right\|$	-0.2717	3.68	-0.5817	1.72	-0.4721	2.12
$m_{h_2}=\sum_{r=0}^{h}\frac{\partial Y_{t+r}}{\partial LINF_{t+r}}=-\left\|\frac{C(9)}{C(6)}\right\|$	-0.0971	10.29	-0.0783	12.78	-0.0933	10.72
$m_{h_3}=\sum_{r=0}^{h}\frac{\partial Y_{t+r}}{\partial LOIL_{t+r}}=-\left\|\frac{C(10)}{C(6)}\right\|$	-0.1748	5.72	-0.0841	11.89	-0.0462	21.65

Source: Research finding.
Note: *Y in each column is the first lag of the dependent variable, respectively LPI_{t-1}, LMI_{t-1}, and $LMTI_{t-1}$.

In the table above, if the shock rises from the positive changes in the exchange rate, the amount of ECT can be measured through $\sum_{r=0}^{h}\frac{\partial Y_{t+r}}{\partial LEXR_{t+r}^{+}}$. The interpretation of this parameter is if a shock from $LEXM^{+}_{t-1}$ brings about the instability of the long-run relationship; approximately 0.35 of the instability will be eliminated in each period. Thus, after roughly three periods, i.e. months, a new long-run equilibrium will be reached. This process will be the same for the other independent variables.

Table 6. Testing the Existence of Asymmetric Relationship

H_0	Value	Chi-square	Probability	Results
LPCI				
Long-Run C(2)-C(3) =0	3.473011	11.18074	0.0004	Rejected
Dynamic Short-Run				
$\sum_{i=0}^{q_1}\beta_{i_1}-\sum_{k=0}^{q_2}\beta_{k_1}=[C(14)+C(15)+C(16)]-[C(17)+C(18)]=0$	1.252174	5.923187	0.0084	Rejected
Error Correction Model				
$m_{h_1}^{+}$ - $m_{h_1}^{-}$ =0	0.235347	4.027636	0.0265	Rejected
LMI				
Long-Run C(2)-C(3) =0	3.774532	12.56703	0.0002	Rejected
Dynamic Short-Run				
$\sum_{i=0}^{q_1}\beta_{i_1}-\sum_{k=0}^{q_2}\beta_{k_1}=[C(13)+C(14)]-[C(15)+C(16)+C(17)]=0$	1.510952	5.092847	0.0138	Rejected
Error Correction Model				
$m_{h_1}^{+}$ - $m_{h_1}^{-}$ =0	0.278625	6.116542	0.0075	Rejected
LMTI				
Long-Run C(2)-C(3) =0	3.251019	9.341260	0.0012	Rejected
Dynamic Short-Run				
$\sum_{i=0}^{q_1}\beta_{i_1}-\sum_{k=0}^{q_2}\beta_{k_1}=[C(13)+C(14)]-C(17)=0$	0.838543	6.154353	0.0074	Rejected
Error Correction Model				

$m_{h_1}^{+}$ - $m_{h_1}^{-}$ =0	-0.76871	3.741234	0.0317	Rejected

Source: Research finding.

Finally, Wald test is, usually, the final diagnostic test to statistically evaluate the authenticity of applying NARDL. The Wald test, which is based on Chi-square statistics, examines whether there is any significant difference between two coefficients of a model. In this regard, we will apply this test to assess the existence of an asymmetric relationship between the positive and negative components of exchange rate, which is the only variable asymmetric coefficients of which can be tested by Wald test due to the fact that it has two different components, positive and negative. on different dependent variables, i.e. LPCI, LMI, and LMTI. To be more precise, there are three separate subsections in each system modelling (for dependent variables such as LPCI, LMI, and LMTI.), which are the long-run, dynamic short-run, and error correction models. Therefore, the mentioned Wald test should be applied on the positive and negative components of exchange rate in each subsection of the NARDL model that is estimated for the LPCI, LMI, and LMTI.

As can be seen in table above, it has been approved that there are statistically significant asymmetric relationships between positive and negative components of the exchange rate in all the mentioned equations and different time horizons.

Conclusion

Analyzing the impacts of real exchange rate shocks (a Dollar to Rials) on three export-oriented businesses (petrochemical, mine, and metal stock indexes), activing on the Tehran Stock Exchange market, has been conducted by a nonlinear asymmetric model, NARDL, in the period from 2012:01 to 2020:01. In this regard, addition to positive and negative components of real exchange rate, inflation, oil price, and international sanctions have been considered as the control variables. In line with this, the results of the research are as follows:

First of all, "fear of appreciation" hypothesis as one of the main concerns of this paper is rejected; consequently, "fear of depreciation" is accepted on the ground that the direct relationships among the dependent variables and exchange rate components have been proven. More precisely, when the exchange rate increased, the LPCI, LMI, LMTI have been raised and when the exchange rate decreased, these dependent variables have been felt down. The reason behind this issue roots in the type of these three industries. Indeed, these are export-oriented industries for which exchange rate appreciation gives rise to their products demand depreciation. In other words, the higher exchange rate, the more expensive products in the international arena, vice versa.

Secondly, the other research hypothesis, “various export-oriented industries in the Tehran stock market produce an asymmetrical and different reaction to exchange rate appreciations and depreciation”, is confirmed in both the long- and short- run horizons. In fact, the coefficients of the exchange rate positive and negative components, in the different time horizons equations of these three industries, were various so that the positive effects of exchange rate on petrochemical industries are higher than those of mine and metal industries, while the negative impacts of the real exchange rate on mine and metal industries is more than that of petrochemical industries. There are some cogent reasons for this phenomenon. Firstly, having less alternative as well as being more applicable in different industries, petrochemical industries have more demand than the two other research dependent variables. Moreover, supply shortage, towards aggregate world demand for petrochemical products, makes them more strategic even than the products of other export-oriented industries. To be more precise, the results of the study support the idea that in comparison with mine and metal products, petrochemical ones have more demandable.

Thirdly, the final hypothesis, "effects of real exchange rate shocks on export-oriented businesses follows a nonlinear and asymmetric behavior", is accepted. Since the results of whole NARDL model were statistically significant based on F-Bound, for the long-run models, and F-Statistics, for dynamic short-run models, the nonlinearity of the relationship among variables has been approved in all research estimated models. Moreover, asymmetric relationship among dependent variables and two separate components of the exchange rate, in long-run, dynamic short-run and error correction term viewpoints, have been confirmed based on Wald test results. Regarding to this, it seems that the "inflationary channel" for the positive effects of exchange rate works more for mine and metal than petrochemical industries. Indeed, when the exchange rate increase, two events would occur in Iran's stock market, exchange rate pass-through via inflationary channel and more demand for the export-oriented products due to reducing relative prices. These conditions, along with low marginal cost of petrochemical, mine and metal products, because these three industries have fewer operative costs (in dollar) like meeting foreign row materials together with fixed cost (in dollar) that need to be met once like importing technology. They bring about more profitability in such industries. Thus, through positive investors' expectations, international demand, and inflationary pass-through, an exchange rate appreciation lead to an increase in the three survey dependent variables. However, when an exchange rate decrease has taken place, both the relative and competitive advantages of these three industries would be declined due to becoming more expensive than before exchange rate decrease. Therefore, an exchange rate depreciation gives rise to reduction in sales and export amounts of the three export-oriented industries. In this context, the point is that the same amounts of exchange rate appreciation and depreciation make assorted changes in each of petrochemical, mine and metal stock price industries. It means that, the LPCI, LMI, and LMTI react asymmetrically to the exchange rate either appreciation or depreciation so that the effects of exchange rate depreciations in mine and metal industries are more than the same impacts of exchange rate appreciations. Nonetheless, in petrochemical industries, the influences of exchange rate appreciations are more than those of exchange rate depreciations. This issue roots in the more scarcity of petrochemical products than mine and metal. More accurately, the global reserves for producing petrochemical products are less than those of mine and metals. Such a circumstance brings about more downward sticky price for petrochemical stock index than the two other industries.

Related to the exchange rate and stock price relationship, findings of the present study are consistent with the results of Xie et al. (2020); Warshaw (2020); Sikhosana and Aye (2018); Krapl (2017); Tian and Hamori (2016); Dieci and Westerhoff (2013); Fang et al. (2009); Muller and Verschoor (2006); Bartram (2004); Koutmos and Martin (2003); Miller and Reuer (1998).

The other findings of the investigation are pertinent to the effects of the inflation, oil price, and sanction on the Petrochemical, mine, and metal stock indexes. In this regard, the inflation changes directly affect, respectively, the LPCI, LMTI, and LMI in the long- and dynamic short-run horizons. It is axiomatic that an increase in the inflation gives rise to the national currency devaluation, subsequently, decline in relative prices of exported goods, rise demand for the products, make more profitability, and ultimately augment their stock prices. However, oil price has an indirect relationship with the dependent variables so that the impacts of this control variable on petrochemical stock index is far more than the others in each time horizons. In fact, an enhancement of the oil price has boosted the foreign exchange revenues, increase the foreign currency supply, consequently, appreciate the national currency value, become the more expensive product prices, have less demand, and finally reduce in the export-oriented stock prices. Furthermore, during the study period, the international sanctions make a stunning number of limitations on Iran's export effects of which have been reflected on these three industries by reduction of their stock prices.

Ultimately, in terms of ECM and longevity in the NARDL framework, the positive and negative exchange rate shocks have the shortest longevity among other independent variables. After the exchange rate shocks, in order, the inflation and oil price shocks are prolonged. This means that, although in each period, the ECM of positive and negative exchange rate components are statistically different from each other, the amounts of the exchange rate error corrections are more than the inflation and oil price ones. Hence, if a shock from the exchange rate leads to a short-run imbalance, it will be eliminated far sooner than an imbalance caused by the inflation and oil price. indeed, the effects of the exchange rate are, faster, transmitted to the export-oriented stock prices than the impacts of the inflation and oil price.

References

[1] Adeniyi, O., & Kumeka, T. (2019). Exchange Rate and Stock Prices in Nigeria: Firm-Level Evidence. *Journal of African Business, 21*(2), 1-30.

[2] Argha, L., Mowlaei, M., & Khezri, M. (2020). Investigating Impact of the Selected Domestic and Foreign Assets Returns on Stock Price Index Returns in Iran: An Approach from DCC-FIAPARCH Model. *Applied Theories of Economics, 6*(4), 251-274.

[3] Babajani Baboli, M., Jalaei Esfandabadi, S. A. M., & Zayandeh Roody, M. (2018). The Impact of Shocks in Oil price and Exchange Rate on Inflation in Iran: The Application of the VAR Approach. *Environmental Energy and Economic Research (EEER) Journal, 2*(1), 51-61.

[4] Bahmani-Oskooee, M., & Saha, S. (2015). On the Relation Between Stock Prices and Exchange Rates: A Review Article. *Journal of Economic Studies*, *42*, 707–732.

[5] Bartram, S. M. (2004). Linear and Nonlinear Foreign Exchange Rate Exposures of German Nonfinancial Corporations. *Journal of International Money and Finance, 23*, 673–699.

[6] Chen, S. S., & Lin, T. Y. (2019). Do Exchange Rate Shocks Have Asymmetric Effects on Reserve Accumulation? Evidence from Emerging Markets. *The Scandinavian Journal of Economics, 121*(4), 1561-1586.

[7] Chkili, W., Aloui, Ch., & Nguyen, D. K. (2012). Asymmetric Effects and Long Memory in Dynamic Volatility Relationships Between Stock Returns and Exchange Rates. *Journal of International Financial Markets, Institutions and Money, 22*(4), 738-757.

[8] Dieci, R., & Westerhoff, F. (2013). On the Inherent Instability of International Financial Markets: Natural Nonlinear Interactions Between Stock and Foreign Exchange Markets. *Applied Mathematics and Computation*, *221*, 306-328.

[9] Dornbusch, R., & Fischer, S. (1980). Exchange Rates and The Current Account. *American Economic Review, 70*(5), 960-971.

[10] Erdoğan, S., Gedikli, A., & İsmail Çevik, E. (2020). Volatility Spillover Effects Between Islamic Stock Markets and Exchange Rates: Evidence from Three Emerging Countries. *Borsa Istanbul Review, 20*(4), 322-333.

[11] Fang, W. S., Lai, Y. H., & Miller, S. M. (2009). Does the Exchange Rate Risk Affect Exports Asymmetrically? Asian Evidence. *Journal of International Money and Finance, 28*(2), 215-239.

[12] Haeri Nasab, Z., & Sohaili, K. (2019). The Effect of the Main Variable of Money Market on Stock Price Index in Iran. *Iranian Journal of Finance, 3*(2), 88-104.

[13] Heidari, H., Refah Kahriz, A., & Mohammadzadeh, Y. (2019). Stock Market Behavior of Pharmaceutical Industry in Iran and Macroeconomic Factors. *Economic Change and Restructuring, 52*, 255-277.

[14] Ho, L. C., & Huang, C. H. (2015). The Nonlinear Relationships Between Stock Indexes and Exchange Rates. *Japan and the World Economy, 33*, 20-27.

[15] Jahangiri, K., & Hoseini Ebrahimabad, S. A. (2017). The Study of Monetary Policy, Exchange Rate and Gold Effects on the Stock Market in Iran Using MS-VAR-EGARCH Model. *Financial Research Journal, 19*(3), 389–414.

[16] Khosrowzadeh, A., Alirezaeib, A., Tehrani, R., & Hashemzadeh Khourasgani, G. (2020). Does Exchange Rate Non-Linear Movements Matter for Analyzing Investment Risk? Evidence from Investing in Iran's Petrochemical Industry. *Advances in Mathematical Finance & Applications, 5*(1), 11-28.

[17] Komijani, A., Gandali Alikhani, N., & Naderi Abbandani, E. (2013). The Long-run and Short-run Effects of Crude Oil Price on Methanol Market in Iran. *International Journal of Energy Economics*

and Policy, 3(1), 43-50.

[18] Kordlouie, H. R., Sadeghi, L., & Sadeghi, N. (2018). Investigating the Relationship Between Earnings Quality, Audit Quality and Capital Cost Despite Iran's Economic Sanctions in Tehran Stock Exchange. *Journal of Management & Technology, 18*(3), 30-48.

[19] Koutmos, G., & Martin, A. D. (2003). Asymmetric Exchange Rate Exposure: Theory and Evidence. *Journal of International Money and Finance, 22*, 365-383.

[20] Krapl, A. A. (2017). Asymmetric Foreign Exchange Cash Flow Exposure: A Firm-Level Analysis. *Journal of Corporate Finance*, *44*, 48-72.

[21] Miller, K. D., & Reuer, J. J. (1998). Asymmetric Corporate Exposures to Foreign Exchange Rate Changes. *Strategic Management Journal*, *19*, 1183-1191.

[22] Muller, A., & Verschoor, W. F. C. (2006). Asymmetric Foreign Exchange Risk Exposure: Evidence from U.S. Multinational Firms. *Journal of Empirical Finance, 13*(4–5), 495-518.

[23] Sarrafi Zanjani, M., & Mehregan N. (2018). Asymmetric Effect of Exchange Rate Risk on the Stock Index of Export-Oriented Industries Using the NARDL Model. *Journal of Economic Modelling Research, 9*(33), 89-116 (In Persian).

[24] Shin, Y., Yu, B. C., & Greenwood-Nimmo, M. (2014). Modelling Asymmetric Cointegration And Dynamic Multipliers in A Nonlinear ARDL Framework. In R. C. Sickles and W. C. Horrace (Ed.), *Festschrift in Honor of Peter Schmidt* (281-314). New York: Springer.

[25] Sikhosana, A., & Aye, G. C. (2018). Asymmetric Volatility Transmission Between the Real Exchange Rate and Stock Returns in South Africa. *Economic Analysis and Policy, 60*, 1-8.

[26] Statistical Centre of Iran (2020). Retrieved from www.amar.org.ir

[27] Tian, S., & Hamori, S. (2016). Time-Varying Price Shock Transmission and Volatility Spillover in Foreign Exchange, Bond, Equity, And Commodity Markets: Evidence from The United States. *The North American Journal of Economics and Finance, 38*,163-171.

[28] Warshaw, E. (2020). Asymmetric Volatility Spillover Between European Equity and Foreign Exchange Markets: Evidence from The Frequency Domain. *International Review of Economics & Finance, 68*, 1-14.

[29] Xie, Z., Chen, S. W., & Wu, A. C. (2020). The Foreign Exchange and Stock Market Nexus: New International Evidence. *International Review of Economics & Finance, 67*, 240-266.

[30] Zamanian, Gh., Mahmodpour, K., & Yari, S. (2017). Exchange Rate Uncertainty Effect on Export-Oriented Companies at Tehran Stock Exchange (yield) Rate of Return: A Panel- Vector Autoregressive Model. *International Journal of Economics and Financial Issues; Mersin, 7*(1), 207-213.

[31] Zarei, S. (2020). Analyzing the Asymmetric Effects of Inflation and Exchange Rate Misalignments on The Petrochemical Stock Index: The Case of Iran. *Munich Personal RePEc Archive (MPRA Paper), 99101*, 1-20.

[32] Zolfaghari, M., & Sahabi, B. (2015). Development of A New Model to Measure the Market Risk of the Food and Pharmaceutical Industries Index by Using GARCH- Markov Consolidated Models. *Quarterly Journal of Quantitative Economics, 11*(4), 79-111 (in Persian).