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A Model for Examining Exchange Rate Shocks Affecting on Financial Sustainability in Export-Oriented Companies

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ABSTRACT

One of the variables affecting the behavior of enterprises is the exchange rate. Uncertainty about the amount of exchange rate volatility for each firm is considered as a risk. The aim of this study is to explain a model to investigate the effect of exchange rate shocks on the financial sustainability of export-oriented companies. In this regard, the data on exchange rate, tax, oil revenue and export variables on financial sustainability was collected for 19 groups of companies from 2008 to 2019. To achieve the research goal, the Panel Vector Autoregressive Model (PANEL VAR) using the generalized method of moments (GMM) was used to analyze the data. Then the results were interpreted using the Impulse Response Function and variance decomposition. The results of the IRF show that the effect of exchange rate volatility on the financial sustainability variable is initially negative, but has a positive effect over time and is neutralized after several periods. The same goes for an impulse equal to a standard deviation in tax. Also, the oil revenues and exports impulse have negative and positive effects on financial sustainability, respectively. According to the results of variance decomposition, it can be said that the effect of exchange rate on financial sustainability is greater than the effect of sustainability on exchange rate, because the exchange rate shocks have more explanatory power for sustainability fluctuations.

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1. Introduction

One of the most significant elements in the economic policies of every country is the exchange rate. It is also one of the vital issues that should always be considered in the cost calculations of industrial entities. In fact, exchange rate fluctuations are unexpected movements in which the exchange rate rises or falls over a period of time (Oloba & Abogan, 2013). Under the gobal economic circumstances in the last few years, the fluctuations from the exchange rate has become more determinant, since in international monetary markets exchange rates are among the most important factors. Exchange rate fluctuations impact economic and industrial activities, international banking transactions, and global wealth distribution. Today the stability of exchange rate is a principle foundation for every economic activity. Volatility in exchange rates affect commodity demand, production costs, and enterprises' income. It also leads to changes in the supply and demand in the labor market as well as investment.

When it comes to Iran, particularly in the past four decades, the Iranian Rial (IRR) has suffered from extraordinary devaluations against foreign currency, especially US Dollar. This dramatic loss of value has not taken place through a stable trend. Rather, various profits and other macroeconomic variables could possibly be influenced by movments in the exchange rate. Ultimately, this may result in macroeconomic disequilibrium. As uncertainty about the exchange rate fluctuation is considered a risk for any firm, it can affect the cash flow of the firm and lead to financial crisis for companies and effects on sustainability.

Corporate sustainability has become a fashionable keyword in companies, large and small. Corporate sustainability is a growing concern among investors, who seek not only economic profit, but also social benefits (Beattie, 2019). Sustainability is a key element in company strategies (Liu et al., 2018). Achieving financial stability brings great benefits for each countries's economy, such as achieving economic growth macroeconomic stability, while lack of financial stability will lead to increase in the debt-to-GDP ratio and a crisis for central governments, as happened in East Asia and Argentina (Falahati et al., 2017).

The reaction of various economic parts to exchange rate shocks are different. So, the main goal of this investigation is to provid a model to examine the effect of exchange rate shock as one of the sources of the creation of uncertainty on the sustainability of export-

unpredicted shocks during different periods of time have had their negative impacts on the local currency. On this basis, the rise of exchange rate has always grabed particular attention in the scope of macroeconomic policy debates.

The exchange rate fluctuation makes planning for business firms, particularly exporting companies difficult. It also causes the production costs to rise and consequently reduces the competitiveness of manufacturers in marketing and sells of the products. In the case of commodity market approach, movements in the exchange rates impacts the marketing and sales of enterprise and its profit level, which will ultimately affect its stock price. In an economy, one of the element of the price competition of enterprises is the real exchange rate.

The performance of multinational companies is influenced by fluctuations in exchange rates. Such fluctuations exacerbate the relation between commercial entities and financing establishments. Commercial enterprises and financing firms considerably gain from exchange rate stability in analyzing the performance of purchases and funding, which reduces their risks. Interest rates, wages, unemployment, the quality of output, sells, oriented companies in various industries. The structure of the present article is as follows:

In continuation, the theoretical foundations and internal and external studies conducted in the field of exchange rate fluctuations and the stability of companies are discussed. The next part includes the research method and the model used. In the fourth part, the results of model estimation are reviewed and analyzed. The final section includes summaries, conclusions and suggestions.

2. Theoretical foundations and research background

2.1. Theoretical foundations

2.1.1. Exchange rate shocks

Exchange rate is the equivalent value of a foreign currency against another unit of currency. In other words, the rate at which one currency (local) is paid to acquire another (foreign) currency. It is also known as conversion factor. It has to branches nominal rate and actual rate. Inflation affects the real exchange rate while it does not have any effect on the nominal. The nominal

rate of exchange can be described in terms of multilateral and bilateral. Furthermore, if we see any movement in the real exchange rate then we refer to it as the presence of fluctuation. And, when we categorize the exchange rate function into different patterns, it is refered to as exchange rate regime. When a rate of exchange remains on changed for a while it is called Fix exchange rate. This is while where there is a presence of fluctuation in the exchange rate it is refered to as a system of floating exchange rate. The rate, which falls between the floating and fixed exchange rates, is known as "manged" floating exchange rate.

According to the literature, exchange rate fluctuations has to do with the unusual movements of the exchange rate. Since decades ago, the effects of exchange rate fluctuations have been much noticed. The significant of exchange rate is quiet obvious in all economic sectors and influences people's welfare and social life. When it comes to international trade any increase or decrease in the rate of exchange effects economic growth and leads to changes in income and expenditure levels for both exporting and importing countries.

Movements in exchange rate are also caused by variations in other macroeconomic factors. For instance, changes in the supply and demand of a currency in the long run, pertain to changes in value of imported and exported goods. In countries with strong currencies any adjustment in the exchange rate will have the greatest effects on the value of other currencies because those involved in international trade usually are looking for safe investments with as much favorable returns as possible. Similarly, if imports exceed exports, there will be a change in the trade balance, the tendency for foreign exchange will increase, and therefore, the exchange rate for such countries will decrease. If GDP increases, real domestic currency depreciation decreases. Thus, GDP affects exchange rate fluctuations and performs other variables as well. In addition, various macroeconomic parameters are severely affected by movements in the rates of exchange.

In this connection, majority of commercial entities that function in an economy are directly or indirectly impacted by changes in the foreign currency market. Those industries, which are active in international trade, are the first ones that directly will be impacted by the exchange rate fluctuations.

When there are frequent fluctuations in the exchange rate, such a rate will be unreliable, because it can disrupt

the activity of economy. From literature in the international trade, the value of a country's currency playes an important role in determining export and import prices, if changed positively, resulting in economic prosperity. Thus, the volatility of exchange rate has an important role in the flow of commercial trade. In other words, the definition of exchange rate volatility is the exchange rate tendency to change. The volatility of exchange rate can lead to a high cost economy, because business actors tend to cover risks by putting up high prices on their products and services. So, the competitiveness of domestic products becomes low due to high price pressures. McKinnon and Ohno have the opinion, that the excessive exchange rate volatility and recurrence of misalignment may suppress trade flows, change the direction of investment policy, and the inaccuracy of site selection for multinational corporations. Moreover, the degree of variation of exchange rate could reduce the volume of international trade, because it makes the profitability for international transactions uncertain (Subanti et al., 2019).

The consequences of uncertainty in exchange rate on international trade, during the past four decades, has been investigated in detail as both real and nominal exchange rate have gone through periods of severe fluctuations. Since the failure and collapse of the Bretton Woods system. However, in terms of direction and degree of impact on the volume of international trade there is no one unique view about the precise effect of exchange rate uncertainty.

On the one hand, an upward movement in exchange rate has a negative impact on international business, because it leads to increase in the cost which is associated with the rise in exchange rate risk. This is while some studies show that the effect of exchange rate volatility on international bussines is either vague or positive, because such an effect depends on factors like hedging and option opportunities, the degree of risk aversion, and the currency denomination of contract.

Changes in the country currency value or rate of exchange bring about changes in local production cost and also impacts the labour market in accordings to appreciation or depreciation of currencies. The drop in exchange rate leads to the growth of local jobs in production or nonproduction sectors. At the same time, the volume of investment may drop as higher volatility normally increases the uncertainty.

2.1.2. Sustainability

Corporate sustainability in large and small companies has become a key word. Corporate sustainability is a growing concern among investors seeking not only economic but also social benefits. Sustainability is often defined as meeting current needs without compromising the ability of future generations to meet those needs. There are three main pillars to sustainability: Econofmic, environmental, and social. These three dimensions are informally referred to as people, land, and interests. The economic dimension of sustainability is where most businesses feel they are in a direct position. To be sustainable, a business must be profitable. In other words, profit cannot go beyond the other two pillars (Beattie, 2019).

Sustainability is a very important issue for the big companies in the world today (Jafari.Jam, 2016). A comprehensive and scientific indicator system is essential for sustainability assessment because, it can provide useful information for better decision making and monitoring feedback mechanisms for dimensions of sustainability.

In order to be sustainable, a company must have an unreduced level of total net assets in its financial statement, appraised at the social cost. It also has to be examined when it assets are a valuated based on prevailing private cost. To make a pragmatic a valuation of a firm or countries sustainability one needs to pay attention to its economic performance as well as its inviromental performance. This definition relates sustainability to fundamental preoccupation of commercial managers, investment productivity and profit.

Due to the growing importance of financial stability and sustainability, especially after the recent financial crisis, there is no single definition for them. According to Alaoud and Al-Sadiq (2008), there are two main tendencies in defining financial stability and sustainability: The tendency that seeks to define financial instability and the tendency that seeks to define financial stability. A financial system is stable when it has the ability to facilitate the performance of the economy and eliminate endogenous or unforeseen financial imbalances. In the opposite direction, according to Mishkin (2010), financial instability occurs when shocks to the financial system by interfering with the flow of information cause the financial system to be unable to perform its main task, namely the optimal allocation of funds. He believes that strengthening the stability of the

financial system has prevented financial crisis and should be one of the goals of fiscal policy; This is because financial crises hinder the ability of financial markets to optimally direct the flow of funds to productive investments and lead to a sharp decline in economic activity. Also believes that the existence of a healthy and efficient banking system for countries is a major prerequisite and the main factor of sustainable economic growth; Because it creates added value in various economic sectors, facilitates international relations and attracts foreign investors (Asadi, Yavari & Heydari, 2020).

2.1.3. The relationship between exchange reeehhhcknnndrrrmuuuumuuumiiiyy

In fact, exchange rate fluctuations indicate instability and uncertainty in the relative price trend, which increase risk and uncertainty in the return on investment, thereby economic agents can predict their economic policies and fluctuations in their exchange rate. The exchange rate reduces production and, as a result, increases the value of the industry. As a result, sudden changes and fluctuations in the exchange rate can have a negative effect on economic growth by reducing investment, trade volume and profitability (Namazi & Kasgari, 2007). In a given firm active in foreign trade and having foreign transactions, exchanges rate fluctuations will lead to increase or decrease in cost or revenues, thereby affecting the company's profitability. Exchange rate fluctuations will have a significant impact on the investment decisions of firms. Exchange rate fluctuations also affect the outlook for future cash flow due to the direct impact on cost-effectiveness of firms. (Torabi, 2014).

If the exchange rate appears to fluctuate sharply, the value of exported goods and the cost of imported goods will fluctuate due to the time lag between the contract and the receipt of export earnings. Such fluctuations cause changes in the price of goods and the resulting inflation will be generally harmful to the economy. The outcoms is an atmosphere of uncertainty and gambling and speculation in the foreign exchange market and in the economy in general. Ofcourse, the scope of this exchange rate game is not limited to the forex market, but will also extend to the commodity market, because exchange rate fluctuations will initially cause price fluctuations in goods of foreign origin and then even spread to local goods (Majbobi, 2010).

The relation between an entity's exchange rate and value is determined through entity's assets and function,

and its liabilities. Naturally, varriations in assets' value, operations and libalities may be impacted by sudden exchanges fluctuations. In companies that are involved in exports of product the appreciations of local currency reduce their income to national currency. This drop in income is due to the decrease in revenue per unit of product exported and reduced competitiveness and export of product quantity. On the contrary, weakening the local currency will lead to rise the income of exporting firms, due to increase competitiveness, export volume and income of each manufactured item in the local currency. Therefore, increase in the exchange rate benefits exporting companies and improves their stock returns.

In contrast to exporting companies, a rise in the rate of exchange (depreciation of the local currency) results in rise in the cost of product, making imports more expensive, and therefore reduces the companies' profitability. Of course, in multilateral monopolies, the company can transfer the cost increase to a large amount to the ultimate end user and make itself significantly immune against variation in the rate of exchange. When it comes to local companies, which have external competition, the rise in the rate of exchange lowers the competitiveness of foreign companies in the host country, thereby making the shares of local companies profitable and valuable. When it comes to local companies that have foreign exchange assets with investment abroad, an increase in the exchange rate makes foreign exchange assets and their investments more valuable, and as a result, the company stock prices go up. On the contrary, in companies that have foreign currency debts, an increase in the exchange rate makes their debts heavier and, as a result, reduces the stock value of the company.

One of the components of financial sustainability used in the present study is profitability. We consider companies that have significant profits face less risk, so they are more interested in investors. Research has shown that low and stable earnings fluctuations indicate its quality. Thus, investors invest more confidently in the stocks of companies whose profit trends are more stable.

2.2. Research background

With regards to the importance of the subject under discussion, lots of researches have been conducted in this field, some of which are mentioned below:

By examining the impact of exchange rate shock on stock prices of selected firms, Koosha (2016) showed that exchange rate shock had a positive and considerable effect on stock prices of the firms listed on the Teharn stock exchange. She also, learned that the ratio of book value to market value has a negative and significant effect on the stock price of companies. Moreover, she found out that the three variables of liquidity ratio, dividend per share and inflation also had a positive and significant effect on companies' stock prices.

In 2017, the relationship between exchange rate movements and the profitability of exporting firms, listed on the Tehran Stock Exchange, was studied by Raei, Hassanzadeh & Bayazidi. Furthermore, during the period from 2004 to 2011 fifty-six export companies, which were divided in to three industrial categories of chemical products (28 companies), basic metal products (20 companies) and metal ores (8 companies) were closely monitored. They combined/integrated regression models were used to test the hypotheses. The findings showed that in the industries that were studied, the impact of fluctuations in rate of exchange on different performance criteria of the firms has not been felt.

Back in 2017, two economic researchers (Rashid & Waqar) studied how the movements in the rate of exchange and its volatility impact the export behavior of manufacturing firms. In their research they also revealed that both the variation in exchange rate as well as its volatility impacts companies of various sizes differently. Through use of the two-step system generalized method of moment estimator on their data for a sample of 221 Pakistani production firms, they found that the real exchange rate depreciation has positive impacts, while the exchange rate volatility influences the company's exports negatively. They also learned that compare to large firms, small and medium-size exporting companies (SME's) most probably benefits from currency devaluation. In regards to effect of exchange rate volatility the two researchers further found out that adverse impact of exchange rate volatility is weaker for large-sized entities, as compare to SME's firms. New findings confirm the presents of none-linearity in export-deterring(favoring), effects of exchange rate volatility (depreciation) on exporting behavior depending on firm size. The outcome that was based on estimation, indicated that even thogh exchange rate fluctuations unforiegn sells operation of the companies the size of the efect is considerabley different from one company to another. In other words, those medium sized companies that were not listed in the stock market and those that were not so dependent on exports, experienced severe negative effect of exchange rate movement, while other

companies, by far, satied safe and immune to depresing impact of exchange rate fluctuations. Moreover, the extent to which the fluctuations in exchange rate affects firm's exports depends on age of the business entity and the sector in which it is active.

The Exchange rate, its asymmetric shocks and distributions were investigated by Demian and Mauro back in 2018. The ability of exports to change and adapt to the movements of the rate of exchange has been hot topic among the financial experts, however, whithout reaching a common understanding and agreement. By using a novel sector-level dataset based on firm level information, Demian and Mauro showed that exchange rate elasticities will increase by 2-fold when the country and sector specific firm productivity distribution is taken into account in empirical estimates. Besides that, exports become sensitive towards serial increases of exchange rate, but relatively not so affected by drops in the rate. Ultimately, large variations in the rate of exchange seem to the important.

In 2020, the effects of exchange rate fluctuations on the financial performance of quoted conglomerates in Nigeria in a period of 12 years from 2007-2018 were examined by P. Uche, Iliemena, & Happiness. Multiple regression analytical estimation technique with the help of SPSSv21 was used in this study. The findings indicated that exchange rate movements have considerable negative effect on ROCE and ROE, while a positive, but mild effect on ROA. The conclusion drawn from this study is that foreign exchange fluctuations have significant negative effect on financial performance of quoted conglomerates.

Back in 2020, the impacts of exchange rate volatility on Indonesia's primary export commodities to the top five export markets, such as China, India, Japan, South Korea, and the United States, were studied by Sugiharti, Esquivias and Setyorani. To estimate the value of exchange rate volatility, GARCH model with monthly data, covering from 2006 to 2018 was used. Total exports were compared by employing a linear (ARDL) and a non-linear autoregressive distributed lag model (NARDL (. The impacts resulting from exchange rates movements were both negative and positive (expected) in exports at commodity and trade partner case-to-case levels. Both aggregate ARDL and NARDL models suggested that Indonesian exports were negatively affected by exchange rate fluctuations.

The asymmetric and non-linear effects of the real exchange rate shocks on the stock indexes of various

export-oriented companies like petrochemical, basic metal, and mining industries in Tehran Stock Exchange from 2012 to 2020 was studied by Saadati, Honarmandi and Zarei. The conclusion drawn from NARDL approach illustrated that not only exchange rate shocks had significant effects on different stock indexes, but these relationships were asymmetric and non-linear.

3. Methodology

The present study is a Descriptive/Correlational Research and because it provides a model to study the effect of exchange rate shock on the stability of companies and its results are used by investors, owners, etc., therefore; it is practical. In this research, the presented model investigates the effect of currency shocks on the stability of export-oriented companies using Panel VAR and annual data in the last 12 years during the years 2008 - 2019. The statistical population of this research is all export-oriented companies of the industry plan with more than 10 employees from 2008 to 2019. The present sample is 19 groups of companies along with the ISIC classification in accordance with the activities of companies during the last 12 years, which is collected by the Statistics Center of Iran and data analysis is done based on the model in the form of STATA software.

4. Materials and methods

VAR models (vector autoregressive models) in macroeconomic literature are an alternative to the model of simultaneous multivariate equations. All variables in a VAR system are usually examined endogenously, although the identification of constraints based on theoretical models or statistical methods may be imposed by the effect of exogenous shocks on the system. In the equations in which the estimation of the specific invisible effects of each production group and the existence of a dependent variable interval in the explanatory variables is a major problem, the Generalized Method of Moments-GMM, which is based on dynamic panel models, is used. The vector autoregression model with panel data, assuming the variables are endogenous, allows the researcher to investigate the effect of shock on each of the variables. In addition, the panel data has more information, more variability, less collinearity, a higher degree of freedom and higher efficiency than time series and cross-sectional data. The main purpose of this study is to investigate the effect of exchange rate, taxes, oil revenues and exports on the stability of production groups using panel data technique in the form of PVAR model for 19 groups of

companies from 2008 to 2019. Due to the major advantages of the panel data method as well as the limitations of using time series models in short periods such as statistical limitations and uncertainty about the exogenousness of a variable, it is possible to alleviate this concern using the autoregressive method in panel data format. As usual, after examinig the descriptive statistics of the variables, in the first step, the durability of the variables must be ensured. Then, in the next step, the studied model is estimated by the Generalized Method of Moments-GMM and used the impulse response reaction to interpret the results. All variables

are considered in logarithmic form in the model. Using logarithmic form causes the estimated coefficients to be independent of the units of measurement of the variables because of the relative changes (Gujarati, 2011). The logarithmic form of the vector autoregression model for each index corresponds to the following relation:

$$lfs_{it} = \alpha_1 + \beta_1 lex_{it} + \beta_2 lxerc_{it} + \beta_3 loilr_{it} + \beta_4 ltaxr_{it} + \varepsilon_{it} lex_{it}$$
$$= \alpha_2 + \beta_6 lfs_{it} + \beta_7 lxerc_{it} + \beta_8 loilr_{it} + \beta_9 ltaxr_{it} + \varepsilon_{it}$$

$$lxerc_{it} = \alpha_3 + \beta_{11} lex_{it} + \beta_{12} lfs_{it} + \beta_{13} loilr_{it} + \beta_{14} ltaxr_{it} + \varepsilon_{it}$$

$$loilr_{it} = \alpha_4 + \beta_{16} lex_{it} + \beta_{17} lxerc_{it} + \beta_{18} lfs_{it} + \beta_{19} ltaxr_{it} + \varepsilon_{it}$$

$$ltaxr_{it} = \alpha_5 + \beta_{21} lex_{it} + \beta_{22} lxerc_{it} + \beta_{23} loilr_{it} + \beta_{24} lfs_{it} + \varepsilon_{it}$$

Where i represents the production group, lfs_{it} the sustainability of the production group, lex_{it} the export of the production group, $lxerc_{it}$ the real exchange rate, $loilr_{it}$ oil revenue, $ltaxr_{it}$ the tax paid by the production group.

4.1. Variables

Financial Sustainability: The financial sustainability variable derived from the economic dimension of corporate sustainability has been introduced in a study conducted by Jiang et al(2018). To estimate financial sustainability, a composite index consisting of several components was estimated by PCA method and calculated as follows:

$$fs = \sum W_{ji} X_t = W_{j1}X_1 + W_{j2}X_2 + \cdots + W_{jP}X_P$$

In this formula, W represent the coefficients of factor scores and p represents the number of variables.

The components of financial sustainability used in this research are as follows:

1- The corporate profitability: The profitability of the production group is measured by the ratio of profits to cost and rate of return on common stockholders' equity.

2- The debt paying ability: wich is measured by debt asset ratio.

3- The cash obtaining ability: It is measured by net working capital.

Export: The export variable of a production group whose definition category includes the supply of goods and services by persons (natural and legal) residing to non-resident persons (natural and legal) and is given in dollars in the model.

Real exchange rate: In fact, an exchange rate has been adjusted. In other words, in order to be able to calculate the purchasing power of the desired currency correctly, in addition to the exchange rate in the open market, the domestic price index and the price index of the country's major trading partner must also be considered. In other words, in the real exchange rate, the relative prices of the two countries are taken into account.

Oil revenue: Oil revenue means revenue from crude oil exports, inspections and natural gas. Oil revenues enter the country's economy in dollars, but since the official exchanges in the country are done in rials, the central bank, as the government bank, receives the oil dollars from the government and pays the equivalent in rials to the government.

Taxes: Taxes paid by the production group include mandatory and performance taxes paid by the production group to the government each year.

In the next section, before estimating the research model, the statistical characteristics of the variables and then the stationary test are examined. According to the first step of the estimation process, the optimal lag is determined. Then, the basic pattern of the research is estimated and the results related to its stability are reported. Then, using Impulse Response Function, the reaction of variables in case of impulse is analyzed. Finally, the variance decomposition of the research variables is analyzed.

4.2. Descriptive statistics of model variables

Table1: Descriptive statistics of vector autoregression model variables

Variables	mean	max	min	Sd	skewness	kurtosis	N
Lxerc	9.191687	10.9669	8.013447	.7054435	.2675472	2.500084	228
Taxr	.0117596	.2490281	.2490281	.0278701	6.482668	48.06867	228
Loil	1.559415	6.883227	-3.012734	2.161231	.1433026	2.381677	228
Lex	13.32595	19.58383	5.924256	2.993473	-.1263487	2.348416	228
Lfs	-1.955411	-.5782746	-3.63325	.5984951	.0272253	2.736289	228

Source: Research findings.

Table (1) shows descriptive statistics on exchange rate, taxes, oil revenues, exports and sustainability variables. As can be seen, exports have the highest and sustainability has the lowest average. Also, the smallest data is related to sustainability and the largest data is related to Exports. The standard deviation calculated in the table shows that the export fluctuations are greater than the other variables.

4.3. Variables stationary assessment

Static tests are used to prevent false regression estimation. In the panel data, there are different tests to assess the statics of the variables. In this study, the Im-Pesaran-Shin unit root test was used. Hypothesis 0 of Im, Pesaran & Shin test indicates variable's non-stationary. Therefore, if the calculated statistic value is greater than the critical value at the current confidence level, the null hypothesis based on non-stationary will be rejected. The results of Table (2) and the study of the values of the calculation statistics show that the null hypothesis of non- stationary variables is rejected, in other words, all variables of the model are Stationary.

Table2: Im-Pesaran-Shin unit root test (with width from the process origin)

Variables	Z statistic	Pvalue
lfs	-19/9198	0/0000
lex	-15/784	0/0000
loilr	-12/352	0/0000
lxerc	-13/3673	0/0000
ltax	-13/5948	0/0000

Source: Research findings.

4.4. Selection of optimal lag

Information criteria of Akaike (AIC), Schwarz and Hannan Quinn were used to estimate the optimal lag selection of the model. The results of estimating the mentioned statistics for the first to third time are in the form of table (3). Considering that the optimal model is the model that has the lowest value of MQIC and MAIC, MBIC (Andrews & Lu, 2001). Therefore, based on the criteria for selecting the Optimal Lag of the model, the second order was selected as the optimal order of the model.

Table 3: Selection of the optimal lag based on the criteria

lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	0.979474	70.42884	۰.0299682	-180.7652	-29.57116	-90.99142
2	0.989097	31.48487	.1734625۰	-94.11215	-18.51513	-49.22527
3	0. 990773	0	0	0	0	0

Source: Research findings.

4.5. Model estimation

The next step is to implement the model based on the lag, which here, as observed the second time lag is selected. Panel auto-regression model is estimated using GMM method. The results of model estimation are summarized in Table (4) which shows the model coefficients. As can be seen, in situations where the variable of financial sustainability is a dependent variable, it has a negative and significant relationship with one lag with itself and a negative and significant relationship with the variables of oil revenues, exports and taxes with two lags. The basis of the vector autoregression model, whether time series mode or panel data, is predictive and also due to the presence of lag variables that are difficult to interpret, the coefficients estimated in PVAR are not directly economically interpreted and accordingly, to interpret the outputs of this statistical and econometric method, impulse response function and variance decomposition are used.

Table 4: Estimation of panel vector autoregression model coefficients

loilr	lxerc	lex	Ltaxr	lfs	
.7284093 1.60	.0558192 1.76	-1.861911 -2.96	.1531863 0.80	-.3689098 -3.02	**Lfs (-1)**
.2183423 0.90	-.0421502 -1.92	-.370803 -0.97	.1342623 1.38	-.0808731 -1.04	**ltaxr(-1)**
.0621302 0.41	-.0354076 -2.80	.1892328 0.81	.0209838 0.33	.0301947 0.67	**lex (-1)**
1.059415 1.07	.6849168 4.99	-1.304373 -1.04	-.6050617 -1.22	-.3174718 -1.38	**lxerc(-1)**
.3408966 1.21	-.0666837 -2.71	-.0736175 -0.18	-.0062637 -0.05	-.0131314 -0.15	**loilr(-1)**

|					
-.7861982	.0822297	1.034557	.1077462	-.1173041	**Lfs(-2)**
-2.08	2.63	1.88	0.47	-1.18	
.7282405	-.0597408	-1.340029	.2285535	-.2724119	**ltaxr(-2)**
3.62	-3.23	-4.57	2.05	-4.52	
.244327	-.0390331	-.3356459	.091775	-.084837	**lex(-2)**
2.11	-3.19	-1.67	1.36	-2.29	
-.68629	.1269156	-.3815505	.6316219	.111508	**lxerc(-2)**
-0.83	1.06	-0.37	1.50	0.55	
.8045127	-.0588165	-1.368634	.1006361	-.1288288	**loilr(-2)**
4.54	-2.89	-4.69	0.84	-2.19	

Note: The first line for each variable represents the estimated coefficients and the second line represents the Z statistic.

Source: Research findings.

4.6. Panel var model stability test

The model stability test or model stability indicates that the model is reversible and contains an infinite moving average vector that can be used to impulse response function and variance decomposition. The results of model stability are shown in Figure (1) and considering that the specific values of this model are less than one and the root of the companion matrix is located inside the unit circle, therefore; the condition of stability is established in the PVAR model.
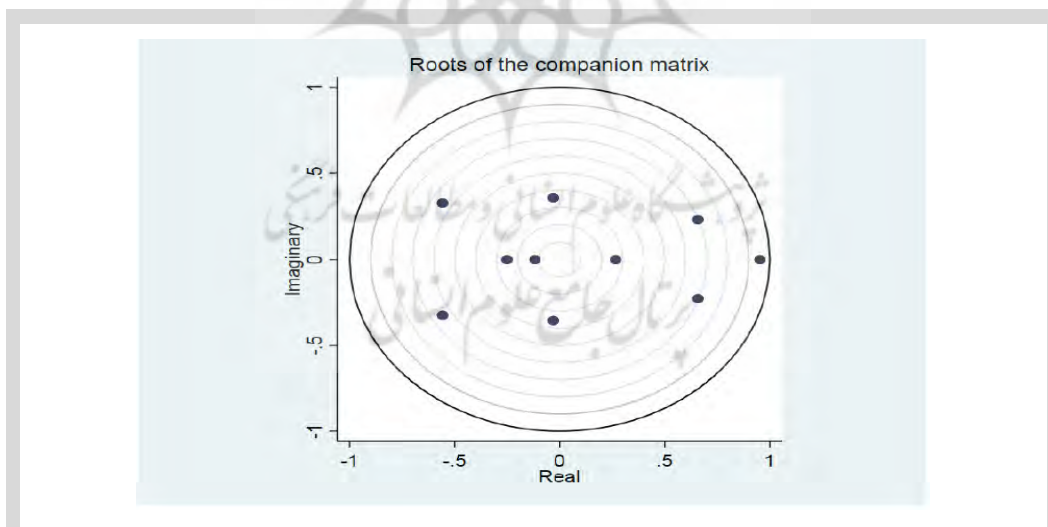
**Figure 1**: Stability test of the Model

Source: Research findings.

4.7 Analysis of impulse response function

The last step is to analyze the model by generating a shock. Figure (2) shows an overview of the effects of the momentum of the certain variables on sustainability. In other words, the Impulse Response Function are used to investigate the long-term effects of exchange rate shocks. Since the shock size depending on the standard deviation is variable, the shock size due to currency disturbances is the same in all models. The results of the

model are shown in the figure below, considering that the eigenvalues of this model are less than one and the root of the companion matrix is located inside the unit circle, therefore; the condition of stability (sustainability) in the PVAR model is remained. The estimated coefficients in vector autoregression models often do not have a specific economic interpretation directly. However, by-products (such as Impulse Response Function and Forecast Error Variance Decomposition), which is obtained after estimating the vector autoregression model can contain

important interpretations. The Impulse Response Function examines the behavior of variables over time due to a standard deviation of change in the equation disorder in order to check the effect of a certain shock on the variable. It is shown that if a sudden change (shock) occurs in a variable, what will be the effect on the variable itself and other variables during different periods. Figure 2 shows the impulse response of the lfs variable versus the shocks received as a standard deviation from the pattern variables.
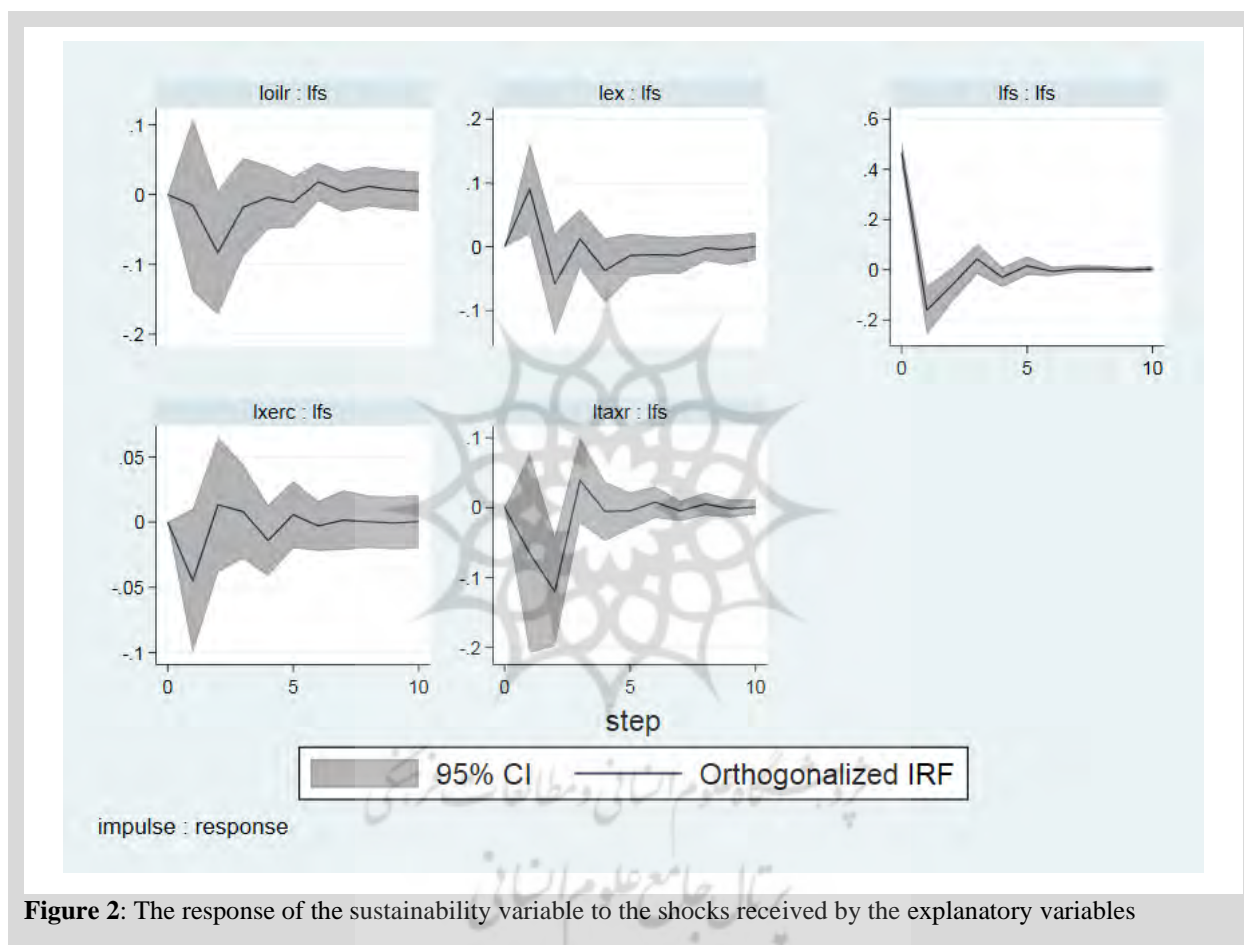
Figure 2: The response of the sustainability variable to the shocks received by the explanatory variables

Source: Research findings.

According to the IRF chart, if the response of the variables to the shock caused by their own disorders in the form of downward and tends to zero in the long run, so, the model is stable. Otherwise, the model is divergent and is removed from future analyzes. The bold lines in the middle represent the instantaneous reactions of the lfs variable, and the upper and lower margins of the positive and negative margins for the standard deviation of the instantaneous reactions are at the 95% confidence level, which is calculated using the Monte Carlo simulator with 1000 repetitions.

In terms of oil revenue shock, as can be seen, it has a negative effect on sustainability and almost reaches balance after 7 periods. The reason for this is also due to the Dutch disease. This is while the effect of exports on sustainability has been positive and is neutralized after three periods. Regarding taxes, it is observed that initially, it has a negative effect on sustainability and then has a positive effect on sustainability and is neutralized after four periods. Although this effect is small, but in a way in the form of exogenous growth pattern, it can be concluded that tax ultimately has a positive effect on the sustainability of companies.

An impulse as much as a standard deviation in the exchange rate on sustainability initially has a negative effect but over time has a positive effect, and after 5 periods this effect is neutralized. So the exchange rate volatility affects t the sustainability of companies. The reflection of these changes is obtained in the balance sheet, profits or losses of companies and changes the output and sales of the company. On the other hand, exchange rate volatility affect the cost of imported raw materials and equipment and change the cost of production and, consequently, the company's profit margin. With the rise in the exchange rate, the value of the company's products gets increased, especially export goods. Investors react to this increase, and the stock index gets increased. This reaction takes place according to the theory of rational expectations before the increase in assets of the company and the process decreases after the increase in the value of assets, at the end of the fiscal year. The reaction of lfs from their shocks is positive, which tends to zero after 6 periods; Therefore, a positive

shock in lfs increases lfs. According to the chart above, the effect of this shock is somewhat short-lived, so that after about a period, the positive effect of the shock is eliminated. In companies with high profitability, investment growth has a positive and significant effect on the relationship between profit and current value per share (Izadinia and Azimi Dastgerdi, 2014). In other words, a positive shock occurs in the incoming lfs, this is a sign for other investors to invest or increase their investment, which will lead to greater profitability.

4.8. Results of variance decomposition

While the Impulse Response Function represent the reaction of an endogenous variable over time to the impulse caused by another variable in the system, variance decomposition measures the share of each impulse in the variance of the endogenous variable of the system. The results of variance are presented in Table (5).

Table 5: results of forecast error variance decomposition of sustainability

loilr	lxerc	lex	Ltaxr	Lfs	Period
0	0	0	0	1	1
.0003683	.0071385	.0300948	.0181049	.9442935	2
.0232333	.0070401	.039063	.0655985	.8650652	3
.0238884	.0071567	.0390182	.0703318	.859605	4
.0237141	.0077788	.0432108	.0698584	.8554381	5
.0240692	.0078687	.0437079	.0697924	.8545618	6
.0251673	.0078814	.0440956	.0698669	.8529887	7
.0251924	.0078812	.0446335	.0698885	.8524045	8
.0256259	.0078767	.0446154	.0699356	.8519464	9
.0257793	.0078768	.0446782	.0699254	.8517403	10

Source: Research findings.

Table 5 shows the variance decomposition of lfs (sustainability). According to this table, the relative share of the fluctuations of sustainability in its changes in period one is 100% and other factors are ineffective and other factors are ineffective. The percentage of sustainability changes in future periods gradually

decreases to 85% in the tenth period. Wich with this amount, the largest share of sustainability changes in the tenth period is also explained by itself. In the second period, exports have the largest share in explaining sustainability changes. The share of this variable increases slightly in future periods and reaches 4% in the

tenth period. Oil revenue has the least power to explain changes in sustainability in the second period. Over time, this share has increased to 25% in the tenth period. In the second period, taxes have the greatest power to explain sustainability after exports. This amount, in the following periods, exceeds the share of exports and reaches 69% in the tenth period.

5.Conclusions and suggestions

The main purpose of this study is to design a model for examining exchange rate shock which affect the financial sustainability in export-oriented companies. In this study, the impact of exchange rates, taxes, oil revenues, and exports on the financial sustainability of 19 groups of export-oriented companies were studied according to ISIC classification and were estimated through the PVAR model using the (GMM) method from 2008 to 2019.

In line with the above objective, at first, the stationary test of variables was done. Then, information criteria of Akaike (AIC), Schwarz and Hannan Quinn (HQIC) were used to estimate the optimal lag of the model. The results showed that the optimal interruption of model is two.

In the next step, by using GMM method Panel Var Model was estimated, which showed that majority of the model coefficients were significant. The results of model stability indicated that the specific values of this model were located inside the unit circle, and so the model was stable.

Finally, the results were interpreted by using the Impulse Response Function and Variance Decomposition. The results, obtained from the Impulse Response Function, also showed that the impulse effect, in the size of a standard deviation, in the exchange rate, taxes and oil revenues on the variable of financial sustainability is initially negative, but over the course of time, moves in a positive direction and is neutralized after a number of periods. But the impulse effect, in the size of a standard deviation, in the export on the variable of financial sustainability is initially posetive, but over the course of time, moves in a negative direction and is neutralized after a few periods. What is quite obvious is that the response of all variables to an impulse, the size of a standard deviation, moves to zero over the course of time, and this shows that the model is convergent.

Furthermore, according to the results of variance decomposition, it can be said that the exchange rate impact on financial sustainability is much more than the effect of sustainability on exchange rate. This is because exchange rate shocks have more explanatory power for

financial sustainability shocks. The results indicate that the impact of exchange rate shocks on the components of financial sustainability are significant. Therefore, the basic hypothesis of the research, the overall effect of exchange rate shocks on the financial sustainability of export-oriented companies has been confirmed.

In comparison of the results of the present study with those of others, our findings are in line with the results of studies conducted by Ruth (2021), Budiono (2017), Jalaee, Mir and Rahimipoor (2016); Botha and Jaco (2017), however not in the same direction as Raee, Hasanzade and Bayazidi (2017), P.Uche, Iliemena and Happiness (2020).

To summarize, because managing and neutralizing the impact of exchange rate fluctuations, oil revenues and taxes on the financial sustainability of export-oriented companies is beyond the control of the firm's managers, it is recommended for managers to focus on managing the effects of export fluctuations on their company's financial sustainability and to adopt appropriate strategies to stabilize the company's sales and exports in the face of economic turmoil, caused by fluctuations in the variables. Also, in order to be safe from fluctuations caused by currency shocks, investors should invest in different industry groups in order to reduce the risk of abnormal fluctuations.

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