

US Withdrawal from JCPOA and the Turmoil in Iran's Economy

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Abstract

Many individuals and companies make their economic decisions based on political developments. This article examines an important political event, namely the withdrawal of the United States from JCPOA and its impact on the Iranian capital market. With the withdrawal of the United States from the JCPOA and the United States' threats to resume sanctions, Iran's economy had experienced turmoil and drastic changes, which clearly saw in the days before and after the resumption of sanctions in Iran's financial markets. In this study, we intend to examine the changes resulted from the US withdrawal from JCPOA, its impact on Iran's oil-dependent economy, financial markets, analyze the spread, and severity of turbulence in the Iranian economy, especially the Iranian financial markets using multivariate GARCH methods. In this regard, the multivariate GARCH model (DCC) and analysis of variance are used to investigate these events' effect on the Tehran Stock Exchange index.

Keywords: ARCH, Economic Dependence, Economic Sanctions, Intensity of Turbulence in Iran's Economy, Linear combinations of univariate GARCH models, Multivariate generalized autoregressive conditional heteroscedasticity, Nonlinear combinations of univariate GARCH models, US Withdrawal from JCPOA, Multivariate GARCH

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Introduction

In the current era, international developments and economic globalization (economic dependency) creates opportunities and consequently costs for developing countries. The use of international developments depends on how countries take advantage of international opportunities and minimize costs. Like many other countries whose political and economic issues are intertwined with international developments, Iran has its economy influenced by international political factors and issues. This impact on the Iranian economy, especially in the Iranian capital market, is visible with the stock index changes after critical political events such as the United States' withdrawal from JCPOA. To better understand this situation, by modeling for changes and economic fluctuations, we can form a diverse beam to some extent by predicting turbulence and fluctuations in the Iranian market. In this case, financial and economic issues can be assessed as much as possible during critical political events. A quick look at financial data shows that returns are riskier than other time horizons in some periods. In this case, we are faced with the phenomenon of turbulence or fluctuation of asset returns, which is called variance heterogeneity of returns. There is also a degree of autocorrelation in risky financial markets that are not expressed in simple models. The parasite presented an Auto-Regressive Conditional Heteroskedasticity (ARCH) that examines a time series' efficiency over a given period. However, Bowlerslow developed the parasite model to express the conditional variance in its model's process correlated with the Auto Regressive Moving Average (ARMA).

ARCH's generalized model is called the Generalized Auto-Regressive Conditional Heteroskedasticity model, or GARCH, which uses autoregression and the moving average simultaneously in variance heterogeneity. The nonlinear combination of several GARCH models created a new model that shows the heterogeneity of variance and turbulence transmission between several markets. This model, called multivariate GARCH, is used to study the relationship between markets and provide a diversified portfolio to reduce risk. The Dynamic Conditional Correlation model (DCC) is one of the multivariate GARCH model types that consider the conditional heterogeneity of variance over variable time, making the model dynamic and more realistic. In this paper, this method is used to examine the relationship between exchange rates and stock indices.

Another case study in this article is measuring the intensity of turbulence before and after a political event to compare the intensity to understand the impact of political events; in

addition to financial and economic issues, political issues should also be considered to arrange an optimal beam. To estimate this method, the analysis of variance (ANOVA) is used during the two time periods. Analysis of variance is a set of statistical models that examines the mean in groups and their related functions, such as variance, in a group or between several groups, and here between two-time intervals. In both intervals, their intensity is measured and compared with each other. In this article, we first determine whether there is a transmission of turbulence within the exchange rate market (Dollar) and the Iranian stock market (Stock Exchange Index)? To do this, we will use the Dynamic Conditional Correlation model. We then consider an important political event, the US presidential election, and examine the magnitude of the turmoil before and after Donald Trump won the US election. Finally, the intensities of turbulence are compared with each other, and the impact of political factors and events on economic and financial factors in Iran will be analyzed.

Research Background

Various studies have been conducted on the transmission of turbulence between financial markets. In recent years, many of these researches have been intertwined with political issues and have led to new and exciting topics, some of which are mentioned.

José Alberto Candelaria examined the spread of turbulence between Latin American markets during two efficiency crises and used the dynamic conditional correlation method; he showed that these financial crises and selective policies had affected the fluctuations between these markets. Investors must consider both financial and political crises in order to secure investment (Candelaria, 2009). Kamel Naoull et al. used a Dynamic Conditional Correlation method to study turbulence transmission between emerging markets and the US stock market. They exhibited that this contagion and solidarity is more intense in times of economic crisis, sometimes due to political decisions (Naoui, 2010). Inchang Hwang et al. used the multivariate dynamic conditional correlation method - MGARCH, to investigate the impact of corruption and displayed the spread of turbulence between 38 countries and exposed corruption even in developed markets. Adam Mohamed Rahim and Mansur Masih examined political unrest and its impact on the spread of turmoil between Asian Islamic markets and the US stock market. They used daily data from the Moroccan stock market and the Dow Jones Industrial Average, using the DCC model to show that it would be better for investors in Islamic countries to have a various portfolio of stocks from different countries during political unrest, and they also concluded that political unrest is

very useful in stabilizing the regional market (Islamic countries) (Adam, 2014).

Anna Janiga-Ćmiel - Investigated the spread of harmful, destructive turbulence between several selected European countries and Poland. Using the GARCH dynamic conditional correlation model, she showed that Poland, one of the EU member states, is becoming infected with economic development. She also disclosed that economic pairs such as France and Poland, Belgium and Poland, the Netherlands and Poland, Denmark and Poland are interdependent in economic development. Economic development in the pairs of Germany-Poland and Britain-Poland is strongly overlapping (Anna Janiga-Ćmiel, 2016). In an article, Kazutaka Kurasawa presented that the Japanese market is mostly influenced by political change in the United States and Japan. This research used the DCC multivariate dynamic conditional correlation model to analyze the effects of the variable time policy uncertainty; it proved that there is turbulence between the US exchange rate and the stock market, the severity of which depends on the two countries' political decisions. (Kurasawa, 2016). Dahiru A. Bala and Taro Takimoto used the multivariate dynamic GARCH conditional correlation method to study turbulence transmission between developed markets in financial crises. They used the Student T-Bias approach to examine the severity of these financial crises and showed that the markets under study are contagious and this spread of turbulence intensifies in times of crisis, so investors must always consider these factors in their choice of portfolio arrangement policies. In Iran, the use of dynamic conditional correlation method and the multivariate GARCH was also used for several research types, including Abu Nouri and Abdullahi's study, where they used GARCH multivariate conditional correlation models between different segments of the Iranian stock market. The results of this study show that different parts are affected by their past returns. Based on ARCH and GARCH coefficients, the transmission of fluctuations between different sections is seen directly and indirectly (AbuNouri & Abdullahi, 2012, pp. 1-16). Seyed Hosseini and Ebrahimi examined the transmission of turbulence between the three indicators of Iran, UAE, Turkey, and world oil prices. In this study, the Vector-Garch model showed the transmission of turbulence from the UAE market to the Tehran market, while this effect was not observed in reverse, meaning from Tehran to the UAE. The data were also estimated by the BEKK model, which was the same as the previous model, but with the difference, in this model, the transmission of turbulence from the world oil price index to the Tehran market was not observed.

Additionally, the results obtained from the application of the Constant Conditional Correlation (CCC) model confirmed the existence of turbulence from the global oil market to the Tehran market (Hosseini and Ebrahimi, 2013, pp. 81-97). Firooz Fallahi Et al. examined the correlation between the stock market, currency, and golden coins in Iran using the dynamic GARCH conditional correlation model. They proved that there is a high conditional correlation between exchange rate returns and gold coins, and using the Markowitz portfolio optimization method, they concluded that it would be better to allocate a significant portion of the asset to invest in the stock market (Fallahi, 1393). Khatib Semnani Et al. examined the effects of fluctuations in Iranian crude oil price on the Tehran Stock Exchange's return index. The results show no positive and significant transmission in the long and short term between the variables of fluctuations in the price of heavy Iranian crude oil and the yield index of the Tehran Stock Exchange.

On the other hand, according to the model results, a long-term and inverse relationship between the mentioned variables is a component of Vector-Garch error (Semnani, 2014, pp. 89-114). Moghaddam and Sezavar examined the relationship between the conditional correlation of international capital markets and the Tehran Stock Exchange's oil market. They resulted that fixed conditional correlation and a dynamic conditional correlation between the Tehran Stock Exchange index and other indices show that the highest correlation is with New York and Nasdaq stock index (S&P), and the lowest correlation is with the global oil price index (Moghaddam and Sezavar, 2016, pp. 195-213). In his dissertation, Felli used the analysis of variance and the Markov switching model to examine the turbulence overflow from the oil market to several different industries and measured each overflow's intensity to compare which ones are more effective (Felli, 2016).

Definition of Concepts

To better understand this research, we use the two concepts of rentier government and economic dependence since these two concepts help us focus on specific aspects of the facts and helps to better and more accurately examine the impact of the US withdrawal from the JCPOA.

A. The concept of rentier state: Rent is a term derived from economics - which has been widely used in political and economic discussions. In cultural terms, rent means renting land or leases, and in general, any income that is not the result of work and productive efforts is called rent (Tibian, 1992, p. 1). The term rent is used to describe incomes that are much higher than

expected returns. Rent is an income earned without much effort, as opposed to concepts such as wages and profits that must be earned as a result of effort and economic activity (Hosseini Khan 2007, pp. 21-23). Adam Smith considers rent to be a particular type of source of income that differs from other sources of income such as profit and wages. This type of income goes to a specific person or group without the need for productive or value-adding effort or activity. However, in a healthy economy, profits and wages result from productive effort (Mirtarabi, 2008, pp. 112-113). In a political economy, the concept of rent means revenues that the government receives from sources of raw material sales or receipts from foreign sources, which are not related to the domestic economy's productive activities and are not obtained from a productive activity of the domestic economy. Hazem Beblawi considers rent to be reserved for natural resources and states that mineral resources generate rent. Few laborers are employed to extract minerals, and the proceeds from the sale of minerals are given to the government. Because some governments' primary source of income is from mineral or foreign sources in the form of rents, such governments are known as rentier governments (Haji Youssefi, 1998, p. 92). Most Middle Eastern governments are present in most economic spheres, and they have primarily shaped their economic dominance over the country's natural resources and other sectors of the economy. As competition has become a monopoly in these countries, we witness the emergence of rentier governments (Sajedi, 2011, p. 108).

B. The concept of economic dependence: The theory of dependence was introduced more seriously in development sociology. Paul Baran's ideas mainly expressed dependency theories in the late 1910s. The Eklamo program's failure and the crisis of Marxism in Latin America in the 1960s profoundly affected forming the theory of dependence. Proponents of this theory argue that dependency theory is a critical response to Adam Smith's theory. The Smith School believes that international trade leads to regions' specialization and reduces customs tariffs, providing maximum economic growth opportunities. Dependency theory states that because natural resources, climate, and workforce supply are unequally distributed among communities, every country should produce productively around its natural talents. Thus, international trade exchanges are formed in such a way as to provide maximum production capacity in the field of certain items, raw materials, and goods and services. Contrary to Adam Smith, many dependency theorists argue that the global economy cannot be conceived as a system of equal trading parties. This is because the superiority of industrial societies' military, economic and political power imposes inequality of exchange conditions

on less developed societies that depend on the export of raw materials and human resources.

Industrial societies, by imposing the exclusive production of raw materials from less developed societies to developed societies, not only make them heavily dependent on raw material exports, but it makes them heavily dependent on raw material exports; however, in an unequal system, the exchanges of raw material exporters are obliged to depend on the world market and succumb to instability in raw material exports. This means that due to the dependence on the export of raw materials or single products, these countries' economies will be dependent on determining the world price of the relevant commodity, which can always have negative consequences (Sajedi, 2014, pp. 182-183). Critics of the dependency theory also argue that the international system's structure has created such a strong dependence on vulnerable countries' economic sectors. Thus, underdeveloped countries' development opportunities are lost and create a significant obstacle in their progress and development. This school's focus is based on the fact that the development of third-world countries should not be considered in isolation from advanced countries' development. Instead, all the world countries should be considered a single system to achieve progress and development for all countries (Khaledi, 2015).

C. Interdependence: In response to critics of the theory of economic dependence, many economists and authors have proposed a solution to the theory of interdependence that can be a logical response to the critique of the theory of dependence. They argued that national units' economic interdependence is a process that has expanded and complemented with globalization and that economic interdependence has moved toward coherence with a conceptual transformation that has so far removed many trade barriers. Richard Cooper emphasizes the economic dimension of interdependence and considers it the sensitivity of economic interactions between two or more states to economic developments within those states (Moshirzadeh, 2008, p. 136). Entering the House of Interdependence has accessories. These supplies are due to the level of internal development, and if the development is not sufficiently created inside, it acts as a one-sided dependent that is always influenced by others (Seyfzadeh, 2007, p. 138). The rule of the principle of interdependence on the relations of the political and international economic system and its characteristics in developing a single liberal system and eliminating economic, political, cultural, and ideological boundaries have been the main areas of the globalization process. With the emergence of globalization of the economy and the removal of many trade barriers, the field of capital transfer and human and technological resources has

expanded. Many websters have been created to collaborate and take advantage of shared capacities to maximize benefits. Within globalization, the process of the economic interdependence of countries has increased, and governments and other economic enterprises for further growth and productivity have expanded economic relations across borders to the point that interdependence has given way to cohesion. Different views have been formed among thinkers and experts about economic interdependence, and each of them had its perspectives. The theory of interdependence looks at the requirements for creating a platform for international convergent dynamics because it exploits joint scientific, technical, and ideological human capital and internal and external national territories' dynamics. Therefore, within the framework of interactive attitudes and practices, other countries' resources and experiences can be achieved. In reality, countries that have grown significantly have benefited from extensive international relations in various political, economic, and scientific fields, such as China and South Korea's economic situation. Of course, it is essential to note that the more traditional and closed governments are, the more complicated their adaptation to globalization will be, and interdependence will not easily provide them with the necessary convergent international dynamics. Because of globalization and interdependency, countries' economies, especially economic powers, are so intertwined that the onset of a recession in one country quickly spreads to other countries. The economies of raw material exporters are more affected by this type of turmoil. For example, the heavy dependence of oil-exporting countries' economies on this commodity is a great weakness for them. It creates conditions for their economies to be affected by fluctuations in oil prices or influential powers by focusing on this vital economic factor, and to reduce their oil exports in due time through various means (such as sanctions) and put their economy in turmoil.

Iran's economic dependency on oil

Today, the importance of oil is not hidden from anyone (exporter and consumer). Oil as a strategic commodity has had a significant impact on the economic growth of oil-rich countries and importers of this commodity. Energy security has been raised as one of the most critical issues in the international system, especially between developed and developing countries. The dependence of the world today on oil is essential in several ways. Oil produces energy for industrialized countries and is a source of income and wealth for oil-exporting countries. This raw material is so valuable that thousands of materials and derivatives are obtained from it, such as petrochemicals, a sizeable profitable industry. Oil has also become a factor in gaining power and

prestige for the countries that own it and has occasionally been the cause of conflict and competition worldwide (Mirtorabi, 2013, p. 24). Due to Iran's high dependence on oil, this substance is Iran's economic artery, and many countries are exporting this fossil substance. High oil revenues have caused the economic system of oil-exporting countries to be largely monopolistic and dependent on the world market's economic conditions. One hundred and ten years have passed since the date of commercial oil extraction (1908 AD) in Iran until today, and this material is still considered the engine of the mobility of Iran's economy. The role of oil is evident in economic issues and other issues such as the country's security and the dependence of industrial, war, logistics, and other forces on this energy. In both regimes (Pahlavi and the Islamic Republic), oil has played a role as the most essential and key industry in Iran. In the last months leading up to the 1939 revolution, one of the world's largest oil exporters was paralyzed by workers' strike in the oil fields of Iran's economy, and the world oil price again fell into chaos after the oil shock of 1974 due to the cessation of Iranian oil exports (Razavi, 2002, p.123). In other words, Iran's economy, the world's second-largest oil exporter, was hit hard by the closure of oil pipeline valves and the non-export of this substance abroad.

The severity of the impact of this economic blow on the words of the US and Soviet ambassadors clearly showed this fact, that is, when they stated that "the most crippling method of the Islamic Revolution in material and economic terms was struck, and the most decisive one was the strikes of the oil industry, which led to the cessation of oil exports and the fall of control to the revolutionaries.

This frustrated the Shah, and the world's public opinion realized that the Shah's monopoly on power in Iran had broken down" (Nejati, 1993, p.175). This statement clearly shows the extent to which Iran's economy in the Pahlavi period was dependent on oil. Unfortunately, this oil dependence has not decreased after the revolution either, because about seventy percent of different presidencies' budgets in the years after the revolution are still dependent on oil revenues (Political Bimonthly, 2008). The presence of oil in Iran has given rise to the rentier government and the rentier community, both of which are anti-development. The shadowing of rent-seeking ideas and spirit on Iran's government and society has opened the way for the use of oil resources as much as possible, which will continue to put the Iranian economy in the grip of oil and its derivatives. Throughout Iran's history, oil has been a significant obstacle to developing inward-generating sectors and has mostly met the global market's needs. Despite all the Islamic Republic officials' statements about getting rid of oil dependency, it must

be admitted that this oil dependence has continued to this day, and this oil income is intertwined in the economic, political, and social veins of Iran. This dependence is so severe that with an oil shock in the international market or an effective embargo on Iran's oil sector, its economy is in turmoil. Since oil is the lifeblood of Iran's economic life and the dependence of Iran's oil revenues, like many oil-rich countries in the Middle East, it is a threat to the single-product economy and their national security. One of the problems of oil-rich countries is the Dutch disease that afflicts their economies. Dutch disease refers to a situation in which the extraction of a natural resource such as oil, resulting in a considerable increase in foreign exchange earnings from its export, has led to an increase in prices in the goods and services sector. As a result, imports intensify, weakening producers' competitiveness and exports in the oil country and consequently losing their share of the world market. In other words, the national currency increases abnormally, and the performance of the country's exports of other goods decreases. For example, in most years of the ninth and tenth administrations, oil prices rose sharply to \$ 148 a barrel, and the government's coffers were filled with currency. According to statistics, Iran's total oil revenues from 1981 to 2013 were equal to 1010/92 billion dollars. The share of income of the period (eight years) of Ahmadinejad's government from these 31 years has been more than 17%.

Nevertheless, this income could not improve the country's economic growth and development in the two periods of Ahmadinejad's government, with this volume of oil revenues. Because unbridled oil revenues were allocated to imports due to lack of proper management, industrial and even agricultural products faced many problems in these two periods. This colossal oil revenue during this period caused the Dutch disease to intensify the Iranian economy. Consequences of the aggravation of the disease in the Iranian economy, during the ninth and tenth governments of the Islamic Republic, led to an increase in inflation and a decrease in productive activities, followed by an increase in unemployment; all of which led to a decrease in economic growth and destruction of industrial infrastructure. Additionally, to this extent, oil dependence has clearly shown that Iran's economy and national security are severely affected in the face of oil sanctions.

Iran Economic Sanction

Sanction means the systematic refusal of a state or group to establish social, economic, political, and military power to punish or change the sanctioned behavior to achieve acceptable behavior (Feizi, 2015, p. 176). Today, sanctions are increasingly used in international economic relations, imposed on a particular

state's goods and services. This embargo can sometimes apply to all goods (Evans and Nunam, 2003, p. 110). Hoffbar and Scott argued that economic sanctions mean the deliberate and voluntary removal of government or threatening to cut trade and financial ties (Valizadeh, 2012, pp. 351). Sanctions are most effective when exercised by a considerable economic power or a combination of several powers. Despite the decline in relative hegemonic power after 9/11, the United States is still the most influential player in the international political economy, and in many respects, its domestic power structures play a global role. According to the World Bank, published in 2108, the share of US gross domestic product (GDP) in the world economy in 2017 is equal to 2444%. With a quick look at the world economy statistics, the dominance and influence of the United States in the world economy can be seen.

World Economy

US oil embargo on Iran (D'Amato) during the presidency of Bill Clinton, announcing sanctions for American companies investing more than \$ 40 million in Iran's oil and gas industry, caused some of the American's top oil companies to refuse to invest in Iran, and those non-US oil companies had also paid more attention to Iran's oil affairs (Rohani, 2011, p. 14). When major oil companies were refusing to do deals with Iran, the Iranian Oil Company was forced to enter into negotiations with second-class companies with lower technology, such as China Oil Company or Petronas Malaysia, and had to give them more

concessions than the normal ones. Because since 1999, Iran's national risk situation was very high and was ranked immediately after Iraq and Sudan (Nassri, 2002, pp. 134-138). Although some of the world's most reputable companies, such as Total of France, continued to cooperate with Iran on oil under certain "high risk" conditions, Iran could never obtain the necessary amount of investment from such companies to receive exploitation of oil wells. Since the oil industry is the most crucial part of the Iranian economy, this part of the Iranian economy is always considered by the

sanctioning countries' economic sanctions. Iran's economic dependence always allows the big sanctions countries to use this Achilles heel to destabilize the Iranian economy. With the coming to power of the ninth government (Mahmoud Ahmadinejad) in 2005 and a series of nuclear measures in Iran, especially the

The Formation of JCPOA and its Impact on the Iranian Economy

With the 11th government (2013) coming to power, and the slogan of moderation in Iran, and the policy of de-escalation in the region as well as interaction with the world, many hoped that Mr. Rouhani's government's negotiation with the major sanctions powers, the hostilities and sanctions would be reduced and Iran would emerge from isolation. To this end, and to get rid of the economic problems and stagflation that had caused many problems for the Iranian nation's livelihood, the Rouhani government tried to solve this problem using the diplomatic apparatus of the Islamic Republic.

To that end, Iran's nuclear program was handed over to a team from the Foreign Ministry led by Foreign Minister Mohammad Javad Zarif (Daryaei, 2016, p. 13). After a series of lengthy negotiations between the Iranian diplomatic mission and senior P5 + 1 representatives (Russia, China, the United States, France, the United Kingdom, and Germany), following the two Vienna-Lausanne Interim Agreements in July 2015 (14 January 2015), the Joint Comprehensive Plan of Action (JCPOA) was reached under the Vienna Agreement (Shirazi, 2016, pp. 4-38). The JCPOA has been considered a great victory for Hassan Rouhani's government at home and abroad since the diplomacy of the 11th the government was able to break the eight-year negotiations between Iran and the P5 + 1 members and hold direct talks with the US representatives in the form of bilateral or multilateral meetings. Although fundamentalists in Iran and Israel criticized the JCPOA, it was still a significant achievement for Rouhani's government. Iran's economic transformation after the JCPOA nuclear deal, although it was not as extensive and in-depth as expected, it made it possible for some foreign companies to enter Iran. In the era of international developments and globalization and the economic dependence of developing countries, the opportunity to benefit from international facilities and foreign investment is provided to these countries to a large extent. Iran's economy, like many developing countries are tied to international developments. However, the intensity of international political factors and issues in the Iranian economy are very high. For example, with a look at the Iranian capital market, it can be seen that the stock index in Iran is undergoing dramatic changes in the international arena after important political events inside the state itself. Many believed that with the acquisition of JCPOA and the entry of some foreign companies into the Iranian economic market, as well as a fundamental change in the foreign policy of the Islamic Republic, the Iranian government, would gradually abandon its aggressive policy and pursue a policy of de-escalation, confidence-building,

and engagement in the Middle East and the world. Within the JCPOA, it has been stated that Iran would pave the way for the suspension of sanctions imposed by the UN Security Council by fulfilling its nuclear commitments and providing specific information to the International Atomic Energy Agency. By fulfilling its commitments, Iran could suspend many sanctions, especially oil purchase sanctions, which were a significant obstacle for Iranian oil buyers. It was expected that with the lifting of the Security Council nuclear sanctions and unilateral US sanctions, the Iranian government would have easy access to trade, finance, technology, and energy. In addition, by lifting the sanctions, the 11th government could have brought about a dramatic change in the Iranian nation's aviation and safety industry.

Trump's Victory in US Elections and its Withdrawal from JCPOA

Harsh anti-Iran and anti-JCPOA rhetoric during the 2016 presidential election of Donald Trump indicated that if he took power in the United States, the Rouhani administration would face economic hardship at home and regional political isolation. His entry into the White House and his abandonment of Obama's colluding policy with the Islamic Republic of Iran pleased some fundamentalist factions in Iran and some regional rulers (Sajedi, 2019, p. 251) because the nuclear deal was very worrying for some Middle Eastern countries (Israel, Saudi Arabia), which did not have a favorable view of Iran's actions. In their view, the nuclear deal's seemingly abandonment is a confrontational approach by the Islamic Republic, which seeks to engage with the West and some regional governments under its guise, thus affecting their role in the Middle East. Within no time, Iran's internal developments (criticism of fundamentalists, military pressure, demonstrating missile power, and writing the slogan of Israel's destruction on them) as well as the increase of Iranian military forces in Syria, and expanding influence in other parts of the Middle East, the interactive image of the Islamic Republic of Iran faded with the American government. This allowed American and Israeli politicians to introduce Iran's Islamic Republic as an aggressive regime in the international arena. With Trump winning the election and taking power, he tried to force one of his election slogans and involve Congress in this issue by delegating the United States' withdrawal from JCPOA to Congress. However, Congress dodged this critical issue and left it to Trump himself. Finally, on May 8, 2018, Trump announced the United States' withdrawal from the JCPOA agreement, which was criticized by Rouhani's administration and other members of JCPOA.

Considering the actions taken against the JCPOA and the United States' withdrawal from it, there were many fluctuations in Iran's financial and monetary economy. The JCPOA, as a multilateral agreement registered with the United Nations, had revived Iran's oil revenues and had a significant impact on Iran's economic sector. However, with the United States' withdrawal from the JCPOA agreement and the US threats to resume sanctions, Iran's economy has suffered from turmoil and drastic changes, which was clearly seen in the Iranian financial markets in early 2018. To understand the changes resulting from the US withdrawal from JCPOA and its impact on Iran's economy, financial markets, and the spread of turbulence in these markets, we investigate using multivariate GARCH methods and analysis of variance. Then we show the intensity of the spread of turbulence and fluctuations in Iran's financial markets and stock exchanges.

Multivariate Garch

Autoregressive conditional heteroscedasticity

The autoregressive model based on variance heterogeneity (Arch) was first introduced by Engel (1982) as one of the nonlinear models for the financial time series. One of this model's features is that it depends on the time of assuming fluctuations in returns.

Table 1: Types of multivariate GARCH models

Nonlinear composition of univariate GARCH models	Linear composition of univariate GARCH models	Direct generalization of Bolersulf variable GARCH models
CCC	Latent Factor	VEC
DCC	Generalized Orthogonal Models (O-GARCH, GOGARCH)	Bekk
GDC		Factor Models
Copula-GARCH Models		Flexible MGARCH
		Risk metrics
		Full Factor GARCH Models

Dynamic Conditional Correlation Model (DCC)

Given that the constant correlation consideration may sometimes be unrealistic over time, the Constant conditional correlation (CCC) model is not always practical. Thus, a model was created that brings this model closer to reality by considering the correlation variable over time. The dynamic conditional correlation model (DCC) was a model that seems more practical with these conditions, and this model has been used in this study. There are various estimates of the dynamic conditional correlation model, but one of the most widely used is the 2002

Generalized autoregressive conditional heteroscedasticity

In some Arch model applications, conditional variance equations with relatively long intervals are used to determine the structure of the intervals to avoid the problem of negative parameters invariance; it is necessary to be able to select a process with a long memory and a more flexible interrupt structure than the Arch Class. Another generalization is proposed as the generalized ARCH process by Bollerslev (1986) to achieve more flexibility.

Multivariate generalized autoregressive conditional heteroscedasticity

Linear combinations of univariate GARCH models are linear combinations of several univariate models, each of which is not necessarily a standard GARCH model. Nevertheless, Nonlinear combinations of univariate GARCH models allow the researcher to determine each conditional variance separately on the one hand and the conditional correlation matrix on the other.

In Table 1, the types of multivariate GARCH models are categorized by Bowens Et al. (Bauwens, Laurent, and Rombouts)

parasite model. The dynamic conditional correlation model is similar to the Constant conditional correlation model, except that the correlation varies over time. The dynamic conditional correlation model is one of the most valid models that has been introduced in relation to modeling variable-time correlation parameters for the multivariate portfolio. This model maintains the ease of estimating the fixed conditional correlation model and considers the correlations as variables. The dynamic conditional correlation model creates a constant definite covariance matrix of variance at any point in time.

Analysis of Variance

Overflow intensity was measured in this study using the variance analysis proposed by Dibold and Yilmaz (2012). This approach is based on the H-step-ahead forecast-error variance decomposition for each N variable in the N variable vector autoregression. In this approach, it is possible to examine part of the variance of the prediction error of variable i, which can be attributed to shocks caused by variable j, and by adding these effects, the overflow index is calculated. Transmission in financial markets refers to the fact that a loss in an asset, or a set of assets, may increase the risk in other assets or other countries (Branger Et al. 2009). In overflow analysis, it would be appropriate to consider the direct effects from (or to) a particular market.

$$DS_i^g(H) = DS_{i \rightarrow j}^g(H) - DS_{i \leftarrow j}^g(H)$$

The net overflow index's positive values indicate the presence of overflow effects from the market I to other markets, while negative values indicate that market I receive overflow effects (Dibold and Yilmaz, 2008).

Model Estimation

In this study, we first examined the spread of fluctuations from the foreign exchange market to the Iranian stock market, using data from 2009 to 2019 for this purpose, and then we measured and compared the intensity of turbulence in the two periods before and after the American presidential election. Also, the period under review includes 2070 data. To evaluate the

performance and better understand how they affect each other, the logarithmic efficiency of two

indicators of the formula was calculated and considered.

In this formula represents the price in the time of t and rt-1 represents the price in a previous period.

The trend of changes in the efficiency of the two-time series is shown in Figure (1).

Figure 1. Logarithmic returns of the total Tehran stock market index and the price of the dollar

The statistical characteristics of the Tehran Stock Exchange logarithm and the exchange rate (US dollars and Iranian Rials) from April 2010 to January 2018 are shown in Table 2.

Table No. 2. Statistical characteristics of logarithmic returns of the total Tehran stock market index and the price of the dollar

Index type	number of samples	Jarque-Bera Test	Elongation	Skewness	Standard deviation	Maximum	Minimum	Average
Return of Iran Stock Exchange	2070	2740.730	8.578743	0.427535	0.007207	0.52608	-0.056703	0.001219
Dollar price returns	2070	166792.4	46.99280	0.562436	0.012831	0.157797	-0.182322	0.000730

The amount of skewness in both time series can be considered insignificant, but according to the amount of elongation in both time series, they can be assumed to be flattened, which makes us assume that the distributions used for these series are T-student.

Also, the results of Dickey-Fuller and Phillips-Peron tests on both indicators are as follows:

Table 3. The results of meaningful tests of the total stock index of Tehran and oil.

Index type	Type of test	Value of test statistics	P-value	Test result
Return of Iran Stock Exchange	Dickey-Fuller	-19.73375	0/0000	Data is meaningful
	Phillips-Peron	-34.61122	0/0000	Data is meaningful
Dollar price returns	Dickey-Fuller	-36.48504	0/0000	Data is meaningful
	Phillips-Peron	-43.82396	0/0000	Data is meaningful

The spread of turbulence from the dollar price to the Tehran Stock Exchange index using the dynamic conditional correlation model, one of the multiple GARCH models, is estimated in Table 4.

Table 4 DCC model results

Possibility	Test statistics	Standard deviation	Correlation	Parameter
0000/0	534256/2	000000/0	000025/0	M (1,1)
0000/0	476453/0	000000/0	000000/0	M (1,2)
0000/0	532826/5	000023/0	000072/0	M (2,2)
0000/0	354677/7	000867/0	095832/0	A1(1,1)
0000/0	740034/2	001534/0	00746/0	A1(1,2)
0000/0	364704/7	003245/0	037489/0	A1(2,2)
0000/0	09487/58	006478/0	897389/0	B1(1,1)
0000/0	6576/66	003276/0	237676/1	B1(1,2)
0000/0	4657/78	05434/0	986323/0	B2(2,2)

In the above table, the parameters M are constant coefficients, A is ARCH coefficients, and B are Garch coefficients. Table 4 shows that at the level of 1%, both time series are affected by their past Arch and Garch coefficients. Both Arch and Garch coefficients from time series 1 (dollar price) to time series 2 (Tehran Stock Exchange index) are significant, and this means that there is a transmission of turbulence from the exchange rate to the Tehran Stock Exchange index. In this estimate, the Tehran Stock Exchange index, dependent variable, and dollar

price are considered independent variables. After examining and observing the spread of turbulence from the dollar price on the total index of Tehran Stock Exchange, in this section, the period is divided into two part before and after Trump's victory in the U.S. election, to determine whether the U.S. elections and developments affected the Tehran Stock Exchange, which is one of the important capital markets, or not. Using the variance analysis, we measured the severity of the turbulence in two equal periods before and after Trump's election victory.

Table 5: The severity of the turmoil before Trump won the U.S. election

Variable	Overall Index	The price of the dollar	Contagion from others
Overall Index	28/99	9/65	9/65
The price of the dollar	0/02	63/99	0/02
Transmission to others	%02	9/65	9/67
Total transmission to itself and others	30/99	109/28	%2/66

According to Table 5, the intensity of turbulence from the dollar price to the Tehran Stock Exchange is about 9.65 units, and in total, there is about 3% of turbulence in these two markets.

Table 6. The intensity of turbulence after Trump's victory in US elections

Variable	Overall Index	The price of the dollar	Contagion from others
Overall Index	77/95	25/23	25/23
The price of the dollar	4/3	65/95	3/4
Transmission to others	4/3	25/23	27/55
Total transmission to itself and others	07/100	122/9	%8

According to Table 6, the intensity of turbulence from the dollar price to the Tehran Stock Exchange is about 23 units, which is an increase of 13.6 units compared to the previous period, and in total, about 6% of turbulence transmission between these two markets has increased up to 8%.

The results show that the Tehran Stock Exchange, which is the main symbol of the capital market, is affected by some variables such as exchange rates and currency market fluctuations are transferred to the capital market. Now, these effects intensify during some crises and cause more unrest.

Measuring the severity of the turmoil during Trump's victory and comparing it to the time before his victory suggests that Iran's capital market is affected by political developments. Since this vulnerability is not directly measurable (there is no specific variable to indicate political developments), we tried to show this impact by dividing time into two periods before and after the transformation.

Conclusion

Exports and imports play a significant role in the economy of the Islamic Republic of Iran. Many goods and raw materials are imported. Also, refineries and oil companies are active in oil and gas exports. These imports and exports have caused Iran to have extensive relations with other countries, and since all these exchanges and international transactions take place with the dollar currency, the fluctuations of this currency are expected to affect the capital market strongly. On the other hand, the dollar is one of the parallel markets of Iran's capital market, which usually influences each other and determines each other's movement. Therefore, for two decisive and logical reasons, one can expect the spread of turbulence from the fluctuations of the dollar exchange rate on the capital market, firstly, imports and exports, and secondly, the aspect of dollar investment in Iran. The first part of this study's statistical results meets the high expectations and show a spread of turbulence from the dollar price on the Tehran Stock Exchange index. According to the results of Table 3, which used a dynamic conditional correlation model to show the transmission of turbulence, the Arch and Garch coefficients were significant in this model, and this means that from the independent variable to the dependent variable, which in this article were the dollar price to the Tehran Stock Exchange index, there is a spread of turbulence.

The second part examined the US presidential election and its impact on the Iranian economy. The results showed that the intensity of the spread of turbulence from the dollar price on

the Tehran Stock Exchange index before and after the election of Donald Trump to the US presidency was different; this intensity of the fall of the Tehran Stock Exchange index is visible after the victory of Donald Trump. The comparison of Tables 4 and 5 illustrates this well. The spread of turbulence from the dollar before Trump's victory, the Tehran Stock Exchange was about 9.65 units, which reached 23 units after Trump's victory in the election. Also, the percentage of turbulence spread in the total between the two-time series of the dollar price and the Tehran Stock Exchange index has increased by about 6%. A comparison of the two tables shows that there has been a fundamental change in the Tehran Stock Exchange index, its turbulence has increased sharply, and this disorder is due to another time-series, which is the exchange rate.

From the study, it can be seen that in this period, the fundamental change in the Iranian economy is due to the US elections, which is the main topic of this article. In a general conclusion, this article shows that political discourses and theories are not only analysis and discussion but also have scientific and statistical evidence. Politicians and statesmen who are well aware of Iran's oil dependency should always review these results and make the right decisions, away from excitement and prejudice, based on logic and science, so that we do not see strange inconsistencies in Iran's critical economic indicators. Because whenever the country's economy is affected by these severe imbalances, it is shaken, and it is challenging and time-consuming to compensate for such damages caused by these severe fluctuations. In addition, by predicting the movement of other markets, especially the foreign exchange market, and by considering critical political developments, it is possible to obtain a correct estimate of the capital market's movement and make appropriate decisions to advance economic goals. According to the results obtained due to the political developments in Iran and the United States after the JCPOA, it can be said that in 2019, Iran's economy was severely shaken by new US sanctions (especially oil sanctions) that spread more in the financial market and stock market.

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