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International Journal of Energy Economics and Policy

Provided in Cooperation with:
International Journal of Energy Economics and Policy (IJEEP)

This Version is available at:
http://hdl.handle.net/11159/8419

The Effects of External Uncertainties against Monetary Policy Uncertainty on IRANIAN Stock Return Volatility Using GARCH-MIDAS Approach

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ABSTRACT

This study investigates the effect of two external uncertainties of US Economic Policy Uncertainty (EPU) and OPEC oil price uncertainty against domestic monetary policy uncertainty on Iran's stock return volatility. Reaching this goal, GARCH-MIDAS approach is employed that makes it possible using different variables with different frequencies during the period from January 2009 to September 2017. The research uses Iran's stock return with high frequency and other variables with low frequencies. The results of the GARCH-MIDAS model show that the increase in the US EPU, the OPEC's oil price uncertainty and Iran's monetary policy uncertainty increase volatility of Iranian stock returns. US EPU significantly impact on Iran's stock return volatility, which implies that the Iranian stock market has gradually merged into the global economy. However, oil price uncertainty has stronger effect on the stock return volatility than US EPU. In addition, monetary policy uncertainty is the strongest in affecting stock return uncertainty. Iranian policymakers can reduce the volatility of stock return by decreasing domestic monetary policy uncertainty.

Keywords: US Economic Policy Uncertainty, Monetary Policy, Oil Price, Iran's Stock Volatility, GARCH-MIDAS
JEL Classification: G12

1. INTRODUCTION

Iran's stock market has experienced great development in the last decade compared to other markets. However, considering the growth rate of the total stock index over the past ten years, the stock market index has highly fluctuated during these years. According to (Bekaert and Harvey, 1995) stock market integration leads them to be heavily influenced by external factors. So, the volatility of Iran's stock market is expected to be affected by investors' fears of the world economic uncertainties. In other words, external uncertainties are important factors in affecting decisions of the investors and financial asset prices (Drechsler, 2013). Uncertainties make investors transfer their investments to

other sectors of the economy and change the stock market index. Uncertainty Indicators introduced in recent years and may affect stock prices (Baker et al., 2016; Su et al., 2018). Economic policy uncertainty (EPU) that is determined by newspaper coverage of the repeated events is an important factor that can shift economic activity. It indicates the role of government in creating financial or monetary uncertainty. The global financial crisis which began in the United States in 2008-2009 and spread to the rest of the world highlights the importance of the US uncertainty indexes. This research investigates the role of news-based US EPU as well as OPEC oil price uncertainty on Iran's stock market volatility. It considers OPEC oil price uncertainty because of the relationship between Iran's stock market and crude oil market in recent

years. In one hand, industrial productions significantly depend on crude oil price, and on the other hand, the stock indexes of the petrochemical, refining, chemical, and other oil industries have a large share of the total stock market index. Therefore, the uncertainty in crude oil price is expected to have a significant impact on the financial sector. Apart from these two external uncertainties that can not be controlled by policymakers, monetary policy is an important factor that affects the stock market index. The effects of monetary policy on the stock market, as a channel that transmits monetary policy to the economy, is of high interest among economists (Li et al., 2010; Razmi et al., 2016; Razmi et al., 2015). The most important role of monetary policy is affecting economic variables by controlling the volume of money and total liquidity. Therefore, any instability in liquidity can lead to fluctuations in other macroeconomic variables. The effects of money on the stock price can be explained from various angles. In one hand, an increase in liquidity causes an imbalance in the real balance of money. Thus, people try to invest excess money to buy financial assets, including stocks to maintain their real balance and consequently, cause an increase in stock prices. On the other hand, expansionary monetary policy results in lower interest rates, higher demand for stocks and higher stock price.

This research has been completely innovative in two ways, subject and methodology. In terms of the subject, the study comprehensively covers the gap that exists in stock market research by examining and comparing the effects of three uncertainties on stock price volatility, the external uncertainties include US EPU and oil price uncertainty against domestic monetary policy uncertainty in Iran. To the best of authors knowledge, this type of research that considers important external uncertainties as well as domestic uncertainty has not been considered yet. Besides, considering oil price uncertainties on stock markets is a new topic in recent researches. However, monetary policy uncertainty is not studied yet. Most of researches dedicated to find the effects of one external or internal shocks to stock prices not their uncertainties. From the methodological aspect, GARCH-MIDAS methodology of this research is considered as a new method of econometrics and has been able to solve the problem of using time series with different frequencies. Although high-frequency data can be used for empirical analysis, this reduction of frequencies can lead to loss of information. Therefore, GARCH MIDAS of Engle et al. (2013) model is completely appropriate in this analysis.

In the next section we present the literature review and then the research introduces and illustrate the GARCH-MIDAS model. In the fourth section, the results of the model estimation are explained and finally, the conclusion is represented in the fifth section.

2. LITERATURE REVIEW

Modeling and anticipating volatility are important for risk management, asset allocation and policy making and has attracted the attention of many academics and professionals (Carrieri et al. (2007). Kostanjcar et al. (2012) found that volatility in financial markets can be attributed to the risk aversion and uncertainties to expected returns for traders. (Longin and Solnik, 2001; Solnik et al., 1996) showed that correlation among international markets is usually higher in bad or fluctuating periods. The effects of US economy on other stock markets countries are also have considered in some research. (Bekaert and Harvey, 2003) considered the movements of fluctuations to other parts of the economy. They also emphasized on the shifts of fluctuations from the US stock market to other global markets due to the US largest stock market. Similar research was done by (Arshanapalli and Doukas, 1993) in which they showed that the US stock market had impacts on markets in France, Germany and England. Rapach et al. (2013) also found that US stock returns could significantly predict the stock returns of non-US industrial countries. In addition, some empirical studies have used uncertainty indicators to investigate the relationship between uncertainty and stock market return or volatility. Asgharian et al. (2015) considered the relationship between the long-run volatility of the US stock market and macroeconomic variables using the GARCH- MIDAS model. Their results showed that macroeconomic variables are important determinants of long-run stock market fluctuations. They also discovered corporate profits and unemployment rates had the highest potential for forecasting long-run stock fluctuations. Su et al. (2017) examined the role of news-based US uncertainty in predicting long-run volatility of the US market by using GARCH-MIDAS approach. They found that potential news fluctuations could well predict long-run volatility in the stock market. Su et al. (2018) studied the impact of US economic uncertainty on stock market fluctuations in nine selected countries using the GARCH-MIDAS model. They considered three different indexes: EPU, financial uncertainty (FU) and news implied volatility (NVIX). The results show that US uncertainty proxies act differently in anticipating of the long-run stock market fluctuations. The EPU was positively correlated with stock market fluctuations in the industrialized countries and had the greatest impact on the UK and Japan. However, FU did not predict long-run stock market fluctuations in most countries. Contrary to the EPU results, NVIX had a negative relationship with stock market volatility and was a strong indicator in anticipating stock market fluctuations in countries other than the G7.

The effects of oil prices and monetary policy on the stock index have been studied so far by many researches i.e. Razmi et al. (2016) discovered the effects of oil price shocks on stock prices of ASEAN-4 countries. They also comprised the effects of oil price and monetary policy on stock prices in Razmi et al. (2015). However, the role of uncertainties of the oil price and monetary policy in affecting stock market is a new topic. Few studies have considered the role of oil price uncertainties on stock markets. (Luo and Qin, 2017) discovered the effects of shocks to oil price uncertainties on Chines stock returns. The results showed that oil price uncertainty had negative impact on stock market returns. Similar results were found by Xiao et al. (2018) for investigating the effects of oil price uncertainty on chines sectoral and aggregate returns.

3. DATA AND METHODOLOGY

GARCH-MIDAS model presented by Engle et al. (2013) based on Spline-GARCH of (Engle and Rangel, 2008) in which macroeconomic variables as independent variables with low frequency can be used on a regression with stock returns with high frequency.

$$r_{i,t} = \mu + \sqrt{\tau_t \times g_{i,t}}\, \varepsilon_{i,t} \cdots\cdots, \forall_i = 1, \cdots\cdots, N_t \qquad (1)$$

$$\varepsilon_{i,t} \,|\, \Phi_{i-1,t} \sim N(0,1)$$

Where N_t shows the number of working days on month t, $\Phi_{i-1't}$ indicates information about day of $i–1^{th}$ in period t. Equation 1 consists of two components that are $g_{i,t}$, the short-run variance, and, τ_t the long-run variance (Engle et al., 2013).

Equation 2 shows the conditional variance $g_{i,t}$

$$g_{i,t} = (1-\alpha-\beta) + \alpha\frac{(r_{i-1,t-\frac{1}{4}})^2}{\tau_t} + \beta\, g_{i-1,t} \qquad (2)$$

In which $\alpha+\beta<1$, $\beta\geq0$, $\alpha>0$.

Equation 3 indicates the long-run component that contains data with low frequencies

$$\log(\tau_t) = (m + \theta\sum_{k=1}^{k}\delta_k(\omega)X_{t-k}) \qquad (3)$$

X_t indicates exogenous variable (monthly and quarterly for this research). Equation 4 shows how the weights of the ω can be obtained

$$\delta_k(\omega) = \frac{(k/K)^{\omega_1-1}(1-k/K)^{\omega_2-1}}{\sum_{j=1}^{K}(j/K)^{\omega_1-1}(1-j/K)^{\omega_2-1}} \qquad (4)$$

$\mu, \alpha, \beta, \theta, \omega$ and m are the parameters of GARCH-MIDAS model that can be found by maximizing the likelihood function of Equation 5 Amendola et al. (2017).

$$LLF = -\frac{1}{2}\sum_{i=1}^{T}\left[\sum_{t=1}^{N_t}\left[\log(2\Pi) + \log(g_{i,t}\tau_t) + \frac{(r_{i,t-\mu})^2}{g_{i,t}\tau_t}\right]\right] \qquad (5)$$

4. EMPIRICAL RESULTS

The purpose of this study is to examine the impact of external uncertainties of monthly US economic policy of Baker et al. (2016) and monthly oil price against quarterly liquidity uncertainty, as indicator of monetary policy uncertainty, on daily Iranian stock return volatility (Iranian Ministry of Economic Affairs and Finance, 2017). The data covers the period between 2009 February and 2017 June. Uncertainties of Iranian stock return, OPEC oil price and liquidity are obtained from GARCH models. It is necessary to test the stationary of the data in order to avoid spurious regression. According to the results of the Dickey Fuller test in Table 1, all the variables are not stationary in levels except US EPU but they are stationary in growth rate form. We use standardize of variables to be able to comprise the strength of coefficients of these two variables models. It must be noted; the uncertainties of the variables are extracted from GARCH on stationary form of variables.

The data is used in standardized type so it is possible to compare coefficients of the variables. Before proceeding, it is necessary to estimate the optimal lag length of K. Following Amendola et al. (2017), we choose lag length of 12 months or four quarters that covers 1-year information. Following Conrad et al. (2014), we try to investigate the effects of three aforementioned uncertainties on domestic stock return volatility in three bivariate GARCH-MIDAS models of M1, M2 and M3 in which US EPU, OPEC oil price uncertainty and Iran's monetary policy uncertainty are included in three models, respectively.

Table 2 shows the results of the GARCH-MIDAS model estimation. α indicates the effect of current events on conditional variance and β represents the persistence of fluctuations or the effects of previous events. The closer the rate to 1, the longer it takes eliminating the response to shocks and fluctuations or older information is more important than recent information. In all three models, the effect of older events on stock return volatility is greater than the effects of new events. The research tries to investigate the effect of external uncertainties against domestic monetary policy uncertainty on stock return volatility. The direction and magnitude of those effects can be interpreted through the theta coefficient. The value of θ is 0.16 in M1 model which indicates a positive and significant effect of US EPU on Iran's stock return volatility. US EPU index is based on news and information in US-readable newspapers. Therefore, undesirable economic news in a country like the United States could lead to more volatility in stock return of a country such as Iran. Theta is 0.4 for OPEC oil price uncertainty that indicates the important role of oil price in Iran's economy. It has stronger effect on stock return volatility than US EPU. The coefficient is 0.97 for monetary policy uncertainty that means uncertainties about monetary policy make stock return most volatile. This result indicate stock market

Table 1: Unit root test

Variables	Intercept	Trend and intercept	None
ST	−0.663395 (0.85)	−1.513282 (0.82)	1.688263 (0.97)
SURST	−19.82431 (0.00)	−19.95524 (0.00)	−19.82914 (0.00)
SUSEPU	−3.732945 (0.0049)	−4.019094 (0.0110)	−1.036574 (0.2686)
M	−1.461508 (0.5402)	−1.705564 (0.7261)	−1.099157 (0.2407)
SUGM	−2.945414 (0.0509)	−2.936287 (0.1648)	−2.992273 (0.0040)
OIL	−1.484156 (0.5377)	−2.404665 (0.3750)	−0.284979 (0.5810)
SUROIL	−2.842564 (0.0560)	−2.910988 (0.1636)	−2.857406 (0.0046)

The numbers in parenthesis show probability. Variables are defined as follows ST: Stock price, SURST: Stock return uncertainty standardized value, SUSEPU: US EPU uncertainty standardized value, M: Money supply, SUGM: Uncertainty of money supply growth standardized value, OIL: OPEC oil price, SUROPEC: Uncertainty of OPEC oil return standardized value

Table 2: GARCH-MIDAS coefficients

Coefficients	M1	M2	M3
μ	−0.147***	−0.164***	−0.162***
α	0.378***	0.345***	0.354***
β	0.582***	0.632***	0.611***
m	0.134	1.254**	0.897**
θ	0.168***	0.402***	0.971***
ω	1.001**	49.998**	2.820***

***Indicates 1% significant level and **represents 5% significant level

of Iran is more sensitive to domestic uncertainty. However, the role of external uncertainties in affecting stock return volatility are of high importance.

5. CONCLUSION

The purpose of this paper is to consider the impact of important external uncertainties of US economic policy as well as OPEC oil price against domestic monetary uncertainty on Iranian stock return volatility. The study uses GARCH-MIDAS model that covers the data from Jan 2009 until June 2017. Stock return with daily frequency, US EPU, OPEC oil price uncertainty are in monthly frequency and liquidity in quarterly frequency. In addition, following Conrad et al. (2014), in the GARCH MIDAS Model, for each model, the research introduces one macro variable into the model. The results show that external uncertainties of US EPU and OPEC oil price uncertainty have a positive and significant effect on Iran's stock return volatility. Therefore, bad news that increases US EPU would also increase stock return volatility of Iran. However, the stock market of Iran reacts stronger to uncertainties from oil price than US EPU. It must be noted that Iran's monetary policy positively and significantly affect stock return volatility that is much greater than the external uncertainties. Iranian policymakers can reduce the volatility of stock return by decreasing domestic monetary policy uncertainty.

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