ANALYSIS OF CONDITIONAL ASYMMETRIC VOLATILITY OF REAL GDP AND MAIN ECONOMIC SECTORS GROWTH RATES IN IRAN

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ABSTRACT

GDP growth is one of the basic and effective factors of economic growth of country and it is directly so-called economic growth, so we must pay a lot attention to its volatilities. Most empirical studies of economic growth exclude these volatilities and the dimension of conditional volatility shocks.

In this paper we search for evidence of conditional volatility in quarterly real GDP of Iran. Furthermore, in order to investigate the basic reasons of these volatilities, we also examined four main economic sectors including agricultural, industrial and mining, oil and service sectors. The widely accepted exponential GARCH model of Nelson is employed to record the possible existence and asymmetric conditional volatility in real GDP and main sectors. The data set are in constant prices and quarterly observation from 1367 Q1 to 1391Q3.

The government needs to use these volatilities to implement stabilizing policies which are the new method for analyzing of GDP and help for understanding the existing disturbances and growth rates. In this paper we capture the real GDP volatilities and its main determinants, afterwards it proves that the necessity of well-advised government intervention.

As a result of this paper, it is calculated the equation for growth rate variance and persistence and asymmetry are gotten. Also, the negative shocks of GDP have more effects on future values of GDP than positive ones by equal values. Moreover, the results show that oil shocks are the most important reasons of real GDP volatilities. Consequently, for removing the variations, strategic action of government and diminishing the effectiveness of oil are needed. The results can be used for growth and development to achieve an economy with a stable and increasing growth.

Keywords: *EGARCH Model, Real GDP Growth Rates, Conditional Standard Deviation, Oil Shocks, Iran Economy.*
JEL CLASSIFICATION: O47, E32, E37.

1. INTRODUCTION

Gross Domestic Product is one of the most important economic .This variable depends on several factors, such as: Oil shocks, Outbreak of war and also monetary and foreign exchange shocks. In oil-exporting countries, such as Iran, oil revenues can affect GDP considerably, so oil shock can be one of the most important reasons of creating GDP fluctuations and also changing the growth rate. Oil- consuming countries are less affected by oil price inconsistency than industrial countries. Generally economic health in each country depends on stable development of that country, so it is expected that unpredicted amounts in macroeconomics such as: real GDP conditional variability help the understanding the changes in market variability. Being aware of such unpredictability can help better and more realistic growth of interval prediction in economic and GDP, as former collected data are allowed to affect GDP dispersion of growth rates prediction and can be applied practically. The main goal of this research is showing real GDP asymmetric conditional variability of growth rates in Iran and the effect of positive and negative shocks on that. In other words, the main issue in this research is analyzing GDP fluctuations, variability and observing existence or lack of GDP growth rate continuous variability and lack of symmetry in Iran, so in order to observe GDP growth rate continuous variability and also lack of symmetry in Iran, a specific and accurate model through asymmetric conditional variability – ARMA- GARCH models by pointing to causing basic factors such s oil shocks. The result of this research helps better and more accurate analysis of economic phenomena. For example: if the economy of a country leads to variable shocks, regularly, the government interference would be essential. In addition, GDP negative shocks can cause considerable future variability through positive shocks. In case of fixing macroeconomic variables and economic stabilization policies would be more considerable. For more accurate studies of affecting factors on GDP growth rate variability, main sub branches of economical activities includes: agriculture, industry, oil and services are analyzed and the existence and lack of conditional variability is observed by using mentioned model.

2. LITERATURE REVIEW

Daniel B.Nelson(1991) introduced GARCH model for the first time with the possibility of observing asymmetry and continuing variability of financial asset returns. After that , several studies in case of observing asymmetry and continuing variability of financial asset returns and growth rate of real GDP across the world are presented, such as: Kin Yip Ho and Albert K.C (2004) in case of China GDP growth rate analysis ,Philip M.Bodman (2006),et in case of output variables in Australia , Vu Thanh Hai , Albert K.Tsui and Zhaoyong Zhang, et(2009) in case of measuring asymmetry and continuity in real output conditional variability for East Asian Tigers, Wenshwo Fang, Stephan M. Miller (2008) in case of GDP growth rate variability modeling article in Japan and Kin-Yip ho, Albert K.Tsui and Zhaoyong Zhang studies in case of conditional asymmetry variability of commercial cycle , as a witness of OECD countries.

After all, in case of real GDP growth rate variability in Iran inconsiderable studies have been done and different time series variability and possibility of asymmetry variability and continuation aren't focused so much. However, some studies have been done, such as; Haidary ET studies (2010) with the title of (the effect of economic uncertainty and economic growth in Iran; observance based on GARCH model that focuses on the relation between economic growth uncertainty and economic growth from 1988 to 2005 by using seasonal data and different usage of GARCH models and GML. The result of this research doesn't reject Friedman hypothesis (1968) based on lack of meaningful specific relation between these two variables. Also observing positive and negative shocks effect on uncertainty shows; the existence of asymmetry effects, in case that economic growth negative shocks influenced uncertainty more than positive shocks. Komayjani and Mehmandoost(2010) observed the dynamic effect of oil shocks and monetary policy on Iran economic growth and calculating the share of each one in economic growth from 1974 to 2006 in an article titled and analyzed an assessment of shock effect and monetary policy on Iran economic growth and dynamic interaction effects due to made shocks in pattern with use of (VAR) model includes: Variance decomposition of the forecasting error (EFVDs) and Impulse response functions (IRFs). The gained results through this research shows: oil shocks in Iran were effective considerably on economic growth, but in spite of effectiveness of oil shocks on liquidity and creating gained expansionary monetary policy, monetary shocks couldn't affect economic growth. Hadian and Hashempoor (2003) focused on extracting long-term components of the business cycle and erratic shocks of Iran real GDP and also identifying business cycles causes of emergence in Iran economy in an article titled: identifying business cycles in Iran economy and predicted Iran real GDP according to 3 mentioned elements from 2000 to 2005. The method includes three steps: the first step is explaining and analyzing Iran real GDP to the mentioned components. Second step includes: presenting an issue about assessment, recognition and observance of business cycles causes of emergence and finally third step is predicting mentioned components to asses Iran real GDP for a period of five years. It is supposed; Iran real GDP annual time-series data are the total of three components of long-term trends, cyclical fluctuations and erratic movements. To separate these components, Hodrick – Prescott filter is used in two steps. In first step, this filter is used to extract long term procedure. In second step, cycle component is extracted through gained remaining. Then some of the macroeconomic variables are used to observe movement and sensitivity. Finally, in order to predict mentioned components, ARIMA patterns are used. The results of the research showed: Iran GDP long term procedure growth rate was negative in early years of revolution and beginning of imposed war (1982 -1988) and last years of war (1986-1988). Also the results showed: Iran economy in that year passed the seventh business cycle and continue to period of stagnation in eighth business cycle from 2001 to 2004. Then improvement period starts. The results of this article also show: the fluctuations of Iran's economy are compatible with business cycle. In this article, the existence of Parallel relation between some of macroeconomic variables and GDP was observed and confirmed. Finally, high sensitivity of investment and export is an important proof to create economic cycles. Of course in fourth chapter, the field of forming this hypothesis is experience of economic fluctuations in Iran, affected by shocks. Further findings show: revenue from oil export is the reason to create business cycle in Iran economy. In this case, Granger causality test is used to face this variable. Resulting experimental evidence shows: this variable has all conditions the cause of the business cycle, as oil revenue has high Sensitivity coefficient and also leading variable and high correlation coefficient.

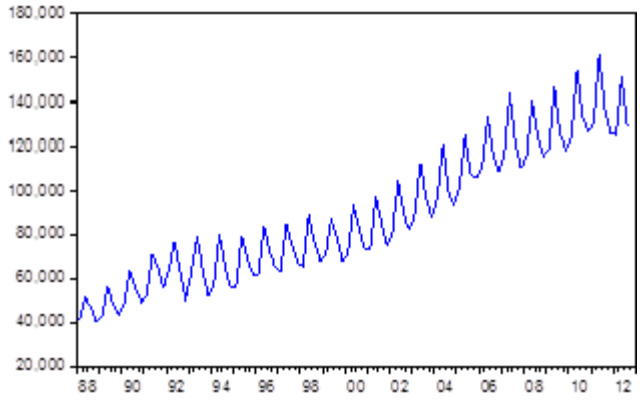
3. THEORETICAL FOUNDATIONS

GDP is important among macroeconomics indicators, since it is analyzed as the most important Growth index and economic performance. According to the importance of economic growth, fluctuation and variability in this field is so important too. According to the fact that GDP is collected annually and seasonally, in order to have better registration and observance of fluctuation and variability, using seasonal data is used, as seasonal national accounts are more updated than annual national accounts and has more data and quality contents than short term basic statistics. According to update feature, observing and registering business cycle and Scheduling economic policy with business cycle is impossible only through seasonal national accounts. one of the seasonal national accounts advantages is that: In a series of relatively long term of seasonal data the possibility of reflecting dynamic relations between economic

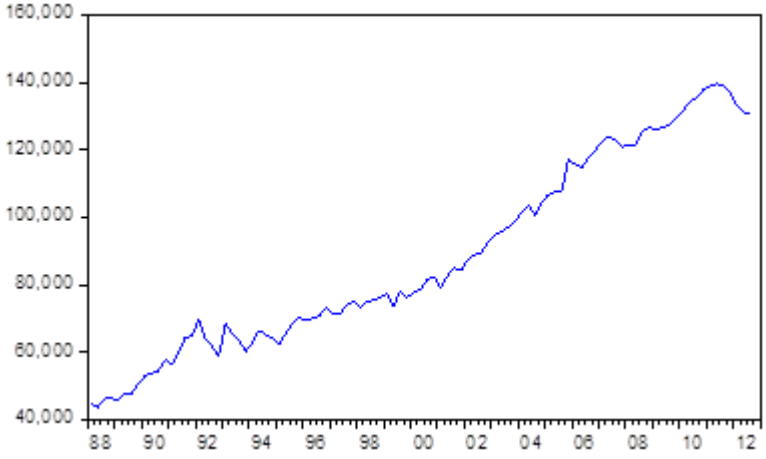
variables, especially along with interruptions and primacy is provided and due to quadrupling the number of observations than annual time series , the efficiency of mathematical techniques like econometric analysis would be increased. After all, due to clear presence of seasonal patterns in seasonal time series, Identifying the basic process of economic change in such data would be in trouble, so adjusting seasonal accounts time series is another step in presenting proper seasonal statistics to analyze current economic situation and optimal forecast of future changes. There are several methods to eliminate seasonal patterns of time series that the most important ones are X11, X11-ARIMA and X12-ARIMA techniques. Each one of seasonal adjustment is not adjusted with relations between time-series modeling and the triple components presents observation from seasonal adjusted series. According to various techniques which are presented in field of data seasonal adjustment, X11 methods are offered as the standard methods in field of historical time series seasonal adjustment and are usually used .as it is mentioned, in this research seasonal real GDP time series is used with the possibility of GDP change accurate observance. Furthermore, in order to eliminate seasonal patterns from seasonal real GDP X11method with the help of EVIEWS software is used. After that the continuously compounded growth rate of the seasonally adjusted quarterly real GDP is calculated by following formula. In this equation Y presents adjusted seasonal real GDP:

$$r_t = \log\left({}^{y_t}/_{y_{t-1}}\right) \times 100 \qquad (1)$$

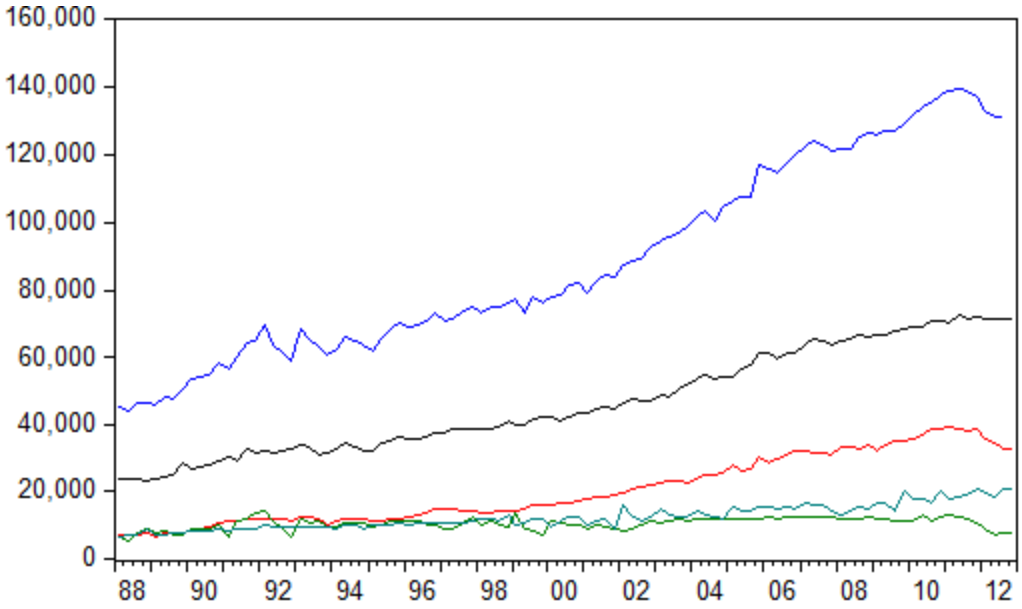
In Figure 1, Iran seasonal real GDP at constant price of 1997 can be seen that the vertical axis is seasonal real GDP numerical amount based on Rials and horizontal axis is research time series (Q1-1997 to Q3-2012). By eliminating seasonal patterns from seasonal real GDP, Iran adjusted real GDP (At constant price of 1997) in Figure 2 and according to economic activities in Figure 3 can be seen.



Figur 1- Seasonal real GDP at constant price of 1997 for Iran



Figur2- Adjusted Real GDP



Figur3- Adjusted Real GDP According to economic activities

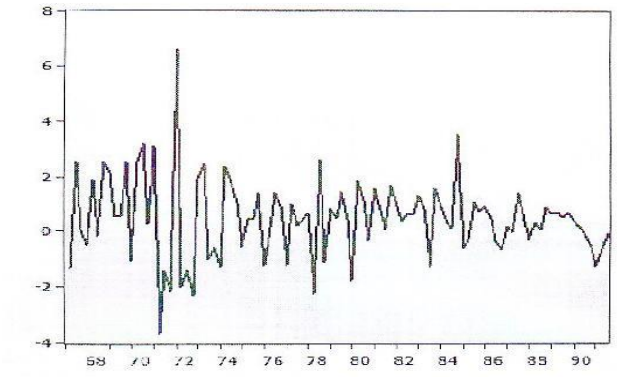


Figure4. adjusted seasonal real GDP growth rate (Q1-1997 to Q3-2012)
Source: Authors Calculations

In countries such as Iran that the vast majority of their export is restricted to limited goods such as oil and there is high revenue dependence to such export goods, so GDP and variability because of revenue shock would be affected due to these goods, so negative shocks (such as Rising oil prices) or positive (such as oil price fall) would affect society economic growth. Researches show: revenue fluctuation has negative impact on economic growth and one of the most important reasons of GDP variability in Iran is oil shock. Sometimes governments` interference and policy in this field can help the continuity of variability, so such variability should be recognized and measures should be taken to eliminate them.

Variability world which is used in main title of this article refers to change standard deviation in value of financial tool within specific time and in order to assess the amount of risk , that tool would be used in that time era. It is usually based on annual or seasonal periods and it is asserted in a case of complete number or a percentage. Most of the properties can be vary in specific time period. The amount of asset can rise, fall or remain fixed. This fluctuation

can be aggravated at the same domain (for example through prices) and lead to stagnation for long period of time. If real GDP variability fluctuates over the time and be asymmetric (different effects of negative and positive shocks on a variable is called asymmetry), considering these features in economic theories would be essential. In fact measuring conditional variance leads to realistic prediction of intervals, as gained extra data can affect real GDP growth rate variance prediction. Furthermore, modeling and recognizing conditional variance anisotropy effects (ARCH) are along with important statistical concepts. Ignoring such impacts can lead to error in asymptotic efficiency of parameter estimation (Repeated rejection of serial correlation conventional test). The goal of this article is registering variable continuity and also asymmetry. Affirming a proper model of asymmetric conditional variability can help the better conception of obtained politics results in an economy. For example, in case of continuing variability in economic, government interference is essential. It is considerable to mention that conditional variability means: variance of an error term can vary, provided that variance of prior periods, had variability and due to this fact, continuity of variability could be seen. If real GDP negative shocks create bugger variability than the same positive shocks, applying stabilization policies would be essential. In this case and for registering conditional asymmetry variability in GARCH modeling research methodology section GARCH modeling is presented (Nelson 1991) .in econometrics ARCH model (ENGLE 1982) considers current error variance as a function of last period error variance. This model relates error variance and square error of last period and is usually used for modeling financial time series to show time series variability accumulation; it means variability periods that leads to relative composure. ARIMA GARCH model which is considered for error variance ,is a conditional variable restoring model. (Bolleselv1986)

3.1. Oil shocks and GDP variability in Iran

As it is mentioned, Iran economy dependency to oil revenues is considerable, so representing brief explanation of oil shocks is essential. The first oil shock and sharp increase in oil happened in 1350 that price of oil from 1972 to 1974 raised 5 times (Gaskari et2005). The second oil shock happened in 1978 and oil price increased due to incidence of revolution, oil industry workers strike and as result oil export block in Iran. In contrast to two mentioned shocks, the third shock was along with oil price fall in 1985 to the lowest price. Oil price that decreased regularly after several years from revolution in Iran and re-export, reached the lowest amount in 1985. The fourth oil shock occurred in1991, due to Iraq invasion to Kuwait and as result invasion of U.S.A and the alliance to Iraq, so oil price increased. (Halafi and Eghbali (2005) the fifth shock was along with the sharp rise in oil price from 2007 to 2008. Fear of oil reserves shortage caused crisis worldwide and this sharp rise, affected Iran real GDP (Tayabi ET 2011, so oil shocks in Iran economy can be considered one of the most important reasons of GDP variability factors of growth rate. There are many conducted studies in Iran about oil price variability such as Hadian and Parsa(2006)studies and Mehr Ara and Oskuee (2006)studies. There are also articles in field of oil price variability risk that a conditional variance anisotropy model is correlated to two used variables. (Ebrahimi and Ghanbari , 2006).

4. DATA AND METHODOLOGY

Data used in this article includes: Iran real seasonal GDP and according to main activities in fields of agriculture, oil, mine & industry and service groups which is provided according to the price of 2005 from central bank and it is used after seasonal adjustment (as it is mentioned before). GDP is one of Economy scales. In other words, the total price of good and final service produced in country is in specified interval that is measured with currency of that country. For Iran, 25 years data from 1988 spring to 2012 fall are collected and can be seen in figure 1 and also figure 2 GDP growth rate. As it can be seen, in spite of short time fluctuations, Iran real GDP has an upward trend that suggests long term growth. As it is mentioned in previous section, available fluctuations can be due to different economical conditions that oil shock in Iran is the most important reasons. As seasonal GDP data from 1988 was available in central bank, and wasn't accessible before that, some GDP shocks effect in mentioned Figures can`t be seen, but it is clear that: oil affect Iran GDP considerably. It is considerable to say that: national adjusted GDP growth fluctuation which can be seen in Figure 3 is adjusted according to seasonal data and GDP adjusted amount with X11 method can vary according to different time periods. After all, oil shock is one of the reasons to lead fluctuation and other factors such as stagnation, inflation and generally economic revolutions can affect GDP, lead to GDP fluctuation. For better understanding, adjusted real GDP growth rate series Figure, calculating torques values, minimum and maximum of that can be seen in table 1. As it can be seen, the numerical value of skewness represents skewness to left of GDP growth rate series Figure.

Kurtosis represents less stretch in Figure of normal distribution. This result is generalized to other growth rates except, industry and mine section that with the skewness to right. Then Jarque –Bera test is used for identifying distribution normality or abnormality that is shown in table 2. According to test statistic, Iran seasonal real GDP growth rate distribution normality assumption can`t be rejected, so GDP growth rate series is distributed normally. This result can be generalized for other growth rates in table 2.

4.1. Research model: ARMA (P,Q) –EGARCH(1,1)

ARCH family models generally are formed for financial series modeling with variance inequality. ARCH model is presented by R.F.engel for the first time and by expanding that, Extensive studies have been done in field of conditional variability modeling in financial section. Then Bulersolo(1986) presented GARCH model by generalizing this model with vast usage in different economic sections, especially in financial time Series Analysis. In these models, components of the conditional mean equation, conditional variance equation and error conditional distribution should be clarified. In GARCH (P,Q) model P presents degree of regression and Q represents moving averages degree. Average equation and variance is as following:

$$Y_t = X_t'\theta + \epsilon_t \qquad (2)$$

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \, \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_j \, \epsilon_{t-i}^2 \qquad (3)$$

Equation 1 is a function from exogenous variables with an error and equation 2 is called conditional variance according to prior period data. Conditional variance is a function of three posts; variability prior data with the help of interruptions squares equation error components, E2T and prior period variance assessment Q2t-i.

In studying such variability by GARCH models, there is an inevitable fact; negative shocks cause bigger variability than the same positive shocks in return rate with high conditional variability, so many of ARCH main model components that weren't able to recognize variability asymmetry expanded and one of the most acceptable GARCH models that show asymmetric effects is GARCH modeling which was presented by Nelson in 1991. This model is designed for formulating and predicting conditional variances. The dependent variable functional variance is from dependent and independent prior amount or exogenous. Nelson observed the advantages of using this model instead of GARCH standard model totally. First, EGARCH doesn't consider limitation for a, y and ß parameters in variance equation that leads to estimation. Second, special degree of fluctuation behavior is authorized in conditional standard deviation and ß coefficient can be positive or negative. Third, in contrast to GARCH standard model , the possibility of asymmetry variability in EGARCH(1.1) model is proved by y time parameter with meaningful difference with zero. Fourth, continuity of variability in EGARCH (1.1) can be interpreted, as structure variance equation of a model simulates, logarithmic linear autoregressive. Totally as this model has no equal principle for parameters….

Average equation**:**

$$r_t = \pi_0 + \sum_{i=1}^{p} \pi_i r_{t-i} + \varepsilon_t + \sum_{j=1}^{q} \theta_j \varepsilon_{j-i}$$

Variance equation**:**

$$\log(\sigma_t^2) = \omega + \alpha\left(\left|{}^{\varepsilon_{t-1}}/_{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\pi}}\right) + \gamma \, {}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} + \beta\log(\sigma_{t-1}^2)$$

The seasonally adjusted real GDP growth rates have been and continue the variability and asymmetry parameters, respectively, and are determined. The EGARCH (1,1) indicates the degree of autoregressive term moving average GARCH and GARCH term in the variance equation. In addition, the average equation to determine p and q values (degrees of MA and AR) models, ARMA (p, q)-EGARCH (1, 1) model to estimate the coefficients of p and q are smaller Akaike is selected**.**

5. THE ESTIMATION AND RESULTS

Results Rma model - a - GARCH presented in this section , followed by the presence (or absence) Stability and variability of growth rates is asymmetric . In general, this research focuses on the structure of conditional standard deviation of real GDP. In addition, the relationship between the standard deviation of the particular circumstances of each economic condition is explained . One of the most important time series data used in the empirical analysis . Research has always been assumed that the time series is stationary if it is not, based on the distribution of conventional statistical tests , the same tests. Therefore not reliable. However, if the variables are not stationary time series , possibly spurious regression problem occurs . To determine the competency model , Dickey Fuller test is used to determine whether the series growth rate in all series models are static or not , respond . Then the model will be discussed. To determine the best model according to the Schwarz Bayesian factor. The optimal interval of Dickey Fuller test, is

approximately equal to 8 . After determining the optimal lag Dickey Fuller test results, if the test statistic was greater than critical value (which is usually assessed at the 5% level) then null hypothesis is rejected and the series will be stationary. The results for major economic sectors growth rate is also applicable. Table (3) Dickey Fuller test results are visible**.**

Table 3 - Results of Dickey Fuller test for GDP growth rates and major subsectors of the economy

Probability*	The test statistic	Model	Variable name
0.0000	-8.016158	With intercept and trend	Growth rate of real GDP
0.0000	-7.801833	With the intercept	
0.0000	-10.73439	Without intercept and trend	
0.0000	-11.32999	With intercept and trend	The growth rate of the agricultural sector
0.0000	-11.38414	With the intercept	
0.0001	-10.45531	Without intercept and trend	
0.0000	-17.59338	With intercept and trend	Growth in oil sector
0.0000	-17.65305	With the intercept	
0.0000	-7.40840	Without intercept and trend	
0.0000	-11.33703	With intercept and trend	The growth rate of industry and mining sector
0.0000	-11.22374	With the intercept	
0.0000	-10.11440	Without intercept and trend	
0.0000	-1.981283	With intercept and trend	Growth of the service sector
0.0000	-8.366966	With the intercept	
0.0000	-8.591674	Without intercept and trend	

* Significant at the 5% level - interrupt number is equal to 10 levels significantly depending on the type of time series model is different.

According to the test results in Table 3, all series are stationary growth. Therefore, the assumptions of normal distribution of errors, ARMA model - a - GARCH maximum likelihood estimation technique that uses software EVIEWS estimation. Best model will be choosing based on Schwartz. The results of this model for the growth rate of GDP have been shown in Table 4**.**

Table 4 - Estimation results for real GDP growth rate of seasonally adjusted

Probability*	The test statistic	Coefficients		Equation
0.0000	6.176535	0.517539	(π_0)	Mean
0.1873	-1.318639	-0.078337	AR(1)	
0.0000	-32.28981	-0.876765	AR(2)	
0.0007	-3.393498	-0.180768	AR(3)	
0.0604	-1.878151	-0.026519	MA(1)	
0.0000	131.6599	0.970646	MA(2)	
0.2164	-1.236151	-0.582127	(ω)	Variance
0.0001	3.932379	0.939691	α	
0.0997	-1.646082	-0.162391	γ	
0.0000	-6.013787	-0.628029	β	

According to this data, the equation average quarterly growth rate of real GDP will be modified as follows:

$$r_t = 0.517539 - 0.876765r_{t-2} - 0.180768r_{t-3} + \varepsilon_t - 0.026519\varepsilon_{j-1} + 0.970646\varepsilon_{j-2}$$

Seasonally adjusted real GDP growth rate of the variance equation:

$$\log(\sigma_t^2) = 0.939691\left(\left|{}^{\varepsilon_{t-1}}/_{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\pi}}\right) - 0.162391\,{}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} - 0.628029\log(\sigma_{t-1}^2)$$

As the variance equation autoregressive earlier model is, β levels and causes continuous variation explained . Equal to the value of 0.628029 - and this variability is significant at the 5% level for the country is ongoing. Moreover, this estimate is observed for 10% level of significance is equal to 1.646082 - in. This variability is asymmetric. The negative coefficient indicates that the growth rate shocks GDP, greater variability than positive shocks have the same size . It states that the economy is more vulnerable to negative shocks and the impact of GDP shocks could be the reason for the imbalance. When negative shocks will receive GDP economic factors may be inclined to reduce consumption and private investment, causing a decline in real GDP is faster and wider. It is assumed that the volatility of aggregate demand in the short -term impact on the actual product. In other words, bottlenecks and supply-side factors in the short term, further development will be hindered. However, the growth involves the expansion of products or an improvement in technology which may be realized in the short term is not easy. Although supply-side constraints may lead to an imbalance in the influence of shocks to GDP, however, do not explain the asymmetry .negative occurs; leading to a sharp drop in investment is rapidly penetrating into different sectors of the economy. Therefore, the central bank will have to distribute cash to exchange rates remained constant, followed by internal adjustment of the price adjustment should be carried out in front. If rigid market segments exist, the markets may fail and lead to the continued stagnation and deflation as much economic activity or leaving huge capital and work inverses the parts actually have a decrease in real GDP, it may worsen**.**

In order to further understand the causes of seasonally adjusted real GDP growth rate volatility and varieties, major sectors of economic activity, including agriculture, oil, industry, mining and services are analyzed and the model for a series of growth of each of these segments, estimates has been . It is worth mentioning that the difference between the value-added production costs and value created by these groups , based on data received from the Ministry of Petroleum and National Gas Company National Iranian Oil Company (the Central Bank) is reached. In addition ,

information such as the amount and price of crude oil and natural gas , the interbank exchange rate , the price of petroleum products , crude oil and natural gas for domestic consumption , production costs and prices of oil products in the base year as the basis for computing the group are used . Thus, the effect of seasonal shocks to the exchange rate in this sector have been remarkable , allowing direct observation of the effects of oil shocks on the part decreases .was rejected . In this model, the value of oil relative to the exchange rate, adjusted for seasonal swings and then the mean and variance equations are estimated. Estimates of the mean and variance growth equations for each of the major economic sectors in Table 5 are visible. The next stage of verification models for the growth rate of each series of diagnostic tests will be done in the next section

Table 5 - Estimation results for the growth rate of the major economic sectors

Probability*	The test statistic	Coefficients		Equation	Variable name
0.0000	9.595670	0.437308	Constant coefficient (π_0)	Mean	The growth rate of the agricultural sector
0.0000	-15.07274	-0.664304	ÓAR(1)		
0.0000	-12.81484	-0.578043	AR(2)		
0.0000	-14.47692	-0.487453	AR(3)		
0.0000	6.842636	2.384680	ω	Variance	
0.0000	6.544996	1.218227	**α**		
0.0805	-1.747868	-0.186859	**γ**		
0.0000	-6.223633	-0.571464	**β**		
0.0022	-3.067242	-0.043554	π_0	Mean	Oil sector growth
0.0000	-15.56384	-0.519413	MA(1)		
0.0365	-2.091738	-0.032317	MA(2)		
0.0273	-2.207662	-0.038704	MA(3)		
0.0000	4.696630	0.049228	MA(4)		
0.0000	-9.947628	-3.185608	ω	Variance	
0.0000	9.428681	3.884708	**α**		
0.8234	-0.223231	-0.034678	**γ**		
0.0000	15.53287	0.989778	**β**		
0.0000	11.76925	1.107817	π_0	Mean	The growth rate of industry and mining sector
0.0000	-6.292840	-0.164612	AR(1)		
0.3092	1.016851	0.054877	AR(2)		
0.0152	2.428492	0.999265	ω	Variance	
0.0001	3.923960	1.314560	**α**		
0.5916	-0.536580	-0.069673	**γ**		
0.0000	-7.561008	-0.614154	**β**		
0.0000	10.07118	0.445756	π_0	Mean	Growth of the service sector
0.0000	8.153045	0.325796	AR(1)		
0.0000	-29.94979	-0.933410	AR(2)		
0.0000	-6.406791	-0.616817	MA(1)		
0.0000	27.62808	1.041606	MA(2)		
0.0000	-4.211126	-0.385454	MA(3)		
0.2628	1.119749	0.117226	ω	Variance	
0.1866	-1.320723	-0.176001	**α**		
0.4794	0.707301	0.062844	**γ**		
0.0000	40.59431	0.971704	**β**		

Value of oil relative to the exchange rate is adjusted, Source: Findings

Equation, the mean growth rate of the agricultural sector.

$$r_t = 0.437308 - 0.664304r_{t-1} - 0.578043r_{t-2} - 0.4874453r_{t-3} + \varepsilon_t$$

Equation, the mean growth rate of oil

$$r_t = -0.043554 + \varepsilon_t - 0.519413\varepsilon_{j-1} - 0.32317\varepsilon_{j-2} - 0.038704\varepsilon_{j-3} + 0.49228\varepsilon_{j-3}$$

Equation, the mean growth rate of industry and mining sector

$$r_t = 1.107817 - 0.054877 r_{t-2} + \varepsilon_t$$

Equation, the mean growth rate of the service sector

$$r_t = 0.445756 + 0.325796\, r_{t-1} - 0.933410\, r_{t-2} + \varepsilon_t - 0.616817 \varepsilon_{j-1} + 1.0416066\, \varepsilon_{j-2} - 0.385454\, \varepsilon_{j-3}$$

Agricultural growth rate variance equation

$$\log(\sigma_t^2) = 2.384680 + 1.218227 \left(\left| {}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right) - 0.186859\, {}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} - 0.571464 \log(\sigma_{t-1}^2)$$

Oil sector growth rate variance equation

$$\log(\sigma_t^2) = -3.185608 + 3.884708 \left(\left| {}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right) + 0.989778 \log(\sigma_{t-1}^2)$$

Industry and mining growth rate variance equation $\log(\sigma_t^2) = 0.999265 + 1.314560 \left(\left| {}^{\varepsilon_{t-1}}/_{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right) - 0.614154 \log(\sigma_{t-1}^2)$

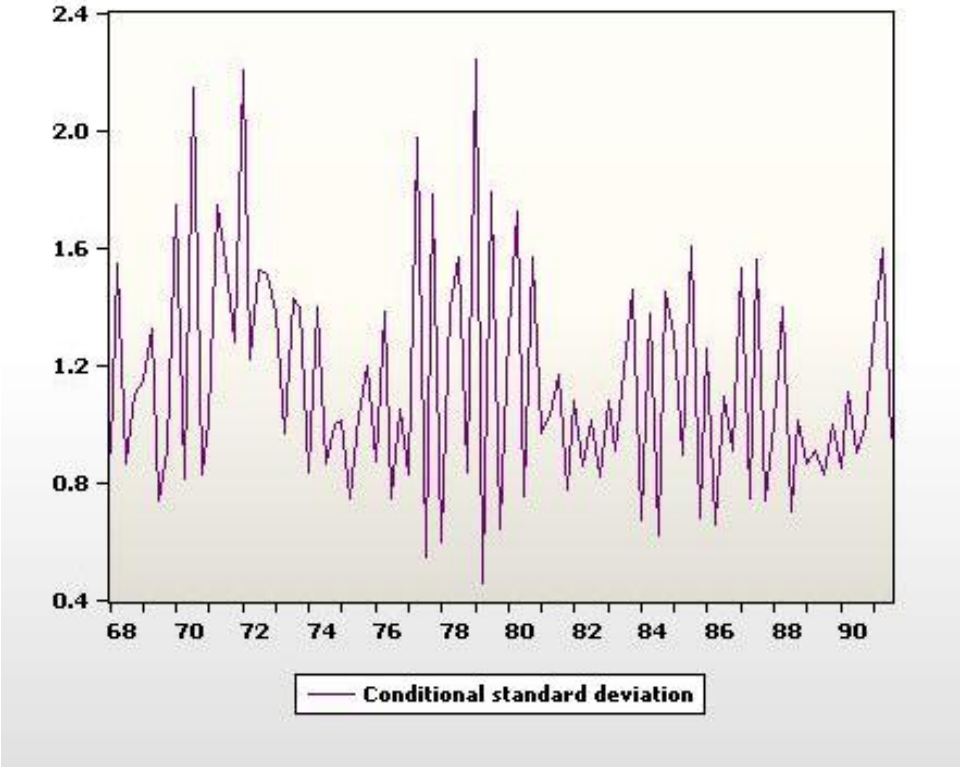
Service sector growth rate variance equation

$$\log(\sigma_t^2) = 0.971704 \log(\sigma_{t-1}^2$$

5.1. Conditional standard deviation:

After the estimation, we can draw the graph of the standard deviation of growth rates that conditional. Conditional standard deviation can be related to economic conditions. As was noted previously, the high variability can ¬ shocks, economic downturns and adverse policies related. As mentioned in the Iranian economy, oil shocks have a significant impact on the volatility of the real GDP growth rate . Each of these fluctuations can be seen in the standard deviation of each economic events such as oil shocks , among others. It is observed that the standard deviation is a chaotic process and is associated with economic fluctuations and shocks on GDP . In Figure (5) conditional standard deviation series of vertical growth rates and the horizontal axis is time**.**

Figure (5) - the conditional standard deviation of real GDP growth rate series



5.1.1. Diagnostic Tests

As stated in the research model after model selection ARMA - E - GARCH as a model for sustaining and asymmetry of growth rates volatility requires the use of diagnostic tests to confirm the suitability of this model and prove it. In this section White, Jack and Arch – LM tests used to investigate the suitability of the research for the series : the growth rate of real GDP , agriculture, oil sector, industry and mining sector, service sector**.**

5.1.2. White test

White heteroscedasticity test must be used to diagnose this Violation of the normal assumptions. White test for estimating the error terms in Table (6) is observed. According to the test results of both models, the lack of variance heteroscedasticity hypothesis cannot be rejected. The heteroscedasticity indicative of positive and negative shocks in the economy of inefficient policies that proper government intervention is needed to solve them**.**

Table (6) - White test

Probability	The test statistic	Type of test	Variable name
0.0310	2.125173	No cross words	Growth rate of real GDP
0.0000	139.9974	Cross terms	
0.0000	12.29121	No cross words	The growth rate of the agricultural sector
0.0000	91.85413	Cross terms	
0.0000	17.72254	No cross words	Growth in oil sector
0.0000	799.2063	Cross terms	
0.0000	9.845369	No cross words	The growth rate of industry and mining sector
0.0000	18.22689	Cross terms	
0.0000	39.87890	No cross words	Growth of the service sector
0.0030	202.1161	Cross terms	

Source: Findings

5.1.3. Jack test – to

Given the mean and variance estimation equations in growth rates , the distribution of the error component is considered normal for Jack to verify this hypothesis test to check for normal distribution of residuals growth rate of real GDP growth rates under sections economy including agriculture, industry and mining, and oil services are used. The results for each of the error components of the growth rates in Table 7 is visible and suggests that the null hypothesis of normal , normal distribution of the variable of interest , can not be rejected and therefore the waste is normally distributed**.**

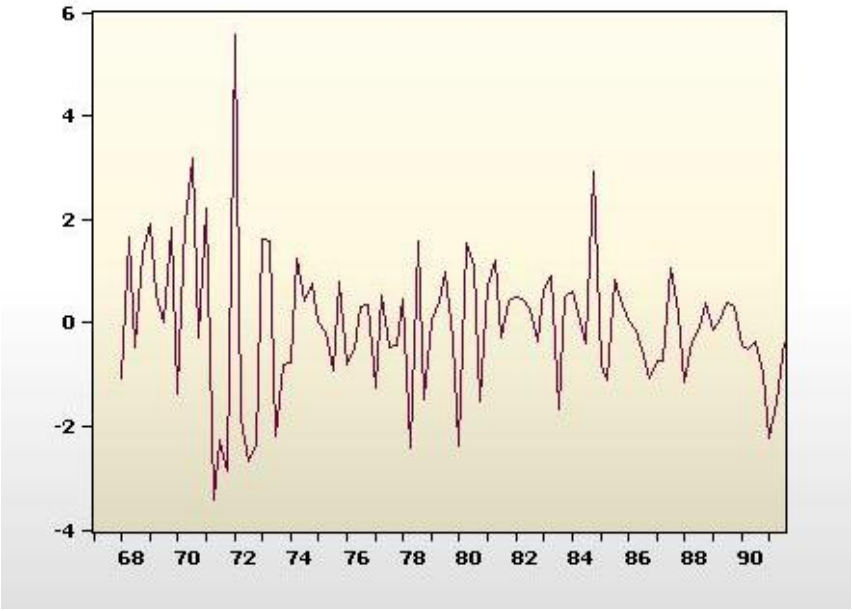
Table (7) - Jack test results - to the waste growth rates

Prob	The test statistic	Variable name
0.000029	20.88346	Growth rate of real GDP
0.000000	156.9091	The growth rate of the agricultural sector
0.000000	338.7082	Growth in oil sector
0.001746	12.70120	The growth rate of industry and mining sector
0.000000	59.86540	Growth of the service sector

Source: Findings

Moreover, the Figure (6) is also conditioned waste of time in terms of GDP growth rate model is visible.
As seen in the chart, it is not possible to distinguish any particular trend, implying that the residuals are random in nature.

Figure 6 - the residual of the estimation the growth rate of real GDP



Source: Findings

5.1.4. Arch test - LM

Arch test - L - I used to fit the model is defined and standardized residuals . The results show that the model is good enough or not. Given that the objective of this study was to assess the presence (stationary and asymmetry) volatility growth rate of real GDP is below the major economic sectors , the results Arch - L - M Arch residual effects on growth rates would imply , the model used will be good enough . The null hypothesis test based on the absence of effects on Arch and the results in Table 8 are visible. According to statistics and probability achieved real GDP growth rate series , based on the null hypothesis of no effect and therefore inappropriate Arch model series ¬ GDP growth rate is rejected

. As a result , the model is appropriate, therefore, its mean and variance equations as a tool for economic analysis and more accurate than the GDP growth rate and can be used their growth.

Table (8) - ARCH-LM test results for waste growth rates

Probability	The test statistic	Variable name
0.0035	8.957997	Growth rate of real GDP
0.9388	0.408360	The growth rate of the agricultural sector
0.0397	2.890666	Growth in oil sector
0.3630	1.113733	The growth rate of industry and mining sector
0.4304	1.025812	Growth of the service sector

Source: Findings

Test results Arch - L - M for the major economic sectors in the oil sector (relative to foreign shocks is seasonally adjusted) , indicating the suitability of the model and reject the null hypothesis is based on the lack of arch effect . However, the results of these tests are inappropriate for other sub- sectors, the growth rate series models used for oil, mining and industry leading service. According to the results it could be regarded that, the main reason of volatility in Iran's real growth rate of GDP are the oil shocks and whit this shocks it's possible to describe the Continuity and asymmetry of this volatility.

CONCLUSIONS

Iran's economy depends on oil and hence oil revenues and subsequent shocks, volatility and its impact on GDP fluctuations cannot be ruled out. Persistence and asymmetry of the fluctuations affect the economy. The research for this fluctuations, the growth rates of the combined GDP of the GDP quarterly was calculated using the model ARMA - E - GARCH to model the variability of the asymmetric condition, the equations for the mean and variance of growth rates, the estimated will. The estimation results using the definitions of each of the estimated parameters such as volatility persistence (due to there being a parameter) is recognized as the variance of each period (the formula) is related to prior periods . The asymmetry (due to significant parameter) was observed, indicating that the asymmetry of the positive shocks than negative shocks greater impact on GDP is size . Test results Arch - L - M Series represents the effect on the growth rate of GDP and Arch oil and the accuracy of the model. White heteroskedasticity test also showed that the variance of the parameters of the proposed model and confirms the accuracy of the model. The equations derived from the model results can help governments implement policies in particular economic conditions have contributed to the adoption of policy-based facts. The growth rate of real GDP affected by the awareness of positive and negative oil shocks and dependence fluctuations to any of these shocks and identify them, track appropriate economic policies by the Government to adopt policies that will brighten the fluctuations exacerbate, not.be . Sometimes it is possible to create an economic factor shocks to consumption and investment in particular sectors, and this tends to lead to further decline in the GDP . Since fluctuations detailed explanation based on economic conditions related to the objective of this research has not been addressed much closer examination it is left to future research. For example, the type and amount of expression and examined the effects of shocks. It is hoped that the findings for the understanding of the economic issues

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