



Investigation of Relationship between Oil Shocks and Macro-Economic Variables Economic Growth, Inflation and Foreign Trade

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ABSTRACT

Petroleum is an important income resource for petroleum-exporting countries and it is an important raw material in production process of petroleum-importing countries. Oil price variations can cause instabilities in macro-economic variables in both groups of countries. Because Iranian economy is highly dependent on petroleum export, oil price variations can have a lot of impacts on Iranian economy. Study of oil shocks is therefore an important subject for economists due to oil price variations and instabilities in petroleum market. The present research tries to investigate the impact of oil shocks on macro-economic variables. The investigated time period was 1980-2011 in which two oil shocks took place. Regression model was used for data investigation. Macro-economic variables such as inflation rate, economic growth and external trade were investigated. Results showed that oil price has a positive and significant impact on GDP and external trade but a linear regression model between inflation and oil price cannot be defined.

KEYWORDS: oil shock, inflation, economic growth and external trade.

INTRODUCTION

An investigation of petroleum industry trend reveals that the high level of attention this material has received over history can be attributed to its applications in different sectors. In general, a factor is favorable when it has the maximum efficiency along with the lowest production costs and maximum profitability and the importance of petroleum depends on its various applications in different economic sectors (Fathizadeh, 2005). Economy of petroleum-exporting countries like Iran is highly affected by oil price and its export. This was specifically propounded after the first oil shock in 1973. This phenomenon (oil shock) has had different impacts on economy of countries especially petroleum-exporting countries (Eghbali and Hallafi, 2006). Investigation of oil shocks is important from several aspects. The first is that oil shocks can be used as exogenous factor in investigation of transactions mechanism. The second is that oil shocks can be used as capable factors in macro-economy. The third is that time dynamics has had significant changes over the past few years (Muller, 2009). Iran has always been one of the richest countries in terms of petroleum reserves. Since 1970s, Iranian economy became more and more dependent on petroleum industry and Iranian economy turned into a single-product economy. This dependence is the greatest barrier against economic development. This restricts income-making process and brings economy prone to threats. Oil price variations can affect internal and external Iranian economy. Since petroleum price is determined internationally, it can be affected by political and economic factors and influence Iranian economy (Pashayee Fam and Farahani, 2007). On one hand, some believe that oil brings considerable amounts of financial resource for consumption and investment in Iran and provides facilities for rapid growth in comparison with a no-petroleum economy. On the other hand, some believe that structural and infrastructural weaknesses of Iranian society and economy are barriers ahead of appropriate use of petroleum income potentials and oil rents have intensified the weaknesses. Consequently, while oil income has contributed to consumption and production in Iran to some extent, it has contributed to economic and political retardation. A group of the supporters of this viewpoint believe that elimination of structural weaknesses and adoption of appropriate policies can strengthen the positive impact of petroleum on Iranian economy (quarterly of Novelties of Economy, 2012). Moreover, oil price variations can have positive or negative impacts on Iranian economy due to the importance of petroleum in Iranian economy. An example can be the influence of oil shock in 1973 on Iranian economy. In the present research, we try to find relationship between oil shocks and three macro-economic indices: economic growth, inflation and external trade volume.

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Theoretical framework

Oil shocks

In 2010, reports showed that almost 55% of the world's oil reserves are in middle east and this region is an important and strategic area for oil supply. In 2010, more than 752.5 billion barrels of oil reserves were in Middle East and 264.5 billion barrels of oil were in Saudi Arabia. Other oil-rich countries include Iran, Iraq and Kuwait which had more than 100 billion barrels of oil (Hasanzadeh and Kiyavand, 2010). Oil is the main income resource in Iran. Reduction of oil price from 147 \$/bbl in January 2008 to below 40\$/bbl in the end of 2008 showed the deep impact of oil shock on oil economy. OPEC, which is the main petroleum-producing country, has always played a significant role in oil price and it has been under pressure by different states (Hasanzadeh and Kiyavand, 2010). OPEC oil portfolio price went up from 92\$/bbl in the beginning of 2008 to 141 \$/bbl and then decreased to 33 \$/bbl (the lowest price since summer 2004) in the end of 2008. Petroleum demand reduced by 0.3 million barrels per day in 2008 and this is expected to increase by 1.4 million bbls/day. OPEC also held Algeri Meeting in 2008 and reduced its petroleum production by 4.2 million bbls/day in comparison with September 2008 (Hasanzadeh and Kiyavand, 2010). Iranian petroleum industry came to existence in 1908 after 7 years of exploration and discovery of petroleum in Masjid-i-Soleiman in Zagros Mountain Range slopes. Petroleum industry is the motor of Iranian economy and has some important functions like a basic role in fulfillment of macro-level national targets in 20-year vision, development of national economy, progress of Iranian Diplomacy and guarantee of national security via regional and international collaborations. Moreover, it constitutes 28% of GDP, 84% of national foreign exchange earnings and 95% of national energy supply (history of petroleum industry, Journalists' Club). Iran has 151 billion barrels of recoverable liquid hydrocarbon and 33.1 trillion cubic meter of recoverable natural gas and is considered as one of the main energy-producing countries. According to Oil&Gas journal (2011), Iran has 137 billion barrels of proved oil reserves (9.3% of total world reserves) and ranks fourth after Saudi Arabia, Venezuela and Canada. Iran has about 12% of the present reserves of OPEC. In January 2011, OPEC published its annual statistical bulletin for 2010. In this bulletin, Iranian proved reserves amounted to 151 billion barrels. Iran is the second oil-producing member of OPEC. In 2011, Iran produced about 3.6 million barrels per day. Iran has 40 active oil fields. 27 fields are onshore and 13 fields are offshore. More than 50% of reserves are in 6 giant fields. About 85% of Iranian onshore oil exist in south-western Iran in Khuzestan Province close to Iran-Iraq border (Sayyadi and Berkeshli, 2012). Within the past few years, Iran was the third oil-exporting country after Saudi Arabia and Russia. Of course, in spite of the existence of rich oil resources in Iran, petroleum production has not increased significantly within the past years. This can be attributed to barriers ahead of presence of international energy companies and international sanctions on Iranian petroleum industry (Sayyadi and Berkeshli, 2012).

Inflation

Inflation means an increase in general level of prices over a particular period of time. Inflation rate is equal to change in price index which is usually consumer's price index.

Keynesian viewpoint mentions two main reasons for inflation: reduction in total supply or increase in total demand. (Monetarist) viewpoint believes that growth in money supply which exceeds economic growth rate is the main reason for inflation. In other words, inflation is the absence of correspondence between circulating money volume and supply of products and services. Approximately all economists unanimously agree that long-term inflation is originated from money supply and liquidity increase. When inflation rate increases, purchase power of money decreases. One of the roots of inflation is absence balance between government costs and incomes. In other words, when government's costs exceed its incomes in annual budget, budget deficit occurs. If the government borrows from central bank or sells foreign exchange incomes (for example obtained from petroleum sale) to central bank for solving deficit problem, monetary base and total liquidity increases in economy and this increase in liquidity has some inflation effects. The most important factors of inflation in Iran are as follows:

1. provision of budget deficit via government's borrowing from central bank or selling foreign exchange incomes resulted from oil export will result in increase in monetary base and liquidity and an increase in liquidity results in an increase in general level of prices (=inflation).
2. Structural factors resulted mainly from absence of coordination between sectors, infrastructural defects and supply stickiness in key sectors like industry and agriculture which result in supply stickiness in these sections so that when demand grows rapidly, supply cannot be increased proportionally and simultaneously and this results in inflation. One of the ways of controlling inflation is adoption of correct monetary policies; in other words, stable and predicted growth of money volume is necessary for controlling inflation. Many countries like South Korea, Mexico, Newland and England have recently adopted proper monetary policies and reduced inflation rate to a single-digit figure (mainly below 5%). One of the main reasons for these successes was independence of central bank in the mentioned countries.

Volume of foreign transactions

Before emergence of money, trade was conducted directly and in the form of direct product-to-product or service-to-service exchanges. In Iran, cereals, in Tibet, tea, in Virginia, Tobacco, in Ethiopia, pepper and salt, in Russia, sable skin and around Mediterranean, sheep was measurement and valuation criteria. However, metal coins were used and became common because the mentioned criteria had some problems like being too large or going bad. Gradually, metal coins trade was also difficult and everything was prepared for appearance of paper money. The first modern bank which published paper money was England's Bank. There are three functions for money from economy's viewpoint:

1. Value criterion, 2. Means for trade, 3. Means for storing value.

The First World War and the great economic recession and therefore states need for more paper money for satisfying financial resources of war made this system collapse. Supply of paper money was followed by inflation and economic/political instabilities. Therefore, this required foreign exchange supervision of states. After Second World War, states decided to hold their currencies constant with respect to USA dollar and strengthen their commercial transactions easily. However, this was continued only until 1971 (due to USA confronting trade deficit). After that, due to special global conditions, currencies were exchanged easily and currency prices were determined by means of market supply and demand and not by governments' policies. Since then, banks tried to manage their currency resources and established systems for buying promising currencies and selling currencies which did not have good future market. Therefore, foreign currencies exchange formed because every bank adopted its own strategy. States can specify their currency exchange rate by means of the following methods:

1. floating exchange rate system, in which currency has its place in market as a result of balance or imbalance between supply and demand forces.
2. a fixed transactions rate system in which currency value is specified by government or central bank
3. a system which is a combination of floating rate and fixed public rate and government may intervene in controlling currency value.

When money value of a country decreases normally, its export will increase and import will decrease. Therefore, trade deficit is disappeared and economy becomes strong, unemployment rate is decreased and economic growth rate and economic activities increase. In general, currency exchange market in its present concept was formed in 1971. Of course, at that time, transactions were done via telephone or fax and in limited volume and it was owned by great banks and very rich persons. However, advances in communication devices since 1998 made it possible to transact via internet.

Economic growth

Growth is the quantitative change of a variable in a particular time period. Growth is the long-term capacity of production for increasing total supply in order to satisfy population needs. In fact, economic growth is persistent growth in production which is usually accompanied by population increase and infrastructural changes. An economic system becomes successful only when all-embracing economic growth for more production is an important target of that system. Historians consider mercantilism as the origin of new era of relations between western European countries and the new world. These relations caused human knowledge wide growth. In this period, growth meant increase in national wealth via production. However, no theorizing was conducted in this period of time. Adam Smith, who is usually called "the father of Economy", published his book "wealth of nations" in 1776. He studied the reasons for different progress changes in countries. Growth was an important macro-economic concern for many classic economists in 18th and 19th centuries. Economic development has a wider concept than economic growth. Economic development involves quantitative changes in economic demands, production type, motivations and production organization. Most determining factors of economic growth (like technology and infrastructural changes) are embedded in economic development. Therefore, economic development contains absence or presence of economic growth. For short, differences between economic development and growth are as follows:

1. economic development is more general than economic growth;
2. economic growth is a purely quantitative phenomenon but economic development is a combination of quantitative and qualitative aspects (like changes in social, political, cultural, economic and scientific bases);
3. without economic development, economic growth is possible but without economic growth, economic development is difficult;
4. economic growth and increase in per capita income is necessary for economic development;

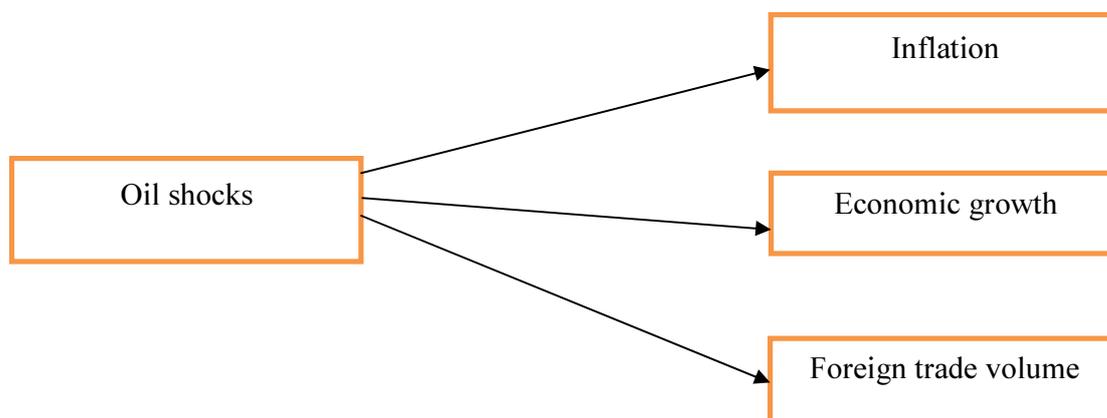
5. economic development is a more advanced stage than economic growth. It involves comprehensive changes in production texture and allocation of resources in different economic sections;
6. economic development is not only an economic change but it is accompanied by other social, political and cultural changes.

According to this table, the greatest economic growth belongs to Angola and Azerbaijan. This can be attributed to increase in oil price in 2007 and this continued to 2008.

On the other hand, these countries have weak economies and their economic growth will be more rapid in primary stages. China is one of these countries. China had a growth rate of 10% in 2008. It is expected to insert wealth into the world in the present year more than any other country.

Research conceptual model

The present research is an adjusted form of Mihuta& Daniela's research in 2012. Research model is as follows:



Research hypotheses

1. There is a significant relationship between oil shocks and economic growth.
2. There is a significant relationship between oil shocks and inflation.
3. There is a significant relationship between oil shocks and foreign trade volume.

METHODOLOGY

The present research is a correlation study. Further, we referred to website of Iranian central bank for collecting data on oil prices in 1980-2011 period and referred to Iranian Center for statistics website for collecting data on economic information. Therefore, field method was used for collecting data. The present research was conducted in Iran and statistical population is Iranian economic statistics. Data related to 1980-2011 period were used as sample.

Data analysis

- Investigation of relationship between macro-economic variables and oil price in 1980-2011.

First, we must investigate normality of observations distribution using Kolmogrov-Smearnov test in order to select an appropriate correlation test. If data distribution is normal, Pearson correlation test is used. Otherwise, Spearman correlation test will be used. Results of Kolmogrov-Smearnov test are summarized in table 1.

test	GDP	inflation	Oil price	Foreign trade
Test statistic	.852	.627	1.297	1.690
significance	.462	.826	.069	.007

Results of Kolmogrov-Smearnov test show that GDP, inflation, and oil price variables have normal distribution and "foreign trade" has a non-normal distribution. Therefore, Spearman correlation test is used for investigation of correlation of data. Results of Spearman correlation test have been summarized in table 2.

Table 2: results of Spearman correlation test

Foreign trade	Oil price	inflation	GDP	test	variable
.983**	.505**	-.357*	1.000	Correlation coefficient	GDP
.000	.004	.048	.	significance	
-.286	-.460**	1.000	-.357*	Correlation coefficient	inflation
.118	.009	.	.048	significance	
.498**	1.000	-.460**	.505**	Correlation coefficient	Oil price
.004	.	.009	.004	significance	
1.000	.498**	-.286	.983**	Correlation coefficient	Foreign trade
.	.004	.118	.000	significance	

Results of correlation test show that there are significant relationships between variables except for foreign trade and inflation rate. Results show that there is a negative relationship between GDP and inflation, there is a positive relationship between GDP and oil price, there is a positive relationship between GDP and oil price, there is a negative relationship between inflation and oil price, there is a negative relationship between inflation and foreign trade and there is a positive relationship between foreign trade and oil price.

Table 3: regression coefficient for investigation of relationship between GDP and oil price

coefficient	Coefficient value	Test statistic	significance
Oil price	.008	7.172	.000

Since test significance value is smaller than 0.05, H0 which indicates zero regression coefficient is rejected. Further, since regression coefficient is positive, it can be concluded that oil price has a positive and significant influence on GDP.

Table 4: table of regression coefficients for relationship between oil price and foreign trade

coefficient	Coefficient value	Test statistic	significance
Oil price	.930	13.663	.000

Since significance level is smaller than 0.05, H0 is rejected and zero regression coefficient is rejected. Therefore, it can be said that there is a significant relationship between oil price and foreign trade. Further, considering the costiveness of regression coefficient, it can be said that oil price has a positive and significant impact on foreign transactions volume.

Investigation of the impact of oil shocks on GDP

In order to investigate the impact of oil shocks on GDP, relationship between oil shock and GDP was investigated in three periods of time: 1980-1985-1986-1997 and 2009-2010.

Table 5: regression coefficients table for relationship between oil price and GDP

coefficient	Coefficient value	Test statistic	significance
Oil price	.929	7.911	.000

Results of regression model fit show that H0 (zero regression coefficient) is rejected. Considering the fact that the estimated coefficient is positive, it can be said that oil price has a positive impact on GDP. Considering the above discussion, it can be said that oil price variations influence GDP. Consequently, there is a relationship between oil shock and GDP.

Table 6: table of regression coefficients for relationship between oil price and GDP

coefficient	Coefficient value	Test statistic	significance
Oil price	0.960	10.790	.000

Results of regression model fit show that H_0 (zero regression coefficient) is rejected. Considering the fact that the estimated coefficient is positive, it can be said that oil price has a positive impact on foreign transactions volume in 1980-2011.

First target: investigation of the impact of oil shock on GDP

We developed a hypothesis for achieving this aim: "there is a significant relationship between oil shock and GDP". We investigated the relationship between oil price and GDP using three separate regression models in three periods: 1980-1985, 1987-1997, 1998-2010. Results showed that the model fitted to observations in 1980-1985 is not significant. Therefore, it can be said that variations of oil price in this period did not impact GDP. Further, results showed that the model fitted for 1987-1997 data is not significant. This shows that variations in oil price in this period cannot affect GDP. Therefore, it can be said that 1986 oil shock did not influence GDP behavior.

Further, results showed that the model fitted for observations in 1997-2010 is significant and GDP can be predicted by oil price in this period. Therefore, it can be said that 1997 oil shock did influence on GDP. In addition to the above discussion, since 1986 oil shock was a negative shock and 1998 shock was a positive shock, it can be concluded that a negative shock does not influence GDP but a positive shock influences on GDP.

Considering the fact that the estimated coefficient is positive, it can be said that oil price has a positive impact on GDP.

Considering the above discussion, it can be concluded that variations in oil price influence on GDP. Therefore, the first hypothesis is supported.

Second hypothesis: there is a significant relationship between oil shock and inflation.

We investigated relationship between oil price variations and inflation rate in three periods: 1980-1985, 1986-1997 and 1999-2010. Therefore, three regression models were fitted for observations in the three periods.

Results showed that a significant regression model cannot be drawn for observations of the three periods. In other words, since significance value was greater than 0.05 for 1980-1985 period, it can be said that H_0 (zero regression coefficients) is supported. Since significance value was greater than 0.05 for 1987-1997 period, it can be said that H_0 (zero regression coefficients) is supported. Since significance value was greater than 0.05 for 1999-2010 period, it can be said that H_0 (zero regression coefficients) is supported.

Considering the above results, it can be said that there is no relationship between inflation and oil price in general. Therefore, inflation is not affected by oil shocks and the second hypothesis is rejected.

Third hypothesis: there is a significant relationship between oil shock and foreign transactions volume.

In order to investigate the impact of oil shocks on foreign transactions volume, relationship between oil shocks and foreign transactions volume was investigated in three periods: 1980-1985, 1986-1997 and 1998-2010. To this end, three regression models were fitted for observations in the three periods.

Results showed that we cannot define a significant regression model for observations before 2006 oil shock. In other words, it can be said that the hypothesis of zero regression coefficients is verified.

Further, results showed that the model fitted for data in 1987-1997 period is not significant. This shows that variations of oil price in this period cannot affect foreign trade. Consequently, it can be said that 1986 oil shock was not effective in foreign transactions volume behavior.

Further, results showed that the model fitted for observations in 1997-2010 is significant and variations in foreign transactions volume can be predicted by oil price variations. Therefore, it can be said that 1997 oil shock affected foreign transactions.

Moreover, it can be said that since 1996 oil shock was a negative shock and 1998 oil shock was a positive shock, a negative shock does not impact on foreign transactions volume but a positive shock affects foreign transactions volume.

Considering the fact that the estimated coefficient is positive, it can be said that oil price in 1999-2010 has a positive impact on foreign trade.

Considering the above discussion, it can be said that oil price variations influence on foreign transactions volume. Therefore, the third hypothesis is supported.

Conclusion

Considering the results of investigation of relationship between oil shocks and macro-economic variables including economic growth, inflation and foreign transactions and presence of relationship between oil shock and economic growth and foreign trade and absence of relationship between oil shock and inflation rate, it can be said that oil price variations cannot be effective in inflation in Iran and therefore sanctions on oil industry cannot be effective in increase in products and services prices within the past few years. Therefore, economists should find another reason for inflation without considering oil price variations.

Considering the results of the research and importance of oil in macro-economic variables, the following recommendations are presented:

- Commercial policies must be adopted so that Iranian economy is driven towards free market economy and competition between internal and external industries is developed and national industries are able to increase their competitiveness in global markets and therefore industrial products export is increased.
- Economic policy-makers must be careful with converting foreign exchange incomes resulted from petroleum incomes into budget when oil price increases in global markets because increase in money supply increases demand and this finally increases inflation rate and reduces national money value.
- Policy-makers must change the culture of using external products into using internal products so that external products' consumption and import is not increased when oil prices increase and oil income should be used for importing capital products and used in improving industrial infrastructure.

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