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The Relationship between Inflation Rate, Oil Revenue and Taxation in IRAN: Based OLS Methodology

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Abstract
In this paper we investigate the relationship between inflation behaviors relying to using oil revenue and taxation revenue as two distinguish original sources in Iranian economy. We employ the Ordinary Least Square (OLS) as methods for analysis data in short and long run periods. In this study, we found that the oil revenue and corporate tax are significant variables to measurement of consumer price index. Taxation has both positive and negative impact in economic growth and consumer price index due to increasing and decreasing inflation rate. Since increase export oil cause to increasing in price level in Iran, government ought to try to allocate the earning from selling of oil. On the other side, increasing in corporate tax cause to price level rises. So, policy makers and economics should reduces taxation on corporate to make incentive in investors to more investment.
Key Words: Microeconomic variables, Inflation rate, Taxation, OLS Methodology, Iranian economy

1. Introduction

The history of oil exploration and extraction dates back a long time ago, especially for Iran. The base of the Iranian economy has been placed on the extraction of natural resources. The first oil field was discovered in 1908. Since oil has become the source of income and main commodity produce for the Iranian economy, the development of other economic sector has been neglected. Fluctuations in oil prices lead to unreliable situation in the main macroeconomics. There are so many studies taken by other researchers' show that the majority of economic variables in oil-production swing due to changing oil prices or the quantity of oil exports. It affects the performance of economic activity with regard to its impact on other variables such as inflation, the real exchange rate, money supply, trade balance, real interest rate, etc. Moreover, fluctuations in oil revenue have significant impacts on monetary and fiscal policy, although its severity can vary by country. Hamilton (1983) pointed out that there are particular effects for oil shocks, in which resulted from 1949 to 1973 on US economy. The influence of oil revenue and oil shocks can be different in periods. For example, Hooker (1996) concluded that Granger cause a variety of U.S. macroeconomic indicator variables for data up to 1973 are not for data from then to the present which are shown to be robust. Most of the oil exporting countries is severely dependence on oil revenue at during period.

Esfahani et al. (2012) pointed out in the two past decades the ratio of oil revenue to GDP was about 26 percent in members of the Organization of the Petroleum Exporting Countries (OPEC) such as Kuwait, Libya, Nigeria, Saudi Arabia, and Venezuela. Intense affiliations of oil exporting countries in the Middle East have led to become ignorant to other channels to source government income. While in developed countries there are channels to using as main sources of income for governments. These channels are the exporting of manufacturing goods or different rates of taxation for different classes of people. In recent research by Bornhorst et al. (2009), suggested that there is a balance between natural resource endowment as income resource and revenue from other domestic source like, taxation (Bornhorst et al. 2009). They (2009) examined the offset between government revenues from hydrocarbon (oil and gas) related activities and revenues from other domestic sources (tax) in a panel of 30 hydrocarbon producing countries. They found significant negative relation between domestic resource revenue and natural resource revenues. It appears a 1 percent increase in hydrocarbon revenue in relation to GDP lowers non-hydrocarbon revenues by 0.2 percent in domestic resource revenues.

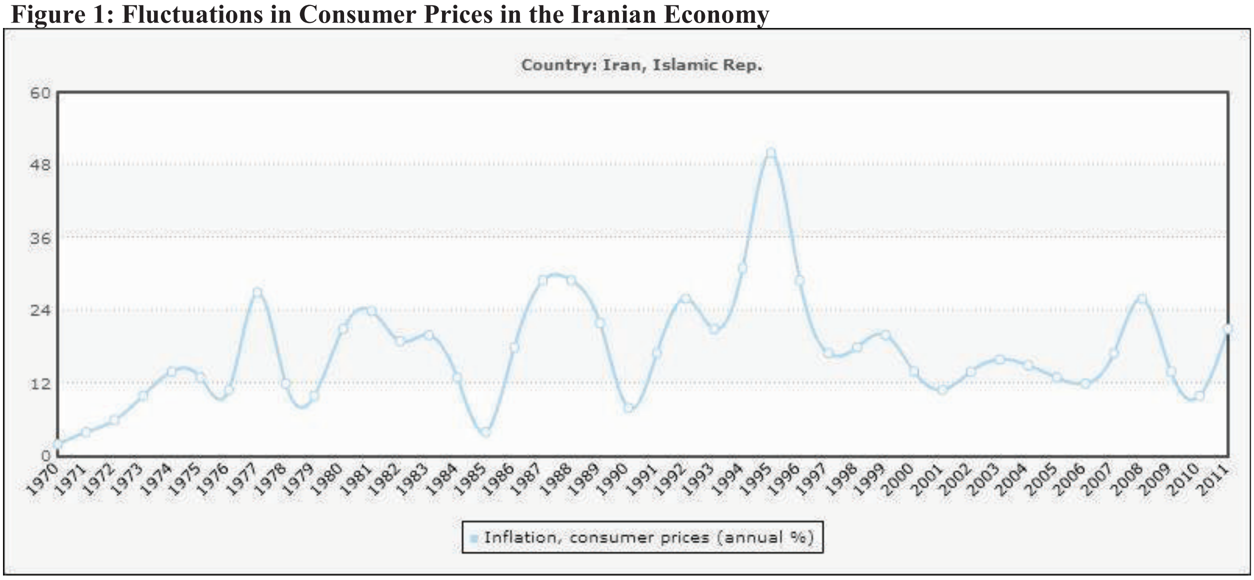
However, this phenomenon (relying on natural source revenue) leads to lower the public scrutiny of government to people, and on the other side it leads to lack of motivation to foster private sector activities in development prospects. The main distinction between depending on oil revenue rather than tax revenue or domestic resource tax is about stability and predictability. We conclude that since the first oil price shock in 1973 oil revenue cannot be reliable as a source of income for exporting countries. Many times in history, oil shocks, whether on the supply side or demand side, was not predictable. Fiscal dependence on the hydrocarbon sector (especially oil income) and inattention non-oil earning bring fiscal management highly challenging in oil-exporting countries (Anshasy & Bradley 2012).

In this paper we investigate the relationship between inflation behaviors relying to using oil revenue and taxation revenue as two distinguish original sources in Iranian economy. We employ the Ordinary Least Square (OLS) as methods for analysis data in short and long run periods. The rest of this paper proceeds as follows: section 2 is briefly history of inflation in Iran. Section 3 present some literature that take by previous researcher about oil revenue and taxation revenue in different country. Section 4, presents the theoretical model of the paper. Section 5 focuses on collection data, period, and methodology using in this paper. Section 6 presents empirical results and discussion and finally, section 7, explain some summary and final result.

2. The History of Inflation in Iran at a glance

Inflation is one of the most sensitive and controversial debate among the policy makers and economists. The prices level in the market was debate between economist from former economists such as Smith and Ricardo until now. Inflation can be respond by many fluctuations in macroeconomics whether endogenous or exogenous. Inflation is a notable and prominent issue in the Middle East countries, especially Iran. As Figure 1 shows us, the price level has been fluctuating since the revolution in 1979.

Figure 1: Fluctuations in Consumer Prices in the Iranian Economy



Data source: World data bank

In four decades, The Iranian economy has been confronted with some significant internal and external events such as Iran-Iraq war, first gulf war and etc.

The first phenomenon that caused a strong shock to the economy of Iran was 8 year Iran-Iraq war. Although external events has made difficult situation for Iranian economy, but the internal factors such as negative trade balance due to heavy dependence on export oil, misconstruing on the allocation of credit and foreign exchange, distortions in the pricing system including the exchange rate and interest rate cause imbalances in the supply and demand for goods and services (Chavoshzadeh et al. 2012). These elements caused inflation to hike up in range of 20 percent to 30 percent in recent years. Many researchers and scholars have anticipated the causality between macroeconomic variables and changes on price level.

Bruno and Easterly (1998), for example, found an ambiguous relationship between growth and inflation. But it can be determined that the growth rate of the economy will be lower in high levels inflation. By considering Mankiw (1989), we figure out that inflation has no direct negative or positive relationship with different situations in the economy. Mankiw (1989) stipulated that inflation goes up during booms in the economy and goes down during recessions. Furthermore, inflation not only has relationship with internal factors in the country economy, but it can be influenced by external factors. Badinger (2009) provided a study of the linkage between globalization and inflation, by using cross-section of 91 countries over the period 1985-2004. He found a significant negative relationship between inflation and financial openness, with a one percent increases in financial openness or trade, the inflation rate will reduced about 0.2 to 0.4 percent.

It should be kept in our minds that financial openness and trade can affect inflation. Other studies imply that increasing trade and financial deepening can be advantageous for reducing the annual rate of inflation beyond condition that the inflation rate lays between 4% and 19%, whereas the effectiveness of finance-trade is less, when inflation rates lie outside this range (Rousseau & Yilmazkuday 2009). Also they found the high level price intercepts the finance-growth connection most severely, but the impacts of high inflation are not that susceptible to its level since a country is in the high inflation range. In half-value inflation rate, is strong relation across finance-growth, meaning that small changes in the inflation rate can have strongly negative effects on growth (Rousseau & Yilmazkuday 2009).

3. Literature Review

3.1 Oil Revenue

Today, with advances in production techniques in the manufacturing and industrial sectors the requirement for raw materials such as oil and gas has increased more than before. Oil plays important strategic role in Iran's exports. In fact, Iran is one of the largest oil exporting countries in the world. Since a major share of Iran's budget revenue comes from oil revenue so the Iranian economy depends very much on oil exporting (Farzanegan & Markwardt 2009).

Oil revenue and consequently, oil price shocks not only affect the macroeconomics variables and economics activities in oil-exporting countries, but it do have to some influences on the velocity of economic growth in the oil-importing countries. Oil revenues shocks (whether increases or decreases in oil revenue) lead to transmission of performance between sectors in economics structure. Oil booms and consequently, oil recessions have significant influences on economics activities from different aspects. Oil revenue shocks have positive and negative impacts on the economy (Emami, & Adibpour 2012). The first channel that oil revenue is impression to the economics activities have been mentioned by Barro et al. (1992). They indicate that with rising oil revenue in oil exporting countries, the governments try to apply the oil Dollars financing development expenditures. They mentioned that fiscal policy will expand due to increasing oil revenue.

In addition, expansionary fiscal policy on a result of rising oil revenue will lead governments to spend on public goods and infrastructure and thus can stimulate investment and output (Barro & Martin 1992). Impression on monetary policy is the second channels of transmission from energy economics on other sectors. With growing oil revenue, the available oil dollars will increase. The government usually sells the available dollars in the free market to exchange for the local currency. In such conditions it causes an appreciation of the local currency against the foreign currency, and the price of imported goods will be cheaper for domestic consumers and imports will increase causing the bankruptcy of domestic firms, and hence an increase in unemployment (Emami & Adibpour 2012).

Many researchers have concentrated on oil revenue shocks in developed countries and non-oil revenues. Headmost studies about concerning of oil revenue and its shocks back to the decade of the 1980s by Darbi (1982) on the US economy. Although Darbi (1982) was unable to find significant relationship between the oil price and price of goods, but Hamilton (1983) underscored that oil price shocks have severe influences on economics activities from 1949 to 1973. In the recent study Blanchard et al. (2007) gave some different results in relate to effects of oil prices on macroeconomics variables from the 1970s to 2000 in a group of industrialized economies. They achieved five main conclusions. The first one is, considering the influences of oil price shocks with large shocks of a different nature simultaneously. They have provided some documentation on other goods prices were important in the 1970s, but they did not find any identified for other shocks in 2000s. The other conclusion was about different impact of oil shock on macroeconomics over time. The third conclusion is plausible from the first result. They believe that these fluctuations decrease real wage rigidities. Such rigidities are required to generate the type of large stagflation in response to adverse supply shocks such as those that happened in the 1970s. The fourth in which plausible from second relates to changes is the rising credibility of monetary policy. And finally, the fifth conclusion is that a third plausible cause for these changes is simply the decrease in the share of oil in consumption wage to the marginal rate of substitution and thus unemployment appears to have increased over time.

Despite of so consideration of researchers on developed country in their studies, but there are little workouts about developing countries. We will mention some of these studies. Eltony and Alwadi (2001) examined oil price shocks and oil revenue on seven macroeconomics variables about Kuwait. Their examination indicated that there is high degree of interrelation between oil revenue and government development, and all revenue and current expenditure. However, government development can have strong effects relatively. Other studies implicated by Raguindin et al. (2005). They examined the effects of oil price shocks on some macroeconomic variables in the Philippines economy from 1981 to 2003. They pointed out in which oil price shocks lead to stretch out reduction in the real GDP of Philippines. It's remarkable that they found oil price decreases has some stronger impacts on variable's fluctuations than oil price increases.

Berument et al. (2010) studied in order to examine how oil price shock can affect the output growth of selected MENA (Middle East and North Africa) countries. Their prediction suggest that rising oil price have a notable and positive effect on the output of Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Syria, and the United Arab Emirates. However, oil price shocks do not bear effects on the outputs of Bahrain, Djibouti, Egypt, Israel, Jordan, Morocco, and Tunisia (Berument et al. 2010). Eltejaei et al. (2012) studied the impact of oil revenue fluctuations on some macroeconomics variables in the Iranian economy during the period 1990 to 2008 with quarterly data. They found that the positive shocks lead to increase economic growth. They also estimated that fluctuations in oil price and oil revenue cause to inflation and government current and capital expenditure take quite asymmetric response to both negative and positive shocks (Eltejaei & Afazali 2012).

Our analysis not only considers the impact of oil price on inflation but also the effects of tax revenue as important source of income. In next section we will present some literature about taxation.

3.2 Taxation Revenue

The main sources of earnings for countries are taxation revenue for developed countries and oil revenue for oil-exporting countries. In recent years, due to volatility and unstable of oil price in particular and oil revenue in general, many developing countries strike to tax reform. Composition of tax revenue like oil revenue has large effects on macroeconomic variables. Tax reform has complex influences on main factors of economics simultaneously. Tax reforms implemented by countries have resulted in an increase indirect taxes which cause the consumer price index (CPI) and simultaneously, the tax reform lead to a increase in the after tax income of consumers (Diewert & Fox 1998). Nashashibi et al. (1993) studied tax revenue base on the exchange rate, terms of trade and import liberalization across 28 countries in Sub-Sahara. They implied that by undermining the tax base will lead to fall exchange rates, declining terms of trade and decreasing liberalization. Koreshkova (2006) stated that undergrounding and formal sectors of the economy have distinct impacts on different aspects of economic activities generally and tax revenue particularly. He mentioned that the underground sectors of the economy are vast in poor countries relative to rich countries. His results indicate that the size of the underground sector negatively correlated with per capita GDP. Average CPI is so high across countries that have large underground economies. Also, he found that the inflation rate is negatively related to tax revenue.

4. Hypotheses about the Transmission Channel

The effect of oil revenue, income tax and corporate tax on the consumer price index has been derived from background macroeconomics theories in text books rather than using any special model. Our goal is not to test special economic theory. As regards the explanatory variables have influences on fiscal policy and monetary policy; these variables have impacts on consumer price index, also. In most of developed countries to controlling of consumer price index, the policy makers using taxation as main factor of fiscal policy (Demary 2010).

In this paper we have mentioned some hypothesis to transmissions channels from oil revenue, corporate tax and income tax on consumer price index. We explain the effect of oil revenue, corporate tax and income tax as independent variables, on consumer price index as the dependent variable. (1) Oil Revenue: as we discussed before, oil is the main source of government earnings is in Iran. Such dependence of the Iranian economy on oil revenue causes its economic performance to rely on it. By increasing oil revenue and government expenditure the monetary policy will be expansion. This means that money supply rises due to exchange of petro dollar with the local currency in the market. This operation cause to explosion of money across people, consequently, by increasing liquidity lead to demand for commodities rising. Finally, oil revenue is found to be positively correlated with the consumer price index. By increasing oil revenue the consumer price index will increase. (2) Corporate Tax: the respond of price level of commodities versus corporate tax can be twofold. We assume that corporate tax has negative relation with the consumer price index. Fluctuations in taxation have impacts on the quantity of investment and saving by corporations in production and spending. By increasing the corporate tax cause reduces the corporate motivation to investment more and lead to more savings by investors. Demand for commodities will fall resulting in more saving. So finally, the price of goods and services will be down and the consumer price index is reduced. On the other side, corporate tax lead to increases in the cost of production, and consequently, it causes to price level be rise. (3) Income Tax: Individuals decrease their demands respond to falling in amount of achievable money. By imposing taxation in society not create new money but also the amount of money transmission from one side to other side. Imposing the income taxation reduces buying power of the people so, decreases demand and reduces price level. Following, we assume that income tax is related with the consumer price index negatively.

Table 1 Hypotheses about transmission channels

	Reaction of consumer price index to …
Oil revenue	+
Corporate tax	-/+
Income tax	-

Note: + indicates that we expect a positive impulse response, while –indicates that we expect a negative response. +/- indicates that both effects maybe possible.

$$Q_d = f\,(OI^{+},\ CT^{+/-},\ IT^{-},) + \varepsilon \qquad (1)$$

we will use two side hypotheses in this study

$$CPI_t = \beta_0 + \beta_1 OI_t + \beta_2 CT_t + \beta_3 IT_t + \varepsilon_t \qquad (2)$$

$H_0 = \beta_0 = 0, \quad \beta_1 = 0, \quad \beta_2 = 0, \quad \beta_3 = 0$

$H_1 = \beta_0 \neq 0, \quad \beta_1 \neq 0, \quad \beta_2 \neq 0, \quad \beta_3 \neq 0$

6. Data and Methodology

Nowadays, the countries with endowment natural resource as mining or hydrocarbon, they try to concentrate about imposing taxation on corporate or individuals, even. The most reason is about volatility of energy prices in world market. Iran as one of the most endowment natural materials as oil and gas using rarely on imposing tax. In this study we decide to compare the influences of income from natural revenue and income from imposing taxation on consumer price index.

Main objective of this study is figure out whether any relationship across Oil Revenue (OI), Corporate Tax (CT) and Income Tax (IT) as explanatory variables and consumer price index (CPI) as explained variable in Iranian economy. The full sample comprises yearly from 1971 to 2008. Actually, our main concentrate is on after Islamic Revolution in 1979. We provided the data from Economic Time Series Data Base section in central bank of Iran website.

In order to figure out of reaction of macroeconomic variables on each other we use an Ordinary Least Square (OLS). Ordinary Least Square (OLS) is a regression estimation technique that calculates the coefficients of equation to minimize the sum of the squared residuals, thus:

$$\text{OLS minimizes SUM } \hat{e}^2$$

The residual, ê, is the difference between the actual Y and the predicted Y and has a zero mean. In other words, OLS calculates the slope coefficients so that the difference between the predicted Y and the actual Y is minimized. (The residuals are squared in order to compare negative errors to positive errors more easily.)

The OLS estimates of the **βs**:

- are unbiased – the **βs** are centered around the true population values of the **βs**
- have minimum variance – the distributions of the ß estimates around the true **βs** are as tight as possible
- are consistent – as the sample size (n) approaches infinity, the estimated **βs** converge on the true **βs**
- are normally distributed – statistical tests based on the normal distribution can be applied to these estimates.

6.1 How to evaluate the OLS model?

- Evaluating the overall performance of the model

We hope that our regression models will explain the variation in the dependent variable fairly accurately. If it does, we say that "the model fits the data well." Evaluating the overall fit of the model also helps us to compare models that differ with the data set, composition and number of independent variables, etc.

There are three primary statistics for evaluating overall fit:

1. R^2

The coefficient of determination, R^2, is the ratio of the explained sum of squares (ESS) to the total sum of squares (TSS):

$$R^2 = ESS/TSS = \sum([Y - \hat{e}] - \mu_Y)^2 / \sum(Y - \mu_Y)^2 \quad (3)$$

where ESS is the summation of the squared values of the difference between the predicted Ys (Y - ê) and the mean of Y (μ_Y, a naive estimate of Y) and TSS is the summation of the squared values of the difference between the actual Ys and the mean of Y.

The R^2 ranges from 0 to 1 and can be interpreted as the percentage of the variance in the dependent variable that is explained by the independent variables.

2. Adjusted R^2

Adding a variable to a multiple regression equation virtually guarantees that the R^2 will increase (even if the variable is not very meaningful). The adjusted R^2statistic is the same as the R^2 except that it takes into account the number of independent variables (k). The adjusted R^2 will increase, decrease or stay the same when a variable is added to an equation depending on whether the improvement in fit (ESS) outweighs the loss of the degree of freedom (n-k-1):

$$\text{Adjusted } R^2 = 1 - (1 - R^2) \times [(n - 1)/(n - k - 1)] \quad (4)$$

The adjusted R^2 is most useful when comparing regression models with different numbers of independent variables.

3. F-stat

The F statistic is the ratio of the explained to the unexplained portions of the total sum of squares (RSS=SUM $\hat{e}^2$), adjusted for the number of independent variables (k) and the degrees of freedom (n-k-1):

$$F = [ESS/K] / [RSS/(N - K - 1)] \quad (5)$$

The F statistic allows the researcher to determine whether the whole model is statistically significant from zero.

Our dependent variable in the equation is consumer price index as showing of inflation rate. Our independent variables are oil revenue (OI), income tax (IT) and corporate tax (CT). The consumer price index model is specified as follows:

$$CPI_t = \beta_0 + \beta_1 OI_t + \beta_2 CT_t + \beta_3 IT_t + \varepsilon_t \quad (6)$$

where CPI is consumer price index, OI is oil revenue, CT is corporate tax and IT is income tax, β_1, β_2, β_3, are coefficient of independent variables and β_0 is constant term, and ε_t is error term.

7. Empirical analysis

7.1 Hypothesis test (individual test):
By employing OLS test in Eviews 7 software we take some result as following:

$$CPI = 11.75 + 0.001OI + 0.025\,IT - 0.002\,CT \quad (7)$$

(3.439041) (0.000153) (0.002555) (0.000490)

t = 3.417982 7.842325 10.568113 -5.766675

R-squared = 0.993314

Adjusted R-squared = 0.992724

F-statistics = 1683.776

We use t-test to test the hypothesis of individual regression coefficient and select 5 and 10 percent level of significant in this test. There are 34 degrees of freedom (equal to N-K-1, or 38-3-1). So at 5 percent level of significant, the critical t-value in two sided is **2.021 < Critical t-value < 2.042**. If the t-value is larger than critical t-value then we can reject the null hypothesis at 5 percent level of significant, assume the sign of estimated regression coefficients are same from what we have expected.

7.1.1 T-test
Ho: $\beta_1 = 0$

H_1: $\beta_1 \neq 0$

Decision rule: Reject Ho if |tk| > tc also has the sign implied by H_1, otherwise do not reject Ho.

Decision: reject Ho since 7.842325 > 2.042 and 7.842325 is positive.

Conclusion: In the case of oil revenue, we reject the null hypothesis that $\beta_1 = 0$ at 5 percent level of statistically significant and conclude that oil revenue is positively related to consumer price index, since the t-value of oil revenue is 7.842523 which are bigger than critical t-value 2.042.

Ho: $\beta_2 = 0$

H$_1$: $\beta_2 = 0$

Decision rule: Reject Ho if |tk| > tc also has the sign implied by H$_1$, otherwise do not reject Ho.

Decision: For β_2, we can reject Ho since 10.568113 > 2.042 and 10.568113 is positive.

Conclusion: In the case of income tax, we do reject the null hypothesis that $\beta_2 = 0$ at 5 percent level of statistically significant and can conclude that income tax is positively related to consumer price index, since the t-value of income tax is 10.568113 which are bigger than critical t-value 2.042.

Ho: $\beta_3 = 0$

H$_1$: $\beta_3 \neq 0$

Decision rule: Reject Ho if |tk| > tc also has the sign implied by H$_1$, otherwise do not reject Ho.

Decision: For ß3, do not reject Ho since |5.766675| > 2.042 and 5.766675 is negative.

Conclusion: In the case of corporate tax, we do reject the null hypothesis that $\beta_3 = 0$ at 5 percent level of statistically significant and can conclude that corporate tax is negatively related to consumer price index, beside, the sign of estimated coefficient of corporate tax is opposite from what we have expected, since the absolute t-value corporate tax is 5.766675 which are bigger than critical t-value 2.042.

7.1.2 P-value

P-value is an alternative method to test the hypotheses about individual regression coefficient. This paper uses 5 percent level of significant to run the tests. Assume that the sign of regression coefficient is same as what we have expected, if p-value is smaller than level of significant then we can reject null hypotheses. Since our test in this study is two sided test, so the p-value does not need to divided by 2.

Ho: $\beta_1 \neq 0$

H$_1$: $\beta_1 = 0$

P-value = 0.0000

α-value = 0.05 @ 5%

Decision rule: Reject Ho when p-value < α-value, otherwise do not reject Ho.

Decision: Reject Ho since p-value (0.0000) < α-value (0.05).

Conclusion: The p-value for oil revenue is 0.0000 and is smaller than 0.05, so we reject the null hypothesis that $\beta_1 = 0$ at 5 percent level of statistically significant, and conclude that oil revenue is positively related to consumer price index.

Ho: $\beta_2 = 0$

H$_1$: $\beta_2 \neq 0$

P-value = 0.0000

α-value = 0.05 @ 5%

Decision rule: Reject Ho when p-value < α-value, otherwise do not reject Ho.

Decision: reject Ho since p-value 0.0000 < α-value (0.05).

Conclusion: The p-value for income tax is 0.0000 and is smaller than 0.05, so we do not reject the null hypothesis that $\beta_2 = 0$ at 5 percent level of statistically significant, and can conclude that income tax is positively related to consumer price index.

Ho: $\beta_3 = 0$

H_1: $\beta_3 \neq 0$

P-value = 0.0000

α-value = 0.05 @ 5%

Decision rule: Reject Ho when p-value < α-value, otherwise do not reject Ho.

Decision: reject Ho since p-value 0.0000 < α-value (0.05).

Conclusion: The p-value for corporate tax is 0.0000 and is smaller than 0.05, so we can reject the null hypothesis that $\beta_3 = 0$ at 5 percent level of statistically significant, and can conclude that corporate tax is negatively related to consumer price index.

7.1.3 F test (Overall test):

F-test is a formal hypothesis test that is designed to deal with the null hypothesis that contains multiple hypotheses or a single hypothesis about a group of coefficients. There are 34 degrees of freedom (equal to N-K-1, or 38-3-1). So at 5 percent level of significant, the critical F-value is between 2.84 < Critical F-value < 2.92. If the F-value is larger than critical F-value then we can reject the null hypothesis at 5 percent level of significant.

Ho: $\beta_1 = \beta_2 = \beta_3 = 0$

H_1: Ho is not true.

F test = 1683.776

Decision rule: Reject Ho if F-value > Critical F-value, otherwise do not reject Ho.

Decision: Reject Ho since F-value (1683.776) > critical F-value (2.92)

Conclusion: The value of F-statistic is 1683.776 and it is bigger than 2.92, so we can reject the null hypothesis at 5 percent level of statistically significant and conclude that our estimated regression coefficient equation have a significant of overall fit.

7.2 Confident Intervals

A confident interval is a range that contains the true value of a item a specified percentage of the time. This percentage is the level of confidence associated with the level of significance used to choose the critical t-value in the interval. For an estimated regression coefficient, the confident intervals can be calculated using the two side critical t-value and the standard error of the estimated coefficient:

$$\text{Confident interval} = \beta \pm t_c \,.\, SE(\beta) \qquad (8)$$

In my model and my t-test of the significance of the estimate of the coefficient oil revenue is:

$$\text{Log CPI} = 11.75 + 0.001\text{Log OI} + 0.025\text{ Log IT} - 0.002\text{ Log CT} \qquad (9)$$

$$(3.439041) \quad (0.000153) \quad (0.002555) \quad (0.000490)$$

Well, coefficient and standard error of oil revenue are $\beta_1 = 0.001$, SE (β_1) = 0.000153, so we need a 90 percent two sided critical t-value for 34 (38-3-1) degree of freedom. As can be seen in statistical Table for Critical t-value, the t_c is 1.697. By substituting these values into equation (8), we will get:

Confident interval = 0.001 ± 1.697 • 0.000153 = (0.000741 – 0.001259)

In the other word, the interval from 0.000741 to 0.001259 will contain the true coefficient 90 percent of time in oil revenue variable.

By coefficient and standard error of income tax are β_1 = 0.025, SE (β_2) = 0.002555, so we need a 90 percent two sided critical t-value for 34 (38-3-1) degree of freedom. As can be seen in statistical Table for Critical t-value, the t_c is 1.697. By substituting these values into equation (8), we get:

Confident interval = 0.025 ± 1.697 • 0.002555 = (0.02066 – 0.02755)

In the other word, the interval from 0.02066 to 0.02755 will contain the true coefficient 90 percent of time in income tax variable.

Finally, by coefficient and standard error of corporate tax are β_1 = 0.002, SE (β_3) = 0.000490, so we need a 90 percent two sided critical t-value for 34 (38-3-1) degree of freedom. As can be seen in statistical Table for Critical t-value, the t_c is 1.697. By substituting these values into equation (8), I get:

Confident interval = 0.002 ± 1.697 • 0.000490 = (0.0011 – 0.0028)

In the other word, the interval from 0.0011 to 0.0028 will contain the true coefficient 90 percent of time in corporate tax variable.

7.3 Omitted Variables

Omitted variable, defined as an important explanatory variable that has been left out of a regression as an important (Studenmund 2010). Whenever we have an omitted variable, the interpretation and use of my equation becomes suspect. If a variable is omitted, then it is not included as an independent variable, and it is not held constant for the calculation and interpretation of β. This omission can cause bias: It can force the expected value of the estimated coefficient away from the true value of the population coefficient. One of approach to solving of omission problem in equations is using the R-adjusted squared. After adding or dropping of other variable by take looking of R-adjusting squared, we can conclude that the variable is omitted or not. One of the most-used formal specification criteria other than R-adjusted squared is the Ramsey Regression Specification Error Test (RESET). The Ramsey RESET test is a general test that determines the likelihood of an omitted variable or some other specification error by measuring whether the fit of a given equation can be significantly improved by the additional β_4, β_5, β_6, term. The additional terms act as proxies for any possible omitted variables or incorrect functional forms. If the proxies can be shown by the F-test to have improved the overall fit of the original equation, then we have evidence that there is some sort of specification error in our equation.

$$CPI = 4.531943 + 0.002053\ OI + 0.037749\ IT - 0.002920\ CT - 0.002343\ Y_1 + 2.19\ Y_2 - 2.73\ Y_3$$

	(0.000287)	(0.003531)	(0.000688)	(0.000993)	(2.24E-6)	(1.48E09)
T – Value:	7.142065	10.69036	-4.241037	-2.360186	0.981437	-0.183992

R-adjusted squared: 0.997357

N = 38 (annually 1971-2008)

$RSS\rho = 9963$

RSS = 3299

The appropriate F-statistic to use is one that is presented in original equation (getting from B-2 table):

$$F = \frac{\frac{RSS\rho - RSS}{M}}{RSS\frac{1}{N-k-1}} \tag{10}$$

WhereRSS_ρ, is the residual sum of squares from the restricted equation, RSS is the residual sum of squares from the unrestricted equation, M is the number of restrictions and N-k-1 is the number of degree of freedom in the unrestricted equation. By substitution the number of estimated in equation (10) I get:

$$F = \frac{\frac{9963-3299}{3}}{3299\frac{1}{32}} = 20.95$$

The critical F-value to use, 2.92, is found in Statistical Table B-2 at the 5 percent level of significant with 3 numerators and 31 denomerator degrees of freedom. Since 20.95 > 2.92, we can reject null hypothesis that the coefficients of the added are jointly zero, allowing us to conclude that the there is indeed a specification error in original equation.

7.4 Variance Inflation Factors (VIFs) Test

In this section we will take VIF test in order to determination of Multicollinearity problem. This problem deals with violations of the Classical Assumption VI. Multicollinearity violates Classical Assumption VI, which specifies that no explanatory variable is a perfect linear function of any other explanatory variables. If two explanatory variables are significantly related, then the OLS computer program will find it difficult to distinguish the effects of one variable from the effects of others. Multicollinearity ruins our ability to estimate the coefficients because the two variables cannot be distinguished. The major consequences of Multicollinearity are: (1). *Estimates will remain unbiased,* (2). *The variances and standard errors of the estimates will increase,* (3). *The computed t-scores will fall,* (4). *Estimates will become very sensitive to changes in specification,* (5). *The overall fit of the equation and the estimation of the coefficients of non-multicollinear variables will be largely unaffected.* One measure of the severity of multicollinearity that is easy to use and that is gaining in popularity is the variance inflation factor (VIF). The variance inflation factor (VIF) is a mentioned of detecting the severity of multicollinearity by looking at the extent to which a given explanatory variable can be explained by all the other explanatory variables in the equation. The VIF is an index of how much multicollinearity has increased the variance of the estimated coefficient. A high VIF indicates that multiconearity has increased the estimated variance of the estimated coefficient by quite a bit, yielding a decreased t-score. To calculation of variance inflation factor for β:

$$\text{VIF}(\beta) = \frac{1}{1-R^2} \quad (11)$$

Where $\boldsymbol{R^2}$ is the coefficient of determination of the auxiliary regression in step one. While there is no table of formal critical VIF values, a common rule of thumb is that if VIF (β) > 5, the multicollinearity is severe. As the number of independent variables increases, it makes sense to increase this number slightly.

We use VIF to examine the multicollinearity problem which is by looking at the extent to given an independent variable that can be explained by the rest of the independent variables in the equation. If VIF ($\beta_{i)}$ is bigger than 5 it has multicollinearity problem.

$$VIF(OI) = \frac{1}{1-0.916226} = 11.936877$$

The VIF for oil revenue is 11.93 which is bigger than 5, so we conclude that this variable has the multicollinearity problem.

$$VIF(IT) = \frac{1}{1-0.978583} = 46.691880$$

The VIF for income tax is 46.69 which is bigger than 5, so I can conclude that this variable have multicollinearity problem.

$$VIF(CT) = \frac{1}{1-0.959375} = 24.615384$$

The VIF for corporate tax is 24.61 which is bigger than 5, so we can conclude that this variable has the multicollinearity problem.

Table 2 Variance Inflation Factors test to Multicollinearity problem

Variance Inflation Factors

Sample: 1971 2008

Included observations: 38

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	11.82700	1.533587	NA
OI	2.34E-08	16.71500	11.93661
IT	6.53E-06	61.56586	46.69216
CT	2.40E-07	29.76723	24.61517

As we seen in the table the VIF for all of variables are more than 5. So we conclude that there is multicollinearity in the equation. In our model income tax has most correlated with other variables. To remedies the multicollinearity in the models we have some choice. First way to remedy of multicollinearity is do nothing. One reason for doing nothing is that multicollinearity in an equation not always reduces the t-scores enough to make them insignificant or change the βs enough to make them differ from expectations. A second reason for doing nothing is that the deletion of a multicollinearity variable that belongs in an equation will cause specification bias. If I drop such a variable, then we are purposely creating bias.

7.5 Heteroskedasticity Problem

Another serious problem we may face in regression analysis is heteroskedasticity. This arises when the assumption that the variance of the error term is constant for all values of the independent variables is violated. This often occurs in cross-sectional data, where the size of the error may rise or fall with the size of independent variable. There are three major consequences from heterokedasticity*: (1). Pure heteroskedasticity does not cause bias in the coefficient estimates. (2).Heteroskedasticity typically cause OLS to no longer be the minimum-variance estimator. (3). Heteroskedasiticy causes the OLS estimates of the SE(β)s to be biased, leading to unreliable hypothesis testing* .Econometricians do not all use the same test for heteroskedasticity because heteroskedasticity takes a number of different forms, and its precise manifestations in a given equation is almost never known. One of the most popular approaches to solve this problem is White test.

7.5.1 White Test

To run a white test we have pass through three stages:

1. Obtained the residuals of the estimated regression equation.

2. Use these residuals as the dependent variable in a second equation that includes as explanatory variables each from the original equation, the square of each time every other. In my equation, my original independent are OI, CT and IT. The white equation is:

$$(e_i)^2 = \beta_0 + \beta_1 OI + \beta_2 IT + \beta_3 CT + \beta_4 OI^2 + \beta_5 IT^2 + \beta_6 CT^2 + \beta_7 OI.IT + \beta_8 OI.CT + \beta_9 IT.CT \quad (12)$$

3. Test the overall significance of equation (12) with the chi-square test. The appropriate test statistic here is NR^2, or the sample size (N) times the coefficient of determination of equation (12). This test statistic has a chi-square distribution with degrees of freedom equal to number of slope coefficients in equation (12). If the $NR^2 >$ critical chi-square value, then we reject the null hypothesis and conclude that it's likely that we have heteroskedasticity. If $NR^2 <$ critical chi-square value, then I cannot reject the null hypothesis of homoskedasticity.

Ho: There is no heteroscedasticity.

H_1: There is heteroscedasticity.

$(e_i)^2 = 97.12597 + -0.097636OI + 0.366867IT + 0.455542CT + 4.9034443OI^2 – 6.557996IT^2 + 5.177389CT^2 + 7.173989OI.IT – 5.002068OI.CT – 2.555193IT.CT$

N = 38

$R^2 = 0.737654$

$N.R^2 = 38 \times 0.737654 = 28.0288$

We use 5 percent level of significant run the White test, the degrees of freedom is 9 so the critical chi-square value is 16.92. The NR^2 is equal to 28.02 which is bigger than 16.92 and the probability of chi-square is 0.0009 which is smaller than 0.05 so we can reject the null hypothesis and conclude that I have heteroskedasticity.

By employing OLS test in Eviews software I take some result as following:

$$CPI = 11.75 + 0.001OI + 0.025\,IT - 0.002\,CT$$

(3.439041) (0.000153) (0.002555) (0.000490)

t = 3.417982 7.842325 10.568113 -5.766675

R-squared = 0.993314

Adjusted R-squared = 0.992724

F-statistics = 1683.776

Well, 0.001 means that the model implies that the 1 percent increasing in oil revenue lead to rising consumer price index by 0.001. So other estimations have as same as meaning. For income tax, we can conclude in which by 1 percent increasing in income tax consumer price index will increase by 0.025 percent. Well, 0.002 tells that by 1 percent increasing in corporate tax 0.002 percent will decrease. Corporate tax related with consumer price index negatively but oil revenue and income tax have positive relation. The numbers of parenthesis are standard error. By dividing coefficients on standard error we can achieve t-value. Note that the sign of t-value is always the same as that of the estimated regression coefficients, and the standard error is always positive. R-squared that has written in below of equation is for fit or its name is coefficient of determination. Measures of this type are called goodness of fit measures. R-squared measures the percentage of the variation of dependent variable around the estimate dependent variable that is explained by the regression equation. Since OLS selects the coefficient estimates that minimize RSS, OLS Provides the largest possible R-squared, given a liner model.

The value of R-squared close to one shows an excellent overall fit, whereas a value near zero shows a failure of the estimated regression equation. So in my estimation the value of R-squared is 0.993314. So its mean that my estimation is over fit. But the major problem with R-squared is that adding another independent variable to a particular equation can never decrease R-squared. So to resolve these problem econometricians theorists introduced the degree of freedom, or the excess of the number of observations (N) over the number of coefficients (including the intercept) estimated (K+1). Adjusted R-squared measures the percentage of the variation of dependent variable around its mean that is explained by the regression equation, adjusted for degree of freedom. So most of econometricians, nowadays, use the adjusted R-squared rather than R-squared. Although R-squared and adjusted R-squared measure the overall degree of fit of an equation, they don't provide a formal test of overall fit for all of coefficient. So to maintain this goal we use the F-statistics. We have to compare my F-value in equation with F-statistic in Table B-2 that showing the critical values of the F-statistic. We can conclude that my estimation of coefficients in equation are significant when the value of F-value bigger than F-statistical in critical value table. Thus my F-value (1683.776) so bigger than F-statistic, then, we can conclude that my estimation is significant.

8. Conclusion

In this study, we found that the oil revenue and corporate tax are significant variables to measurement of consumer price index. Taxation has both positive and negative impact in economic growth and consumer price index due to increasing and decreasing inflation rate. Since increase export oil cause to increasing in price level in Iran, government ought to try to allocate the earning from selling of oil. On the other side, increasing in corporate tax cause to price level rises. So, policy makers and economics should reduces taxation on corporate to make incentive in investors to more investment.

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DATA

	Consumer price index (1995 = 100)	Oil Revenues (billion Rials)	Income Tax (billion Rials)	Corporate Tax (billion Rials)
1971	1.6	155.3	11.9	15.2
1972	1.7	178.2	14.6	20.5
1973	1.9	311.3	18.6	28.8
1974	2.2	1205.2	20.4	44.9
1975	2.5	1246.8	30.2	113.3
1976	2.8	1421.5	47.9	128.9
1977	3.6	1497.8	57.5	160.2
1978	4	1013.2	58.4	200.1
1979	4.4	1219.7	72.3	143
1980	5.3	888.8	65.9	45.9
1981	6.6	1056.4	78.2	227.6
1982	7.8	1689.5	96.8	173.9
1983	9.4	1779.4	90.4	208.3
1984	10.6	1407.7	105.9	257.7
1985	11	1208.6	136.2	357.7
1986	13.1	434.7	163.5	373.5
1987	16.8	853.2	166.4	374.4
1988	21.6	809.3	171.7	392.5
1989	26.4	1515.1	223.3	340.1
1990	28.5	3375.1	309.2	495.6
1991	33.3	3549.4	482.8	774.6
1992	41.9	5145.9	546.7	1297.3
1993	50.8	14683.2	766	1601
1994	66.8	21479.7	1124.9	2398.3
1995	100	29431.2	1869.2	3296.2
1996	128.9	38153	2993.7	5378.3
1997	151.3	36446.7	3484.6	6857.8
1998	178.3	22530	3897.1	7923.6
1999	214.1	44170.4	5383.1	10048.4
2000	245.4	59448.5	6834	11295.5
2001	273	71957.1	8703.7	12371.9
2002	312.1	102626.4	8247.6	17152.3
2003	363.6	128153.9	9008.3	20375.7
2004	417.2	150413.3	11773.3	26027.5
2005	473.6	186342.4	15253.1	64459.9
2006	530	181881.2	19451.3	72861.7
2007	627	173519.1	25960.6	92610.8
2008	786.4	215650.3	31587.7	127794.2