SciencesPo
KUWAIT PROGRAM

"Causes of Inflation Across Main Oil Exporting Countries"

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Fall 2016

This paper has received the *KSP Student Paper Award*

of the Kuwait Program at Sciences Po

Causes Of Inflation Across Main Oil Exporting Countries

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ABSTRACT

An analysis of the possible determinants of inflation in oil exporting countries specifically (Algeria, Iran, Nigeria, Saudi Arabia and Venezuela) is conducted in this paper. The study covers the period from 1991 to 2014 using panel data analysis. Findings show that high inflation is associated with high oil price, low money growth, high exchange rate, and low population growth. However country specific analysis shows different inflation determinants across these countries. Results show that the main determinants of inflation for Algeria and Nigeria arise from exchange rate variations, whereas the determinants of inflation for Iran are from monetary factors, demand side factors and from exchange rate variations. Moreover the sources of inflation in Saudi Arabia come from the supply side factors and the demand side factors. Venezuela inflation sources ascends from several factors; monetary, supply side and demand side factors.

Keywords: Inflation; Panel Data; Oil Exporting Countries.

JEL Classification Numbers: E31, C33, E50.

I. INTRODUCTION

Inflation has been a rising concern since the 1970s, many studies have investigated inflations using different aspects. The highest average inflation rate ever recorded in the world was in the 1980s and 1990s at 15% and 16% respectively. Moreover the industrialized nation's highest inflation differed and was recorded at 9% in the 1970s, on the other hand the developing countries recorded an alarming inflation percentage of 37% on average Al-Shammari and Al-Sabaey (2012). The sources of inflation from country to another and from time to time varies significantly

Mass studies investigated the determinants of inflation in many countries, however not many have been implemented for oil exporting countries. Many studies analyze the relationship between inflation determinants through demand and supply side factors along with monetary factors and external sources. Many literatures use to analyze sources of inflation around the world using four main aspects. These studies include Al-Shammari and Al-Sabaey (2012) for developing and developed countries, Kandil and Morsy (2011) use domestic and external factors for GCC countries. In this paper the estimated model extends the work by Al-Shammari and Al-Sabaey (2012). This approach diverges from the literature, where the emphasis is on the inflation differentials across countries of the (OPEC).

The main aim of this study is to investigate the determinants of inflation for selected members of the Organization of the Petroleum Exporting Countries (OPEC). Countries included are Algeria, Indonesia, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela. The contribution of this paper is to extend the study of inflation determinants for oil exporting countries and to show the variations across each specific country. Moreover due to the recent downward trend in oil

prices that will take in consideration in the changes of oil prices and determining inflation in these countries.

The study investigates the determinants of inflation across oil exporting countries using a data sample from 1991 to 2014 using panel data analysis (pooled and random effect). The estimated model first is tested using the whole data sample including all member countries. Second the model examines variations of inflation across countries. The findings show that sources of inflation differ from country to country. The main determinants of inflation for Algeria and Nigeria are similar and arise from the exchange rate, whereas the determinants of inflation for Iran arise from monetary factors, demand side factors and from exchange rate. Moreover the sources of inflation in Saudi Arabia arise from the supply side factor and the demand side factor and the inflation sources for Venezuela arise from several factors; the monetary, supply side and demand side factors.

The rest of this paper is organized as follows. Section II covers relevant literature. Section III demonstrates an overview of inflation determinants. In section IV, the model specification and methodology used in the study are explained. In section V, Data is described. The empirical results are explained in Section VI. The conclusion and policy implications are provided in section VII.

II. LITERATURE REVIEW

There has been a mass of studies investigating the determinants of inflation across the world. Many studies investigate the inflation phenomenon across different countries. However, not many studies have investigated the determinants of inflation across oil exporting countries. This paper aims to study the inflation determinants across selected oil exporting countries.

A study by Al-Shammari and Al-Sabaey (2012) investigate the sources of inflation across fifty-nine developed and developing countries using a panel model. Their findings show that sources of inflation for developing counties are government spending, exchange rate, world oil prices and money supply growth. Whereas sources of inflation for developed countries include government spending, money supply growth, world oil process, interest rate, nominal effective exchange rate, and population.

On the other hand, Moser (1995) studied the inflation of Nigeria and findings show that the main determinant of inflation is monetary expansion. Moreover Imimole and Enoma (2011) examine the impact of exchange rate depreciation on inflation in Nigeria for the period 1986–2008, results show that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation in Nigeria. Mohammed et al (2015) examine the determinants of inflation in Algeria and their findings show that Algeria's inflation rise only from external factors; imports price, oil price and effective nominal exchange rate.

Hasan and Alogeel (2008) investigate the inflationary process in the GCC and findings show the determinants of inflation in the long run for Kuwait and Saudi Arabia are mainly from imported inflation, exchange rate, and oil prices. Kandil & Morsy (2011) also studied the inflation in the GCC, their findings show that imported inflation from major trading partners and oil revenues strengthen inflationary pressure. Additionally findings by Altowaijri (2011) for factors that influence inflation in Saudi Arabia, are high oil prices, increase in world prices, and fall of the dollar.

Asgharpur, Kohnehshahri and Karami (2007) examine the causal relationship between the interest rate and inflation rate in a panel of 40 selected Islamic countries and the results imply that interest rate and inflation are positively related and recommend that banks need to reduce

interest rates to decrease inflation. Farzanegan and Markwardt (2008) investigate the relationship between oil price shocks and macroeconomic variables in Iran. Their findings show that the Iranian economy is highly vulnerable to oil price fluctuations both positive and negative oil price shocks raise inflation significantly.

Yoon et al (2014) study concerns the demographic changes impact on macroeconomic variables of 30 OECD countries. Results show that population growth affects the inflation rate positively. Moreover they argue that population dynamics and their interactions with macroeconomic variables can be varied, and have different impact on inflation depending on the stage in the demographic transition. They further explain that if an economy is experiencing a rapid declining and a significant aging of its population it could have a significant deflationary impact on inflation; through lower aggregate demand and a negative wealth effect from falling asset prices, and changes in relative prices reflecting different consumption preferences.

Moreover Bullard et al. (2012) study of demographics, redistribution, and optimal inflation findings is consistent with Yoon et al (2014). Bullard et al (2012) study confirms that with an ageing population dynamics will cause a downward pressure on inflation or even lead to deflation. On the contrary a study of the relationship of inflation and population growth with GDP of 40 developing countries from year 2009 to 2011 by Khan et al (2013), their findings show no relationship between population growth and inflation.

Darrat (1985) empirically analyzed the levels of inflation in three major oil exporting countries. Findings show that the higher the money supply and lower the real income growth the higher the inflation in these countries. Moreover Naghdi et al (2012), study of the of the 2007 financial crisis on OPEC member's inflation, results show that for a one percent increase in oil price causes inflation to increase by 0.08 percent points.

III. OVERVIEW OF INFLATION DETERMINANTS

There have been countless studies that have studied the determinants of inflation in various countries. However there have not been many studies determining the sources of inflation across the different OPEC Countries. This study investigates the main sources of inflation of selected members of the Organization of the Petroleum Exporting Countries (OPEC), namely Algeria, Iran, Nigeria, Saudi Arabia, and Venezuela.

There are many factors affecting inflation, the factors chosen in in this study have been extracted from previous studies. The variables are the monetary factors: interest rate and growth of money, the demand side factors: government expenditure and population growth. World oil price is considered to be a factor that affects the supply side. The exchange rate is considered to be an external factor effecting inflation.

The importance of the world oil prices in this study is due to the continuous fluctuations in the world oil prices. Graph 1 in Appendix A, shows the world oil price fluctuating drastically over the years from 1991 to 2014. The lowest oil price was recorded in year 1998 due to the Asian Financial Crisis. The Asian Financial Crisis resulted for low demand for oil, accumulating oil surplus which caused a fall of the prices to an average of $12.28 per barrel. In year 2000 OPEC cut its production of oil and increases oil prices to about $27.6 per barrel, nonetheless the oil price fell once again in the following year. However since 2002 to the beginning of 2008, oil prices flourished and reached $94.1 per barrel. Mid of 2008, oil prices dropped again and reached $60.86 per barrel by 2009 reflecting the World Financial Crisis. Oil prices started recovering right after the World Financial Crisis and reached to a maximum of $109.45 per barrel in 2012, but starting declining afterwards reaching $96.29 in 2014 which was explained

due to the rapid growth in the supply of oil from non-OPEC countries as Baffes et al (2015) show in their study of The Great Plunge in Oil Prices: Causes, Consequences, and Policy Responses.

Moreover the inflation rate changes from period to period and differs from country to country. Graph 2 in Appendix A. shows the inflation rate measured by CPI for the selected oil exporting countries (Algeria, Iran, Nigeria, Saudi Arabia, and Venezuela). The graph shows inflation rates volatility, and the differences of inflation across the countries. The inflation rates have been fluctuating a lot over the years from 1991 to 2014. The inflation rate is different from country to country and from period to period as shown in Graph 2.Saudi Arabia has the lowest and most stable inflation rate among the other countries. Saudi Arabia lowest inflation rate was recorded in 1999 at -1.34% and highest in 2011 at 5.8%. Whereas the inflation rate for Algeria, Iran, Nigeria, and Venezuela fluctuate more at higher rates. Algeria lowest inflation recorded was in 2000 at 0.33% and highest was in 1992 at an inflation rate of 31.62%. While inflation rate for Iran was utmost in 1995 and lowest in 2010, at inflation rates of 49% and 10% respectively. Nigeria Inflation was recorded in 1995 at 72% and lowest measured was in 2007 at 5.3%. Venezuela has the highest inflation throughout the years and among all the oil exporting countries, the highest recorded inflation was in 1996 at 99.8%, and the lowest inflation calculated for Venezuela was in 2001 at 12.5%.

IV. METHODOLOGY & MODEL SPECIFICATION

This paper examines the sources of inflation across oil exporting countries. While the majority of studies use time-series model to investigate inflation determinants across countries panel model analysis is employed in this paper for multidimensional analysis of inflation across

the oil exporting countries. The model for inflation determinants is tested first using the whole data sample, then is tested for each country separately. The study follows the work of Al-Shammari and Al Sabaey (2012), which investigates the inflation for developed and developing countries. The model is as follows:

$$CPI = \beta_0 + \beta_1(M) + \beta_2(i) + \beta_3(EXC) + \beta_4(Poil) + \beta_5(Pop) + \beta_6(EXP) + \varepsilon$$

Where inflation is the dependent variable and is measured by the consumer price index (CPI), and the independent variables are: money growth (M) is the percentage change of money over the years; (i) denotes for interest and is measured by the lending interest rate of each central bank; Yearly average Exchange rate is denoted by (EXC); World Oil Price (Poil) is measured by US Dollar/PB; Population (Pop) measured by millions of people residing in each country; Government spending in billion US Dollars is denoted by (EXP) and ε is an error correction term.

The data is measured first using the pooled OLS, assuming there is no distinctive aspects from country to country, denying the heterogeneity that might exist among the selected members of the OPEC. Moreover the determinants are measured using Random Effect Model and Fixed Effect Model and next the Hausman Specification Test is conducted to specify which model is appropriate for this study. Another model is developed for country specific determination of inflation by implying interaction terms for each country to investigate inflation differentials across the selected countries.

According to the estimated model, Money growth is expected to have a positive effect on inflation. Whereas a negative relationship is expected for exchange rate to have with inflation. World oil prices are anticipated to have a positive relationship with inflation. Moreover

population and interest are expected to have a bilateral relationship with inflation. Government expenditure is predicted to have a positive relation with inflation

V. DATA

The study of inflation determinants covers selected member countries of OPEC from year 1991 to 2014. The data is obtained from the World Bank *(World Development indicators)*, the IMF data base *(International Financial Statistics)*, Central Bank of Iran and the SAMA *(Saudi Arabian Monetary Agency)*.

The money growth variable is measured by the growth of money and is obtained from the IMF database *(IFS)*. The interest is measured using the central bank's lending rates obtained from the IMF database (*IFS)*, Central Bank of Iran for Iran interest rate, and SAMA for the Saudi Arabia interest rate. Exchange rate is measured by the average yearly exchange rate and is obtained from the IMF database *(IFS)*. Price of oil is measured by the world crude oil price. Population is measured by millions of people and is acquired from the World Bank.

The variables are expected to be significantly affecting inflation in the selected OPEC countries. The independent variables are categorized into four groups which are monetary factors which include Interest (i) and money growth (M), external factors which include exchange rate (EXC), supply side factor which includes Price of oil (Poil), and demand side factors which include Government Expenditure (EXP) and Population (Pop).

VI. EMPIRICAL RESULTS

VI.I Pooled Results

From Table 1 in Appendix B, the results of the pooled OLS regression model show the model is adequate and most of the variables are statistically significant at one percent level. The variables that are statistically significant at one percent level are money growth, exchange rate, price of oil, and population. The significance of money growth, exchange rate, and prices of oil is consistent with the results of AlShammari and AlSabaey (2012) for developing countries. Moreover the significance of money growth is consistent with the findings of Imimole and Enoma (2011) and Moser (1995). The Oil prices is found to be consistent with the findings of Kandil & Morsy (2011). Moreover surprisingly the findings show that the growth of money and population are negatively related to inflation. Indicating high growth of money supply and high population growth is associated with low inflation in the selected oil exporting countries. The growth of money supply findings is consistent with the findings of Al-Shammari and Al Sabaey (2012). Moreover the negative population- inflation relationship findings is consistent with the findings of Yoon et al (2014) and Bullard et al (2012) indicating that the negative relationship arise in the selected countries due to a declining and aging in its population. The interest and government expenditure variables are found to be insignificant in the pooled sample. Moreover oil price has the highest positive coefficient highly indorsing inflation in the selected countries. The overall results of the pooled data analysis is not accurate, as it treats all the countries the same and denies the heterogeneity, therefore other models are developed to explain the variations between countries.

Table 2 in Appendix B, shows the results of the Random Effect Model and the Fixed Effect Model. The Fixed Effects result in Table 2 shows that the model is adequate, with four statistically significant variables; the interest, exchange rate, oil price and population. Nearly 83% of the variation of inflation is explained by the variation of these statistically significant

variables. Moreover the Random Effects model is adequate, with four statistically significant variables; the money growth, exchange, oil price and population. 65% of the variation in inflation is explained by the statistically significant variables. The Hausman Specification Test is run to indicate which model is appropriate for this study. In Table 3 in Appendix B the results of the Hausman Specification Test shows that the P-value is (0.000) and is less than five percent we reject the null hypothesis of Fixed Effect and accept the alternative hypothesis the Random Effect Model.

Based on the Random Effect Model in Table 2 in Appendix B. the coefficient of interest is statistically insignificant across the selected countries. The money growth coefficient shows significance across all countries, and shows the opposite sign indicating that the higher the money growth the lower the inflation, in oppose to the quantitative theory of money. On the other hand the exchange rate is found to be significant and shows high exchange rate leads to high inflation. The price of oil is found to be significant and shows the expected sign, representing that any change in the price of oil will be reflected on inflation, as the price of oil increases so will inflation across all selected member countries of the OPEC. The coefficient of population is significant but shows inconsistency with the economic theory, as the population grows, the population demand more money, leading to an increase in the money supply causing high inflation but it is consistent with the findings of Bullard et al (2012) and Yoon et al (2014). Government expenditure shows insignificance across the selected countries.

VI.II Extended Results – Country Specific

This paper contributes by showing the variations of inflation sources across selected oil exporting countries (Algeria, Iran, Nigeria, Saudi Arabia, and Venezuela) by testing the model using interaction terms to identify country specific determinants of inflation. Results for Kuwait and Indonesia will not be reported due to insignificancy.

The results showed variation of inflation determinants across the selected oil exporting countries, however some similarity between Algeria and Nigeria was recorded. The main determinants of inflation in Algeria is the exchange rate and is statistically significant at 10 percent level. This suggests that the higher the exchange rate the higher the inflation as shown in Table 4 in Appendix B. Consistent with the findings of Mohammed et al (2015).

Moreover results in Table 5 in Appendix B show the three main determinants of inflation in Iran; high interest rate, high exchange rate and low population growth. Interest rate is statistically significant at 1 percent level and has a positive relationship with inflation, which is consistent with the findings of Asgharpur, Kohnehshahri and Karami (2007) where this positive relationship is explained by: high interest rate raises product's prices shifting the supply curve to the left and consequently raising inflation. High exchange rate, and low population growth are highly statistically significant at 1 percent level. The negative relationship between population growth and inflation is consistent with the findings of Bullard et al (2012) and Yoon et al (2014).

Moreover the main source of inflation in Nigeria is the exchange rate and is statistically significant at 10 percent level similar to the result of Algeria, indicating the higher the exchange rate the higher the inflation results are in Table 6 in Appendix B. The results are consistent with the study by Ebirunga and Anyaogu (2014) in their study of exchange rate, inflation and interest rate relationship.

Saudi Arabia main determinants of inflation are the oil price and government expenditure. The oil price is statistically significant at 10 percent level whereas government expenditure is statistically significant at 5 percent level. The results are shown in Table 7 in Appendix B, thus indicating the higher the government expenditure the higher the inflation and the higher the world oil price the higher the inflation in Saudi Arabia. High oil prices and high inflation can be reported due to the high inflow of oil revenues and due to Saudi Arabia's high imports from abroad which are being manufactured at higher costs due to the increase of the input prices. Results obtained is consistent with the study of Hasan and Alogeel (2008) in their study of inflation in the GCC, and similarly to the study by Kandil & Morsy (2011) of inflation in the GCC and the findings of Altowaijri (2011) of inflation determinants in Saudi Arabia.

Whereas the sources of inflation in Venezuela arise from interest rate, money growth, world oil price, and negatively related to population. The interest rate is statistically significant at 5 percent level. Money growth, price of oil, and population are highly statistically significant at 1 percent level and government expenditure is statistically significant at 10 percent level. Indicating high interest rates, high money growth and high world oil prices, and low population growth lead to high inflation in Venezuela. In Table 8 in Appendix B.

VII. CONCLUSION & POLICY IMPLICATIONS

In this paper, panel model analysis with random effect was conducted to determine the inflation sources in the selected OPEC countries. Using yearly data spanning from the year 1991 to 2014. Inflation is measured using the Consumer Price Index. (CPI), in relation to six independent variables, which are fragmented into four different categories: The demand side factors which consist of the population and government expenditure. The supply side factors include world oil price. The monetary factors include; money growth and interest, and finally the

external factors include the exchange rate. The main determinants of inflation for the oil exporting countries are associated with high oil price, low money growth, high exchange rate, and low population growth.

Country specific determinants differed from a country to another and this was expected due to their different economies. Algeria main determinant of inflation is the exchange rate. Iran has multiple sources of inflation. High inflation in Iran is associated with high interest rates, high exchange rate and low population growth indicating an ageing or a decline in labor force. Moreover high inflation in Nigeria is related to high exchange rates. Saudi Arabia inflationary sources arise from high world oil price and high government expenditure. Numerous variables in Venezuela increase inflation, high interest rates, high money growth and high world oil price and low population growth increase inflation. Such findings are very important in guiding the countries authorities in curbing and combatting future inflationary pressures.

The empirical findings showed the inflationary determinants are relatively different for each country. Accordingly, authorities should implement policies to combat inflation. Authorities in Algeria need to implement appropriate exchange rate policies. Similarly can be suggested for Nigeria to combat inflationary pressures. Iran however needs to control inflation by effectively using monetary policy to decrease interest rates to decrease inflation as Asgharpur, Kohnehshahri and Karami (2007) suggested, and implement an appropriate exchange rate policy, and to study the dynamic changes of their population. Saudi Arabia can fight inflation through implementing fiscal policy by decreasing government expenditure. Moreover authorities in Venezuela should adopt either monetary policy to manipulate interest rate and money supply to control inflation arising from the monetary factors or fiscal policy to curb inflationary pressures

arising from government expenditure. They also need to study the dynamics of their population to be able to anticipate any decline in labor force and act towards it to avoid deflation.

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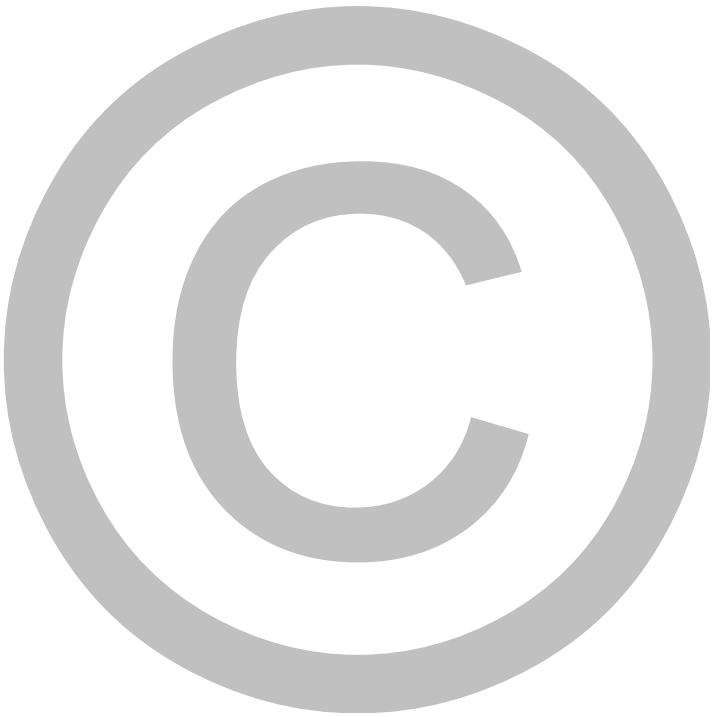
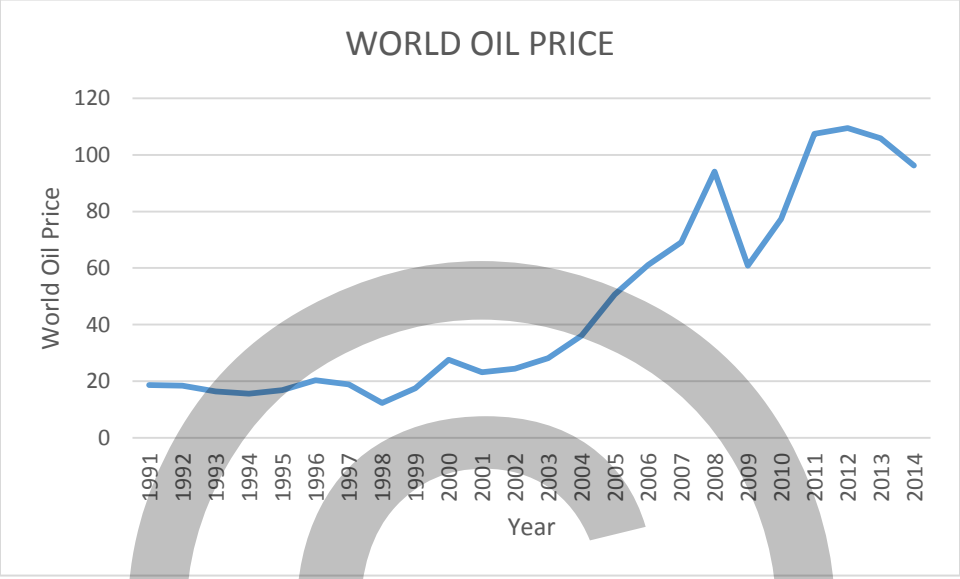
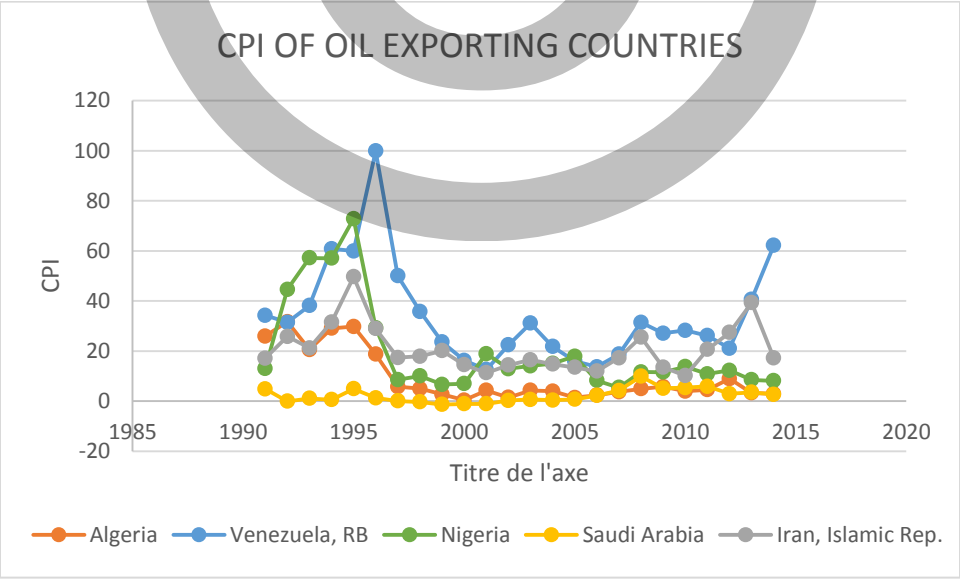


Appendix A

Graph 1: World Oil Prices



Graph 2: CPI of Oil Exporting Countries



Appendix B

Table 1: Benchmark Results: Pooled Sample

Dependent Variable: CPI	Pooled OLS
Interest Rate	-.2153146
	(0.411)
Money growth	-.7539283***
	(0.000)
Exchange Rate	.003488***
	(0.000)
Price of Oil	.630724***
	(0.000)
Population	-1.23e-07***
	(0.000)
Government Exp.	4.49e-11
	(0.586)
Constant	53.92903***
	(0.000)
R2	0.6383
Obs.	168

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 2: Fixed Effect Model and Random Effect Model Results

Dependent Variable: CPI	Fixed Effect	Random Effect
Interest Rate	1.357428***	-.1994522
	(0.000)	(0.446)
Money growth	-.0793781	-.7491823***
	(0.460)	(0.000)
Exchange Rate	.0058323***	.0035593***
	(0.000)	(0.000)
Price of Oil	.5137171***	.6301451***
	(0.000)	(0.000)
Population	9.27e-07***	-1.25e-11***
	(0.000)	(0.000)
Government Exp.	-7.75e-11	4.55e-11
	(0.376)	(0.583)
Constant	-54.8353***	53.61089***
	(0.000)	(0.000)
R2/Within R2	0.8299	0.6505
Obs.	168	168

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 3: Hausman Specification Test

Dependent Variable: CPI	Fixed Effect	Random Effect	Difference Between Fixed and Random Effect
Interest Rate	1.357428	-.1994523	-1.55688
Money growth	-.793781	-.7491823	-.6698042
Exchange Rate	.0058323	.0035593	-.002273
Price of Oil	.5137171	.6301451	.1164281
Population	9.27e-07	-1.25e-07	-1.05e-06
Government Exp.	-7.75e-11	4.55e-11	1.23e-10
Prob>Chi2	0.000		

Table 4: Pooled OLS-Algeria

Dependent Variable: CPI	Coefficient
Interest Rate	-.1023377 (0.964)
Money growth	0.4466823 (0.604)
Exchange Rate	.9687673* (0.086)
Price of Oil	-.3941589 (0.445)
Population	-1.47e-06 (0.496)
Government Exp.	7.14e-10 (0.550)

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 5: Pooled OLS- Iran

Dependent Variable: CPI	Coefficient
Interest Rate	4.807054*** (0.008)
Money growth	0.5186842 (0.523)
Exchange Rate	0.005921*** (0.000)
Price of Oil	0.1784093 (0.725)
Population	-2.50e-06*** (0.000)
Government Exp.	8.03e-10 (0.368)

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 6: Pooled OLS -Nigeria

Dependent Variable: CPI	Coefficient
Interest Rate	-.7715953 (0.619)
Money growth	.5477792 (0.176)
Exchange Rate	.2911402* (0.068)
Price of Oil	-.3089077 (0.644)
Population	-6.51e-08 (0.846)
Government Exp.	1.85e-09 (0.183)

Note: The table reports the p-values in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 7: Pooled OLS-Saudi Arabia

Dependent Variable: CPI	Coefficient
Interest Rate	-.4772196 (0.889)
Money growth	.1818298 (0.863)
Exchange Rate	-7.696305 (0.671)
Price of Oil	.8235788* (0.084)
Population	7.16e-08 (0.983)
Government Exp.	8.20e-10** (0.034)

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Table 8: Pooled OLS- Venezuela

Dependent Variable: CPI	Coefficient
Interest Rate	1.55285* (0.010)
Money growth	1.35419*** (0.000)
Exchange Rate	-1.098465 (0.873)
Price of Oil	1.004304*** (0.002)
Population	-3.16e-06*** (0.000)
Government Exp.	1.21e-09* (0.086)

Note: The table reports the P-Value in parenthesis

* Significant at 10%; ** Significant at 5%; *** Significant at 1%