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Causes Of Inflation Across Main Oil Exporting Countries (An Empirical Study)

اسباب التضخم في بعض البلدان الرئيسية المصدرة للنفط (دراسة قياسية)

ملخص البحث

تعتبر ظاهرة التضخم مصدر قلق على الدول المصدرة للنفط منذ السبعينات عندما بدأت الأسعار بالارتفاع، وقد بحثت العديد من الدراسات في ظاهرة التضخم باستخدام جوانب مختلفة. وتحلل هذه الدراسة المحددات المحتملة لظاهرة التضخم في أهم الدول المصدرة للنفط وعلى وجه التحديد الجزائر وإيران ونيجيريا والسعودية وفنزويلا. واعتمدت الدراسة على تحليل و تقييم بيانات السلاسل الزمنية ممتدة من ١٩٩١ إلى ٢٠١٤ وذلك باستخدام عدد من الأساليب الإحصائية كنموذج التأثيرات الثابتة (Fixed Effect Approach) ونموذج التأثيرات العشوائية (Random Effect Approach).

وقد أظهرت نتائج الدراسة وجود علاقة بين ارتفاع معدلات التضخم في هذه الدول وبعض المتغيرات الرئيسية، فالنتائج تشير إلى أن ارتفاع أسعار النفط يؤثر بشكل مباشر وإيجابي على معدلات التضخم في الدول الرئيسية المصدرة للنفط.

في حين أظهرت النتائج بأن هناك علاقة عكسية بين ارتفاع معدلات التضخم والنمو في عرض النقد من جهة، والنمو السكاني من جهة أخرى. كما يوضح تحليل النتائج بأن محددات التضخم قد تختلف من بلد لآخر، حيث تشير النتائج إلى أن المحددات الرئيسية للتضخم في الجزائر ونيجيريا تنشأ من تقلبات أسعار الصرف، في حين أن محددات التضخم في إيران يسببها بشكل أساسي معدلات الفائدة، وأسعار الصرف، وعدد السكان. هذا فإن مصادر التضخم في المملكة العربية السعودية تأتي من الانفاق الحكومي، وأسعار النفط. أما مصادر التضخم في فنزويلا فتعتمد على عدة عوامل وتحديداً معدلات الفائدة، وعرض النقد، وأسعار النفط، وعدد السكان، وأخيراً الانفاق الحكومي.

الكلمات الدالة:

التضخم- الدول المصدرة للنفط - أسعار النفط

Abstract

This study investigates the determinants of inflation in the main oil exporting countries specifically; Algeria, Iran, Nigeria, Saudi Arabia and Venezuela. The study covers the period from 1991 to 2014 using panel data analysis. The country specific analysis shows more readable results than whole OPEC sample. Findings have different inflation determinants across main oil exporting countries. Results show that the main determinants of inflation for Algeria and Nigeria arise mainly from exchange rate depreciation. Whereas the sources of inflation in Saudi Arabia are mainly driven by high oil prices and high government expenditure. For Venezuela and Iran, inflation ascends from several sources including monetary factors, supply side and demand side factors and exchange rate variations. This is due to the fact that these two countries are under a threat of an economic destabilization period.

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 the issue of inflation 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 was recorded at 9% in the 1970s. On the other hand, the developing countries recorded an alarming average inflation rate of 37% on average during the period of 1980s (Al-Shammari and Al-Sabaey, 2012). The sources of inflation varies from country to another and from time to time varies significantly.

Mass of 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. 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, Nige-

ria, 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, studying the sources of inflation across these countries may help considering the changes in oil prices and its effect on determining inflation.

The study investigates determinants of inflation across oil exporting countries during the period from 1991 to 2014 using panel data analysis (pooled and random effect). The estimated model is first 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 arise from the exchange rate depreciation, whereas the determinants of inflation for Saudi Arabia are mainly due to increasing in oil prices and the government spending. Interestingly, determinants of inflation in Iran and Venezuela are driven by many factors unlike Algeria, Nigeria, and Saudi Arabia. These sources include monetary factors, supply side factor, the demand side factor, and exchange rate variation.

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, there is a lack of studies that 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) investigates the sources of inflation across fifty-nine developed and developing countries using a panel model. Their findings show that sources of inflation for developing countries 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. 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 rises only from external factors; imports price, oil price and effective nominal exchange rate.

Hasan and Alogeel (2008) investigate the inflationary process in the GCC. 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. In addition, findings by Altowajri (2011) show that the influence inflation in Saudi Arabia come mainly from high oil prices, increasing world prices, and fall of the US dollar.

Asgharpur, Kohnehshahri and Karami (2007) examine the causal relationship between the interest rate and inflation rate across a panel of 40 selected Islamic countries. Results imply that interest rate and inflation are positively related. Thus, they 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. Their findings show that 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, then 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.

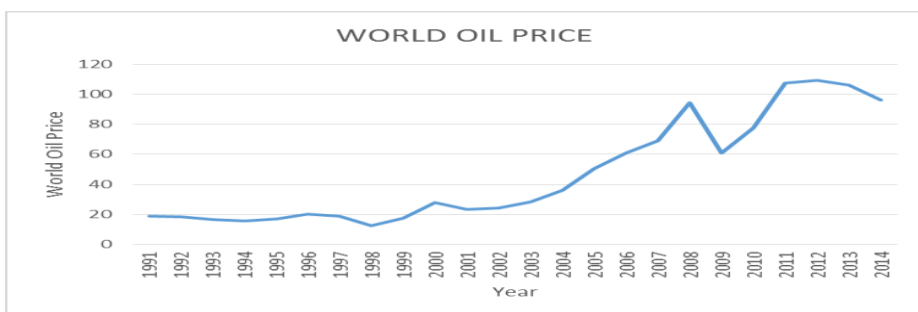
Moreover, a study by Bullard et al. (2012) investigates demographics, re-distribution, and optimal inflation. Their findings have a consistent match with Yoon et al (2014). Bullard et al (2012) study confirms that with an ageing population dynamics, this may cause a downward pressure on inflation or even lead to deflation. On the contrary, a study by Khan et al (2013) show the relationship between inflation and population growth across 40 developing countries from year 2009 to 2011. 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 lead to higher inflation in these countries. Moreover, Naghdi et al (2012) investigate the im-

part of the 2007 financial crisis on OPEC member's inflation. Results show that for a one percent increase in oil price, inflation is to increase by 0.08 percent points.

III. Overview Of Inflation Determinants

There have been countless studies that have investigated the determinants of inflation across 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 in 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 include interest rate and growth of money. Whereas the demand side factors include 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 affecting inflation.



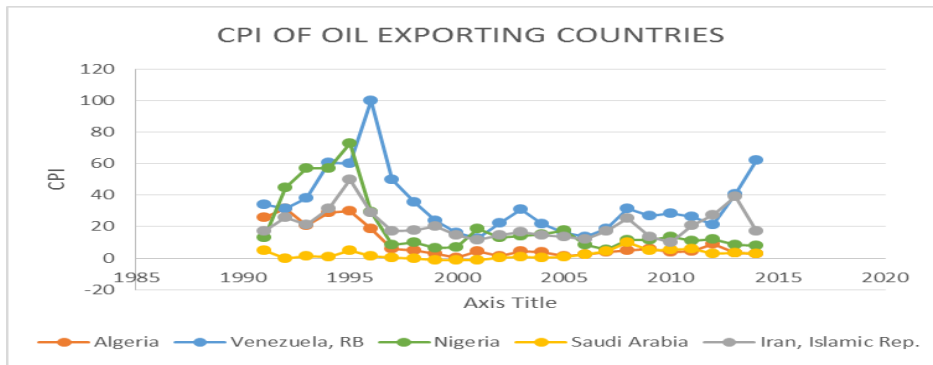
Source: The U.S. Energy Information Administration (EIA)

Graph 1: World Oil Price

The importance of the world oil prices in this study is due to the continuous fluctuations in the world oil prices. Graph 1 at the above, 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 was resulted for low demand for oil, accumulating oil surplus which caused a fall of the prices to an average of 12.28 dollar per barrel.

In year of 2000, OPEC cut its production of oil which caused oil prices to increase to about 27.6 dollar 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 dollar per barrel. Mid of 2008, oil prices dropped again and reached 60.86 dollar 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 dollar per barrel in 2012, but starting declining afterwards reaching 96.29 dollar in 2014 which was explained due to the rapid growth in the supply of oil from non-OPEC countries (Baffes et al, 2015).



Source: World Bank, IMF, and local central banks.

Graph 2: CPI of Oil Exporting Countries

Moreover the inflation rate changes from period to period and differs from country to country. Graph 2 at the above 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. In Graph 2, Saudi Arabia has the lowest and most stable inflation rate among the other countries. The Saudi 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 fluctuates more at higher rates. The lowest recorded inflation in Algeria 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 approach 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:

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

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 rate 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 model above is tested 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 model is tested in the second stage using random effect and fixed effect approach. Next, the Hausman specification test is conducted to specify which model is appropriate for this study. Another estimated model is developed for country specific determination of inflation by implying interaction terms for each country to investigate sources of inflation 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 rate 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 indepe-

ndent variables are categorized into four groups which are monetary factors which include Interest rate (*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

The results of the pooled OLS regression model are shown in Table (1) below. Findings show that the model is adequate and most of the variables are statistically significant at one percent level.

Table 1: Benchmark Results: Pooled Sample

Dependent Variable: CPI	Pooled OLS
Interest Rate	-0.2153146 (0.411)
Money growth	-0.7539283*** (0.000)
Exchange Rate	0.003488*** (0.000)
Price of Oil	0.630724*** (0.000)
Population	-1.23e-07*** (0.000)
Government Exp.	4.49e-11 (0.586)
R2	0.6383
Observation	168

Note: The table reports the P-Value in parenthesis

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

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 con-

sistent with the findings of Al-Shammari and Al Sabaey (2012). Moreover the negative relationship between population and inflation is consistent with findings of Yoon et al (2014) and Bullard et al (20-12) indicating that the negative relationship arises in the selected countries due to a declining and aging in its population. The interest rate and government expenditure variables are found to be insignificant in the pooled sample. Moreover oil price has the highest positive coefficient highly endorsing 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.

Table2: Fixed Effect Model and Random Effect Model Results

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

Note: The table reports the P-Value in parenthesis

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

Table (2) above 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 rate, 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. The Hausman specification test is used to indicate which model is appropriate for this study. In Table (3) below, the results of the Hausman specification test shows that the P-value is (0.000) and is less than five percent, thus the null hypothesis of fixed effect can be rejected and accepts the alternative hypothesis the random effect model.

Table 3: Hausman Specification Test

Depend 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		

Based on the findings of Hausman test, the random effect model in Table (2) is to be chosen. Accordingly, the coefficient of interest rate is statistically insignificant across the selected countries. The money growth coefficient shows a significance result 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. This is can be explained by the fact that most of these oil exporting countries adopt fixed exchange rate system, as a

result the monetary policy cannot be freely used without any action taken by the federal reserves in the USA. Therefore, even when there is a case of low levels of money supply, the actual inflation is accelerating high as a result of other external factors rather than monetary factors namely money supply. 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 Country Specific Results

This paper contributes by showing the variations of inflation sources across selected oil exporting countries; namely Algeria, Iran, Nigeria, Saudi Arabia, and Venezuela. Thus, the model can be tested using interaction terms to identify country specific determinants of inflation. Results for Kuwait and Indonesia will not be reported due to insignificance findings.

Table 4: Pooled OLS-Algeria

Dependent Variable: CPI	Coefficient
Interest Rate	-1.023377 (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%

The results showed variations of inflation determinants across the selected oil exporting countries, however some similarity between Algeria and Nigeria was verified. The main determinants of inflation in Algeria is the exchange rate and is statistically significant at 10

percent level. This suggests that the depreciation in the exchange rate would lead to higher inflation as shown in Table (4) above. This finding is consistent with the findings of Mohammed et al (2015).

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%

Moreover results in Table (5) above, it shows that the three main determinants of inflation in Iran are high interest rate, exchange rate depreciation and low population growth. Interest rate is statistically significant at 1 percent level and has a positive relationship with inflation. This result is consistent with the findings of Asgharpur, Kohnehshahri and Karami (2007) where the positive relationship is explained by the fact

that high interest rate raises product's prices causing a shift for the supply curve (decrease) and consequently raising inflation. High exchange rate, and low population growth are 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).

Table 6: Pooled OLS -Nigeria

Dependent Variable: CPI	Coefficient
Interest Rate	-0.7715953 (0.619)
Money growth	.5477792 (0.176)
Exchange Rate	.2911402* (0.068)
Price of Oil	-0.3089077 (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%

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

(depreciation) leads to higher inflation as shown in Table (6) above. The results are consistent with the study by Ebirunga and Anyaogu (2014).

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%

The main determinants of inflation in Saudi Arabia 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) above, indicating that the higher the government expenditure causes higher inflation in Saudi Arabia. Also findings suggest that the higher the world oil price leads an inflation to increase in Saudi Arabia. The positive relationship between high oil prices and high inflation

can be explained as the increase in oil prices lead to the imported manufactured goods to be produced at higher costs due to the increase of the input prices. This results to the fact that Saudi Arabia imports these expensive products causing higher local inflation. 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.

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%

As shown in Table (8) above, findings display that inflation in Venezuela is positively related to interest rate, money growth, and world oil price. Whereas, inflation is negatively related to population. The interest rate is statistically significant at 5 percent level. Money growth, price of oil, and population are 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.

VII. Concluding Discussions & Policy Implications

In this paper, panel model analysis with random effect was conducted to determine the inflation sources in the selected OPEC countries. The study uses 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. Second, the supply side factors include world oil price. Third group, the monetary factors include; money growth and interest. For

the fourth group, the external factors include the exchange rate. Findings show that the main determinants of inflation for the oil exporting countries are associated with oil price, money growth, exchange rate, and population growth.

Importantly, 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, exchange rate

depreciation and low population growth. 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. These include high interest rates, high money growth, high oil price and low population growth. Such findings are very important in guiding the countries authorities toward curbing and combatting future inflationary pressures.

Table 9: Summary of Main Determinants of Inflation by Country

Sources of Inflation	Algeria	Iran	Nigeria	Saudi Arabia	Venezuela
Interest Rate		✓			✓
Money growth					✓
Exchange Rate	✓	✓	✓		
Price of Oil				✓	✓
Population		✓			✓
Government Exp.				✓	✓
Policy Implications	Flexibility in exchange rate	Maintaining a stable economic structure to isolate shocks	Strengthen monetary & exchange rate policy framework	Diversifying the economy	adopting efficiently monetary & fiscal policy

According to Table (9), a summary of main determinants of inflation by country as well as policy implications are reported. As shown, the main source for inflation in Algeria is exchange rate. The high dependency on imports for the Algerian case creates an effect for the pass through of exchange rate and that in turns leads to higher inflation. The relationship between exchange rate mechanism and inflation depends on the monetary policy reaction and that would vary according to the exchange rate system in the country. Thus, Algeria needs to reconsider a more flexibility in the exchange rate system which may help the economy to better adjust for prices shocks.

The case of Nigeria somehow looks similar to the Algerian case. According to Table 9, the exchange rate depreciation seems to be the main factor for the inflation in Nigeria. Thus, the policy implication that can be drawn relies on the framework of monetary and exchange rate policy. Since the exchange rate system in Nigeria is a fixed regime, then the risk of fulfilling the exchange rate adjustment in Nigeria includes widening the budget deficit and accommodating monetary policy. Therefore such a risk would lead to inflation pressure in Nigeria. Accordingly, the monetary authority should consider strengthen the link between monetary policy and exchange rate policy. Doing so would need a greater flexibility in the short term interest rate for instance interbank rate to be used as a policy instrument to affect the money market.

For the case of Saudi Arabia, higher oil prices and higher government spending lead to higher inflation. For oil price in Saudi case is considered as an

input cost when importing goods and services especially manufactured goods. Thus this would cause an imported inflation. Also the economic growth in Saudi Arabia is driven by government intervention through its spending and this could be a source for inflation at the economy. Therefore, the Saudi Authority needs to make more efforts to diversify the economic activities through creating more opportunities for the non-oil sector with special attention for small and medium businesses.

Regarding the case of Iran, inflation is driven by high interest rate, exchange rate depreciation, and lower population growth. This results confirms the impact of the monetary and exchange rate aspects (interest rate and exchange rate) more than the local demand side (population growth) on inflation levels in Iran. Many studies have shown that economic sanctions on Iran by the United Nation have harmed the oil industry and its main oil revenue. This has made the government to continuously increase the interest rate to attract more investment and to then create more jobs. But as a result, inflation has continued even though the increase in interest rate. Therefore, in order to control the runaway inflation the Iranian authority is asked to maintain a stable economic structure to isolate external shocks as well as monetary shocks.

Finally the Venezuelan case, high interest rates, high money growth, high oil price and low population growth are main factors to influence inflation. Authority in Venezuela should adopt efficiently monetary policy to manipulate interest rate and money supply to control inflation from the monetary factors. The authority should also use efficient-

ly 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.

Although the suggested policy implications for each country is important, authorities should take into account that controlling inflation through these policies might have a side effect once implemented on other factors in the local economy. Therefore more coordination is needed to limit each effect because each economic policy has many effects in the economy rather than curbing inflation.

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Appendix A: DATA

Id	Country
1	Algeria
2	Iran
3	Nigeria
4	Saudi Arabia
5	Venezuela

CPI	Interest Rate	Money Growth	Exchange Rate	Oil Price	Population	Gov.exp	Country ID	Year
2.916406413	8.00	16.67	80.5790	96.29	38934334	41493178620	1	2014
3.253684177	8.00	8.22	79.3684	105.87	38186135	40138242676	1	2013
8.894585294	8.00	8.67	77.5360	109.45	37439427	42476677543	1	2012
4.521764663	8.00	17.89	72.9379	107.46	36717132	41338869093	1	2011
3.913043478	8.00	12.3	74.3860	77.38	36036159	27770783481	1	2010
5.734333414	8.00	3.43	72.6474	60.86	35401790	22153114908	1	2009
4.862990528	8.00	15.67	64.5828	94.1	34811059	22583573335	1	2008
3.673827269	8.00	23.86	69.2924	69.04	34261971	15716052554	1	2007
2.314524087	8.00	19.5	72.6466	61	33749328	13144012246	1	2006
1.382446567	8.00	8.85	73.2763	50.59	33267887	11816632390	1	2005
3.961800303	8.00	9.99	72.0607	36.05	32817225	11751511788	1	2004
4.268953958	8.13	16.2	77.3950	28.1	32394886	10046150268	1	2003
1.418301923	8.58	18.76	79.6819	24.36	31990387	8790534876	1	2002
4.225988349	9.50	25.82	77.2150	23.12	31590320	8088572169	1	2001
0.339163189	10.00	14.13	75.2598	27.6	31183658	7442200586	1	2000

2.645511134	10.75	13.95	66.5739	17.44	30766551	8165349605	1	1999
4.950161638	11.50	19.57	58.7390	12.28	30336880	8573519956	1	1998
5.733522754	15.71	18.26	57.7074	18.86	29887717	7967837285	1	1997
18.67907586	19.00	14.64	54.7489	20.29	29411839	7404701353	1	1996
29.77962649	18.42	9.46	47.6627	16.86	28904300	7001237981	1	1995
29.04765612	16.00	15.7	35.0585	15.53	28362015	7604324299	1	1994
20.54032612	16.00	7.3	23.3454	16.33	27785977	8652816757	1	1993
31.66966191	15.50	26.14	21.8361	18.44	27180921	7689137406	1	1992
25.88638693	16.00	20.8	18.4729	18.62	26554277	6728739311	1	1991
17.23535868	22.00	28.37	25941.6641	96.29	78143644	45526107942	2	2014
39.26636098	15.00	33.22	18414.4480	105.87	77152445	53404044476	2	2013
27.35738864	15.00	25	12175.5472	109.45	76156975	58160790522	2	2012
20.62833206	15.00	20.17	10616.3066	107.46	75184322	59457746326	2	2011
10.13714717	14.00	24.58	10254.1765	77.38	74253373	54628025238	2	2010
13.50026182	12.00	27.03	9864.3025	60.86	73370982	47672218523	2	2009
25.54984461	12.00	11.88	9428.5283	94.1	72530693	42111811203	2	2008
17.21304635	12.00	33.9	9281.1518	69.04	71720859	33888245901	2	2007
11.9395522	14.00	36.35	9170.9429	61	70923164	34093504728	2	2006
13.43311801	16.00	32.85	8963.9589	50.59	70122115	28009228287	2	2005
14.7615087	15.00	28.68	8613.9894	36.05	69321953	21932937524	2	2004
16.46801162	16.00	27.26	8193.8875	28.1	68522074	17534075473	2	2003
14.33593374	17.00	28.41	6907.0530	24.36	67696677	15071353299	2	2002
11.27424713	18.00	29.31	1754.0972	23.12	66812736	16331278175	2	2001
14.47675132	19.00	35.37	1764.9683	27.6	65850062	14172524682	2	2000

20.07070781	19.00	21.5	1753.4664	17.44	64780362	13452671230	2	1999
17.86613421	19.00	20.38	1752.3974	12.28	63616065	14390152102	2	1998
17.34922575	19.00	23.68	1753.4570	18.86	62426086	13206336896	2	1997
28.93734402	19.00	32.46	1751.2977	20.29	61306632	14891714526	2	1996
49.65598585	19.00	30.09	1748.4614	16.86	60318632	13741170715	2	1995
31.44702842	18.00	33.3	1749.2849	15.53	59501292	10311776643	2	1994
21.20263075	18.00	30.25	1268.1594	16.33	58811858	9071295624	2	1993
25.80772262	13.00	24.38	65.5720	18.44	58130099	7830814606	2	1992
17.12856794	13.00	25.58	67.5260	18.62	57288039	6590333587	2	1991
8.057382626	16.55	5.35	158.5526	96.29	177475986	41875601829	3	2014
8.475827285	16.72	12.45	157.3112	105.87	172816517	36846846102	3	2013
12.21700718	16.79	16.79	157.4994	109.45	168240403	37798446590	3	2012
10.84079259	16.02	13	153.8616	107.46	163770669	34974764816	3	2011
13.72020184	17.59	6.82	150.2980	77.38	159424742	32150447112	3	2010
11.53767275	18.36	17.21	148.9017	60.86	155207145	21960315430	3	2009
11.57798352	15.48	58.53	118.5460	94.1	151115683	24221619456	3	2008
5.382223652	16.94	64.24	125.8081	69.04	147152502	16944946311	3	2007
8.239526517	16.90	36.35	128.6517	61	143318011	9975791614	3	2006
17.86349337	17.95	22.6	131.2743	50.59	139611303	7641277503	3	2005
14.99803382	19.18	20.68	132.8880	36.05	136033321	5913395206	3	2004
14.03178361	20.71	13.51	129.2224	28.1	132581484	3486162417	3	2003
12.8765792	24.77	18.82	120.5782	24.36	129246283	3966666158	3	2002
18.87364621	23.44	27	111.2313	23.12	126014935	3624020228	3	2001
6.933292156	21.27	48.07	101.6973	27.6	122876723	3869788785	3	2000

6.618373395	20.29	33.12	92.3381	17.44	119826231	2504838090	3	1999
9.996378124	18.18	22.32	21.8860	12.28	116860691	4472127273	3	1998
8.529874214	17.80	16.04	21.8861	18.86	113975055	4655891053	3	1997
29.26829268	19.84	16.18	21.8844	20.29	111164651	3504805125	3	1996
72.8355023	20.23	19.41	21.8953	16.86	108424822	3449935475	3	1995
57.03170891	20.48	34.5	21.9960	15.53	105753088	3245394032	3	1994
57.16525283	31.65	53.76	22.0654	16.33	103145093	1033035320	3	1993
44.58884272	24.76	59.09	17.2984	18.44	100592458	1746891868	3	1992
13.0069731	20.04	37.38	9.9095	18.62	98085436	1323966536	3	1991
2.670525554	0.25	11.82	3.7500	96.29	30886545	1.97108E+11	4	2014
3.506263617	0.25	8.35	3.7500	105.87	30201051	1.67606E+11	4	2013
2.885962454	0.25	16.49	3.7500	109.45	29496047	1.46981E+11	4	2012
5.823591056	0.25	13.26	3.7500	107.46	28788438	1.3015E+11	4	2011
5.343137255	0.25	5.17	3.7500	77.38	28090647	1.06713E+11	4	2010
5.066632331	0.25	10.81	3.7500	60.86	27409491	95204000000	4	2009
9.868751965	1.50	17.96	3.7500	94.1	26742842	92026133333	4	2008
4.168713364	4.00	20.14	3.7500	69.04	26083522	85946897932	4	2007
2.207346666	4.70	20.41	3.7500	61	25419994	83065954606	4	2006
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0.329698199	2.25	17.25	3.7500	36.05	24055573	59146133333	4	2004
0.586734694	1.25	8.49	3.7500	28.1	23357887	52839466667	4	2003
0.230120174	1.50	15.2	3.7500	24.36	22668102	49204533333	4	2002
-1.112515803	2.25	5.09	3.7500	23.12	22007937	50318666667	4	2001
-1.125	6.75	4.47	3.7500	27.6	21392273	49014400000	4	2000

-1.347894384	5.50	6.83	3.7500	17.44	20825955	41092000000	4	1999
-0.356989861	5.50	3.63	3.7500	12.28	20302193	41384533333	4	1998
0.057151022	5.50	5.21	3.7500	18.86	19809633	43202937250	4	1997
1.222069564	5.50	7.26	3.7500	20.29	19331311	38660347130	4	1996
4.868431031	5.50	3.36	3.7500	16.86	18853670	33624299065	4	1995
0.564325479	5.50	2.99	3.7500	15.53	18373412	32724165554	4	1994
1.055795314	5.50	3.38	3.7500	16.33	17890529	34973564753	4	1993
-0.077006006	5.50	2.56	3.7500	18.44	17398523	40772229640	4	1992
4.861111111	5.50	14.55	3.7500	18.62	16890555	45161014686	4	1991
62.16864998	17.21	60	6.2839	96.29	30693827	66555236519	5	2014
40.63942752	15.90	58.84	6.0480	105.87	30276045	56520747674	5	2013
21.06899563	16.38	53.29	4.2893	109.45	29854238	46486258830	5	2012
26.09021232	17.15	49.2	4.2893	107.46	29427631	36451769986	5	2011
28.18746471	18.35	23.55	2.5821	77.38	28995745	44143327524	5	2010
27.08094145	19.89	23.33	2.1470	60.86	28558607	45131386586	5	2009
31.44059869	22.37	28.8	2.1470	94.1	28116716	37423880298	5	2008
18.69864535	17.11	33.89	2.1470	69.04	27670659	28728856078	5	2007
13.66264564	15.48	72.74	2.1470	61	27221228	21486462040	5	2006
15.95463087	16.81	47.44	2.0898	50.59	26769115	16087832037	5	2005
21.7476693	18.50	49.95	1.8913	36.05	26314483	13444595171	5	2004
31.089674	25.19	62.41	1.6070	28.1	25857553	10762825744	5	2003
22.43278141	36.58	14.64	1.1610	24.36	25399143	12082478143	5	2002
12.53472371	22.45	5.29	0.7237	23.12	24940223	17498952555	5	2001
16.20480731	25.20	33.73	0.6800	27.6	24481477	14584625566	5	2000

23.56989035	32.13	21.67	0.6057	17.44	24023355	12067447339	5	1999
35.78201528	46.35	7.38	0.5476	12.28	23565734	12301214853	5	1998
50.03906989	23.69	55.55	0.4886	18.86	23108003	11615680416	5	1997
99.87714224	39.41	71.4	0.4174	20.29	22649212	3421643069	5	1996
59.91910402	39.74	36.56	0.1768	16.86	22188671	5334284537	5	1995
60.82101008	54.66	68.89	0.1469	15.53	21726808	4085711495	5	1994
38.12161529	59.90	25.55	0.0908	16.33	21263994	4965130665	5	1993
31.42263349	41.33	17.74	0.0684	18.44	20799471	5369784708	5	1992
34.20540069	37.16	47.55	0.0568	18.62	20332247	4994001472	5	1991