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An Investigation of Granger Causality Between Oil-Price, Inflation and Economic Growth in Jordan

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Accordingly, the finding of this study suggests that an increase in oil cost today leads to a small decrease in gross domestic product. This consist with the basic hypothesis which proposes that an increase in oil price (cost) will be harm for economic growth in oil-importing countries like Jordan, but the effect size dose not consist with rate of dependency of economic activities in Jordan on oil. Thus, the study recommends investigating this inconsistent situation.

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I. Introduction

In Jordan like many countries, oil is one of the major factors of economic activity, due to it is the main source for energy. Furthermore, oil has become a social issue as it affects everyone on a way or another. This implies that there is a strong relationship between economic indicators of a country (growth, inflation, budget deficit, current account deficit and ….. etc.) and oil-price changes.

Accordingly, Many economists all over the world has attempted to investigate the relationship between economic indicators such as growth and inflation on one hand and oil-price fluctuations on the other hand in order to explain, forecast and control the effects of these fluctuations. studies have revealed that oil-price fluctuations have great effects on economic activities and indicators. These effects may vary from country to another, depending on the ratio of dependency of the economic activities on oil hand whether the country is importing or exporting oil. Therefore, basically oil price increase should be good news in oil exporting countries and bad news in oil importing countries, and vice versa. Economic activity is affected by fluctuations of oil price through both supply and demand channels. In The supply side and due to the fact thatoil is a basic input of production, so an increase in oil price will raise the production costs which make firms to reduce output. On other hand, in the demand side oil prices changes affect consumption and investment. Consumption is affected indirectly through its positive relation with disposable income. Likewise, investment is affected due to an increase in oil price will rise firms' costs which reduces the retune of investment and this will lessen the investment. Furthermore, real economic activity will be affected indirectly by oil price fluctuations through its impact on exchange rate and inflation.

Given the World's high dependence on oil products which makes oil the largest internationally traded good and its price more vital to today's world economy. Moreover, the prices of energy intensive goods and services are linked to energy prices, of which oil makes up the single most important share. Finally, the price of oil is linked to some extent to the price of other fuels (even though oil is not fully substitutable for natural gas, coal, and electricity, particularly in the transportation sector). For these reasons, sudden fluctuations in the price of oil have wide-ranging consequences. Thus, it is expected that inflation and economic growth rate have a strong relationship with oil-price fluctuations.

In general, there is an interaction between economic growth and oil price. As World economic growth increases the demand for oil increases which pushes up oil prices. Oil prices then, tend to be volatile, at least partly due to variations in the business cycle.

While the increase in GDP growth and economic activity in general, has led to increase in

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energy demand, which in turn raise the oil price and this can lessen the economic growth due to its impact on economic activities. A glance over the figure below shows the close correlation in the timing of oil price hike and economic depressions; this emphasizes the serious negative effect of oil price hike on the economies. In case of oil, Demand function implies that quantity demanded will fall by a certain percentage for each percentage rise of price. Thus, large oil price hike will unavoidably cut oil demand and decrease economic growth.

All other factors remains constant, an oil price increase should be good for oil exporting countries and negative for oil importing countries, while the opposite expected when the oil price decreases. In general, oil as internationally traded good causes a transfer of income from importing to exporting countries depending on terms of trade. The international demand effect would depend on how oil exporting and importing countries would response for an increase of oil price. On one hand, Exporting countries have additional revenues, but these countries used to save a fraction of their revenues for future funds, and their demand increase slowly in response to these revenues. On other hand, importing countries have additional expenses, in response to this, they seek to lessen their demand rapidly. so that net global demand tends to fall in the short term. Consequently, economic growth in exporting countries which induced by higher oil prices has always been less than economic decay in importing countries, therefore, the net effect was negative. As a result, the growth of the world economy was decaying after each oil price hike.

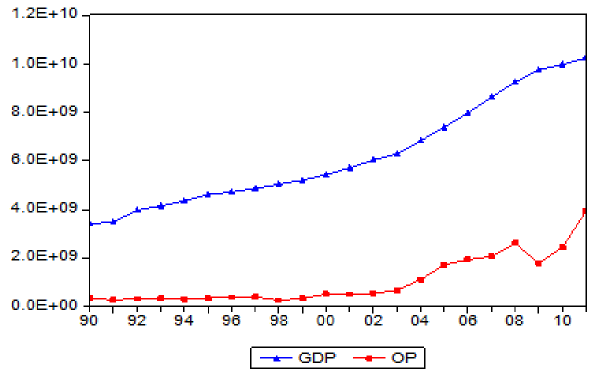
In case of oil importing countries, the increase in oil prices not only induces imported price push or cost push inflation but also demands pull inflation. So as worldwide oil prices rise, this brings domestic inflation in the economy that leads to decline in foreign exchange reserves. As foreign exchange become scarce in supply its value would increase while on the other hand local currency depreciates that brings rise in the import prices & would increase the import bills. It would also worsen the position of trade balance of the country. It would not only appreciate the private expenditures but also public expenditure, which would also increase the consumer price index. All these factors pushed the country to the paucity trap or poverty trap.

Reading the increasing oil costs as generalized price inflation may leads local authorities to adopt restrictive policies which could slow the economy's growth. Excessively restrictive monetary and fiscal policies to deal with inflationary pressures could worsen the declining income and unemployment effects. However, expansionary monetary and fiscal policies may simply delay the fall in real income necessitated by the increase in oil prices, stoke up inflationary pressures and worsen the impact of higher prices in the long run. Also, in terms of the state of the economy, if the economy is already suffering from high inflation and unemployment, then the oil price increases have the potential to cause severe damage by limiting economic policy options and affect the overall economic impact of higher oil prices over the longer term.

Jordan's economy is among the smallest in the Middle East, with insufficient supplies of water, oil, and other natural resources, underlying the government's heavy reliance on foreign assistance. Other economic challenges for the government include chronic high rates of poverty, unemployment, inflation, and a large budget deficit. The global economic slowdown and regional turmoil, however, have depressed Jordan's GDP growth, impacting export-oriented sectors, construction, and tourism.

Unlike most of its neighbors, Jordan has no significant petroleum resources of its own and is heavily dependent on oil imports to fulfill its domestic energy needs which Jordan Currently imports (96%) of it. So, energy is one of the biggest challenges for continued growth for Jordan's economy. The Iraq invasion of 2003 disrupted Jordan's primary oil supply route from its eastern neighbor, which under Saddam Hussein had provided the kingdom with highly discounted crude oil. Since late 2003, Saudi Arabia has become Jordan's primary source of imported oil; Kuwait and the United Arab Emirates (UAE) are secondary sources. Although not so heavily discounted as Iraqi crude oil, supplies from Saudi Arabia and the UAE are subsidized to some extent. Spurred by the surge in the price of oil to more than $145 a barrel at its peak, the Jordanian government has responded with an ambitious plan for the sector. The country's lack of domestic resources is being addressed via a $14bn investment program in the sector. The program aims to reduce reliance on imported products from the current level of 96%, with renewable meeting 10% of energy demand by 2020 and nuclear energy meeting 60% of energy needs by 2035. The government also announced in 2007 that it would scale back subsidies in several areas, including energy, where there have historically been regressive subsidies for fuel and electricity. In another new step, the government is opening up the sector to competition, and intends to offer all the planned new energy projects to international tender.

The figure below provides a starting point to the analysis of oil price behavior and Jordan economic growth relation over the last two decades. The graph shows annually oil cost and Jordan gross domestic product have experienced an upward trends.



In 2011 Jordan's finances have been strained by a series of natural gas pipeline attacks in Egypt, causing Jordan to substitute more expensive heavy fuel oils to generate electricity. An influx of foreign aid, especially from Gulf countries, has helped to somewhat offset these extra budgetary expenditures, but the budget deficit is likely to remain high, at nearly 10% of GDP excluding grants. Jordan likely continues to depend heavily on foreign assistance to finance the deficit in 2012.

This study investigates the causality between crude oil prices at international market and the inflation rate (CPI) and economic growth (GDP) of Jordan. We begin by analyzing the impact of an oil price changes on the economy, followed by an explanation of what tests have revealed about the relation between oil price and economic growth. The paper is organized as follows: section 2 presents the related literature review. Section 3 shows a model of the study. Section 4clarifies the econometric methodology, section 5 offers and analyzes the empirical results . Finally conclude in section 6.

II. Literature Review

World's high dependency on oil products, the relation between oil prices and economic growth has encouraged many economists over the years to carry out studies in order to investigate these relations, and there is a rich spectrum of literature on various aspects of the subject. Following some of these studies:-

Farhani (2012) estimated simple linear regression model (SLRM), dynamic regression model (DRM) and VAR model to evaluate the impact of oil price increases on the U.S economic growth. The results indicate strong weaknesses on the relation between these two factors in what way that the relation has had allow significant effect caused by the existence of breakpoints and the asymmetric effects of the oil price variations. Bouzid (2012) investigated the causal relationship between oil prices and economic growth in Tunisia which is not oil producing rather oil-importing country over a period from 1960 to 2009. The study analyzed that, how change in real crude oil price effects the real GDP of Tunisia negatively and many other factors differently. The results show the existence of a long-term relationship between energy prices and economic growth and Granger pair wise causality test revealed unidirectional causality from real GDP to oil prices. Chou and Tseng (2011) studied The Shocks in global oil prices have always been most important concern in market fluctuations. The discussion about pass-through impact of oil price fluctuation on domestic inflation (consumer price index) helps domestic policy decisions that could inhibit disruptions to the economy caused by oil price shocks. They researched the short run and long-run pass through impact crude oil price on Taiwan's inflation from 1982 to 2010, using the CPI index, core index, and different necessary sub-indices for estimation. The findings expressed that there is a significant and long run pass through impact of crude oil prices on Taiwan's inflation, although the short run pass through impact is not significant. This study applied both recursive regression and rolling regression methods to compare variation in the short term bypass through effects of oil prices and determined that in short term pass through effects inflation rates did not change with the fluctuation in global oil prices in Taiwan. Moreover, since the Consumer Price index comprises on everyday necessities, global oil prices do not cause significant in short term .Berument, Ceylan and Dogan (2010) examined how oil price shocks affect the output growth of selected MENA countries that are considered either net exporters or net importers of this commodity, but are too small to affect oil prices. That an individual country's economic performance does not affect world oil prices is imposed on the Vector Autoregressive setting as an identifying restriction. The estimates suggest that oil price increases have a statistically significant and positive effect on the outputs of Algeria, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Syria, and the United Arab Emirates. However, oil price shocks do not appear to have a statistically significant effect on the outputs of Bahrain, Djibouti, Egypt, Israel, Jordan, Morocco, and Tunisia. When they further decomposed positive oil shocks such as oil demand and oil supply for the latter set of countries, oil supply shocks are associated with lower output growth but the effect of oil demand shocks on output remain positive.Abdul Jalil, Ghani and Duasa(2009) studied the impact of oil prices on GDP in Malaysia. In particular, three types of oil prices; world oil price (PW), world oil price in domestic currency (PWD), and domestic oil price (PD) are tested against the GDP within VAR frame work. Based on the findings, change in PD oil price appears to have the most pronounced effect to the GDP. It is because, significant results of PD analysis are documented both in short-run and long-run tests. In the asymmetric test, significant result is documented in PD analysis only. The finding signifies the presence of asymmetric relationship between oil price changes and the economy. Kumar (2009) assessed the oil prices-macro economy relationship by means of multivariate VAR using both linear and non-linear specifications. Scaled oil prices model outperforms other models used in the study. He studied the impacts of oil price shocks on the growth of industrial production for Indian economy over the period 1975Q1-2004Q3. It is found that oil prices Granger cause macroeconomic activities. Evidence of asymmetric impact of oil price shocks on industrial growth is found. Oil price shocks negatively affect the growth of industrial production and it is found that an hundred percent increase in oil prices lowers the growth of industrial production by one percent. Moreover, the variance decomposition analysis while putting the study in perspective finds that the oil price shocks combined with the monetary shocks are the largest source of variation in industrial production growth other than the variable itself .Kiptui (2009) estimated a conventional Phillips curve to obtain estimation of oil price through to inflation for Kenya. Result indicated inflation being correlated with oil prices, in the early 90's correlation appear to have declined but begun to boost after trade liberalization. The result showed that oil price fluctuations have had significant impact on inflation. Other outcomes are that changes in exchange rate and aggregate demand have had significant influence on inflation. The measure of oil price pass-through is discovered to be 0.10 in the long-run and 0.05 in the short-run to inflation, much lower while comparing to exchange rate pass-through which is 0.64 in thelong-run and 0.32 in the short-run. It means that 10%risein prices of oil leads to 1% increase in inflation in the long-term and 0.5% in the short-term. Therefore Oil price pass-through is incomplete and low in both cases. Meanwhile, Cologni and Matteo (2008) anticipated a vector autoregressive form for the G-7 nations to confirm whether the oil price fluctuation throughoutpast20 years have been affecting the monetary policy action. It was deduced that majority of the countries under examination, an unanticipated oil price fluctuation is ensued by a rise in inflation rate and also a decrease output increase. Moreover, the findings suggested that 1990's impact oil price shocks indicate there was a major element of the impact of the oil price variation was roughly resulted in the aftermath of fiscal policy.

III. Model Specifications for the Study

Using annual data from CBJ's database and IMF's database the present paper examines the relationship between oil price, inflation and economic growth in Jordan, while our model will be:

$$GDP_t = \alpha + \beta_1 OP_t + \beta_2 INF_t + U_t \ldots\ldots\ldots \quad (1)$$

Where GDP_t is real gross domestic product, OP_t is oil imports cost and INF_t is inflation which is measured by consumer price index (CPI_t) while α and β_s are the coefficient to be estimated and the U_t is error term.

This can be reformulated to examine the link between each variables and other variables as follows:-

$$INF_t = \alpha + \beta_1 OP_t + \beta_2 GDP_t + U_t \ldots\ldots\ldots \quad (2)$$

Taking the logarithm form of the equation (1) will yield equation (3) below with "In" standing for the natural logarithm

$$\ln GDP_t = \alpha + \beta_1 \ln OP_t + \beta_2 \ln INF_t + U_t \ldots\ldots\ldots \quad (3)$$

IV. Econometric Methodology

The objective of this section is to examine the presence of interaction and the direction of causality between economic growths, oil cost and inflation in Jordan.

In order to examine the relationship between economic growth, oil cost and inflation in Jordan, a two-step procedure is adopted. The first step investigates the existence of a long-run relationship between the variables through a co-integration analysis. The second step explores the causal relationship between the series. If the series are non-stationary and the linear combination of them is non-stationary, then standard granger's causality test should be employed. But, if the series are non-stationary and the linear combination of them is stationary, Error Correction Method (ECM) should be adopted. For this reason, testing for co-integration is a necessary prerequisite to implement the causality test.

a) *long run relationship*

We perform our investigation of existence of co-integration which clarifies the long run relationship between variables in two steps. First, we test for unit root vs. stationary. Then we test for no co-integration vs. co-integration.

i. *Unit root test*

The objective of unit root test to empirically examine whether a series contains a unit root. Since many macroeconomic series are non-stationary (Nelson and Plosser 1982), unit root test are useful to determine the order of integration of the variables and, therefore, to provide the time-series properties of data. If the series contains a unit root, this means that the series is non-stationary. Otherwise, the series will be categorized as stationary. In order to implement a more rigorous test to verify the presence of a unit root in the series, an Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test are employed.

ii. *Co-integration test*

Johansen and Juselius procedure is applied to test for the existence of co-integration. The Johansen technique enables us to test for the existence of non-unique co-integration relationships in more than two variables cases. Through Johansen procedure of co-integration two tests statistics are suggested to determine the number of co-integration vectors determined based on a likelihood ratio test (LR): the trace test (λ_{trace}) and the maximum eigenvalues test statistics (λ_{max}).

b) *Granger-causality test*

Pair wise causality relationship between variables should be tested through the implementation Granger causality test; Granger (1969), the concept of "causality" assumes a different meaning with respect to the more common use of the term. The statement(y) Granger causes (x) or vice versa, in fact, does not imply that (y) and (x) is the effect or the result of (y) and (x), but represents how much of the current (y) and (x) can be explained by the past values of (y) and (x) and whether adding lagged values of (y and x) can improve the explanation. For this reason, the causality relationship between (y and x) can be evaluated by estimating the following regressions:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta X_{t-i} + \varepsilon_i \qquad (8)$$

$$\Delta X_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{m} \beta_{2i} \Delta X_{t-i} + \varepsilon_i \qquad (9)$$

Where (m and n) represents the lag length and should set equal to the longest time over which one series could reasonable help to predict the other.

Following this approach, the null hypothesis that (x) does not granger cause (y) in regression (4) and that (y) does not Granger cause (y) in regression (5) can be tested through the implementation of a simple F-test for the joint significance of, respectively, the parameters β_{1i} and β_{2i}. Following the equations (4) and (5) were estimated using four lags of each variable which should represent and adequate lag-length over which one series could help to predict the other.

The results of stationary and co-integration tests determine how Granger-causality test should be applied, as follows:

If the variables (y) and (x) are stationary, the standard Granger-causality test should be carried out by estimating the following regressions:-

$$Y_t = \alpha + \sum_{i=1}^{m} \beta_{1i} Y_{t-i} + \sum_{i=1}^{n} \beta_{2i} X_{t-i} + \varepsilon \qquad (6)$$

$$X_t = \alpha + \sum_{i=1}^{n} \beta_{1i} Y_{t-i} + \sum_{i=1}^{m} \beta_{2i} X_{t-i} + \varepsilon_i \qquad (7)$$

If the variables (y) and (x) are non-stationary and integrated of order (1), but, they are not co-integrated, the Granger-causality test could be carried out by estimating regression models (4 and 5) using the first difference series of both variables (Yoo and Kwak, 2004). In general, if the origin series of both variables are non-stationary and the variables are not co-integrated, the Granger-causality test could be performed by using the same order of integration for both series, and reforming model (5 and 6) to suit the order of difference series.

In model (4 and 6), (Y) is caused by past values of both (Y) and (X). Likewise, in model (5 and 7), (X) is caused by past values of the two variables. According to Granger, (X) causes (Y) in model (4 and 6) if ($\beta 2i$) is significant from zero, and that (Y) causes (X) in model (5 and 7) if ($\beta 1i$) is significant from zero. On other hand, (X) does not cause (Y) if ($\beta 2i$) in model (4 and 6) is insignificant from zero, and that (Y) does not cause (X) if ($\beta 1i$) in model (5 and 7) is insignificant from zero. These hypotheses can be verified depending on the joint significance of the parameters ($\beta 1i$, $\beta 2i$) which can be tested through the implementation of a simple F-test.

If the variables (Y) and (X) are non-stationary, integrated of the same order (d), and co-integrated which means that they have a long-run equilibrium relationship, the Granger-causality test should be carried out through estimating Error Correction Model (VECM) which could have the following form:

$$\Delta Y_t = \alpha + \sum_{i=1}^{m} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta X_{1t-i} + \sum_{i=1}^{n} \beta_{3i} \Delta X_{2t-i} + \beta_4 \eta_{t-1} + \varepsilon_i \qquad (10)$$

$$\Delta X_{1t} = \alpha + \sum_{i=1}^{m} \beta_{1i} \Delta X_{1t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta Y_{t-i} + + \sum_{i=1}^{n} \beta_{3i} \Delta X_{2t-i} \beta_4 \eta_{t-1} + \varepsilon_i \qquad (11)$$

Where (η_{t-1}) is error-correction term. The error correction term (η_{t-1}) is the lagged value of the residuals from the OLS regression of equation (8), and the lagged value of the residuals from the OLS regression of equation (9). In (8) and (9), ΔY_t,

ΔX_{1t},$\Delta X_{2t}$and ε i are stationary, implying that their right-hand side must also be stationary. It is obvious that (8) and (9) compose a multivariate VAR in first differences augmented by the error-correction terms (η_{t-1}), indicating that ECM model and co-integration are equivalent representations.

According to Granger (1969; 1988), in a co-integrated system expressed by ECM representation causality must run in at least one way. Within the ECM equation (8), (X_{1t} or X_{2t}) does not Granger cause (Y_t) if all βs =0. Equivalently, in equation (9) (Y_t or X_{2t}) does not Granger cause (X_{1t}) if all β_s = 0. Also, (β_{4s}) the parameters of the error correction term indicate the speed of adjustment of any short-run disequilibrium towards a long-run equilibrium between the variables.

The Granger-causality could be claimed if the parameters (β_{2i},$\beta_{3i}$and β_4) in (8) and, or (β_{2i},$\beta_{3i}$and β_4) in (9) are jointly significant from zero which can be tested by a simple F-test. Similarly, Long-run causality could be claimed if (β_4) the parameter of the error correction term in (8 or 9) is statistically significant which can be tested by t-test.

What have been mentioned above clarifies that testing of stationary then co-integration are an essential requirements which determine how we do Granger-causality test.

Thus, once the variables in a VAR system are co-integrated, we can use a vector error-correction models (VECM) depending on the equations (8 and 9).in which a restricted VAR is used in order to assess the direction of Granger causality and to estimate the speed of adjustment to the deviation from the long-run equilibrium between variables.

Otherwise, unrestricted VAR model could be used to assess the relationship between the variables. This excludes Error Correction Term from equations (8 and 9). Then we simulate the impulse responses for the variables. The impulse response analysis quantifies the reaction of every single variable in the model on an exogenous shock to the model. The reaction is measured for every variable a certain time after shocking the system. The impulse response analysis is therefore a tool for inspecting the inter-relation of the model variables.

Finally, as co-integration, causality tests and VAR model are sensitive to lag length (m) the choice of the number of lag actually employed was assigned toLR: sequential modified LR test statistic (each test at 5% level).

V. Estimation and Interpretation of Results

This study uses annual observations for the period 1990-2011 for three variables: government expenditure (G), money supply (M2) and inflation (consumer price index (CPI)) in order to analyze the possibility of co-integration and causality relationship among them.

a) unit root test

The first step in analysis is to test the unit roots in each variable. Consequently, we apply Phillips-Perron test to check for unit root vs stationary on logarithms of GDP, OP and INF (LGDP, LOP and LINF). From the results of the PP test presented in Table 1.

Table 1: Unit Root Tests

Series	With intercept	With intercept and trend	Decision	Order of integration
Levels	PP	PP		
LGDP	-0.103971 [-3.012363]	-1.643065 [-3.644963]	Not stationary	-
LOP	1.203015 [-3.012363]	-1.952601 [-3.644963]	Not stationary	-
LINF	0.031585 [-3.012363]	-1.556921 [-3.644963]	Not stationary	-
First difference				
ΔLGDP	-4.224322* [-3.020686]	-4.094895* [-3.658446]	stationary	I(1)
ΔLOP	-4.171564* [-3.020686]	-4.926571* [-3.658446]	stationary	I(1)
ΔLINF	-4.848472* [-3.020686]	-4.852617* [-3.658446]	stationary	I(1)

- *Note: * test critical values which denotes significant at 5% level.*
- *The number in parenthesis is the [t] statistic value.*

As a sum up, (LGDP, LOP and LINF) are stationaries in the first difference. This implies that all the series are integrated of order one I(1). Thus, co-integration tests is relevant.

b) Testing Co-integration and Error Correction mechanism

Since the first difference series are stationary, Let us examine the existence of co-integration between variables. Johansen-Juselius procedure is used to test for co-integration between variables. Tables 3 reports the results obtained from the co-integrationtests and presents the result of the trace test (λtrace)) and maximum eigenvalues test (max) statistics for the existence of long run equilibrium between the variables:

Table 2 : co-integration test

Null Hypothesis	λ_{trace}	λ_{max}
r=0	62.20445 [42.91525]	42.58433 [25.82321]
r$\leq$1	19.62012 [25.87211]	15.34550 [19.38704]
r$\leq$2	4.274617 [12.51798]	4.274617 [12.51798]

- *terms in [ ] indicates 5% level critical value*

The null hypothesis of no Co-integration (r=0) based on both the trace test (λ_{trace}) and the maximum eigenvalues test (λ_{max}) between variables (LGDP, LOP and LINF) is rejected at (5%) level of significance. However, the null hypothesis that (r$\leq$1 and r$\leq$2) could not be rejected. The estimated tests indicate that there is only one Co-integration vector between the variables.

c) Causality & VECM tests

Now we can turn our attention to the question of direction of causality. It contains three elements: (a) does oil cost cause gross domestic product, or does oil cost cause gross domestic product? (b) Does oil cost cause inflation, or does inflation cause oil cost? And (c) does gross domestic product cause inflation, or does inflation cause gross domestic product?

As the variables (LGDP, LOP and LINF) are non-stationary at level, integrated of the same order (d), and co-integrated, the Granger-causality test is carried out through estimating Vector Error Correction Model (VECM). Table 4 shows the findings of VECM for the variables:-

Table 3 : Vector Error Correction Model

Regression	ΔLGDP	ΔLOP	ΔLINF
CONSTANT	0.060945 [8.20618]	0.343620 [2.32778]	0.029088 [1.65349]
Error Correction Term (η_{t-1})	-0.586694 [-8.03161]	-0.562858 [-0.38766]	-0.172740 [-0.99830]
$\Delta LGDP_{-1}$	-0.100507 [-0.90719]	-1.276312 [-0.57959]	0.269276 [1.02608]
ΔLOP_{-1}	-0.046731 [-3.40564]	0.045134 [0.16548]	-0.024117 [-0.74198]
$\Delta LINF_{-1}$	0.085251 [0.85618]	-3.871933 [-1.95638]	-0.155586 [-0.65965]
R^2	0.832267	0.220763	0.141612
S.E	0.012565	0.249755	0.029764

- *terms in [ ] are t – statistics*

As it is mentioned before, error correction term (η_{t-1}) captures the short-run dynamics relationship among variables. The above VECM test results show that The lagged error term coefficient (η_{t-1}) in (LGDP) equation is negative and statistically significant. On other hand, although the lagged error term coefficients (η_{t-1}) in (LOP and LINF) equations are positive but they are statistically insignificant. These results indicate that there is a long-run equilibrium relationship between gross domestic product (LGDP) and other variables oil cost (LOP) and inflation (LINF). The value of error term coefficient in (LGDP) indicates that adjustment process is (58%) of the previous year's disequilibrium in gross domestic product (GDP) from its long-run equilibrium path will be corrected in the current year. Furthermore, the estimates of the VECM does support the existence of significant causation relationship in the short run between (GDP) and oil cost (OP) running from oil cost to (GDP) but it is a negative (-0.046%) and low causation. Also, according to the results short-run elasticities of gross domestic product, oil cost and inflation in the equation of (LGDP) are -0.10, -0.046 and 0.085 respectively. It is seen that these elasticities are less than long run elasticity which is the value of error correction model (η_{t-1}).

VI. Conclusion

This paper is an empirical investigation on the directional causality between oil price (oil imports cost), gross domestic product (GDP) and Inflation (consumer price index) for the period 1990-2011 in Jordan. Using Johannes-Juseliusco-integration test, Granger-causality test, and VECM to inspect the long-term relationship, the short-term relationship and the speed of adjustment toward long-term equilibrium between the variables. The tests' results indicate that there is a long-run equilibrium relationship between gross domestic product These results indicate that there is a long-run equilibrium relationship between gross domestic product (LGDP) and other variables oil cost (LOP) and inflation (LINF). The estimation of the adjustment speed indicates that (58%) of any previous year's deviation in gross domestic product (GDP) from its long-run equilibrium path will be corrected in the current year. Furthermore, the VECM reveals the existence of a significant, negative and weak (-0.046) causation relationship in the short run between (GDP) and oil cost (OP) running from oil cost to (GDP).

Accordingly, the findings of this study suggest that an increase in oil cost today leads to a small decrease in gross domestic product. This consist with the basic hypothesis which proposes that an increase in oil price (cost) will be harm for economic growth in oil-importing countries like Jordan, but the effect size dose not consist with rate of dependency of economic activities in Jordan on oil. Thus, the study recommends investigating this inconsistent situation.

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