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THE EFFECT OF OIL PRICE SHOCKS ON THE ECONOMIC GROWTH OF OIL EXPORTES IN MENA REGION USING PANEL APPROACH DURING THE PERIOD (1980-2014)

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Abstract

This research aims to understand the oil market and the OPEC's roles in oil price fluctuations which affect the economy by investigating the existence of the relationship between oil price shocks and GDP in eight selected countries in MENA region basing on the fact that the economies of these nations are heavily dependent on oil.

The study, which covered the period 1980 to 2014 by using the panel approach as an empirical method showed that the oil price shocks effect positively the economic growth in the nominated countries of the region, and the GDP's reaction of these countries towards oil crisis is not the same.

Key words: Oil Price Shocks, Economic Growth, Panel Approach, MENA region, OPEC.

JEL Classification Codes : E00, C23, Q41.

Résumé

Cette recherche vise à comprendre le marché pétrolier et les rôles de l'OPEP dans les fluctuations des prix du pétrole qui affectent l'économie en étudiant l'existence de la relation entre les chocs des prix du pétrole et le PIB dans huit pays sélectionnés de la région MENA en se basant sur le fait que les économies de ces nations sont fortement dépendantes du pétrole.

L'étude, qui a couvert la période de 1980 à 2014 en utilisant l'approche par panel comme méthode empirique, a montré que les chocs des prix du pétrole ont un

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effet positif sur la croissance économique dans les pays désignés de la région, et la réaction du PIB de ces pays face à la crise pétrolière n'est pas le même.
Mots clés : Chocs des prix du pétrole, Croissance Economique, Panel, MENA, OPEP.

1- Introduction:

Oil is one of the most important commodities in today's industrialized economy. It represents its backbone. This global good that surpasses the history, national boundaries and geography is considered as an ocean with strange, unlimited and unsafe side; providing an uneasy ride to those who sail on it because of its price which has been a subject to various fluctuations through the time. These ups and downs which marked the economy were lately called oil price shocks (BASEL A, April 2020).

Starting in 1970's when the world experienced its first substantial movement in oil price knowing as the first oil shocks or the oil embargo and thereby initiating on the relationship between oil prices shock and the economic growth. Along the way, other empirical literatures commence expanding its horizon and other importing countries seemed to be interested of studying the relationship between oil price fluctuation and its impact on the economic growth; as a result, the oil price – GDP relation was widely investigated by economists all over the world ;while the vast quantity of those literatures focused on the organization for economic co-operation and developments (OECD). Few studies were consecrated for oil exporting and developing countries (BARRO, 1991).

Moreover, the existing literatures on the oil exporting countries usually focuses on a single country‘s economy, there is hardly previous research which examined group of exporting countries aiming to investigate the potential divergences among them (CHERATIAN I, 2019)

From the above – mentioning reasons, the purpose of this article is to analyze: How does the oil price shocks effect the economic growth of the oil –exporting countries in MENA region, which are members of the OPEC during the period 1980-2014?

Furthermore, for highlight our problematic we address the following sub questions:

- What is the nature of the relationship between oil prices shock and economic growth of oil exporting countries at MENA region?
- OPEC members in MENA region are they equally sensitive to oil price shocks.
- What is the suitable macro econometrics model that analyze the contribution of oil prices shock at MENA region?

We suggest the following Hypotheses:

- The relationship between oil prices shock and the economic growth is positive for oil exporting countries in MENA region.
- The reaction of economic growth in oil exporting countries in MENA region that are members of the OPEC is alike towards the oil prices shocks.
- The Random effect model is the best model to describe the phenomena in question.

In order to clarify and to realize the relationship between the two major worldwide known perceptions (GDP and Oil price shocks). Panel approach will be the key of the needed process because of its ability for controlling for individuals heterogeneity (GUJARATI, 2004) and it provides more informative data .besides the fact that the study is based on eight countries during the period of 35 years by applying its different models on the data that we have. (BALTAGI, 2005)

2- Data analyzing :

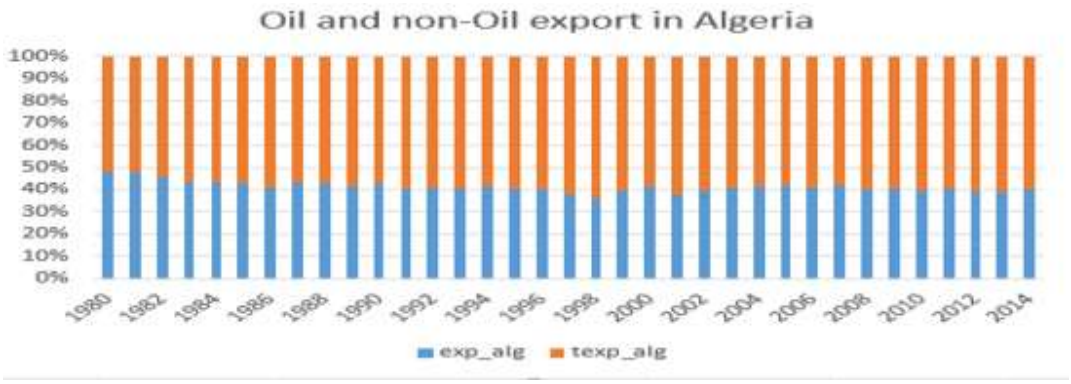
The study will focus on the oil exporting countries in MENA region, which are members of the OPEC, naming: Algeria, Iran, Iraq, Kuwait, Libya, Saudi Arabia, Qatar, and Arab United Emirates.The data were collected from the OPEC's annual statistical reviews and ranged from 1980-2014 (BALTAGI, 2005).

- The dependent variable is: "GDP ", the independent variable is :"oil exports".
- All the used data are yearly and they are presented in value (million dollars m$). (OPEC, 2009,2010,2015,2016)

One of the necessary steps is to see the level of dependency (INDRANI, Economics and Finance, an Analytical Study on the Impact of Fluctuating Oil Prices on OPEC Economies, June 2015) of these

countries. And Because of the lack of information and exact data when it comes to decomposition of the GDP for each countries, the oil exports percentage of total exports are calculated here in order to see if these countries are relatively similar ,and thus comparable.

Figure N°01: oil export and non-oil exports in Algeria, 1980-2014

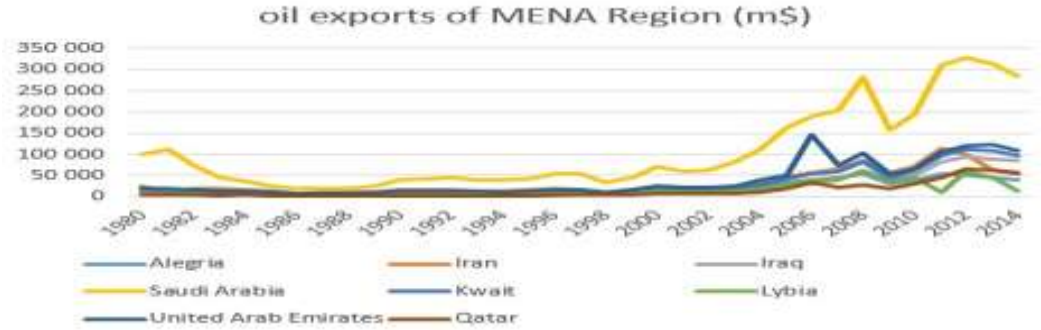


Source: made by the researchers using excel 2013

What is shown by the figure 01 is that oil represents almost 50% of total exports of Algeria (the same case for the other MENA region countries), this further illustrate the predominance of the oil sector in the economies of the MENA region countries (Simone, 2019), and heir consequently limited level of economic diversification. Because for most of them it is considered as a backbone of the economy notably for Algeria.

It is undoubtedly inconvenient to miss the historical oil price shocks when it comes to interpreting the value of oil exports of the MENA region countries that are part of the OPEC

Figure N°02: oil exports of MENA Region



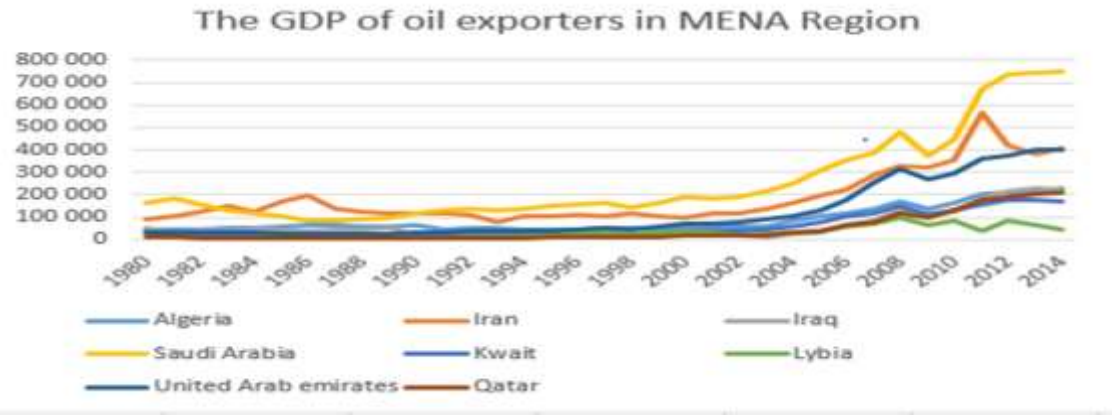
Source: made by the researchers using excel 2013

The graph given above represents the value of oil exports in MENA Region countries, as it is shown; our chosen timespan is a turbulent period with many ups and downs. Starting in 1980 with Saudi Arabia recording the highest level of oil exports among the other countries "it has always been the largest exporter in the area». Meanwhile the other countries recoded less than 50 000m$ with Iran and Iraq registered the lowest levels which can be explained by their war from on part and by the Iranian revolution from the other part when it comes to Iran oil exports.

The exports value levelled off and remained constant between 1980 and 2000 except for Saudi Arabia which experienced sharp decrease from 101 000 m$ in 1980 to 18 000m§ in1986, this sudden decline could be the result of the great oil price collapse of 1986 when the kingdom refused to play the role of the swing producer. Its level of exports has seen a steady increase until 2008 , in that particular year and with oil prices spike, oil exports of all the concerning countries peaked and reached a high (almost 300 000 m$ for KSA and not less than 25 000 m$ for the other countries).this favorable situation did not lasts for long .in the late 2008 the oil price dropped and the region's oil exports sank with it .

By the end of 2011, a remarkable event was marked by this graph, which is the Arab spring. its relative effects on oil sector in Libya was noticeable leaving the rivals sides battling for control over oil field and damaging the ports and refinery.as a result Libyan oil exports bottomed out at a level of 11 000 m$, the oil exports of the region experienced a stability until 2014 when the oil price declined as a result to the declining demand and the exceeded production of NON-OPEC countries.

Figure N°03: the GDP of oil exporters in the MENA Region



Source: made by the researchers using excel 2013

when we visualize the graph we could say that the GDP in the period between 1980 and 2008 stagnated in low levels except for Iran which peaked at 198 248 m$ in 1986, then it experienced a gradual rise for all the countries until it peaked in 2008 (oil price spike). This rise has come to an end and the GDP value of each countries decreased in the following years but still higher than levels in the previous period ,meanwhile Libya's GDP like its exports bottomed out at 36 874m$ in 2011 , as a results to the Arab spring .

What is remarkable here is that interpretation of this graph is does not differ so much from the interpretation of the previous one. Because it has almost the same trend, same ups and downs; the application of panel approach will provide a better explanation to the similarities founded in this graphs and in the same time the differences in GDP and oil exports movements when it comes to countries.

3- Results and discussion:

In this application the study will be focused on the oil exporters in MENA Region

Which are members of the OPEC that means that our cross sectional units are: Algeria, Iran, Iraq, Kuwait , Saudi Arabia ,Libya ,Qatar, United Arab Emirates .

A large number of previous studies have used quarterly data (Jimenez-Rodriguez and Sanchez, 2008) to illustrate the effects of sudden changes in oil price on growth rate, but since the majority of the countries

included in this particular study lacked quarterly information of GDP, yearly data was used. The countries' yearly real GDPs are obtained from the OPEC statistic annual reviews, and ranged from 1980-2014. This timespan varies between the selected countries depending on availability of data.

In addition, since we are looking for the effect on economic growth caused by the oil price shocks, we found it more appropriate to choose"GDP" as a the dependent variable to represent economic growth while the chosen indicator to represents the oil price shocks is the oil exports value, Gujarati in his book "basic econometrics "had followed the following strategy:

3-1. The pooled model:

We will start by disregarding the space and the time dimensions of the pooled data (BALTAGI, 2005) and just estimate the usual OLS regression. By stacking the 35 observations for each country one on the top of the other, thus giving in all 280 observations for each of the variables in the model (for GDP and for Oil Export), the OLS outputs are shown in the Figure n°4

Figure N°4: Result of the pooled model (OLS)

Dependent Variable: GDP
Method: Panel Least Squares
Date: 04/21/17 Time: 22:51
Sample: 1980 2014
Periods included: 35
Cross-sections included: 8
Total panel (balanced) observations: 280

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXP01	2.228562	0.064499	34.55187	0.0000
C	26550.91	3968.350	6.690666	0.0000

R-squared	0.811120	Mean dependent var	105086.7
Adjusted R-squared	0.810440	S.D. dependent var	125019.2
S.E. of regression	54431.41	Akaike info criterion	24.65439
Sum squared resid	8.24E+11	Schwarz criterion	24.68035
Log likelihood	-3449.614	Hannan-Quinn criter.	24.66480
F-statistic	1193.832	Durbin-Watson stat	0.288388
Prob(F-statistic)	0.000000		

3-1-1 Interpretation of the outputs :

By examining the outputs of the pooled regression. We will see that the all the coefficients are individually statically significant and the slope coefficient has the expected positive signs and the $R^2$is reasonably high (almost 82% of GDP variation is explained by this regression), GDP is positively related to oil exports.

The messing ointment is the estimated value of Durbin –Watson statistic is quite low (d=0.288388), suggesting the existence of perfect positive correlation in the residuals.in the other hand, it is known that the low Durbin-Watson statistic could be explained by the specification errors like: excluding variable or choosing incorrect functional form. (GUJARATI, 2004)

3-1-2 Cross section dependency in pooled model :

The existence of autocorrelation could be tested with "the Breusch-Pagan LM" test, and as it is shown in the figure 5: the p value of the test's statistic is too small (0.0000) which lead to the rejection of the null hypothesis, so there is a cross section dependence in residuals.

Figure N°5: Autocorrelation test in pooled model

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: OLS
Periods included: 35
Cross-sections included: 8
Total panel observations: 280
Note: non-zero cross-section means detected in data
Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	291.5126	28	0.0000
Pesaran scaled LM	34.14431		0.0000
Pesaran CD	5.434819		0.0000

Because of the existing correlation between the cross sectional units residuals the use of the SUR model become a necessary step. As it is proven by a lot of economists (CHERATIAN I, 2019) (this model allows for the heterogeneity between individuals by providing their dependency, the result of the estimation of the previous regression using the model SUR are shown in the figure below:

Figure N°6: Result of pooled regression (using the SUR model)

Dependent Variable: GDP
Method: Panel EGLS (Cross-section SUR)
Date: 05/21/17 Time: 22:38
Sample: 1980 2014
Periods included: 35
Cross-sections included: 8
Total panel (balanced) observations: 280
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXP01	2.169393	0.034549	62.79149	0.0000
C	25741.41	1377.060	18.69302	0.0000

Weighted Statistics

R-squared	0.934529	Mean dependent var	1.135596
Adjusted R-squared	0.934293	S.D. dependent var	4.150281
S.E. of regression	0.996798	Sum squared resid	276.2223
F-statistic	3968.146	Durbin-Watson stat	1.105559
Prob(F-statistic)	0.000000		

The results that could be drawn from the previous estimation is that all the coefficients are individually statistically significant and the slope coefficients has the expected positive signs and the R^2 is reasonably high (almost 94% of the GDP variation is explained by this regression); GDP is positively related to oil exports.

The Durbin-Watson statistic (1.105559) unlike the first estimation tells that the serial correlation between residuals could absent in this case which could be proven by the LM test, there is no cross section dependency in this pooled regression using the SUR model.

The estimated model also assumes that the intercept value of Algeria, Iran, Iraq, Kuwait Saudi Arabia, Libya, Qatar and United Arab emirates are the same.it is also assumed that the slope coefficient of the oil export for the eight countries (absence of individuality), it is a restricted regression. Despite the simplicity in pooled model, the true picture of the relationship between GDP and oil exports cannot be well explained across the eight countries; we should take into account the specific nature of each country (BALTAGI, 2005).

3-2. Fixed Effect Model (FEM)

In order, reconsider the individuality of each country the FEM is among the ways to make it happened by allowing the intercept to vary for each country while the slope coefficient is constant.

Figure N°7: Estimation of FEM

Dependent Variable: GDP
Method: Panel EGLS (Cross-section SUR)
Date: 04/21/17 Time: 22:52
Sample: 1980 2014
Periods included: 35
Cross-sections included: 8
Total panel (balanced) observations: 280
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXP01	2.146617	0.036244	59.22680	0.0000
C	29438.71	1586.322	18.55784	0.0000

Effects Specification
Cross-section fixed (dummy variables)

Weighted Statistics			
R-squared	0.952290	Mean dependent var	1.471524
Adjusted R-squared	0.950882	S.D. dependent var	4.478584
S.E. of regression	1.006784	Sum squared resid	274.6895
F-statistic	676.1454	Durbin-Watson stat	1.249153
Prob(F-statistic)	0.000000		

3-2-1 Interpretation of the outputs :

The p value associated to the t-statistic is extremely small (0.000) .so the slope coefficient is statistically significant and in the same time has the expected positive signs. “The GDP is positively related to oil exports “.Moreover, the $R^2$is reasonably high almost 95% of the GDP variation is explained by this regression, however this increase in theR^2 could be explained by the add of dummy variables.

Moving to intercepts, as it is mentioned in the assumptions of the fixed effect model , the intercept values of the eight countries are statistically different; and since the only explicit value here is the one of my benchmark (29438.71),the other intercepts are differentials ones which means they tell by how much they differ from the one of the base.

The differences in the intercepts may be due to the unique features of each countries, in my case of study these differences could be explained by:

- ✓ The differences in hydrocarbon share in the GDP because of the diversifications policies adapted by each countries.
- ✓ The productions cost.
- ✓ Income saved in period of higher oil prices.
- ✓ The large foreign assets and the hug funds in the SWF (sovereign wealth funds)

Another remark that should not be missed here is that the degree of freedom in this estimation is 271.

3-2-2 Cross section dependency in FEM:

The knowledge of the existence of autocorrelation between the residuals of my cross sectional units in a necessary step that we will need in the following estimation, as it is shown in the figure n°8 the p value associated to LM statistics is" 1 " which is extremely high so we accept the null hypothesis "there is no cross-dependence in residuals".

Figure N°8: autocorrelation in FEM

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in weighted residuals
Equation: FEM
Periods included: 35
Cross-sections included: 8
Total panel observations: 280
Cross-section effects were removed during estimation

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	4.564153	28	1.0000
Pesaran scaled LM	-4.200792		0.0000
Bias-corrected scaled LM	-4.318439		0.0000
Pesaran CD	-0.095940		0.9236

3-2-3 Pooled Model versus FEM:

The choice of the best model after getting estimations from both pooled regression and FEM model will be based on: The fact that R^2 value has increased substantially and the fact that the Durbin-Watson d value in much higher almost 1.25 compared to the one in pooled regression which is 1.11, suggesting that the pooled model was mis-specified.

3-3 .The Random effect model:

Many economists looked at the LSDV as a lack of knowledge and the fact that this ignorance should not be explained by the dummy variables but through the disturbance term u_{it}.

Figure N°9: Estimation of Random Effect Model

Dependent Variable: GDP
Method: Panel EGLS (Cross-section random effects)
Date: 05/22/17 Time: 12:44
Sample: 1980 2014
Periods included: 35
Cross-sections included: 8
Total panel (balanced) observations: 280
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXP01	2.230081	0.057511	38.77689	0.0000
C	26497.40	15117.26	1.752792	0.0807

Effects Specification	S.D.	Rho
Cross-section random	41812.74	0.5148
Idiosyncratic random	40595.94	0.4852

Weighted Statistics

R-squared	0.844439	Mean dependent var	17018.33
Adjusted R-squared	0.843879	S.D. dependent var	102558.0
S.E. of regression	40522.87	Sum squared resid	4.57E+11
F-statistic	1509.075	Durbin-Watson stat	0.520988
Prob(F-statistic)	0.000000		

Figure N°10: Random Effect value of each country

VAR 01	Effect
ALG	15550.18
IRAN	85410.33
IRAQ	-19654.29
KSA	-9609.522
KWA	-34563.73
LYB	-28570.71
QTR	-12996.45
UEA	4434.186

Source: made by the researchers using word 2013

3-3-1 Interpretation of the outputs:

The results of the random effect model estimation of our model are presented in figure and figure, several aspects of this regression should be noted:

- The sum of the random effect values given for the eight countries is zero
- The constant with value of (26497.40) is the mean value of the entire cross sectional units intercepts in this case the eight countries, which is also the mean value of the random error component.

- The random effect value of each country tells us by how much the random error component of this country differs from the common intercept value.
- The R^2value is obtained from the transformed GLS regression.

3-3-2 Validation test (Hausman test):

As it is already done before, we have compared the outputs of the two models using both formal and informal measures and it was the FEM, which provide the best estimations.

The procedure applied in this case is the Hausman test in order to know whether the FEM or the random effect model gives the efficient estimators and thus considered as the best model to describe the phenomena.

Figure N°11: The Hausman test output

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000090	1	0.9924

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
EXP01	2.230140	2.230081	0.000039	0.9924

According to the test results the p value is extremely high (0.9924) that means that the hypothesis which should be accepted is the null one "the ε_i is uncorrelated with X_i "in another world "both estimators are consistent but the one provided by the random effect model is more efficient

3-3-3 Diagnostic checking:

In this step we need to test for serial correlation ,the problem here is when we test for the serial correlation in residuals for the ECM, the results show that there is a cross sectional dependence. The LM test results are represented in the figure below:

Figure N°12: serial correlation in Random Effect Model

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: ECM
Periods included: 35
Cross-sections included: 8
Total panel observations: 280
Note: non-zero cross-section means detected in data
Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	291.2882	28	0.0000
Pesaran scaled LM	34.11431		0.0000
Pesaran CD	5.427085		0.0000

Since we find a serial correlation in the chosen model and the software used cannot solve the problem, we were obliged to use STATA in order to correct the existing correlation between residuals, the hole steps (pooled model, FEM, ECM, HAausman test) are re-estimated using STATA and the serial correlation was corrected using PCSE , the figure bellow explains better :

Figure N°13: Correction of the serial correlation using PCSE

```
. xtpcse gdp exp, correlation(psar1)
(note: estimates of rho outside [-1,1] bounded to be in the range [-1,1])

Prais-Winsten regression, correlated panels corrected standard errors (PCSEs)

Group variable:    contryid                    Number of obs      =       280
Time variable:     YEAR                        Number of groups   =         8
Panels:            correlated (balanced)       Obs per group: min =        35
Autocorrelation:   panel-specific AR(1)                       avg =        35
                                                              max =        35
Estimated covariances      =        36        R-squared          =    0.7605
Estimated autocorrelations =         8        Wald chi2(1)       =    254.86
Estimated coefficients     =         2        Prob > chi2        =    0.0000
```

gdp	Panel-corrected Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
exp	1.736864	.1087973	15.96	0.000	1.523625	1.950102
_cons	56852.95	15761.94	3.61	0.000	25960.12	87745.79
rhos =	1	1	.8756915	.6698085	.9708062 ...	.8839541

The result that we could draw from the table are the following:

At 5% level of confidence; our chosen model represents almost 76% of the phenomena, while the p-value associated to wild chi2 (1) is extremely small telling that the model is good, our independent variable, which is oil exports effect positively the GDP .the random effect model is the best choice.

4- Conclusion :

The conclusions that could be drawn from the results obtained from our empirical study using panel method are: the first hypothesis is accepted. so the relationship between oil shocks and the economic growth is positive for developing oil- exporting countries of MENA region .Besides for every"1" unit increase in the oil exports the GDP will increase by(1.736864**)** ;which implies that fluctuations in oil price have a significant influence on their economic activity. thus oil prices remain an important factor in determining future performance of those countries.

The second hypothesis is rejected. Thus economic growth for one country, compared to others differs in reaction to oil price shocks. Which means that the individuality between the chosen countries comes out to the picture ,even though the countries are alike a numerous aspects ,they consist of developing countries that are highly dependent on oil revenues and located in the same region but they do not react in similar manner to oil price shocks. The policies adapted by each country, the proven reserves, the technology, the turmoil and tranquility could be the main factors behind this proven heterogeneity, concerning the third hypothesis ,it was accepted as the estimation showed that the best efficient model is the Random one.

For further research, the study of whether the oil shocks have similar impact on both OPEC oil- exporting countries and Non-OPEC oil -exporting nations or not is an aspect worth to investigate or just keeping the light on the same region and compare between oil exporters and importers .

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