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The Impact of Global Oil Prices on the Israel's GDP Per Capita: An Empirical Analysis

Zaher Z[1]* and Maayan S[2]

Department of Economics, University of Haifa, Israel

Abstract

This paper investigates the relationship between the global oil price and Israel economy based on a quarterly time series data from 1988:Q3 to 2013:Q4, using the method of Vector Error Correction Model (VECM) by using a number of lags for six endogenous variables and a dummy variable. The results show that there is no significant impact of oil price shocks on Israel GDP. It's found that the global oil price is exogenous to Israeli economy and that Israel is not materially affected by oil prices and the economy is not affected in times of rising oil prices.

Keywords: Global oil prices; Empirical analysis; Israel final energy consumption; OPEC cartel

Introduction

A large amount of researchers have investigated the relationship between oil price shocks and economic activities of developed countries since the first oil crisis of 1970's, but only a few studies have mentioned Israel. In fact, a study that examines the connections between global oil prices to economic growth focuses on Israel haven't conducted yet. As of 2009, Israel's oil supply estimated at 1940 billion barrels. The implication of this fact is that Israel significantly dependent on foreign energy suppliers, in order to provide its energy needs. However, in 2009 Israel imported petroleum products accounted for approximately 59% of Israel final energy consumption. Israel imports most of its oil consumption from Russia, Mexico and Africa. In the Last twenty years, states located along the Caspian Sea, especially Azerbaijan and Kazakhstan have become large energy providers for Israel. These countries provide Israel oil barrels type "Brent" that produced primarily in the North Sea [1]. Import of oil is a significant expense to the State of Israel, and changes in oil price have may cause implications on Israel's entire economy. In fact, one-dollar increase in the price of an oil barrel results an additional expense of 65 million dollars annually to the Israeli economy [2]. Additionally, in the early 90's, attempts were made to discover oil reserves in Israel, but were badly depleted reservoirs around the Dead Sea and the Mediterranean coast. In order To deal with this situation, Israel, like many countries that consume imported energy products, formulated energy policy. This policy encourages local production of energy products such as natural gas, solar energy, wind power and integration of these types of energies for local industrial use. Additional goal of this policy is to increase oil inventory accumulation and preservation. Moreover, the Difficulty of finding oil in Israel and the import dependency has brought Israel a great interest in searching for an alternative energy source such as natural gas. Indeed, in 2005, Israel signed an agreement for the transfer of gas from El-Arish in Egypt to Ashkelon via an underwater pipeline. The agreement committed Egypt to supply gas amount of 60 billion cubic feet to Israel. In addition, many gas Drilling were established along the coast of Israel [1] (Figure 1). This figure shows a comparison of importing petroleum products over three decades in Israel. After an increase in oil Import in the 90's, the trend was reversed and Israel import Petroleum products declined in the 2000's. Perhaps this trend can be attributed to gas transfer agreement signed with Egypt in 2005. Another reason may be due to the rise of oil prices in the early 2000's, which led to a decline in oil imports to Israel (Figure 2). The figure above shows a large amount of imported petroleum products during the 90's, compared to a relatively low amount of coal imported. Since 2000 there is an interesting trend when coal import increase, oil imports maintains a permanent trend and falling slightly. This trend may be related to high oil prices that prevailed in early 2000 that led Israel to use coal as a substitute for oil in these years. However, over the last twenty years, oil continues to be the main energy source in Israel.

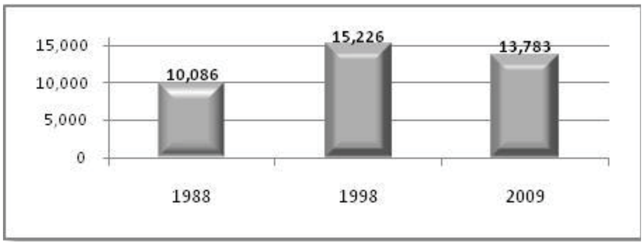

Figure 1: Israel imports of petroleum products (thousands of tons) Central Bureau of Statistics.

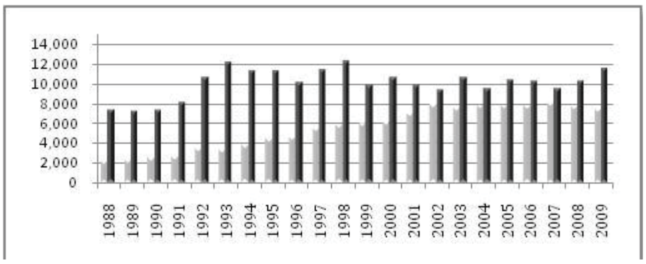

Figure 2: Oil and coal imports (thousands of tons).

***Corresponding author:** Zaher Z, Department of Economics, University of Haifa, Israel, Tel: +972 4-824-0111; E-mail: zaher.89@gmail.com

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Development of oil prices during the years 1960-2012

In September 1960, oil producing countries in the Middle East established OPEC cartel. The purpose of the cartel was to ensure fair prices for oil producing countries, through coordination between them. The organization includes all Persian Gulf oil producers: Saudi Arabia, Iran, Iraq, Kuwait, United Arab Emirates and Qatar. In 1973, during Yom Kippur war, the oil cartel countries boycotted Western countries due to their support of Israel during the war, and later the organization decided to raise the price of an oil barrel. During the 70's, OPEC cartel dictated rising oil prices, without setting output quotas. The increase in oil prices during the 70's and early 80's started the global energy crisis. Rising oil prices and the economic crisis that attacked Western countries led to a series of an efficiency measures in these countries. Political power concentrated in the Gulf region, led to the search and discovery of oil in the North Sea as well as experience in the development of alternative energy sources. These steps led to solve the crisis in the late 80's. Indeed, oil prices fell from 40$ at peak to 7$ per barrel in 1986. In the next years oil prices continued to be volatile [2]. During 1999, the price of oil increased from 12.5$ to $ 27 per barrel. The dramatic price increase was primarily due to increasing demand for oil from industrial countries in Asia. The world's major oil importers, including the United States exerted pressure to increase OPEC's quotas in attempt to lower the price of oil, but even after increasing the quota, the price of oil continued to rise. Rapid development of Asian countries and the increase in demand for oil caused demand to rise faster than the supply and allowed the rise in oil prices. Additionally, oil production in the North Sea and Russia was affected by the increased prices of the OPEC cartel, which became the world's dominant oil supplier. As an emergency measure U.S. government announced the release of its oil inventories in order to lead a decline in prices, which continued to rise [3]. Over the past decade, until July 2008, there was a continuous increase in oil prices. The average oil price of the OPEC cartel in July 2008 was 131$ per barrel, the highest price so far. The main reason for the high price was a rapid growth in the global economy, which resulted in a substantial increase in demand from East Asian countries. Another reason is speculation on the price of oil and the fear from harming the Gulf oil resources in the case of a conflict between the United States and Iran. Rising oil prices caused inflation in various countries. At the end of 2008, the trend reversed, and the price of oil dropped to 38$. This was followed by a decline in oil demand and expectations of negative growth of the global economy following the sub - prime crisis in United States. In 2009, oil prices rebounded and the price was 58$ per barrel [4]. In early 2010 the price has stabilized around $70 per barrel, and later that year jumped to 97$ per barrel. Oil prices continued to rise until the mid-2011 and reached a peak of 120$, due to a decrease in oil production in the North Sea. In the second half of 2011 and 2012 the oil price was volatile ranging from 100-115 per barrel, while the end of 2012 the price of oil barrel type "Brent" was 108$ [5].

Literature Review

Organization of the Petroleum Exporting Countries (opec) a permanent, international organization headquartered in Vienna, Austria, was established in Baghdad, Iraq on 10-14 September 1960. Its mandate is to "coordinate and unify the petroleum policies" of its members and to "ensure the stabilization of oil markets in order to secure an efficient, economic and regular supply of petroleum to consumers, a steady income to producers, and a fair return on capital for those investing in the petroleum industry. The oil crisis in the 70's and the subsequent recession led to a numerous studies on the relationship between fluctuations in oil prices and macroeconomics. Global research organizations have tried to assess the implications of oil price shocks on GDP and economic policies of different countries. Many studies have been conducted on this topic and found a connection between GDP growth and oil price shocks. In recent years, there have been many studies on the relationship between oil prices and the global economy of different countries. These papers revealed different results regarding the relationship between oil price shocks and the economy of various countries [6]. A comprehensive study examining nine industrialized countries, OECD members, found that there is a connection between oil price shocks and GDP growth. Countries were divided to oil importer countries including United States, Japan, Canada, France, Italy, Germany and the European Union, and oil exporting countries, including Britain and Norway. The results were expected to differ in oil-importing and oil-exporting countries. The research hypothesis was that since oil is a basic input in manufacturing many products, mainly in the industry, the rising oil costs will lead directly to an increase in production processes, which cause a reduction in products produced by firms. In addition, the products getting more expensive cause a decrease in disposable income of consumers and reduce investment. Moreover, volatility in oil prices also affect the capital markets, exchange rates and inflation, and all of these in turn also effect on real economic activity in the economy. The results were partly predictable and partly surprising. For oil importer countries it's found that a decrease in oil prices has a positive and similar effect in all countries except Japan. In the case of an increase in oil prices in the short term the effect is negative, while Japan is affected positively. Among the oil importers countries in the article, the rise in oil prices affects mostly on the U.S. economy. In fact, it was found that increase of 100% in oil price causes a loss of 3.2% of GDP to U.S. among oil exporter's countries, primarily the United Kingdom; the results obtained are not expected. UK GDP fell by 1% when oil prices increased by 100%, while a decline of 100% in oil prices cause 6% growth in GDP. In general, more pronounced effects were found when oil prices are rising, and mostly among oil-importing countries [7]. A research conducted in 2010 on the relationship between oil prices and the macroeconomic of China, found an impact of oil prices on China's GDP. The study examined the impact of oil prices on China, and also examined whether China's economy, evolving rapidly, have an impact on the global oil prices. The results found are in contrast to most developed countries studied in the past. It was found that GDP growth in China positively correlated with oil prices. In fact, a 100% increase in world oil prices, causing China's GDP growth of 9%. Possible explanation for these results is the monetary policy of China's government, resistant to shocks such as those of oil prices. As for the hypothesis that China's economy affects oil prices, it's found that the world oil price is still exogenous to Chinese economy and China's economy can't impact oil prices because of the fact that China is still largely dependent on imports of oil from foreign countries [8]. Similar research was conducted in Spain in order to study the relationship between oil prices, GDP and inflation at 17 districts of the state in 2011. The research hypothesis was that a strong relationship between Spain's economy and oil prices shocks will be found, since in 2008 the demand for oil and its products in Spain accounted for 46.9% of the total demand, and most of it came from imports. The results obtained indicate that Spain continues to be significantly dependent on oil and its products compared to other European countries. Although previous papers have shown that the effect of fluctuations in oil prices on industrialized countries is diminishing since 1970, this article found a re-impact of these shocks on the economy of Spain. Moreover, it was found that the effect of oil prices on the manufacturing industry in Spain is very strong, as it's the main consumer of petroleum in the country [9]. Another study, published in 2011 and deals with the economy of Turkey, support the

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results presented in previous articles. Turkey is a small open economy that is highly dependent on imports of energy sources like oil and gas, and imports about two-thirds of the total energy consumption of the country. Conclusions arise from the study shows that in general the effect of oil price shocks on the economy of Turkey is broad and negative, as expected. In fact, fluctuations in oil prices affect the economy not only through direct channels, but also through indirect channels. For an example, it's found that the increase in oil prices leads to a rise in prices of imported goods and the increasing burden of external debt of Turkey, which in turn affect, negatively, on GDP growth in the country [10]. Despite the findings presented above, a study from 2010, which examined the weakening relationship between macroeconomics and global oil prices, brought interesting results. The findings revealed that since the 80's we experience slow shocks and weaker relationship to oil prices comparing to shocks occurred in the 70's. The weakening of the fluctuations in oil prices allow firms and households adjust to oil prices gradually and thus the damage to the economy is decreasing. However, when the researchers focused on the rise of oil prices, it was found that despite the weakening of oil price shocks, their impact on the macro-economy in many countries have increased steadily since the early 80's [11]. Finally, a study conducted in 2010, about the relationship between shocks in oil prices to Middle East countries including Israel, found that Israel and other countries such as Bahrain, Egypt, Morocco, Tunisia and Jordan, are not materially affected by oil prices and their economies is not significantly affected in times of rising oil prices [12]. Our research hypothesis that a weak relationship between Israel economy and oil prices shocks will be found, since in 2009 Israel imported petroleum products amounting to 59% of its final energy consumption, and most of it come from imports.

Methodology and Empirical Results

Simple linear regression model

First, we will examine the simple linear regression model between D (LNGDP) and LN (OILPRICE) by using the two following models:

D(LNGDP) = a + B*LN(OILPRICE) + u

D(LNGDP) = B*LN(OILPRICE) + u

D(LNGDP) = a + B*D(LNOILPRICE) + u

D(LNGDP) = B*D(LNOILPRICE) + u

We start to investigate the linear relationship of oil prices and economic growth. In order to do so, we consider firstly a Linear Regression Model (LRM) between these two factors with, particularly, the GDP per capita as endogenous variable and the oil price as exogenous variable, and we will note that the two variables are measured in natural logarithms to reduce heteroscedasticity. In the second stage, we conserve the same type of model and with a change of the logarithmic oil price by oil price logarithmic variations. Table 1 shows the results for the two estimated models (Model 1 and Model 2). These results indicate statistically significant coefficients for the two cases at the 5% level. The coefficient of determination, noted R^2, is very low (0.06) for the model containing intercept (*a*). This fact indicates a bad adjustment of these models, whereas in the cases of model without intercept (*a*), the coefficient of determination is completely negative that is impossible because it must be always given by $0 < R^2 < 1$. This argument means that the oil price in level (LNOILPRICE) doesn't have significant effect on the economic growth, but rather the oil price returns D (LNOILPRICE). As a result, several researchers have used thereafter the oil price returns D (LNOILPRICE) instead of the oil price (LNOILPRICE). Considering this implication, we propose the distributions of D (LNGDP) and D (LNOILPRICE) using the quarterly data during the period 1988:Q3-2013:Q4 (Figure 3). Now, we will investigate the simple linear regression model between D(LNGDP) and D(LNOILPRICE) by using the two following models (Table 2) shows the results for the two estimated models (Model 3and Model 4). In this case, it is noticed that the estimation results of both models coefficients are all non-significant except for the intercept in model (3). In addition, the coefficients of determination R^2 is very low what indicates a bad adjustment of this model. Hence, we can conclude that the relation between the economic growth and the oil price cannot be a direct linear regression model. Due to this conclusion we are required to think of a model containing more than two variables for measuring the impact of oil price on the Israeli economic growth such as VAR (Vector Autoregressive) model.

VAR model

The VAR model had become one of the leading approaches employed in analysis of the dynamic economic systems, especially in research about the interactions between oil price shocks and macro-economic [8]. Recent empirical papers guide us to establish firstly, the possible existence of relationship between GDP growth rate, oil price, interest rate, exchange rate, number of employees and the average wage. And secondly, the possible existence of bi-directional causality between these variables, consequently, the VAR model appears to be an appropriate estimation Tool for our study. Consider the following VAR model of order (p):

$$Y_t = c + \sum_{i=1}^{p} \phi_i Y_{t-i} + \varepsilon_t$$

where $Y_t=(Y1t, Y2t\ldots Ynt)$ is a *nx1* vector of endogenous variables, while *Yt-1* is the corresponding lag terms of order i. ϕ_i is the *nxn* matrix of autoregressive coefficients of vector *Yt-i* for $i=1,2,\ldots,p$. $c=(c1,c2,\ldots cn)$ is the *nx1* intercept vector of the VAR model. $\varepsilon_t=(\varepsilon_{1t}, \varepsilon_{2t},\ldots \varepsilon_{nt})'$ is the *nx1* vector of White Noise Process.

Identification of variables: The VAR model we propose to build, takes into account six variables in natural logarithms and a dummy variable represented by a series covering the quarterly period 1988:Q3 – 2013:Q4 constructed as follows:

Gross domestic product per capita (denoted by **GDP**). The Central Bureau of Statistics of Israel publishes the GDP data quarterly and seasonally adjusted measured in USD.

Oil price (denoted by **OILPRICE**). We choose the UK Brent crude oil price specified in dollars as a proxy of the world oil price and also because it's the main type of oil Israel imports. The data was derived from the EIA website in monthly frequency and transferred into quarterly frequency.

Interest rate (denoted by **INT**). The effective interest rate affects the interest rates that the commercial banks determine to the public, and thus affects the level of investment in the economy. In addition, it is a monetary tool of the central bank of Israel to control the amount of money in the economy and thus affect the GDP of Israel. We choose the effective interest rate determined each month by the central Bank of Israel, and publishes in it's website since 1988:Q3 and transferred it into quarterly frequency.

Exchange rate ILS-Dollar (denoted by **EXCH**). Exchange rate is an indicator received from financial and capital markets, and an important factor in determining the monetary policy of the State of Israel. Moreover, it affects many sectors in Israel and in particular on the

		a	LNOILPRICE	R- squared	D-W	AIC	SC	HQC
Model (1)	D(LNGDP)	0.059556*	-0.010991*	0.064539	2.11923	-4.13072	-4.07894	-4.10976
		(3.948305)	(-2.613470)					
Model (2)	D(LNGDP)		0.005277*	-0.082764	1.817266	-4.004292	-3.978399	-3.993810
			(5.849725)					

Table 1: Estimation results for model (1) and model (2). Model (1) includes an intercept, Model (2) presents without intercept. T-statistics are given in parentheses. *Indicates the parameters are significant at the 5% level. R^2: coefficient of determination, d: Durbin Watson statistic, AIC: Akaike Information Criterion, SC: Schwarz Criterion, HQC: Hannan-Quinn Criterion.

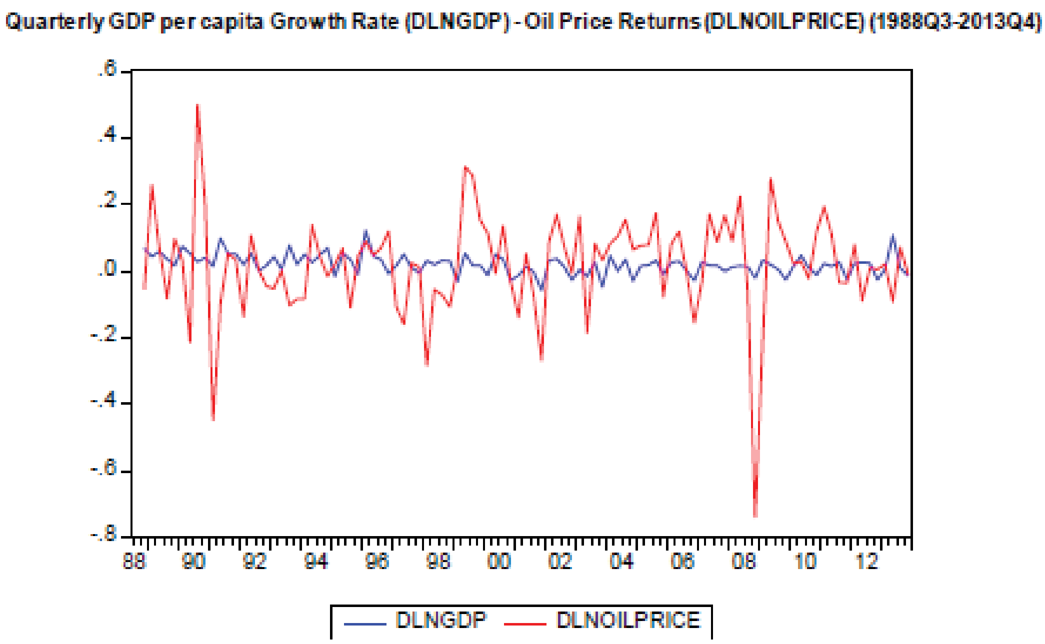

Figure 3: Quarterly GDP per capita Growth Rate (DLNGDP) - Oil Price Returns (DLNOILPRICE) (1988Q3-2013Q4).

		a		D(LNOILPRICE)	R-squared	D-W	AIC	SC	HQC
Model (3)	D(LNGDP)	0.020477*	0.022731		0.012592	1.945231	-4.076679	-4.024894	-4.055715
		(6.538369)	(1.123621)						
Model (4)	D(LNGDP)			0.039911	-0.413791	1.351795	-3.737534	-3.711641	-3.727052
				(1.671209)					

Table 2: Estimation results for model (3) and model (4). Model (3) includes an intercept. Model (4) presents without intercept. T-statistics are given in parentheses. *indicates statistical significance at the 5% level. R^2: coefficient of determination, D-W: Durbin Watson statistic, AIC: Akaike Information Criterion, SC: Schwarz Criterion, HQC: Hannan-Quinn Criterion.

industry in the country, which in turn is an important component of Israel's GDP. The data was derived from the website of the central bank of Israel in monthly frequency and transferred into quarterly frequency.

Number of employees (denoted by **EMP**). The number of employees is the key to assessing the economic system in Israel and to measure the standard of living. Higher employment rates led to tax revenues that allow enlargement of public expenditure on education, health, social services and security. All of these increase the GDP of the country. The data was derived from the website of Central Bureau of Statistics of Israel in monthly frequency and transferred into quarterly frequency Specified in thousands.

Average Wage (denoted by **WAGE**). This statistic is an indicator of changes in salary and economic growth. The data was derived from The Central Bureau of Statistics of Israel in monthly frequency and transferred into quarterly frequency measured in ILS.

Dummy variable (denoted by **WAR**). This is a dummy variable that receives the value 1 or 0. We chose to define the dummy variable as military conflicts or wars in Israel. When there is a military conflict the variable is getting the value 1, otherwise, gets the value 0. This variable has not been used in previous studies we reviewed, but we chose to include it in our model and check whether it has an effect on GDP per capita, since the state of Israel is in the Middle East, it's given to a great military tension, which is often accompanied by terror incidents and military conflicts over the years. All of these events may have a negative impact on GDP (Table 3).

Unit Root Test (ADF Test): The final results of the stationary will be found in Table 4. Based on the Augmented Dickey-Fuller test we conclude that the first difference of GDP, OILPRICE, WAGE, EMP, EXCH and INT are stationary in I (0) so in level, I (1).

Johansen co-integration test: In this test, the first step tries to determine the number of lag used to estimate later the VAR model. In order to do this, we estimate a number of autoregressive processes by fixing a length of lag by keeping only the lag which is minimized by the criteria FPE (Final Prediction Error), AIC (Akaike), SC (Schwarz) and HQ (Hannan-Quinn) and which is maximized by the criterion LR (Likelihood Ratio). According to Table 5, we conclude that FPE and AIC criteria lead us to choose the lag number equal to 2. After this step, we pass to investigate the unrestricted co-integration rank test based on the trace statistic (Table 6) which helps us to determine the existence of the co-integration relation by using the approach of Johansen (1988). The results presented in Table 6 reveal the existence of a co-integration relation (in the long-run the variables move together) between the variables of the model and lead us to run a restricted VAR model that is a VECM (Vector Error Correction Model) by using a number of lag equal to 2.

VECM estimation: The VECM estimation gives us the co-integrated vector which can be written as follows

LNGDP(-1) = -1.97802 - 0.05067*LNOILPRICE(-1) – 1.48774*LNWAGE(-1) + 0.12097*LNINT(-1) – 0.35642*LNEXCH(-1) + 0.70819*LNEMP(-1)

D(LNGDP) = C(1)*(LNGDP(-1) -1.97802 - 0.05067*LNOILPRICE(-1) – 1.48774*LNWAGE(-1) + 0.12097*LNINT(-1) – 0.35642*LNEXCH(-1) + 0.70819*LNEMP(-1)) + C(2)*D(LNGDP(-1)) + C(3)*D(LNGDP(-2)) + C(4)*D(LNOILPRICE(-1)) + C(5)*D(LNOILPRICE(-2)) + C(6)*D(LNWAGE(-1)) + C(7)*D(LNWAGE(-2)) + C(8)*D(LNINT(-1)) + C(9)*D(LNINT(-2)) + C(10)*D(LNEXCH(-1)) + C(11)*D(LNEXCH(-2)) + C(12)*D(LNEMP(-1)) + C(13)*D(LNEMP(-2)) + C(14) + C(15)*WAR.

	Dependent Variable	
V1	GDP	Quarterly IL Real GDP per capita price
		Explanatory Variables
V2	OIL Price	Quarterly UK brent Oil Price in US Dollars
V3	INT	Quarterly IL effective rate
V4	Exch	Quarterly Exchange Rate ILS –US
V5	EMP	Quarterly Number of Employees in IL
V6	WAGE	Quarterly IL Average Wage
V7	WAR	Dummy Variable

Table 3: List of variables used in the analysis of fundamental factors affecting IL real GDP per capita prices and returns.

Level	GDP	OILPRICE	WAGE	EMP	EXCH	INT
Intercept & Trend	-2.936471	-2.802775	-1.824772	-1.415815	-1.463702	-3.825480
Intercept	-4.928854	-0.410148	-3.129298	-1.357319	-3.261111	-0.552589
None	6.360143	1.252204	0.507791	10.01518	0.806177	-1.256657
Decision	non-stationary	non-stationary	non-stationary	non-stationary	non-stationary	non-stationary
1st Difference						
Intercept & Trend	-11.52643*	-8.847866*	-3.555053*	-8.615808*	-8.321831*	-7.909091*
Intercept	-2.193053*	-8.851690*	-1.644133*	-8.597221*	-7.536033*	-7.891871*
None	-1.541593*	-8.709262*	-1.862996*	-1.180717*	-7.346471*	-7.800551*
Decision	stationary	stationary	stationary	stationary	stationary	stationary
Classification	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Table 4: Unit root test (ADF test) results.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	346.4365	NA	2.88E-11	-7.243329	-7.080991	-7.177757
1	1069.332	1338.125	1.30E-17	-21.85812	-20.72175	-21.39911
2	1129.815	104.2369*	7.78e-18*	-22.37904*	-20.26864*	-21.52659*
3	1152.716	36.5443	1.05E-17	-22.10034	-19.01592	-20.85446
4	1190.908	56.06972	1.05E-17	-22.14699	-18.08854	-20.50767

Table 5: Identification of optimal number of lags.

Hypothesized No. of CE(s)		Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
1	None *	0.372987	132.8604	125.6154	0.0168
2	At most 1	0.267307	87.58199	95.75366	0.1203
3	At most 2	0.207240	57.41228	69.81889	0.1972
4	At most 3	0.159539	34.88553	47.85613	0.3962
5	At most 4	0.093466	18.02648	29.79707	0.7704
6	At most 5	0.058649	8.508176	15.49471	0.4154

Table 6: Unrestricted co-integration rank test (Trace).

Long-run causality: According to Table 7, C (1) is the coefficient of the co-integrated model indicating the speed of adjustment towards long-run equilibrium. Since it's not negative and significant at 5% level, we conclude that there is no long-run causality running from the explanatory variables to GDP. Meaning that, all explanatory variables don't have an influence on the dependent variable such as LN (OILPRICE) in the long-run. And we can note for no improvement in the result of the relationship between GDP and oil price when we compare this results with the results found in the simple LRM (Linear Regression Model).

Short-run causality: To test whether the explanatory variables can short-run cause D (LNGDP) or not, we shall use Wald-Test on the following coefficients:

H1: C (4) = C(5)=0

H2: C (6) = C(7)=0

H3: C (8) = C(9)=0

H4: C (10) = C(11)=0

H5: C (12) = C(13)=0

H6: C (15) = 0

Our results accept all null hypotheses, meaning that all coefficients are equal to zero thus indicating the absence of the individually short-run causality of the explanatory variables. However, jointly the variables can have influence on the dependent variable because F-Statistic is significant. We assume that, the reason for the diagnosis divergence in the use of these two criteria, which arrives often in the reality are due to a small sample and less data.

Diagnostic checking: Whether our model where D (LNGDP) is a dependent variable has any statistical error or not, we can note that R-squared value is low (0.33). This fact indicates a bad adjustment of the model because normally if R-squared is less than (0.60) we cannot accept the model. However, F-statistic is significant at the level 1% meaning that our data in the model is fitted well. According to the Residual diagnostics, it appears to have desirable results in the absence of serial correlation and heteroskedasticity in the residuals. The Figure 4 above indicates the histogram of the residuals. We conclude that the distribution is positive skewed (longer in the right side) and with excess kurtosis (leptokurtic distribution) meaning that more of the variance is the result of infrequent extreme deviations. As to the Jarque-Bera test, it is significant at level 5%, meaning that the residuals are not normally distributed. However, we can still accept this model because the coefficients are consistent.

Granger causality test: At this level, we can confirm our result which consists to refuse the direct linear relationship between GDP and oil price because when we look at Table 8 below, we conclude that the GDP is Granger Caused only by the number of employees in the labour market. Meaning that, the past values of LN (EMP) can forecast the future values of LN (GDP). Hence, we don't have a Granger Causality direction between LN (GDP) and LN (OILPRICE). Because of that, it's make sense to have a weakening effect in the direct relationship.

Conclusion

The question regarding the impact of oil price shocks on economic growth presents different results between the models and the variables selected. Because of that, we developed a VAR model which investigates the relationship between these two factors GDP and Oil price. Our results showed that the use of a Simple LRM (Linear Regression Model) can present a non-significant coefficients or a bad adjustment in the direct relationship, and present also a weakening effect in the direct relationship. For this reason, we decided to use the VECM (Vector Error Correction Model) by introducing other factors that may have a high relationship with Israel economic growth and the oil price, a step which may improve our results. However, consistent findings in our results such as to [12] caused to reject our research hypothesis, indicating no relationship between these two factors, meaning that the oil price change doesn't impact the economic growth and that Israel is not materially affected by oil prices and the economy is not affected in times of rising oil prices. Hence, we conclude that the impact of increasing oil price on economic growth depends on a thorough comprehension of this topic and an ability to choose the best appropriate model for this purpose. Thus, the results can be different between working papers and still deserves further attention in future research.

		Std. Error	t-Statistic	Prob.
C(1)	0.110533	0.024560	4.500542	0.0000*
C(2)	-0.364607	0.126045	-2.892677	0.0049*
C(3)	-0.349841	0.126862	-2.757648	0.0071*
C(4)	-0.002381	0.021120	-0.112749	0.9105
C(5)	-0.011460	0.022582	-0.507504	0.6131
C(6)	0.098778	0.150879	0.654685	0.5145
C(7)	0.147525	0.151188	0.975776	0.3320
C(8)	-0.011304	0.015685	-0.720673	0.4731
C(9)	0.008560	0.015217	0.562521	0.5753
C(10)	0.082630	0.092343	-0.894819	0.3734
C(11)	0.125032	0.091583	1.365234	0.1758
C(12)	0.384204	0.384137	1.000177	0.3201
C(13)	-0.024760	0.377183	-0.065646	0.9478
C(14)	0.030731	0.006288	4.876006	0.0000*
C(15)	-0.008425	0.006288	-1.339942	0.1839
R-squared	**F-statistic**	**Prob(F-stat)**	**AIC**	**SC**
0.332168	2.984296	0.000968	-4.214297	-3.821097

Table 7: VECM estimation results.

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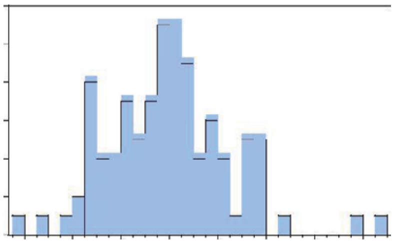

Series: Residuals Sample 1989Q2 2013Q4 Observations 99	
Mean	-2.05e-18
Median	-0.000397
Maximum	0.088922
Minimum	-0.062367
Std. Dev.	0.025412
Skewness	0.517293
Kurtosis	4.188413
Jarque-Bera Probability	10.24111 0.005973

Figure 4: Histogram - Normality Test.

	Dependent Variable					
Independent Variable	**LNGDP**	**LNOILPRICE**	**LNWAGE**	**LNEMP**	**LNEXCH**	
LNGDP		1.114833	5.664090	8.04180*	5.356541	2.562816
LNOILPRICE	5.720575		1.813386	5.04738	8.57693*	16.42055*
LNWAGE	0.300262	2.166962		2.85663	13.16937*	0.726834
LNEMP	7.895147*	13.55195*	1.037069		1.623316	5.464483
LNEXCH	1.098804	8.546248*	1.196839	3.52055		0.524769
LNINT	1.498012	3.130053	3.097587	3.23757	0.183040	
ALL	13.19964	32.38770*	17.66179	14.5990	37.16691*	48.21006*

Table 8: VEC Granger Causality Test.

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