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THE IMPACT OF THE OIL PRICES ON PUBLIC AND PRIVATE HEALTH EXPENDITURES: EMPIRICAL ANALYSIS ON MENA COUNTRIES

Fadime İrem DOĞAN*

Abstract

This paper aims to investigate the impact of the oil prices on health expenditures, while distinguishing public from private healthcare services. To analyze the impact of oil prices, dynamic panel data analysis and Granger causality tests in time and frequency domain analysis are carried out respectively for selected ten countries in the Middle East and North Africa (MENA) for the period of 1995 – 2014. The main findings that modeled with log difference of the used variables are as follows: oil prices have no impact on the public and private health expenditures in the dynamic models. The exchange rate has positive impact on public health expenditures, while the inflation rate has negative and the GDP has positive impact on private health expenditures.

Keywords: Health expenditures, Oil prices, MENA Countries

JEL Codes: *I10, N15, Q40*

Petrol Fiyatlarının Kamu ve Özel Sağlık Harcamalarına Etkisi: Orta Doğu ve Kuzey Afrika Ülkeleri Üzerine Ampirik Bir Çalışma

Kısa Özet

Bu çalışma kamu ve özel sağlık harcamaları ayrımı ile petrol fiyatlarının sağlık harcamaları üzerindeki etkisini araştırmayı amaçlamaktadır. Dinamik panel veri analizleri ve Granger nedensellik ve frekans-alanı nedensellik testleri 1995-2014 yılları arasında seçilmiş on Orta Doğu ve Kuzey Afrika ülkesi için yapılmıştır. Kullanılan değişkenlerin logaritmik birinci farklarıyla kurulan modeller ile elde edilen temel bulgular şunlardır: petrol fiyatları kamu ve özel sağlık harcamalarında bir etkide bulunmazken; döviz kuru oranı kamu sağlık harcamaları üzerinde pozitif, GSYH ve enflasyon oranı da özel sağlık harcamaları üzerinde pozitif ve negatif etki göstermektedir.

Anahtar Kelimeler: Sağlık harcamaları, petrol fiyatları, Orta Doğu ve Kuzey Afrika ülkeleri

1- Introduction

After the major oil price shocks in the 1970s, there have been numerous analysis directed at investigating the impact of oil price shocks on several economic variables, together with the close relationship between oil prices and real-world activities. One of the most relevant economically fundamental is the fiscal side of the economy. Numerous studies examined the impact of oil prices (with negative and positive distinction) on government expenditures, as this is one of the characteristic features of oil exporting economies (see Darby (1982); Hamilton (1983); El-Anashasy et al. (2006); Hall and Jones (2007); Jaba et al. (2014)). Studies generally underline the positive impact of oil prices on government expenditures.

* Ph.D. candidate at Marmara University, European Union Institute, Department of EU Economics, Research Assistant at Altınbaş University, Department of International Trade, irem.dogan@altinbas.edu.tr

However, the literature on the correlation between health expenditures is unsatisfactory. It is observed that fiscal constraints hamper public expenditures especially in non-institutionalized countries. At that point, oil revenues create a significant dependency for oil-exporting countries, which have a further impact on government spending on health services.

This paper is motivated by the following voids in the literature: First, many studies investigate the relationship between oil price shocks and other variables, however there is no empirical study that scrutinizes the impact of oil prices on public and private health expenditures. Second, the paper investigates the short-term impacts of oil prices by using dynamic panel models and causality tests in time and frequency domain analyses. The paper is organized as follows. In section 2 there is a literature review, section 3 describes the data and methodology, section 4 presents empirical results, and finally section 5 is the conclusion.

2- Literature Review

Public health services are common in oil-exporting countries. Countries like Saudi Arabia, the United Arab Emirates (UAE), and Kuwait experienced rapid development in health care, while in countries like Iran and Iraq, public health care services have been impeded by the civil war. On the other hand, economies like Egypt, Israel, and Lebanon have more qualified labor for health care. The need for qualified personnel, medical treatment, and improved technology create difficulties regarding the financing for health care services. Together with fiscal constraints when prioritizing public expenditures, some governments choose to transform the health care system into a private one under the argument that privatized health care systems increase the service quality with better resources and reduce the costs. With constant fluctuations in oil prices, oil-exporting countries may move towards a private health care system (or a mixed system of private and public) in order to obtain greater efficiency in terms of reducing the costs. Moreover, it is important to note that these oil-exporting countries also promote the development of healthcare tourism. Dubai Healthcare City (DHCC) and the International Medical Centre (IMC) in Jeddah are some examples.

Figure 1: Oil Prices ($ per barrel)

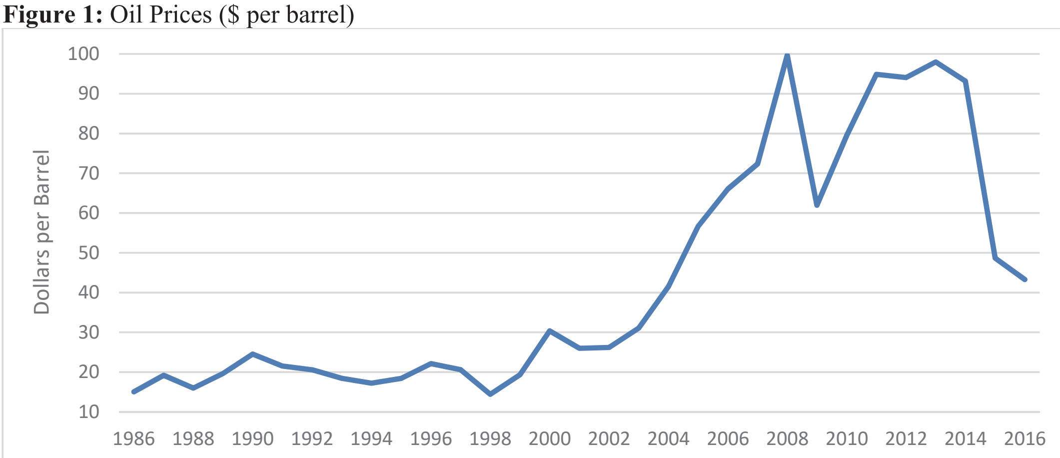
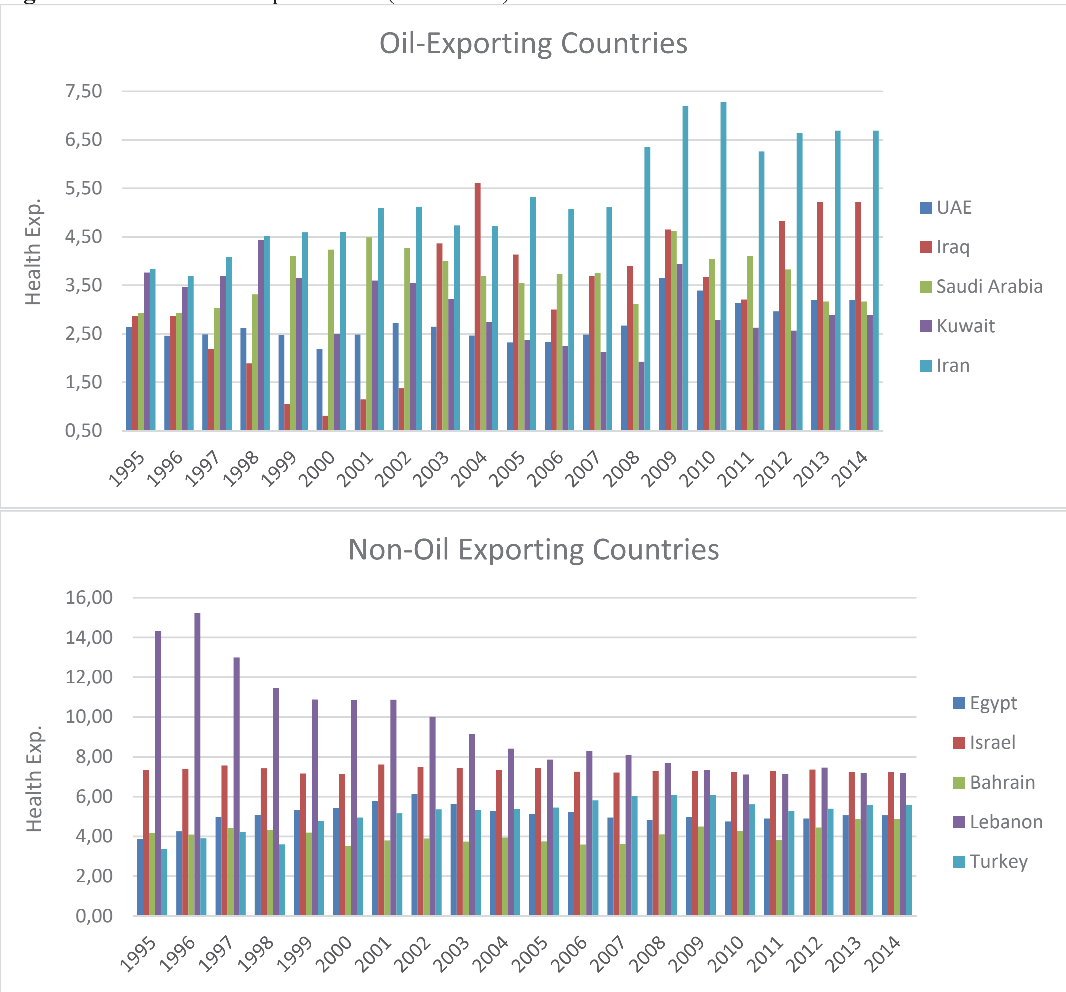


Figure 2: Total Health Expenditures (% of GDP)



There is a remarkable amount of research on oil prices. Seminal works of Darby (1982) and Hamilton (1983) investigate the relationship between oil prices and macroeconomic variables. According to Darby (1982), the relationship is not significant, while Hamilton argues for the exact opposite in almost all recession periods in the United States (the US) from 1949 to 1973. Dizaji (2014) examine the dynamic relationship between government revenues and expenditures in Iran as a developing oil-export based economy. According to El-Anashasy et al. (2006), oil price shocks affect the determinants of the GDP of Venezuela from 1950 to 2001. Farzanegan and Markwardt (2009) examine the possible effect of oil price shocks on macroeconomic variables in Iran by using VAR approach. They state that there is a positive relationship on the supply side of Iranian economy.

When it comes to health expenditures, a very important study is carried out by Acemoglu et al. (2013). They investigate the relationship between income and health expenditures including oil price shocks in the US. They assume that both income and health expenditures are increasing over time. By including oil prices on a particular local area to see the impact of income on health expenditures, they conclude that increasing income does not increase health expenditures. Govindaraj et al. (1997) study health expenditures in Latin America and the Caribbean. They underline that improvements in economic variables lead to increase in health expenditures over the years. According to the 1995 World Bank report, the countries that have established public health care systems have more public health expenditures than others. Hall and Jones (2007) also examined the relationship between income and health expenditures and found a positive relationship. Ssozi and Amlani (2015) investigate the efficiency of health expenditures in 43 countries in Sub-Saharan Africa by utilizing the generalized method of moments (GMM) approach from 1995 to 2011. They conclude that improvements in public services increase public health expenditures. Filmer and Pritchett (1999) examine the impact of public health spending on mortality rates. In an analysis covering 45 countries, they did not find any correlation between health spending and mortality. However, income, economic inequality, education, and religion have positive effects on mortality rates. On the other hand, Rajkumar and Swaroop (2008) investigated the results of the decrease in public health spending on child mortality in 91 countries in 1990, 1997, and 2003. The results indicate that public health spending does not have an impact on child mortality. They argue that this may be the result of other factors, such as corruption. Narayan (2006) examined the health expenditures in G3 countries' (Colombia, Venezuela, and Mexico), the United Kingdom (the UK), Switzerland, and Spain by focusing on the structural breaks from 1960 to 2000. He finds that structural breaks have an impact on health expenditures negatively, except for the UK. Jaba et al. (2014) analyzed the relationship between the dynamics of the inputs and the outputs of health care systems for 175 countries for the period of 1995-2010 by applying panel data analysis. They concluded that life expectancy and state health expenditures are statistically significant and positive. Mou (2013) analyzes the impact of the factors on health expenditures of 13 OECD countries for the period 1981 – 2007. He finds that income inequality and an aging population are less correlated to public health expenditures, when total health expenditures are considered. Brown et al. (2014) examine which factors are associated with the out-of-pocket health expenditures in Turkey by using Turkish Household Budget Surveys from 2003 to 2008. They conclude that poverty is negatively associated with household's out-of-pocket health expenditures. Parker and Wonk (1998) analyze the Mexican National Survey of Income and Expenditures of 1989 in order to find the determinants of health expenditures in Mexico by focusing on the impact of household income on health expenditures. They come to the conclusion that changes in income effect household's health expenditures. Granados and Rodriguez (2015) examine the evolution of population health and health services in Greece, Finland, and Iceland for the period from 1990 to 2011. They find that population health in Greece is as good as Finland and Iceland and as contrary to the claims. Their findings underline that there is not a health crisis in Greece.

3- Data & Methodology

Data

The sample is composed of 10 countries from the Middle East and North Africa (Egypt, Iran, Iran, Saudi Arabia, United Arab Emirates, Israel, Bahrain, Lebanon, Kuwait, and Turkey)[1]. Annual data is used from 1995 to 2014. Databases utilized for all dependent, independent, and control variables are World Development Indicators (WDI), Global Economic Monitor (GEM) Commodities of World Bank Database, World Economic Outlook, October 2017 of IMF, and U.S. Energy Information Administration. Health expenditures data is two-fold: public health expenditures and private health expenditures. Health expenditure is the dependent variable in the equations, whereas, oil prices is the independent variable. The GDP, inflation, and the exchange rate (local currency unit per $) are used as control variables. All variables except inflation are used as log difference.

The models are given below:

$$HE_{it} = \alpha + \beta \cdot Oil_{it} + \rho \cdot GDP_{it} + \sigma \cdot Er_{it} + \mu \cdot \pi_{it} + u_{it} \quad (1)$$

$$HE_{it} = \alpha + \beta \cdot Oil_{it} + \rho \cdot GDP_{it} + \sigma \cdot Er_{it} + \mu \cdot \pi_{it} + \varepsilon_i + e_t + u_{it} \quad (2)$$

where HE_{it} is the health expenditure (where i is the cross-section and t is the time), Oil_{it} is the oil price, GDP_{it} is the GDP of 10 panel cross-section, Er_{it} is the exchange rate, π_{it} is the inflation rate. In equation (2) ε_i allows for the cross-sectional fixed effects and e_t allows for the time effect for all cross-sections. u_{it} is the error term.

In Panel A of Table 1 descriptive statistics and correlation matrix of the variables are reported. Panel B of Table 1 illustrates correlation coefficients. Low values of these coefficients show no multicollinearity problem for independent variables. Variance Inflation Factor (VIF) is applied to double-check the multicollinearity problem. Small values suggest that there is no multicollinearity problem, since all values are less than five. Before emphasizing on the panel data analysis, F test of the heterogeneity of effects at the panel unit level and cross-sectional dependence in panel-data models are checked. No cross-sectional dependence and no heteroskedasticty are found[2]. Stationarity properties of the series are also tested. Panel D of Table 1 gives the results of Im, Pesaran and Shin (IPS, Im et al., 2003), and ADF-Fisher (Dickey and Fuller, 1979) type panel unit root tests. Constant, and a constant and trend is checked. It shows that all of the variables except the inflation rate are stationary in logarithmic difference form according to the IPS and the ADF-Fisher type panel unit root tests.

1 Due to the availaiblity of data these Middle East countries are selected.
2 The results of heterogeneity and panel cross section tests are available from the author upon request.

Table 1: Descriptive Statistics and Correlations

Panel A: Descriptive Statistics					
	Obs.	Mean	Std. Dev.	Min	Max
$PublicH_{it}$	200	0.035	0.355	-0.539	4.051
$PrivateH_{it}$	200	0.001	0.151	-0.609	0.868
Oil_{it}	200	0.084	0.225	-0.476	0.452
Gdp_{it}	200	0.143	0.185	-0.327	1.396
Inf_{it}	200	11.155	30.856	-16.117	387.311
Er_{it}	200	0.080	0.637	-0.414	8.782
Panel B: Correlations					
	$PublicH_{it}$	Oil_{it}	Gdp_{it}	Inf_{it}	Er_{it}
$PublicH_{it}$	1				
Oil_{it}	-0.1832	1			
Gdp_{it}	-0.2288	0.2781	1		
Inf_{it}	0.0503	-0.0131	0.7020	1	
Er_{it}	0.7806	-0.0061	-0.0984	0.1168	1
	$PrivateH_{it}$	Oil_{it}	Gdp_{it}	Inf_{it}	Er_{it}
$PrivateH_{it}$	1				
Oil_{it}	-0.2302	1			
Gdp_{it}	-0.3471	0.2781	1		
Inf_{it}	0.0307	-0.0131	0.7020	1	
Er_{it}	0.2769	-0.0061	-0.0984	0.1168	1
Panel C: Vif					
	Vif	1/Vif			
Oil_{it}	1.21	0.392			
Gdp_{it}	2.55	0.424			
Inf_{it}	2.36	0.827			
Er_{it}	1.10	0.911			

Panel D: Unit Root Tests

	IPS		ADF-Fisher test	
Variables	η_μ	η_τ	η_μ	η_τ
$PublicH_{it}$	-7.0048***	-7.3010***	172.2721***	142.0361***
$PrivateH_{it}$	-6.6828***	-6.9775***	159.1794***	122.3052***
Oil_{it}	-7.5375***	-7.5275***	199.7105***	144.8864***
Gdp_{it}	-5.8936***	-6.1541***	157.9964***	118.9959***
Inf_{it}	-3.7125***	-4.0964***	118.5003***	114.4102***
Er_{it}	-6.2317***	-6.1606***	185.4171***	142.3086***

Notes: Schwarz information criterion is used for the number of lags in the IPS and ADF-fisher type tests. η_μ, η_τ are unit rott tests with a constant, and a constant and trend, respectively. ***, **, * indicates rejection of the unit root hypothesis at the 1%, 5%, and 10% significance lecel respectively.

Methodology

In terms of theoretical and empirical framework, Leu (1986) and Hitiris and Posnett (1992) used an outline containing health expenditures, the GDP, and non-income determinants of health spending. Due to the availability of data, this study aims to use extended variables. Dynamic model is included in the study. Furthermore, lagged value of the dependent variable turns static model into a dynamic model. Dynamic panel GMM[3] of Arellano and Bond (1991) is used to avoid the biases in the panel regression.

$$HE_{it} = (\eta \cdot HE_{it-1}) + \delta + \gamma \cdot X_{it} + \varepsilon_i + \upsilon_{it} \tag{3}$$

where HE_{it} is the health expenditure (where i is the cross-section and t is the time) and HE_{it-1} is the lagged value of health expenditure. X_{it} is the vector of the all variables that effect health expenditures and γ is the coefficient of the X_{it}. ε_i is the cross-sectional fixed effect and υ_{it} is the error term.

In dynamic panel GMM method, the first difference of the error terms and the level forms of the lagged values of the regressors are examined. Lagged values of instrumental variables and the differences of explanatory variables may create estimation problems, i.e., heterogeneity and autocorrelation. As a solution, Arellano and Bover (1995) came up with the system GMM. Apart from the level form of the explanatory variables, their lagged values plus instrumental variables including GMM instruments are utilized in order to eliminate the heterogeneity problem. Besides, the inclusion of the second lag solves the autocorrelation problem, since it is not correlated with the current error term.

Causality Tests in Time and Frequency Domain Analyses

In order to test if the past changes in x (y) have an impact on current changes in y (x) over a specified time period, Granger (1969) causality test is used. This analysis demonstrates outcomes on causality over all frequencies. Geweke's (1982) linear measure of feedback from one variable to another at a given frequency gives us detailed information about feedback relationships between oil prices and health expenditures over different frequency bands.

By using a Fourier transformation to VAR (p) model for x and y series, Geweke's measure of linear feedback from y to x at frequency ω is defined as:

$$M_{y \to x}(\omega) = \log\left[\frac{2\pi f_x(\omega)}{\left|\psi_{11}(e^{-i\omega})\right|^2}\right] = \log\left|1 + \frac{\left|\psi_{12}(e^{-i\omega})\right|^2}{\left|\psi_{11}(e^{-i\omega})\right|^2}\right| \tag{4}$$

If $\left|\psi_{12}(e^{-i\omega})\right|^2$ =0, then Geweke's measure will be zero, then y will not Granger cause x at frequency ω. Breitung and Candelon (2006) altered this test by reformulating the relationship between x and y in VAR equation:

$$x_t = \alpha_1 x_{t-1} + \ldots\ldots. + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \ldots\ldots. + \beta_p y_{t-p} + \varepsilon_{1t} \tag{5}$$

The null hypothesis tested by Geweke, $M_{y \to x}(\omega) = 0$, corresponds to the null hypothesis of $H_0 : R(\omega)\beta = 0$

3 Also known as difference GMM.

where β is the vector of the coefficients of y and

$$R(\omega) = \begin{bmatrix} \cos(\omega)\cos(2\omega)..........\cos(p\omega) \\ \sin(\omega)\sin(2\omega)............\sin(p\omega) \end{bmatrix}.$$

Breitung and Candelon (2006) simplify Geweke's null hypothesis, so that a usual F-statistics can be used to test causality in frequency domain. That's why this study uses Breitung and Candelon (2006) version of Geweke (1982).

4- Empirical Findings

Dynamic analyses are carried for 10-panel cross-sections. Table 2 represents the results of GMM estimates. This paper examines the impact of oil prices on health expenditures distinguishing public and private health expenditures. Regressor (1) represents the dependent variable as public health expenditures, and in regressor (2) dependent variable is private health expenditures. Two-step GMM-system are shown in Table 2. Wald test, Hansen test, and autocorrelation test statistics are reported in GMM estimates. Wald test shows that all models are statistically significant at 1% level jointly in system GMM estimations. Over identifying restrictions are tested with Hansen test (Roodman, 2009). Finally, in order to check the autocorrelation AR (1) - rejects the null hypothesis of no first-order autocorrelation -, and AR (2), - rejects the null hypothesis of no second order autocorrelation -, of Arrelano-Bond (1991) are carried. The dynamic GMM results show, as illustrated in Table 2, that the coefficients of the oil prices, the GDP, the exchange rate, and inflation. It is seen that all variables except the exchange rate are statistically insignificant saying that oil prices, the GDP, and the inflation rate do not have an impact on public health expenditures. However, the exchange rate is significantly positive. When the exchange rate increases, national economies lose their assets. Thus, this might be the most probable reason why they spend on public health expenditures. For the private health expenditures, in line with the expectations, the inflation rate and the GDP have the expected signs (positive coefficient for the GDP and negative for the inflation rate), as in Govindaraj et al. (1997) and Hall and Jones (2007). The GDP is significantly positive at the 1% significance level. The GDP coefficient is 0.175. The coefficient of the inflation rate shows statistical significance with negative effect. This illustrates that when the inflation rate is low, private health expenditures increase in 10 MENA countries. The Wald test is significant as well as AR (1) and AR (2) tests are satisfactory for both models.

Table 2: GMM-System Estimates

	Public Health Exp.	*Private Health Exp.*
H_{it-1}	0.143**	0.129
	(0.076)	(0.119)
Oil_{it}	-0.158	-0.155
	(0.238)	(0.100)
Oil_{it-1}		
Gdp_{it}	-0.375	
	(0.327)	
Gdp_{it-1}		0.175***
		(0.060)
Inf_{it}	0.002	
	(0.006)	
Inf_{it-1}		-0.001*
		(0.000)
Er_{it}	0.410**	0.030
	(0.173)	(0.069)
Er_{it-1}		
Constant		
Wald test	0.000	0.000
Hansen test	1.000	1.000
Diff-in-Hansen test	1.000	1.000
Arellano-Bond test with AR(1)	0.09	0.04
Arellano-Bond test with AR(1)	0.45	0.91
Observations	190	190

Note: standard errors are given in parenthesis. The Hansen test shows the validity of the instrumental variables. The Diff-in-Hansen test reports the p-value for the validity of the additional moment restrictions required. AR (1), and AR (2) show p-values of Arellano-Bond autocorrelation tests. ***, **, * indicate a significance of 1%, 5%, and 10% respectively.

The relationship between oil prices and health expenditures for each country is investigated via causality tests in time domain. Pairwise Granger causality tests are given in Table 3. As illustrated in Table 3, only Iran shows causal relations for both directions from public health expenditures to oil prices and oil prices to public health expenditures. In Lebanon there is a causal relation from health expenditures to oil prices. However, for the UAE, Iraq, and Israel, it is in an opposite direction. In private health expenditures, only the UAE and Lebanon's coefficients are significant. This means that causal link is from private health to oil prices. Since Iran, Iraq, and the UAE are oil-exporting economies, these results are in line with the expectations.

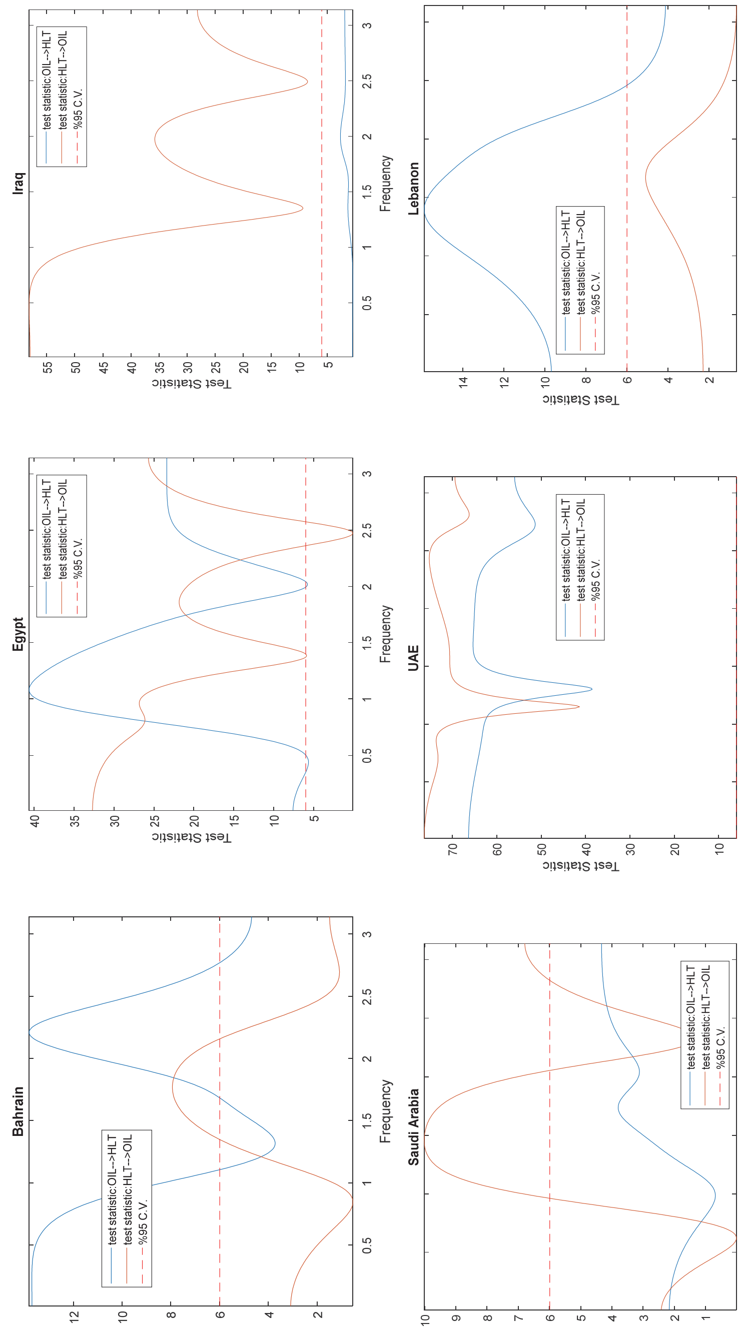
Table 3: Granger Causality Estimates

Public Health	OIL→HLT		HLT→OIL		Optimal lag length
	F-statistics	p-value	F-statistic	p-value	
Egypt	2.949	0.42	2.523	0.45	6
Iran	9.920***	0.01	8.038***	0.01	1
Iraq	0.335	0.87	10.151**	0.02	5
Saudi Arabia	0.345	0.86	0.961	0.53	5
UAE	31.307	0.14	64.346*	0.09	6
Israel	2.176	0.16	4.899**	0.04	1
Bahrain	2.262	0.22	0.608	0.70	5
Lebanon	3.157*	0.09	0.670	0.63	4
Kuwait	0.972	0.34	0.504	0.49	1
Turkey	1.546	0.23	1.802	0.20	1
Private Health	OIL→HLT		HLT→OIL		Optimal lag length
	F-statistics	p-value	F-statistic	p-value	
Egypt	1.668	0.53	1.146	0.61	6
Iran	2.441	0.45	0.848	0.68	6
Iraq	0.757	0.71	1.674	0.53	6
Saudi Arabia	0.705	0.65	0.891	0.56	5
UAE	0.763	0.70	8317.1***	0.01	6
Israel	2.845	0.17	0.590	0.71	5
Bahrain	0.486	0.78	1.214	0.44	5
Lebanon	0.183	0.95	9.565**	0.02	5
Kuwait	2.590	0.19	2.520	0.20	5
Turkey	1.834	0.29	1.205	0.44	5

Note: *, **, *** denote 1%, 5%, and 10% significance respectively. The lag length has been chosen based on minimum AIC.

In Figures 3 and 4, the frequency domain analysis are given. As it was observed in causality analysis in time domain, causality examined is two-way. Low frequencies refer to the long-run and high frequencies refer to the short-run causality. As it is observed in Figure 1, for public health expenditures, in terms of the impact of health expenditures on oil prices, Egypt and the UAE reflect causality both in the short-run and the long-run. However, the direction of the causality is from oil-prices to health expenditures in both the short and the long-run in Iraq. For Bahrain, health expenditures have an impact on oil prices within the [1.5-2.5] range interval. However, for Lebanon there is causal relation in the direction from oil prices to health expenditures in the long-run and from oil prices to health expenditures in the short-run in Bahrain.

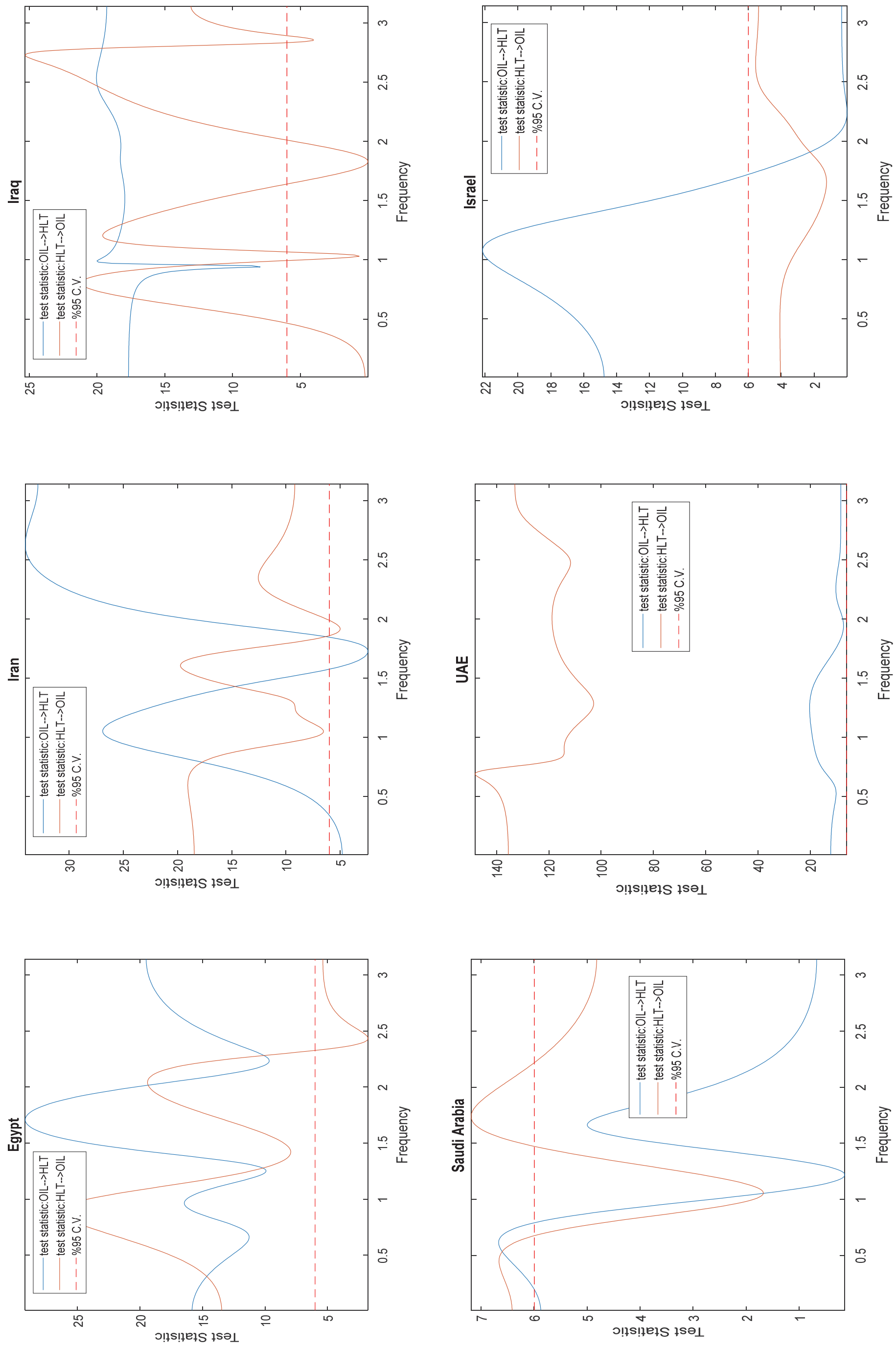
Figure 3: Frequency Domain- Public Health Expenditures[1]

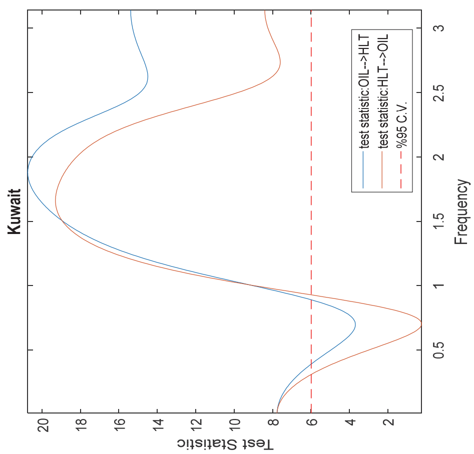


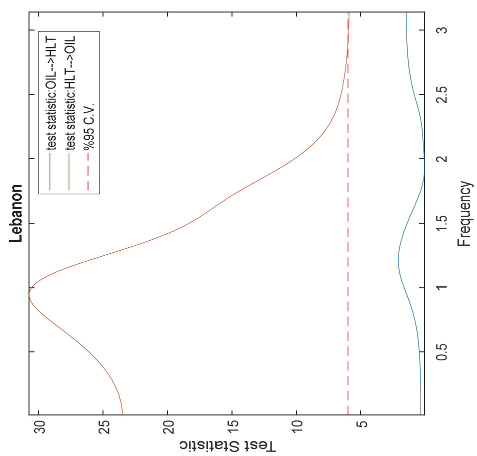
[1] Optimal lags are determined according to VAR analysis. Optimal lag length is 1 for Iran, Israel, Kuwait, and Turkey and frequency domain analysis does not work with 1 lag therefore, these countries are not included.

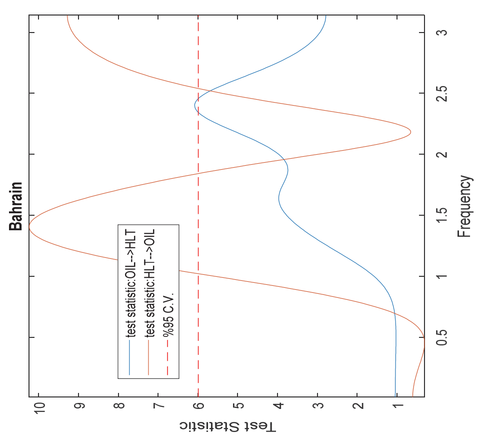
In the case of private health expenditures, Egypt, Iran, Iraq, the UAE, Kuwait and Turkey reflect the direction of the causality from oil prices to health expenditures both in the short and the long-run. Being an oil-exporting country may be associated with that causality. On the other hand, for Israel health expenditures have an impact on oil prices in the long-run. In Bahrain the range is between [1-2] and [2.5-3].

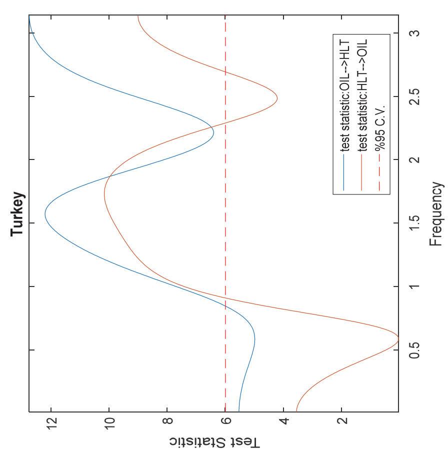
Figure 4: Frequency Domain- Private Health Expenditures




Kuwait
test statistic:OIL-->HLT
test statistic:HLT-->OIL
%95 C.V.
Test Statistic
Frequency


Lebanon
test statistic:OIL-->HLT
test statistic:HLT-->OIL
%95 C.V.
Test Statistic
Frequency


Bahrain
test statistic:OIL-->HLT
test statistic:HLT-->OIL
%95 C.V.
Test Statistic
Frequency


Turkey
test statistic:OIL-->HLT
test statistic:HLT-->OIL
%95 C.V.
Test Statistic
Frequency

5- Conclusion

In this study, the impact of the oil prices on health expenditures is investigated. By applying a GMM-system approach, a balanced panel of 10 MENA countries is collected from the period 1995 – 2014. There is no doubt that oil prices are very important for especially the countries in the MENA region, because of their impact on exports and imports. During the analysis, public and private health expenditures are separately used as dependent variables. The oil price is the independent variable, while the GDP, the inflation rate, and the exchange rate are used as control variables.

The empirical results demonstrate that the increase in the GDP leads to a 0.175 increase in private health expenditures. Moreover, it is also observed that the inflation has a negative impact. It is worth mentioning that the MENA countries analyzed in this paper often trade with each other in the region. This suggests that regional growth, and thus health expenditures are influenced by increases in the oil prices both for oil-exporting and non-oil-exporting countries. Lastly, two-way causality is investigated between oil prices and health expenditures for 10 MENA countries separately. It is observed that the majority of the oil-exporting countries reflect causality from oil prices to health expenditures, while non-oil-exporting countries do not reflect causality, regarding private health expenditures. As a conclusion, it can be argued that with the fluctuations in oil prices, oil-exporting countries may move towards a private health care (or a mixed system of private and public) with the intention to obtain greater efficiency.

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