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Volatility of Oil Revenue and the Real Exchange, Empirical Evidence from Iraq

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ABSTRACT

This paper analyses the extent to which a boom in a particular export commodity sector (i.e., oil) affects relative price of non-tradable goods against tradable goods, the real exchange rate in the case of Iraqi economy. This paper examines whether appreciation or depreciation real exchange rate does exist in Iraqi case?. It produces some empirical evidence for the explanation booming oil sector and appreciation real exchange rate. The main findings form this paper that the Iraqi economy was subject to have the appreciation real exchange rate during high oil revenue. Some of the indications of the high oil revenue, remarkably the increase of relative prices, and the real exchange rate appreciation. The study uses annual time series data sourced from home and international agencies from 1970 to 2013. Due to problem with endogeneity, the data are analyzed through the use of two stages least square.

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KEYWORDS:
Real Exchange rate, Oil Revenue, Iraq

1. INTRODUCTION

According to recent OPEC data (2023), Iraq has the fifth largest proven oil reserves in the world and some of the lowest exploration costs in the region. The oil sector is the main source of government revenue, constituting between 75 and 95 per cent of total government revenue during the period 1970-2014. Since, the price of oil is determined by the international market (exogenously), any change in the price of oil can reflect the changes in global economy. Higher oil prices enhanced local development and modernized the country, generating rapid growth in certain sectors. Over the last five decades, the increased oil revenue has caused appreciation real exchange rate, while during low oil revenue the real exchange rate depreciated. Internationally, Iraq has become one of the main strategic players in the world oil market as a result of its massive reserves and capacity of production, thereby attracting foreign investment and foreign asset ownership. Therefore, that investigating oil revenue and its effect on the whole Iraqi economy is worthy of study, as we have recently seen how declining oil prices led to economic instability in most oil exporting developing nations.

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In this paper, a model will be presented to examine the impact of a commodity export boom on relative price of non-tradable good against tradable goods, under the assumption of a small open economy based on the economic literature. In this case, changes in the real exchange rate occur via changes in the nominal price of non-tradable goods, (Edwards 1983), assuming that the price of tradable goods will be relatively constant during a booming period, or at least the rate of change in the price of tradable goods is less than the rate of change in the price of non-tradable goods. The model also assumes that the oil sector is owned by the government.

2. THE IMPACT OF VOLATILITY OIL REVENUE ON OIL ECONOMIES

The impact of the fluctuation of oil price on economic activities in oil-exporting developing nations has been examined by many scholars (such as; Looney 1990; Usui 1997; Mogotsi 2002**;** Égert and Leonard 2008, and Akpan 2009). The instability in oil price for oil-exporting developing nations may become a curse for economic activities, investment, economic growth and income distribution, appreciation and depreciation of domestic currency, instabilities in government revenue and expenditure (Yaqub 2018). The dependence on natural resources as a main source of government revenue and export earnings confronts policymakers in oil-producing developing nations with the short-term matter of how to address unpredictable fluctuation

in oil prices and revenue, and how to manage and use oil revenue (Looney 1990).

In most oil-producing developing nations, governments sector, which are substantially large, compared with the small private sector, obtain their oil revenue directly. The way governments spend this revenue constitutes a vital characteristic of the economy. Therefore, it is argued that fiscal and monetary policies depend mainly on oil revenue. In oil-exporting developing nations, fluctuations in oil revenue bring change to the real exchange rate. Since any increase or decrease in the price of oil is not permanent, the changeable nature of oil revenue injects fluctuations to the economy. If a positive shock is perceived as temporary, accumulating the budgetary surpluses in most developing countries is politically unpopular and the government will be subject to pressures to upsurge spending, particularly on public projects. For instance, during the period 1974-1978, 85% of the windfall revenues that accrued to the governments of Nigeria were spent on increasing public investment (Gelb 1988). However, the government can use this revenue to finance developmental projects in order to raise welfare. In most developing countries, inefficient public spending results in a waste of expansionary fiscal policy over time makes the economy more vulnerable to oil price volatility (Al-Yousuf 1990). This happens when the oil revenue increases (positive shock).

On the other hand, when the oil price declines (and oil revenues decrease), this typically induces downward adjustments in government spending. This adjustment could be very costly. However, cutting operating expenditures is typically unpopular, since this has negative social consequences. In addition, cutting capital expenditures would disrupt public projects, reduce the productivity of the initial investment, and trigger high social costs. Moreover, if the shock turns out to be permanent (permanent low oil price), the persistent budget deficit and the growing public debt would cast doubt on the question of fiscal policy and current account sustainability, as well as government creditworthiness. Eventually, a larger adjustment at a higher cost would be unavoidable at some point in the future. For instance, in 1986, Venezuela did not allow for any spending adjustment in response to the negative large oil shock (decline oil price). In 1989, the impending balance of payments crisis brought about substantial costly adjustments.

In contrast, it is argued that, declining oil price could have some positive consequences for oil exporting courtiers, among the positive consequences of the decline in oil price, is the fact that a decrease in the rate of extraction might preserve oil as an investment in the long run. This can enable the oil-exporting countries to preserve their oil and to bring the extraction rate to an optimum path. Besides this, the decreases in oil revenues, which accrue directly to the governments, could encourage the governments to make improvements in their economic management. Moreover, if the oil revenue is used for inefficient projects in oil-exporting countries, then a decrease in oil revenue (if this drop is due to quantity and not a decrease in oil price) is not as large as it may appear (Pritchett 2000). In contrast, it is better to produce and export less oil than to exchange further volumes for inefficient projects which drain revenue away from the economy rather than generating economic earnings.

Another issue related to wasteful current expenditure by governments is explained by (Hurlin and Arestoff 2010). Wasteful current expenditure might contain excessive spending on unnecessary expansion of government employment; huge subsidies might be given to several activities, including giving loans with a zero-interest rate, or payment of huge commissions for agents of contractors. Later, when the oil revenue declines, governments curtail these expenditures and then this can be construed as beneficial. Incremental oil is better conserved than spent in wasteful expenditure. Therefore, a fluctuation of government expenditure (either capital expenditure or current expenditure) due to fluctuation of oil revenue leads to an unstable economy, the costs of which are relatively high. On the other hand, it is argued that a negative oil shock usually encourages downward adjustments in government spending. This adjustment might prove to be very costly, as cutting current expenditures is typically unpopular due to its negative social consequences. On the other hand, cutting capital spending would disrupt public projects; this would cause a drop in the productivity of the initial investment, triggering high social costs and eventually leading to a decline in economic growth rate (Hausmann and Rigobon, 2003).

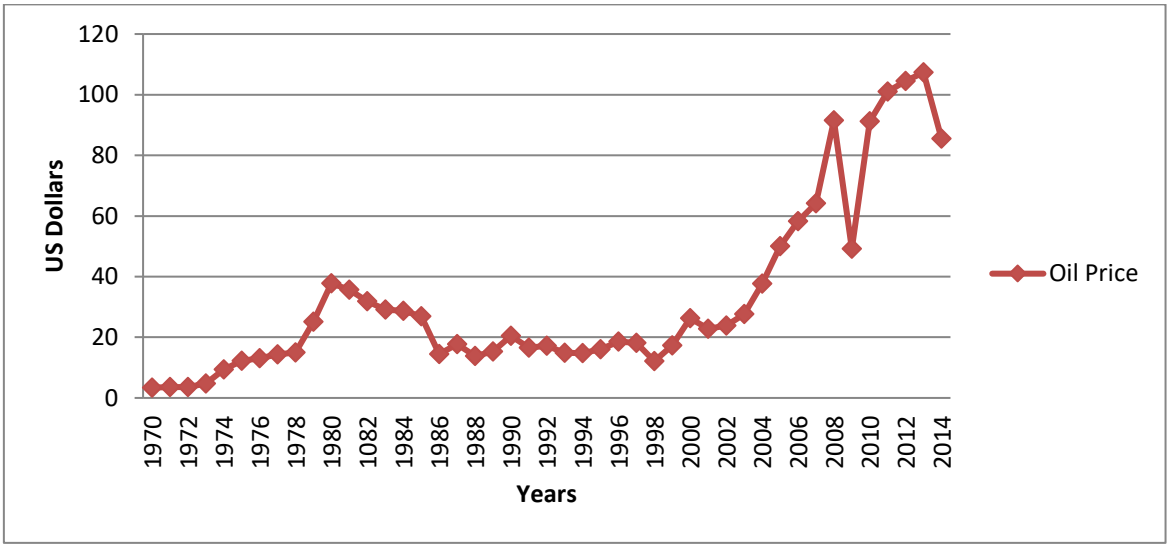
Abd-alhassan (1999) argued that fluctuation in oil revenue has negative influences on development, causing an expansion of money and inflation, emigration from rural areas to urban areas, and damage to traditional productive sectors (tradable agriculture sector). Coleman (2012) argued that high oil revenue encourages appreciation of the domestic exchange rate, which this leads to an increase in local demand and then an increase in import size.

Barnett and Ossowski (2002) argued that reliance on oil revenue, as a main resource, leads to reduced short-term fiscal management and budgetary planning, while the efficient use of public resources would be difficult. For example, in Venezuela, oil revenue accruing to the public sector dropped from 27% of GDP in 1996 to 12.5% of GDP in 1998, before rising again to 22.5% of GDP in 2000. Besides this, a change in the oil price of US $1 per barrel on an annual basis is accompanied by a variation of nearly 1% of GDP in Venezuelan public sector revenue (Ibid). Usui (2007) mentioned that the windfall accompanying an oil boom damaged the authorities' commitment to carry out necessary restructuring of immature economic sectors. Subsidies these sectors, which were easy to finance during the boom period, became very difficult to finance during a slump period. In order to avoid the results of a mismanaged oil boom, oil-

exporting developing countries need to make vital decisions about investment, saving and consumption. In addition, a diversification policy should be carried out during the booming periods.

However, a fast growth in public spending (either investment spending or operating public spending) is likely to decrease the quality of capital formation, in addition to increasing costs as a result of hastier planning and the need to progressively use more costly factors at higher growth rates. On the other hand, cutbacks mean costly cancellation or delay, with partly completed ventures yielding no production. Even if they are completed at a later date, postponement will have declined their rate of profit. Lastly, some programmes and government strategies that were put in place throughout the boom periods might prove difficult to reverse as oil income declines. For instance, restrictions on dismissing civil servants may encourage a ratchet effect in the public wage bill. Politically, it might be difficult to cut investments in the energy sector, even if declines in the world oil market decrease their profitability. "Ratchet Effects" worsen the distribution of resources.

Figure 1, the price fluctuation of crude oil during last five decades.
Spot Crude Oil Price (1970-2014 $/ per barrel)



Source: BP Statistical Review of World Energy, January 2015

In fact, some countries such as Norway, Canada, Chile, Venezuela, Ghana and Kazakhstan have implemented that strategy. Petersen and Budina (2003) confirm that Kazakhstan's stabilisation funds firstly protect the economy from the negative impacts of volatility because of a variation in government tax revenues; secondly, the stabilization fund decreases uncertainty that originates from an instability in natural resource revenues. By transferring revenues to the stabilization fund, the government can improve overall fiscal discipline. However, Mehlum et al. (2006) argued that better governance and stronger institutional arrangements play a major role in minimising the problems regarding the impact of natural resource price volatility on economic performance. Perhaps it is due to this mixed success that Sachs et al. (1995) and Sachs and Warner (1999) found no strong relationship between the slower growth of mining economies and mineral price instability.

The last four decades have demonstrated that a huge annual price movement can occur in either direction. For instance, from Figure 1, it can be seen that oil prices have been dramatically increasing over time. For example, in 1970, the price of oil was about US$3.39 p/b, and then increased to US$37.82 in 1980, but it fell again in 1986 to about US$14.44 and increased again in 2003 to US$ 27.69. The average price increased again by approximately four times from $27.69 in 2003 to $107.32 in 2013. Therefore, it can be said that oil prices have been extremely changeable, twice as volatile as those of other commodities, even when fluctuations are measured as a deviation from recent trends. Furthermore, the fluctuation of oil prices has also been very poorly predicted and it was very hard to separate out temporary fluctuations from trends (Kaufmann 1995).

In summary, the impact of oil price shocks on economic activities has been explained in this section. This section demonstrated that a dependence of a domestic economy on a natural resource sector, like oil, can significantly increase economic instability. Changing revenue due to an increase or decrease in oil price can significantly affect the macroeconomics for oil-exporting developing countries. Therefore, it can be said that the volatility of export price and, consequently, revenue is the reason why developing countries as part of their policy try to diversify their exports. To the extent that production and exports are diversified amongst different primary products and between commodities, manufactures, and service sectors, there is more stability of export earnings. In this case, any fluctuation in the market

would have a reduced impact on total exports. However, oil-exporting developing nations faced other problems, such as a changing Real exchange rate. Next section will be about real exchange rate.

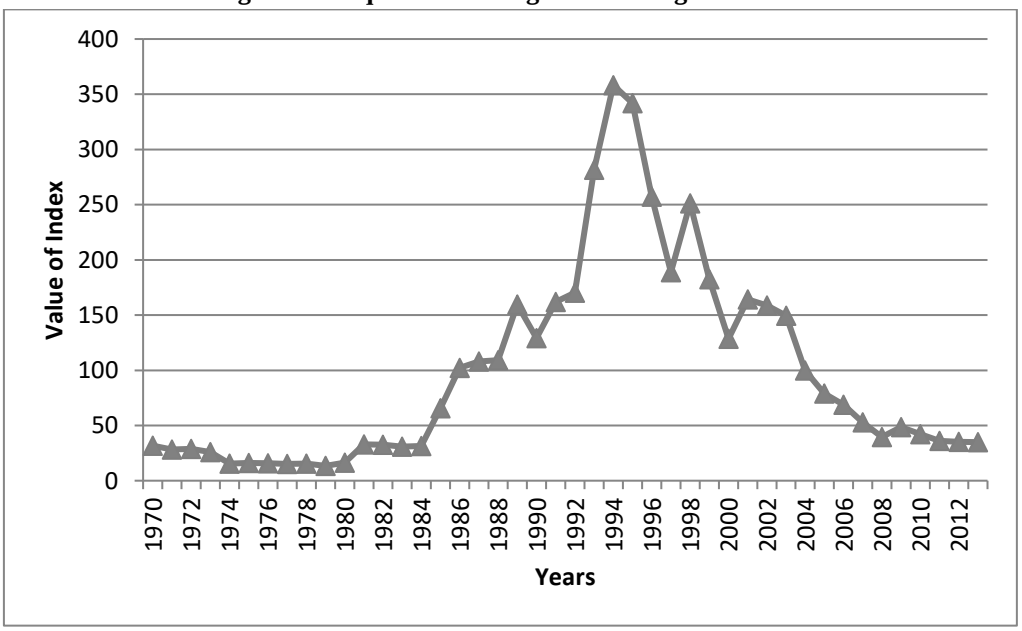
3. REAL EXCHANGE RATE (RER)

It is obvious from the theoretical and empirical literature that either a positive oil production shock or oil price shock exert a significant influence upon the structure of economy throughout real exchange rate. Therefore, the real exchange rate is the key variable that is affected by the shock of oil price and oil production, and the real exchange rate is considered as a key variable that affect the structure of economy in oil exporting countries. Thus, before analyzing the features of the Iraqi economy it is important to analyses the Iraqi RER during last four decades. Among oil exporters countries Iraq is considered as a major oil exporter, the oil price has sharply fluctuated during last four decades compare to other products. Importantly, the level of oil exports in Iraqi has also sharply fluctuated during last four decades (due to Iraq-Iran war in 1980s and economic sanction in 1990s). Thus, the RER in Iraq must be significantly fluctuated these shocks (oil price shock and oil production shock).

Figure 2 shows the appreciation and depreciation of the RER has been experienced throughout the period 1970-1979. This was associated to increased government revenue (due to increased oil prices), which led to increased real government expenditure (Crane et al. 2004). The consequences of increased real government expenditure led to an increase in the rate of inflation in Iraq. However, increased government expenditure caused the average rate of inflation in the non-tradable goods sector (domestic price) to be much higher than the average inflation rate in the tradable goods sector. Furthermore, the appreciating nominal exchange rate also made the price of international goods (tradable goods) cheaper, which means the rate of inflation of tradable goods became less and less. Thus, in the case of increasing prices of non-tradable goods due to increased real government expenditure, and decreasing prices of tradable goods due to appreciation of nominal exchange rate, the appreciation of RER will take place.

On the other hand, once the oil revenue decreased in the 1980s (due to a decline in volume of exports and falling oil prices during the period 1982-1986, and during economic sanctions in the 1990s, the RER started to depreciate sharply. Falling real government expenditure and a depreciation of the nominal exchange rate were considered as a potential reason behind the depreciation of the real exchange rate during the 1980s and 1990s (Abdlaziz et al. 2022). Decreasing real government expenditure meant a decreasing demand in tradable and non-tradable goods, which, in turn, led to a decline in the price of non-tradable goods (since its price is determined endogenously). While the price of tradable goods does not change due to a decreased demand in tradable goods (since its price is determined exogenously), its price is increased due to a devaluation of the nominal exchange rate. Thus, the average inflation rate in the tradable goods sector was higher than the average inflation rate in the non-tradable goods sector, which led to a depreciation of RER.

Figure 2. Iraqi Real exchange rate during 1970-2013



Source: Central Bank of Iraq / Statistical and Research Department / Annual Statistical Bulletin, various issues.

It is noted from Figure 2 that the sharp depreciation of RER took place during the first half of the 1990s as a result of strict economic sanctions on Iraq, which were imposed by the United Nations (UN), and the government revenue from exporting oil became almost zero. More importantly, the nominal exchange rate was devalued by around 5000%

between 1989 and 1995. This was the main factor that led to a sharp depreciation of RER during the first half of the 1990s (Alnasrawi 2002).

However, RER began to appreciate again after the Oil for Food Program (OFFP). According to this program, the Iraqi government was permitted to export a limited amount of oil in order to import foods and medicine. During the OFFP (1997-2003), the Iraqi government gained a limited amount of oil revenue and the real government expenditure increased gradually. Increased real government expenditure attributed to an increase in real income per capita and which, in turn, possibly led to an appreciating real exchange rate via differentiation of the rate of inflation between tradable and non-tradable goods.

After the lifting of economic sanctions in 2003, Iraq was allowed to export unlimited amounts of oil and the price of oil gradually increased after 2004. In addition, the volume of oil production and exports also improved to a higher level after the ruining the government had been oil sector for more than a decade. Real government expenditure, as well as an increased real income per capita, which in turn led to an increased inflation rate of non-tradable. On the other hand, due to the OFFP, the appreciated nominal exchange rate has appreciated from 1449 dinar to 1116 dinar for each US dollar. This has created cheaper tradable goods on the one hand, and increased prices of non-tradable goods sector (due to increased real income per capita) on the other hand.

Overall, one can conclude that the RER in Iraq can, in principle, appreciate (depreciate) because of two main reasons: first, because the relative price of tradable goods to non-tradable goods decreases (increases); second, because of the appreciation (depreciation) of the nominal exchange rate. On the other hand, the appreciation and depreciation real exchange rate is strongly affected by "spending effect" as economic literature analysed (Corden and Neary 1982). Therefore, the following section is about the government budget.

The Iraqi oil sector has experienced solid growth in terms of level of production and export values since the early 1970s, accompanied by unstable increases in the Iraqi real exchange rates. However, the experience of other oil-exporting countries proposes that high oil prices (oil boom period) could cause a contraction of the tradable sectors (agriculture and manufacturing sectors) mostly after appreciation RER (Corden and Neary 1982). Sachs et al. (1995) stated that countries abundant in natural resources would witness a slow growth in tradable sectors compared to poorer natural resource countries. The "Dutch disease" refers to a situation where the reversal of positive effects or negative effects of oil booms on countries hampers their economic transformation where they are extracted. This theory conceptually stemmed from the Netherlands in the 1960s due to the exploitation and tapping of the newly found gas reserves positioned in the North Sea. Revenues denominated in hard currencies were received and the local Dutch Guilder began to appreciate in value sharply. Dutch disease theory predicts that part of the boom revenues is spent on the non-tradable goods which bring about an appreciation of the real exchange rate, and which, in turn, draws resources toward the non-tradable sector from the tradable sector. Furthermore, the increased profitability of a non-tradable sector bids up the prices of factors of production, leading to a reduction of the agriculture and manufacturing sector as a result of the reduction in production factors.

4. ECONOMIC MODEL AND METHODOLOGY OF THE STUDY

The purpose of this section is to empirically estimate the behavioral equations that have been built based on Edward model and using both Ordinary Least Squares (OLS) and Two Stage Least Square (2SLS) regression methods, which are employed using time-series data from 1970-2013. The reason behind using 2SLS is related to problems with "endogeneity". Regarding satisfaction of time series data, before running the regression, it is important to satisfy properties of time series via testing stationarity, co-integration (long-term relationship), multicollinearity and some other tests.

4.1 *Specification of the real exchange rate* (oil revenue as a main variable)

One of the symptoms of the Dutch disease is an appreciation of the real exchange rate resulting from oil revenue (oil boom). The real exchange rate in oil-exporting developing countries is a main key variable that has been affected by changing oil revenue, which in turn affects the whole structure of the economy. In the economic literature, different indices have been used to measure the price of tradable and non-tradable goods. The Dutch disease theory and economic literature predict that a change in commodity exports, for instance crude oil revenue may significantly affect the appreciation and depreciation of RER. In this section, the oil revenue will be employed instead of transmission variables (GE, y and MS). Thus, the null and alternative hypothesis can be written as follows:

$$\mathrm{RER}_t = \beta_0 + \beta_1 OR_t + \beta_2 PT_t + \beta_3 DUMW_t + \beta_4 DUMS_t + \varepsilon_t \quad (1)$$

$$\frac{\beta \mathrm{RER}}{\beta P^*_{T_t}}, \frac{\beta \mathrm{RER}}{\beta DUMW_t} and \frac{\beta \mathrm{RER}}{\beta DUMS_t} > 0$$

$$\frac{\beta \mathrm{RER}}{\beta \mathrm{OR}} < 0$$

It is hypothesised that there is a negative relationship between oil revenue and real exchange rate. While there is a positive relationship between international price of tradable goods and both dummies in one hand and real exchange rate on the other hand.

$H_0: \beta_t = 0$ Null hypothesis

$H_1: \beta_t \neq 0$ Alternative hypothesis

Where $\beta_{1.....4}$ represents the coefficient of oil revenue, international price of tradable goods and both dummy variables.

- ***Statistical Results Model***

The results of the RER model are presented in Table 1, From this estimation, all explanatory variables, including dummies, are significant at 1% level and their signs are consistent with the economic theory prediction. However, before analysing the outcome of the tests, it is vital to check the following diagnostic tests: heteroscedasticity, serial correlation and normality.

Regarding the result of heteroscedasticity shows that the P value is more than 5%, which is equal to 33% and means we cannot reject null hypotheses. This demonstrates that there is a homoscedasticity (no heteroscedasticity exists) in this model. On the other hand, the serial correlation, the result below shows that the *P* value is more that 5% which is equal to 40%. We can easily accept null hypotheses, as this means there is no serial correlation in the model, which is also desirable. However, the normal distribution of the RER model, the outcome shows that the probability value is more than 5% which is equal to 21%. This means that we cannot also reject null hypotheses, meaning that the data is distributed normally. Based on the above analyses, it can be said that the model is satisfied in terms of heteroscedasticity, serial correlation and normality.

Let us start with the first explanatory variable, which is real oil price. Table 1, that shows variable oil revenue has the right negative sign, and is statistically significant at 1 percent level. A 10 percent increase in oil revenue ceteris paribus, led to approximately 11.8 percent decrease of real exchange rate. This means that the RER appreciate by 11.8 percent when the oil revenue increases by 10 percent. It is worth noting that the coefficient of oil revenue is the strongest coefficient among coefficients in this equation.

Table 1. Regression Results of the Real Exchange Rate

Dependent Variable: RER
Method: Least Squares
Date: 10/04/17 Time: 16:42
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.096168	1.159897	-2.669348	0.0112
OR	-1.186088	0.271724	-4.365046	0.0001
PT	0.724307	0.132101	5.482977	0.0000
DUMW	0.561695	0.148366	3.785885	0.0005
DUMS	0.813142	0.198182	4.103000	0.0002
R-squared	0.899927	Mean dependent var		4.155004
Adjusted R-squared	0.883699	S.D. dependent var		0.982756
S.E. of regression	0.335148	Akaike info criterion		0.796422
Sum squared resid	4.155998	Schwarz criterion		1.080270
Log likelihood	-10.52128	Hannan-Quinn criter.		0.901686
F-statistic	55.45521	Durbin-Watson stat		1.436962
Prob(F-statistic)	0.000000			

Diagnostic Test:
Heteroscedasticity = 0.33
Serial Correlation LM = 0.40
Normality (J.B) = 0.21

The estimated coefficients of international price of tradable goods (PT) are also significant at one percent level and have the expected sign (negative sign). The result demonstrates that a 10 percent increase in PT ceteris paribus, leads to depreciate of RER by 7.2 percent; this is also consistent with economic theory.

Finally, the two dummy variables are the last variables that have been included in model 2. The coefficient for the dummy variables (DUMW and DUMS) has shown significance at 1 percent level and a positive sign, which indicates that the Iraqi-Iran war and economic sanctions had a positive (depreciation) impact on RER. A 10 percent increase in the value of DUMW percent. ceteris paribus, led to increase real exchange rates (depreciate) by 5.6 per cent. While the DUMS is much stronger than DUMW, a 10 percent

increase in DUMS ceteris paribus, caused increased real exchange rate by around 8.1

All explanatory variables jointly explain about 89 per cent of the variation in the RER. Thus, the null hypothesis of all explanatory variables is rejected in favour of the alternative hypothesis.

4.2 Specification of the real exchange rate (without oil revenue),

The real exchange rate in oil-exporting developing countries is a main key variable that has been affected by changing the international oil price (oil revenue), which in turn affects the whole structure of the economy. RER is defined as the measure of nominal exchange rates multiplied by international price of tradable goods divided by non-tradable goods price. In the economic literature, different indices have been used to measure the price of tradable and non-tradable goods (see chapter five).

Real exchange rate (RER) is a second research question in this thesis. Now, based on the model, in this section, the independent variables that affect real exchange rate is, which are namely government expenditure (GE), real GDP per capita (y), money supply (MS) and the international price of tradable goods ($P^*_{T_t}$).

$$\text{RER}_t = \beta_0 + \beta_1 GE_t + \beta_2 y_t + \beta_3 MS_t + \beta_4 P^*_{T_t} + \beta_5 DUMW_t + \beta_6 DUMS_t + \varepsilon_t \quad (1)$$

$$\frac{\beta \text{RER}}{\beta \text{GE}}, \frac{\beta \text{RER}}{\beta \text{y}}, \frac{\beta \text{RER}}{\beta \text{MS}} < 0 \qquad \frac{\beta \text{RER}}{\beta P^*_{T_t}}, \frac{\beta \text{RER}}{\beta DUMW_t} \text{and} \ \frac{\beta \text{RER}}{\beta DUMS_t} > 0$$

Theoretically, it is expected that the sign of each GE, y, MS is negatively correlated agapist RER, while each of variables $P^*_{T_t}$, *DUMW* and *DUMS* are expected positively correlated against RER.

The Dutch disease theory and economic literature predict that a change in commodity exports, for instance crude oil price and also "the spending effect", may significantly affect the appreciation and depreciation of RER. For example, it is found that increased international oil prices and government expenditure (spending effect) may lead to appreciating RER and vice versa. Bear in mind the Iraqi monetary authority followed a fixed exchange rate regime against the US dollar. However, the Iraqi central bank could not equalize the market exchange rate (black market exchange rate) and official rate of exchange rate during specific periods of time in the last five decades. Therefore, it is expected that, during high oil prices (boom period), the RER has appreciated (decreased).

$$\text{RER}_t = \beta_0 + \beta_1 GE_t + \beta_2 y_t + \beta_3 MS_t + \beta_4 P^*_{T_t} + \beta_5 DUMW_t + \beta_6 DUMS_t + \varepsilon_t \quad (2)$$

It is hypothesized that there is a negative relationship between the explanatory variables (government expenditure, GDP per capita and money supply) and real exchange rate as a dependant variable. In other words, that the coefficient of $\alpha_{1.....3}$ is negatively related to the real exchange rate, while the price of tradable goods is expected theoretically has a positive relationship against RER. On the other hand, the dummy variables are expected to have a positive relationship against real exchange rate. Since the Iraq-Iran war and economic sanction are expected to depreciate (increase) RER, during these periods of times.

$H_0: \beta_{1.....6} = 0$ Null hypothesis

$H_1: \beta_{1.....6} \neq 0$ Alternative hypothesis

Where $\beta_{1.....6}$ represents the coefficient of each government expenditure and GDP per capita, money supply, price of tradable goods and both dummy variables.

- ***Statistical results***

The estimated regression for model 2 in this section is carried out. The OLS method will be applied. Table 6.8, shows the result of the regressing real exchange as a dependent variable against 6 explanatory variables including both dummies.

Table 2. Regression results of the real exchange rate (Model 2)

Dependent Variable: RER
Method: Least Squares
Sample: 1970 2013
Included observations: 44

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.694389	2.950742	1.252020	0.2184
GE	-0.889135	0.155235	-5.727669	0.0000
Y	-1.541873	0.508456	-3.032462	0.0044
MS	-0.425948	0.178548	-2.385622	0.0223
PT	0.407713	0.537083	0.759124	0.4526
DUMW	0.373406	0.170264	2.193100	0.0347
DUMS	0.915534	0.257787	3.551517	0.0011
R-squared	0.868672	Mean dependent var		4.155004

Adjusted R-squared	0.847375	S.D. dependent var	0.982756
S.E. of regression	0.383936	Akaike info criterion	1.068226
Sum squared resid	5.454043	Schwarz criterion	1.352075
Log likelihood	-16.50098	Hannan-Quinn criter.	1.173491
F-statistic	40.78939	Durbin-Watson stat	0.933042
Prob(F-statistic)	0.000000		

Diagnostic Test:
Heteroscedasticity = 0.66,
Serial Correlation LM = 0.10,
Normality (J.B) = 0.71

The outcome of the serial correlation and heteroscedasticity in this model demonstrates that the null hypotheses are not rejected because the probability value for these tests are 10% and 66% respectively which are more than 5%. This means no serial correlation and no heteroscedasticity (homoscedasticity exists) exists in this model. The normality of the data shows that the probability value is 71%, which is more than 5 percent. This means that the data is distributed normally.

Table 2 demonstrates that government expenditure, GDP per capita, money supply, price of tradable goods and both dummy variables (DUMW and DUMS) are individually and jointly statistically significant in affecting the real exchange rate. Nearly 86 percent of the variation in the real exchange rate is explained by the variation in these explanatory variables.

Let us start with the first explanatory variable, which is government expenditure. This coefficient has the right negative sign and is highly statistically significant at even less than one percent level. A ten percent increase in the government expenditure ceteris paribus, brings about a decrease (appreciate) by 8.8 percent in the RER. Many previous studies found the same results, examples of which are: Olusi and Olagunju (2005), Olomola (2006) and Yaqub (2018). The reason behind the strong coefficient of real government expenditure is related to the fact that the high percentage of government budget goes to recurrent expenditure and most of the recurrent expenditure is spent on the non-tradable goods sector. In this situation, the demand on non-tradable goods increased and the rate of its price would be larger than the rate of increase in the international price of tradable goods.

On the other hand, the coefficient for the GDP per capita variable (y) is the strongest coefficient among coefficients in model 2. Also, its sign is predicted and highly significant, even at the alpha level of 1 percent. A ten percent increase of GDP per capita ceteris paribus, caused to appreciating RER of around 15.4 percent. Therefore, it can be reasoned that GDP per capita played a statistically significant role in explaining the decline (appreciation) of RER. A very strong coefficient of GDP per capita is due, owing to the fact that most of proportion of extra income is spent on non-tradable goods which, in turn, increase its price relative to the tradable goods sector. The GDP per capita has been introduced by Edwards (1983), who found a negative relationship between GDP per capita and RER. In other words, an increase in GDP per capita caused a decrease (appreciate) in RER.

The coefficient of money supply has a negative sign which is consistent with economic theory and statistically significant at 5 percent level. A ten per cent increase in the real money supply ceteris paribus, caused a decrease (appreciation) in the real exchange rate by 4.2 percent. The real money supply behaves consistently with the standard Dutch disease literature's prediction. During times of high oil price, under a fixed exchange rate, the monetary base will surely increase and the result will be inflation. In terms of the theoretical framework, the increased money supply results in an increased demand for non-traded goods and traded goods; this is in accordance with the 'Walras' Law (Drèze 1997). As Edwards (1992) also argued, an increase in money supply becomes one of the main causes of inflation in the economy, which has experienced the increased export price. This finding is consistent with some other recent studies like Iwayemi and Fowowe (2011). The negative sign of the coefficient money supply proved that the increase in real money supply caused a greater increase in the higher domestic inflation rate than the foreign inflation rate, which resulted in the appreciation (decrease) RER (Ahmed et al. 2023).

The result for the coefficient of the price of tradable goods is consistent with the theoretical framework predictions in terms of coefficient sign. But, its *P* value is not statistically significant. A 10 percent increase in the price of tradable goods ceteris paribus, leads to an increase in the RER by 4 percent.

The sign of two dummy variables on the other hand are shown positive, this means these two events have a positive relationship against real exchange rate. The *p* value of DUMW and DUMS are statistically significant at the 5 and 1 percent level respectively. A ten percent increase in DUMW caused to increase (depreciation) real exchange rate by 3.7 percent. On the other hand, a ten percent increase in DUMS brings about 9.1 increases (depreciate) real exchange rate. A possible explanation for having a positive relationship

between both dummies against RER is related to some factors such as, low oil revenue in 1980s due to Iraq-Iran war, almost zero oil revenue in 1990s due to economic sanctions, funding government budget via printing money during both events which eventually led to the devaluation of domestic currency against foreign currencies. Eventually the real exchange rate (increased) depreciated. In overall, the null hypothesis of the coefficients of the all explanatory variables in the model 2 can be safely rejected instead the alternative hypotheses is accepted.

The previous sections were about the relative price and real exchange rates, which are affected by the oil revenue via GE, y, MS, PT in addition to two dummy variables. In the next two sections, we will test to what extent the structure of the economy has been affected by RER.

5. CONCLUSION

This paper employs a time-series technique to investigate and examine the impact of changing oil revenue on the relative prices, real exchange rates via some variables named government expenditure, GDP per capita and money supply. However, before conducting regression, the stationarity and Johannsen con-integration test have been examined. It is found that all variables are non-stationarity at level, but when they transfer to first difference they become stationarity. Stationarity, in the same order for all variables, requires a Johannsen co-integration test to be performed showing, in all equations, that there is a long-run relationship between variables. The issue of multicollinearity is also satisfactory according to VIF test .

The empirical outcomes from the above estimated equations were based on the OLS and TSLS methods. Employing TSLS in this thesis is related to the problem with "endogeneity" which does exist in both model 3 and 4. Regarding the model one, it is found that all signs of the coefficient are the right signs, according to the economic theory and also statistically significant at 1 percent except money supply. The coefficient of determination is also high which 91 percent is. This outcome strongly supported by theoretical and empirical studies .

However, the result of the RER model is slightly different, in terms of size of coefficient and level of significant. Although, all sign of the coefficient has right sign but, among all explanatory variables, the variable of PT is not statistically significant. The coefficient of determination of model 2 is also high which 86 percent is. The result of RER is consistent with Edwards' model of speculation and theoretical groundwork of Dutch disease. Moreover, the outcome of this regression suggests that, in Iraq, the real appreciation resulting from increasing oil revenue has been accommodated partially by the "spending effect" (government expenditure and money supply, GDP per capita and international price of tradable goods).

Overall, the analysis and outcome of this chapter is strongly suggestive that increased international oil prices are responsible for changing the relative price, real exchange rate and changing the structure of the economic sector from tradeable to non-tradeable. It is found that uncertainty about the international oil price implies uncertainty about the magnitude of the reduction in the tradable goods sector and enlarged non-tradable output sector. Moreover, how these changes are managed is important. In oil-exporting developing countries, the extent of the real exchange rates and structural changes will depend, among other things, on the fiscal policy response to how the oil revenue is spent, directly or indirectly by the authorities. Therefore, both fiscal and monetary policies are required to be used when oil prices increase and decrease in order to create a balance between the economic sector and expanding the production of exportable other than those of the oil sector, and at least to restore the initial structure of the pre-oil era.

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