CORVINUS UNIVERSITY of BUDAPEST

Doctoral School of Economics, Business and Informatics

Thesis Booklet

Maitham Al-Dirawi

The impact of fluctuations in the international oil markets on the Iraqi economy

Ph.D. Dissertation

Supervisor: Péter Mihályi, DSc., professor Emeritus

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1. Research background

1.1 Introdaction

Oil is one of the main sources of energy. Beginning in the 1950s, the importance of oil expanded greatly, and by 2023, oil represented about 32% of global energy consumption. While coal constituted 26%, natural gas 23%, nuclear 4%, hydro 6%, and other renewables 8% (Energy Institute, 2024). Petroleum and other liquid consumption will increase by 22% in 2050 (EIA, 2023, and OPEC, 2025a). It will remain the world's largest source of energy by 2050 (EIA, 2020). Oil, in general, was not as important as it is today. For example, in 2014, global consumption of petroleum products reached more than 34 billion barrels, worth $3.4 trillion (Rodhan & Jazz, 2022). Therefore, oil prices significantly affect the global economy and sudden changes in oil prices can have significant consequences. Booms in oil prices cause notable inflation, while the collapse of oil prices brings a slowdown in economic activity. As a result, oil prices have become highly responsive to market forces of supply and demand, resulting in an occurrence called instability of oil prices.

There is no doubt that most of the economies of oil-exporting countries, especially the rentier countries, are characterised by the lack of diversification of their economic structure, and their revenues from the sale of oil represent the primary source on which they are based in the financing of their economies. In Iraq, the second largest producer in OPEC, oil has been strategically essential to the Iraqi economy since the beginning of the 1970s. Iraq depends primarily on oil revenues, representing 90% of its public budget revenues and 98% of its total exports. Therefore, any fluctuations in oil prices would significantly affect the Iraqi economy. For example, the government was forced to reduce wages in the public sector and reduce investment spending, including stopping the establishment of new projects, funding projects under construction, and reducing current spending between 2014 and 2016, when oil prices lost 60% of their value. Also, the government devalued the Iraqi dinar by 20% when oil prices decreased by 40% between 2018 and 2020. These solutions to address the decline in oil prices are reactions that are not well studied scientifically and usually have adverse effects on social and economic aspects. Complicating the issue is the high number of government employees, which has reached 4.5 million, in addition to 3.5 million who receive retirement rights and 2.1 million who receive financial support from the

government as social security. Iraq depends on oil revenues to cover 90% of government spending, 65% of which go to paying public sector salaries, which exceed $60 billion annually.

Since the Iraqi economy depends on oil rent, fluctuations in international oil prices will directly impact the economy. In the event of price stability, the Iraqi government requires more effort to exploit oil revenues for optimal exploitation and to seek solutions to activate other non-oil sources of income and reduce the degree of dependence on oil revenues as an essential factor in advancing the wheel of economic growth by focussing on economic diversification, since dependence on one primary resource, which is oil revenues, is a significant negative economic phenomenon. Therefore, it is necessary to study the possible effects of changes in oil prices on the Iraqi economy, find scientific and academic solutions to the harmful effects of these fluctuations, and do not address them with solutions that deepen the crisis and do not alleviate it.

1.2 Research justification

Many economies have huge oil revenues but have weak economic performance. This phenomenon has been referred to in associated literature as the curse of natural resources. The problem is the failure to avoid the risks that accompany these natural resources. It is not inevitable that the abundance of oil revenues will weaken the economy. Instead, prudent management can make the economy more efficient and dynamic. The availability of oil revenues represents both an opportunity and a challenge in Iraq, as volatile oil prices present Iraq with unique challenges in managing its economy. Unfortunately, Iraq has not been able to manage these gains properly and much money has been spent without realising the desired benefits. Prudent management can make the economy more efficient and dynamic. Therefore, research questions are the basis for our choice of this topic. The researcher's task is to understand the causes of volatility in the oil markets, the extent of the Iraqi economy's dependence on oil revenues, the effect of these changes on the Iraqi economy, and finally, how to avoid them. The study will generate empirical evidence on the impacts of fluctuations in oil prices on the Iraqi economy. Therefore, this study will effectively contribute to academic literature, especially in the context of developing oil exporting countries.

1.3 Theoretical background

Literature focusing on the impact of primary commodity exports on economic growth in countries with high primary commodity exports has shown that the prices of these commodities deteriorate

relative to those of manufactured goods. If these commodity revenues are not utilized efficiently, they will harm the long-term economies of these countries.

The hypothesis, developed by Prebisch (1950) and Singer (1950), emphasizes the deterioration of the terms of trade to the disadvantage of the primary commodity price. In the long run, the prices of primary commodities rise at a slower rate compared to the prices of manufactured commodities. Therefore, a greater quantity of primary commodities must be exported to obtain the same quantity of manufactured commodities.

Prebisch (1950) and Singer (1950) asserted that the developmental stumbling blocks of developing countries stem from their dependence on the export of primary commodities. This is because the demand for primary commodities is insufficient to drive growth, as the income elasticity of demand for primary commodities is lower than for manufactured goods. On the other hand, technological progress increases the efficiency of using primary commodities, which reduces demand. The inevitable result is lower prices and a deterioration in the terms of trade over time, leading to weak economic performance in countries that depend on exporting primary commodities. (UNCTAD & FAO, 2017; Deaton, 1999).

Arezki, Hadri, Loungani, and Rao (2013) aimed to test the Prebisch-Singer Hypothesis. They examined the long- and short-term terms of trade for primary commodity prices compared to manufactured commodities. They used 25 time series, some of which extended back to 1650. They concluded that most commodity prices conform to the long-run Prebisch-Singer Hypothesis, i.e., a deterioration in the terms of trade. They also concluded that volatility has become more severe in recent times, reflecting increased instability in commodity prices. Other empirical evidence has largely confirmed Prebisch and Singer's argument regarding the deterioration in the terms of trade (Hadass & Williamson, 2003; Harvey et al., 2010; Collier & Goderis, 2007; UNIDO, 2009). Real primary commodity prices tend to decline in the long run compared to imported manufactured goods. While a recovery in commodity prices somewhat improves the terms of trade compared to manufactured goods, it does not eliminate their decline. Relying solely on the export of primary goods appears to be an impractical idea for achieving the desired economic growth.

Accordingly, other studies (Blattman et al., 2007; Hausmann et al., 2007; Chenery & Syrquin, 1975) have suggested that to avoid the adverse effects of commodity price instability, countries

should diversify their economies, shift toward industrialization, and encourage industries that reduce dependence on imports. They should also diversify exports, particularly those with high added value. These studies found that countries with a diversified export structure were better able to mitigate the adverse effects of commodity price fluctuations.

Laursen & Metzler (1950) demonstrated that a deterioration in the terms of trade leads to a deterioration in the trade balance by reducing national saving. Harberger (1950) demonstrated the effect of a decline in real income resulting from a deterioration in the terms of trade on consumption and saving behavior. The Harberger-Laursen-Metzler (HLM) Effect is commonly used to understand balance of payments deficits. It provides a good explanation of the behavior of rentier states and their vulnerability to commodity price fluctuations, and it illustrates the relationship between external shocks and the financial behavior of the country in question. Understanding commodity economic cycles and supporting "Dutch Disease" models that study the impact of resource exports on the macroeconomy.

The Harberger-Laursen-Metzler (HLM) Effect emphasizes that a decline in export prices or a rise in import prices leads to a deterioration in the terms of trade. Consequently, fewer imported goods are purchased for the same amount of exports. As a result, real income declines. Individuals attempt to maintain their consumption levels by reducing savings, and the current account deficit also increases according to the following mechanism:

Terms of Trade ↓ → Real Income ↓ → Saving ↓ → Current Account ↓

Conversely, when the terms of trade improve:

Terms of Trade↑ → Real Income↑→ Saving↑ → Current Account ↑

In oil-producing countries, when oil prices decline, the terms of trade deteriorate, export revenues decrease, and while government consumption typically remains unchanged, savings decline, creating a current account deficit. This creates a need to borrow or withdraw from foreign exchange reserves, and the local currency weakens. When import prices rise while oil export prices remain unchanged, the result is a deterioration in the terms of trade and a widening current account deficit. This deficit may be offset by external borrowing or money printing. In practice, some studies have confirmed that this effect is most pronounced in developing countries that export primary

commodities (such as oil or minerals). At the same time, it is less pronounced in advanced economies (Gruss & Kebhaj, 2017).

The Solow-Swan Model with Commodity Inputs suggests that natural resources have a direct, positive impact on GDP and an indirect impact when their returns are used to develop technology and labor (Hartwick, 1977). However, if resources are not used efficiently, the so-called resource curse will emerge. This will result in widespread administrative corruption, weakening the country's institutional structures, and diverting depleted resource revenues toward government consumption spending rather than capital formation. Furthermore, GDP declines as a result of resource depletion.

Studies based on the Solow-Swan model, which includes natural resources, have shown that an economy can maintain sustainable growth if these resources are used efficiently by investing their returns in capital formation and labor development. They have warned against long-term reliance on non-renewable resources because they are not sustainable (Stiglitz, 1974; Solow, 1974). Perhaps the best successful example of achieving optimal use of non-renewable resources is the experience of the Norwegian Sovereign Wealth Fund, which succeeded in maximizing the benefit from oil wealth and avoiding the effects of Dutch disease and the resource curse. The same is what Indonesia did during the 1970s by using oil revenues to develop infrastructure, develop and enhance the skills of the labor force, and follow economic diversification policies (Hill, 1996; Booth, 1998), while many other countries that export minerals suffer from the negative effects of the role of these revenues.

The importance of this model lies in its application to studying and evaluating economic developments in countries whose economies depend on the export of non-renewable resources. It explains the weak economic growth of these countries despite their high revenues. It is considered a successful analytical tool that pushes towards wise management of non-renewable resources to transform them into a practical element in stimulating the economy by investing part of the returns of these resources in developing material and human capital and technological advancement, which helps in diversifying the economy, developing infrastructure, and slowing the depletion of non-renewable resources. Without this, the economy remains afflicted with the resource curse and exposed to fluctuations in revenues as a result of external shocks to which the prices of these resources are exposed, which makes the economies of these countries unstable.

2. Econometric methodology

This study employed 12 economic variables through three models to assess the impact of oil price volatility on the Iraqi economy: the revenue and expenditure model (VAR model), the macroeconomic model (selected variables) (VEC model), and the exports and imports model (VEC model). Tables 1-3 provide a brief description of the variables according to the models.

Table 1: Variable description for the revenues and expenditure model

Variables	Description	Log Form
OILP	Oil prices (OPEC Reference Basket ($/barrel) (2015=100, US$)	LOILP
GOVREV	Government revenue (2015=100, BUS$)	LGOVREV
GOVEXP	Government expenditure (2015=100, BUS$)	LGOVEXP
CUEXP	Current expenditure (2015=100, BUS$)	LCUEXP
BUBDEP	Public debt (2015=100, BUS$)	LBUBDEP

Table 2: Variable description for the macroeconomic model

Variables	Description	Log Form
OILP	Oil prices (OPEC Reference Basket ($/barrel) (2015=100, US$)	LOILP
GDP	Gross domestic product (2015=100, BUS$)	LGDP
INVE	Investment (2015=100, BUS$)	LINVE
M2	Money Supply (Broad money) (2015=100, BUS$)	LM2
TOTRES	Total reserves (includes gold) (2015=100, BUS$)	LTOTRES

Table 3: Variable description for the export and import model

Variables	Description	Log Form
OILP	Oil prices (OPEC Reference Basket ($/barrel) (2015=100, US$)	LOILP
OILEXPO	Oil Exports (2015=100, BUS$)	OILEXPO
EXPO	Exports (2015=100, BUS$)	LEXPO
IMPO	Imports (2015=100, BUS$)	LIMPO

The VAR model, introduced by Sims (1980), is one of the most famous models for examining the interrelationships and causality between variables and predicting the dynamic behaviour of time series because of its flexibility and ease of use in studying the relationship between multivariate time series. The basic assumption of this model is that all variables are endogenous variables and are interconnected in their movement. Therefore, it is a system consisting of a group of endogenous variables in which the value of each variable is determined based on its lagged value, the current,

and the lagged values of the other variables in the system. In the VAR model, the causal effects are usually summarised with impulse response functions and forecast error variance decompositions.

Empirical analyses have proven that the VAR model is particularly useful for describing and forecasting the dynamic behavior of time series of economic and financial variables. Therefore, the VAR model is one of the most famous models used to demonstrate the influence of oil price volatility on macroeconomic variables. (Zhang, 2011; Jimenez-Rodriguez; 2005; Hamilton, 1983; Stock and Watson, 2001; Mork, 1989)

There are two forms of the vector autoregressions model. The first is the unrestricted formula (VAR), used when no cointegration exists between the time series under study. The second formula contains the error correction term, so this formula is known as vector error correction (VEC), which is the restricted form. It is used when the variables are stationary at the first difference, and there is cointegration between the time series under study. In addition to finding out short-run behaviour, the VECM models include cointegrating equations and error correction terms to find out long-run cointegrating relationships in addition to short-run adjustments. The VAR model can be represented as follows:

$$Y_t = \sigma + \eta_1 Y_{t-1} + \eta_2 Y_{t-2} + \ldots\ldots\ldots + \eta_p Y_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots (1)$$

Where Y_t is a n×1 vector of endogenous variables of the model, η i is a n×n matrix of coefficients, σ is a n×1 vector of constant, p represents the maximum number of lags, ε_t is a n×1 vector of the white noise process,

The VEC model can be represented as follows:

$$\Delta Y_t = \sigma + \Pi Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \ldots\ldots (2)$$

Where Δ is the first difference operator, Y_t is the vector of endogenous variables, σ is the vector of constant, ε_t is the vector of the white noise process, Π is the matrix containing the long-run parameter, The matrix Π can be expressed as a product of two matrices (Π = λ β), .λ is the vector of adjustment parameters, β is the vector of cointegration, Γi is the matrix of coefficients, Y_{t-i} is the vector of variables with the t-i lag.

According to Sims (1980), Kirchgässner et al. (2013), and Hamilton (1994). The VAR(p) models are too parameterized, and most coefficients estimated from them are not statistically significant.

The individual parameters can be difficult to interpret meaningfully and are not enough to explain the dynamic relationships among the variables. Therefore, I focused on understanding the dynamic relationships between variables in a VAR model instead of interpreting individual coefficients, usually done through impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). The main steps and the analysis of the framework for the VAR and VEC models are shown in Figure 1.

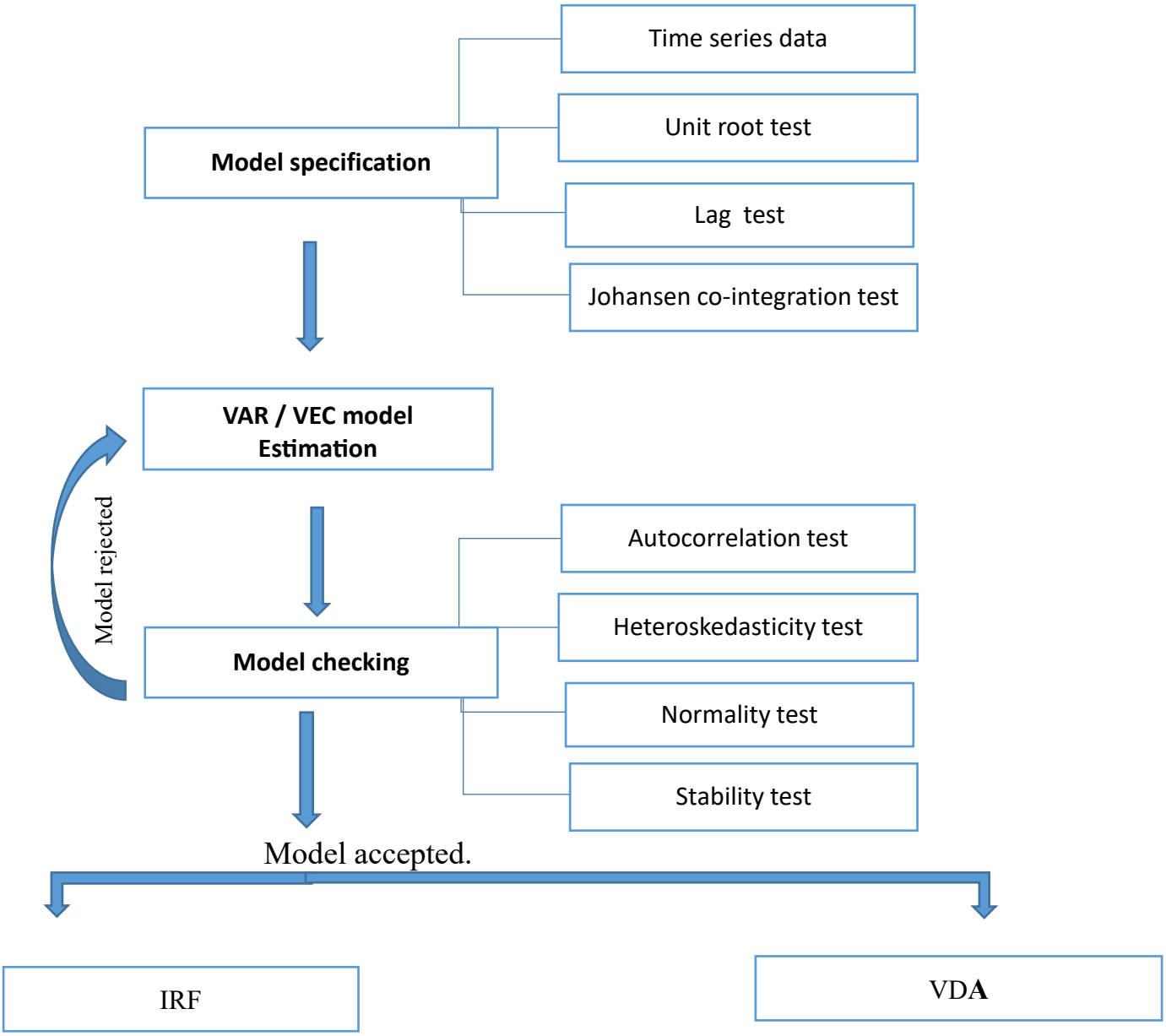

Figure 1: VAR / VEC analysis procedures

Source: adapted from Lütkepohl, 2007

3. Results of the thesis

3.1 Revenue and expenditure model

3.1.1 Impulsive response functions results

Impulse response functions were used to illustrate the dynamic relationship between public budget variables and oil price shocks. In Figure 2 below, the vertical axis shows the reaction of the variables in response to the oil price shock, and the horizontal axis shows the periods in years.

The initial response of LGOVREV to oil price shocks is positive, then begins to decline until it becomes negative in the second year, after which it becomes positive again in the fourth year and fades away in the fifth year. On the other hand, the immediate response of LGOVEXP to oil price shocks was initially positive, then began to decline until it became negative in the second year, before returning to a positive trend in the fourth year and eventually fading away in the fifth year. For LCUEXP, the immediate response was positive and gradually decreased until it became negative during the second and third years. It returned positive during the fourth year and faded in the fifth. On the contrary, the immediate response of LBUBDEP was initially negative but began to increase until it eventually faded away in the fourth year. The results of the impulse response of the revenue and expenditure model variables to oil price shocks demonstrate the significant impact of oil price fluctuations on Iraq's public budget.

3.1.2 Variance decomposition analysis results

As the results in Table 4 indicate, oil price shocks significantly impact general budget indicators in Iraq. Variance decomposition analysis shows that oil price shocks explained most of the variation in government revenues, reaching 86.96% in the first year and 70.86% in the tenth year. On average, oil price shocks explained 72.84% of the variation in government revenues over the ten years. Oil price shocks also explained 22.35% of the variation in government expenditure, 10.21% in current expenditure, and 20.84% in public debt as an average over the ten years.

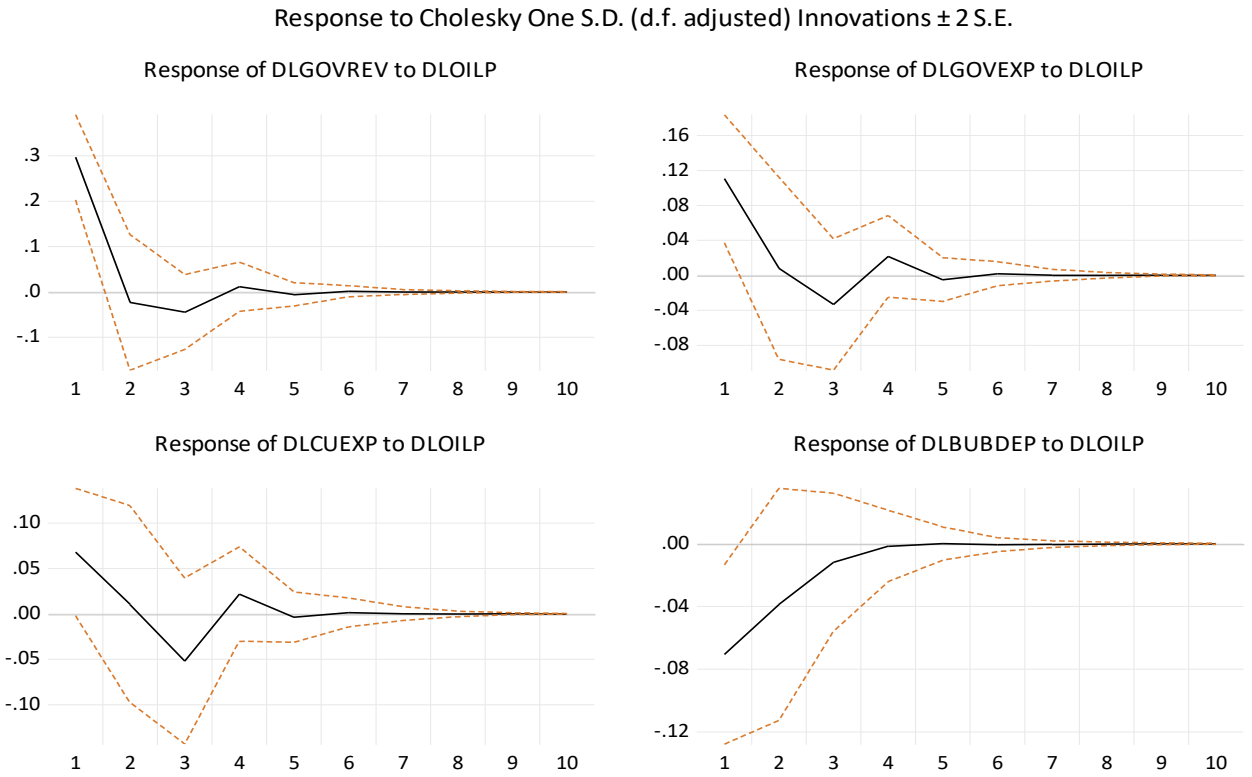

Figure 2: Impulse response function results

Source: Authors' computation

Table 4: Variance decomposition of variables explained by the oil price

Period	DLGOVREV	DLGOVEXP	DLCUEXP	DLBUBDEP
1	86.96820	29.78646	13.57376	20.99691
2	72.98228	20.04113	6.932546	21.01122
3	71.08101	19.82353	9.690004	20.88057
4	70.88428	20.18043	10.18881	20.81543
5	70.86454	20.19298	10.19626	20.80281
6	70.86314	20.19582	10.19866	20.79965
7	70.86276	20.19531	10.19849	20.79868
8	70.86258	20.19521	10.19846	20.79846
9	70.86255	20.19521	10.19848	20.79841
10	70.86255	20.19521	10.19848	20.79839

Source: Authors' computation

3.2 Macroeconomic model (selected variables)

3.2.1 Impulsive response functions results

Figure 3 shows the responses of LGDP, LINVE, LM2, and LTOTRES to innovations in oil prices, respectively. The immediate response of LGDP to the oil price shock was positive. It gradually decreases until it turns negative in the third year and continues until the seventh year when it turns positive again. In the ninth year, it turns negative, continues to be negative in the tenth year, and approaches the baseline. The same thing applies to LINVE, where the initial response is positive and gradually decreases and turns negative in the middle of the third year, then gradually increases and turns positive in the fifth year. In the seventh year, it turns negative and gradually increases until it becomes positive in the tenth year. As for the LM2, the immediate response is positive, but it gradually decreases until it approaches the baseline in the sixth year, then increases gradually and remains positive until the end of the eighth year, turning negative in the ninth and tenth years, but it is very close to the baseline. For LTOTRES, the immediate response is positive but turns negative in the third year and continues to fluctuate below the baseline until it reaches the baseline in the sixth year. It turns negative again in the seventh year and continues until the tenth year when it touches the baseline again.

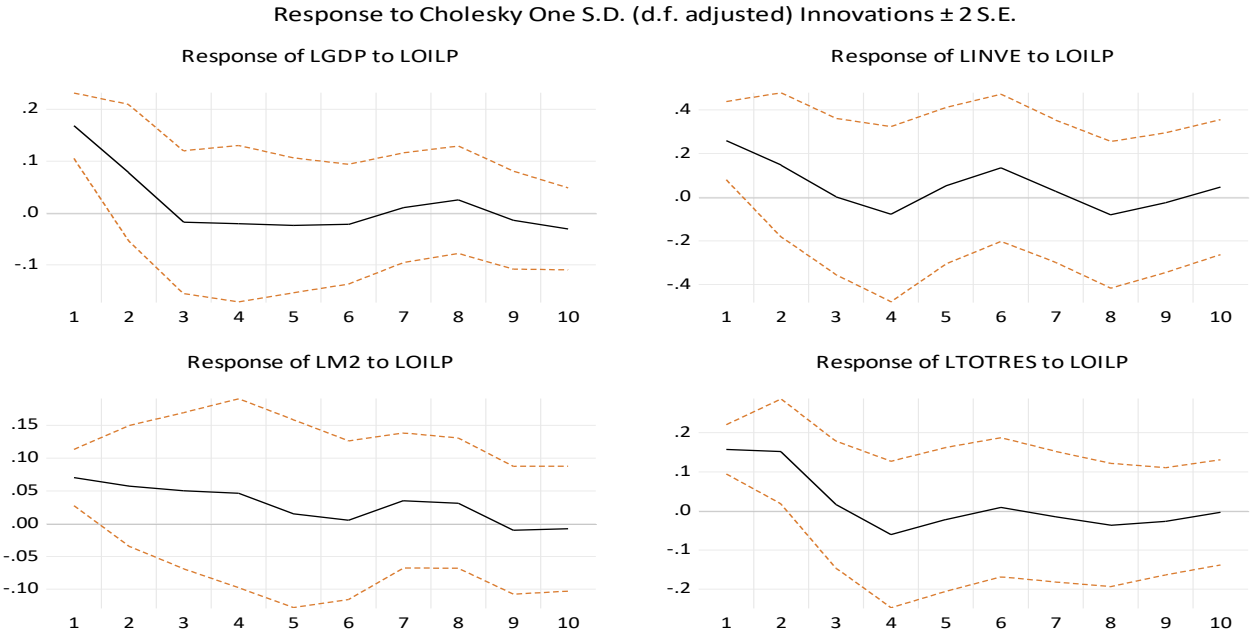

Figure 3: Impulse response function results

Source: Authors' computation

3.2.2 Variance decomposition analysis results

Table 5 reports the result of the variation decompositions for the selected macroeconomic variables: GDP, investment, money supply, and total reserves due to oil price shocks. The results indicate that oil price shocks significantly impact the variation of selected macroeconomic variables. Oil price shocks explained 85.98 % of the variation of GDP in the first year, 55.28 % in the tenth year, and on average, oil price shocks explained 59.26 % of the variation of GDP over the ten years. Regarding investment, the oil price shock explains 57.19% and 49.75% of the variation in the first and tenth years, respectively, with an average of 47.61 % over the ten years.

For the money supply, it explained 6.91% of the variation in the first year and 39.87 % in the tenth year. On average, it explained 23.34% of the variation over ten years. Finally, 50.91% in the first year and 23.88% in the tenth year of variations in total reserves were explained by oil price shocks, with an average of 27.07 % over the ten years. The evidence from the above findings suggests that changes in oil prices lead to instability of macroeconomic variables. It shows the heavy dependence on oil revenues and reflects the significant risks facing the Iraqi economy due to volatility in oil prices.

Table 5: Variance decomposition of variables explained by the oil price shock

Period	LGDP	LINVE	LM2	LTOTRES
1	85.98412	57.19794	6.910568	50.91531
2	84.63090	42.76702	8.564813	41.09790
3	64.63355	44.46445	10.45946	29.55252
4	48.31499	45.72938	15.66509	21.16409
5	46.01800	45.18113	21.76519	18.25964
6	48.62694	45.94904	26.96404	19.18317
7	51.46695	47.44883	31.18044	21.07327
8	53.30512	48.43258	34.60214	22.39143
9	54.36755	49.09628	37.43333	23.19567
10	55.28557	49.75430	39.87419	23.88471

Source: Authors' computation

3.3 Exports and imports model

3.3.1 Impulsive response functions results

The initial response of LOILEXPO to oil price shocks was positive and gradually decreased until it became negative in the third, fourth and fifth years. It turned positive after the fifth year and faded away in the eighth year. The immediate response of LEXPO was positive, then turned negative in the third, fourth, and fifth years, then became positive in the sixth and seventh years, and disappeared since the eighth year. Finally, the immediate response of LIMPO was positive and reached its peak in the second year, then gradually decreased and turned negative since the middle of the third year, then turned positive in the sixth and seventh years, but it was very close to the baseline, then died in the eighth year (see Figure 4).

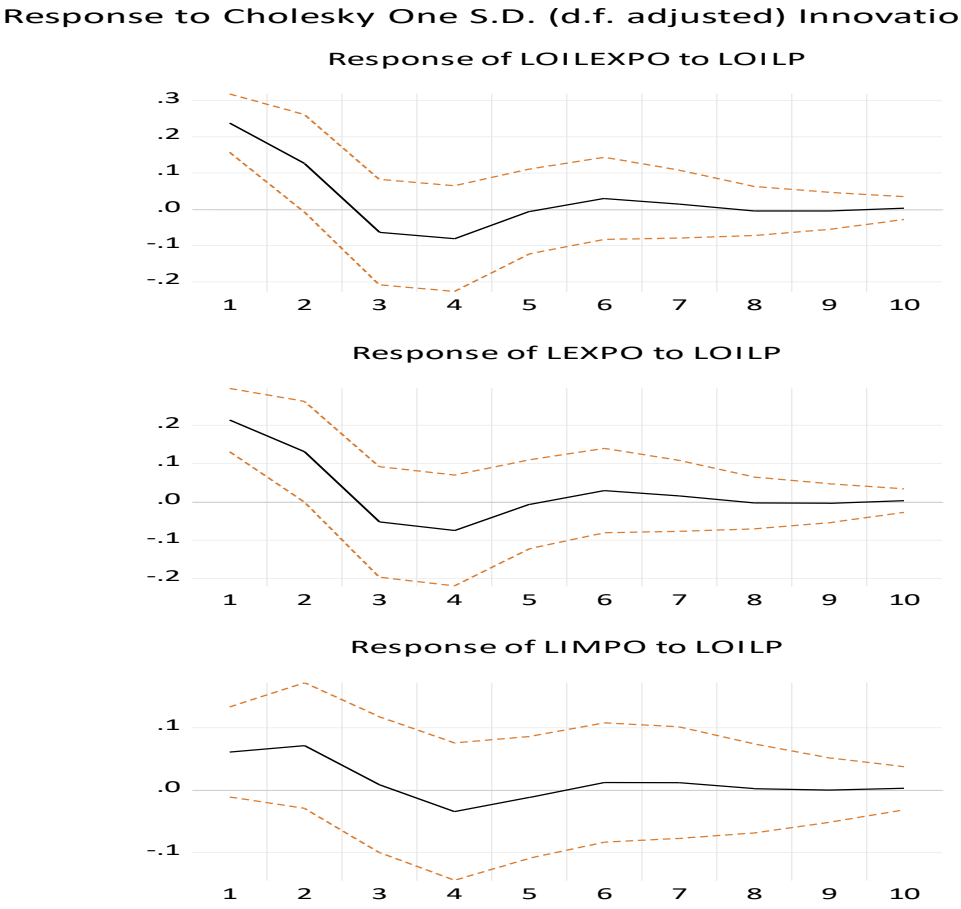

Figure 4: Impulse response function results

Source: Authors' computation

3.3.2 Variance decomposition analysis results

The results from the variance decomposition analysis of variations in exports and imports, presented in Table 6, indicate that oil price shocks significantly impact exports and imports. Oil price shocks explained more than 90.06 % of the variation in oil exports in the first year, 93.88 % in the tenth year, and on average, oil price shocks explained more than 91.5% of the variation in oil exports over the ten years. Regarding exports, it explained 83.92% of the variation in the first year and 90.93% in the tenth year, with an average of 88.02 % over the ten years. For imports, 10.68% of the variation was explained in the first year and 27.87 % in the tenth year. On average, it explained more than 25.48% of the variation in imports over the ten years.

The previous findings show the significant negative effect of oil price volatility on the Iraqi economy. Since oil exports have a crucial role in the Iraqi economy, a decline in oil prices will lead to instability and exposure to continuous fluctuations. Therefore, economic policymakers must take the necessary steps to avoid these fluctuations.

Table 6: Variance decomposition of variables explained by oil price shock

Period	LOILEXPO	LEXPO	LIMPO
1	90.06975	83.92766	10.68890
2	87.89425	85.22042	26.06000
3	89.06390	86.36119	27.66262
4	90.32327	87.26243	26.12114
5	91.60949	88.36535	26.40777
6	92.40904	89.10883	27.09548
7	92.89008	89.55257	27.47972
8	93.26992	89.87677	27.67467
9	93.60287	90.15265	27.77182
10	93.88488	90.39108	27.87348

Source: Authors' computation

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2-Maitham, A. Rodhan. (2024). *The impact of fluctuations in the international oil markets on the Iraqi economy*. World Economics & Finance Bulletin, 33, 183–195.

3-Maitham, A. Rodhan. (2023). *The effect of US shale oil production on local and international oil markets*. International Journal of Energy Economics and Policy, 13**(**4), 433–443**.**

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