Chapter 4
Oil Prices, Macroeconomic Performance, and Sustainability:
The Case of Turkey

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ABSTRACT

This chapter examines the effect of oil prices on selected macroeconomic variables such as economic growth, inflation, interest rate, unemployment, and import in Turkey. Johansen cointegration and vector error correction model (VECM) were used for yearly data from 1990 to 2020. According to the findings, the rise in oil prices in the short term has a positive impact on unemployment and economic growth, which are among the selected variables. However, it is observed that a rise in oil prices in the long term has an unstable volatile effect on selected macroeconomic variables. It is recommended that Turkey (which is a developing oil-dependent country and where macroeconomic variables are vulnerable to oil shocks) should spread its oil providers, focus on domestic energy resources, develop advanced technology to raise the usage of renewable energy resources, and implement energy-saving policies.

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INTRODUCTION

Energy is fundamental for economic and social enlargement and improving the quality of life in all countries (Keser, 2003). However, most of the world's energy sources are produced and consumed yet unsustainably of technology remains stable and total amounts of energy demand increase significantly. Energy production and consumption vary according to the development levels of countries. Energy consumption in developed countries is much higher than it is in developing countries (Amri, 2016). At the same time, energy supply and demand, which decides the unit price of important energy sources such as oil, coal, and natural gas, varies depending on the global economic and political conjuncture. When energy resources are evaluated as an alternative investment tool, energy prices are shaped by non-market factors, speculative trends, and expectations as well as domestic market dynamics. In this context, price increases will inevitably affect the energy demand of most energy-consuming countries. However, the continuous increase in energy prices at the national or international level does not mean that the energy demand or consumption in these economies will decrease in the same way. Although energy prices in a country constantly increase, energy use in this country is not as low as the price elasticity of energy demand; in other words, energy demand is less sensitive to price changes (Esen and Bayrak, 2015).

Among the energy resources, oil has an important place in the economies of the countries because the relationship between the economic performance of the countries and oil prices is quite high. It is seen that the changes in oil prices according to the types of national economies affect the country's economies positively or negatively (Mukhtarov *et al*. 2020). When the literature is examined, some studies reveal a negative relationship between oil prices and economic growth (Mahmood and Murshed, 2021; Van Eyden, 2019; Aimer and Moftah, 2016; Nazir and Qayyum, 2014; Ghalayini, 2011; Bhusal, 2010; Hanabusa, 2009; Jiménez-Rodríguez and Sánchez, 2005). Nevertheless, some studies found oil prices to increase economic growth (Alkahteeb & Sultan, 2019; Benramdane, 2017; Akinlo and Apanisile, 2015; Okoro, 2014; Berument *et al*. 2010). According to the findings of the studies in the literature, oil prices affect the economy positively in oil-importing countries, and oil prices negatively affect economic growth in developing countries (Kiani, 2011). As can be seen, the change in oil price produces different results in oil-importing and exporting countries. The increase in oil prices increases the foreign exchange income in oil-exporting countries, raises the real income level, and creates a current account surplus (Gundogan and Tok, 2019). In other words, the rise in oil prices increases the input costs, decreases the foreign exchange reserves, increases the current account deficit, and decreases real incomes in importing countries with high oil dependency (Iwayemi and Fowowe, 2011). In countries such as Turkey,

which is an oil-importing country, oil price increases can cause macroeconomic instability. It is seen that the fluctuation in oil prices has a great effect on Turkey's macroeconomic variables. In this context, the effect of oil price on economic growth, inflation, interest, unemployment, and import in Turkey is investigated in this study.

To shed light on the relationship between oil prices and macroeconomic factors, this section aims to present both theoretically and empirically the impact of the increase in oil prices on macroeconomic factors in Turkey. In other words, the presented chapter aims to provide empirically important information on the relationship between oil prices and macroeconomic performance in Turkey. For this purpose, the research question of the study is *"What is the effect of oil price on selected macroeconomic variables in the case of Turkey?"*. Particularly, the present chapter purposes to show the influence of oil prices on economic growth, inflation, interest rate, unemployment, and import. To reveal the effect of oil prices on macroeconomic variables, the period 1990-2020 was analyzed using the econometric approach. Hence, this chapter contributes to the existing literature in many ways. Firstly, it is one of initial studies that determines oil prices fluctuations while considering macroeconomic factors such as economic growth, inflation, interest rate, unemployment, and import to overcome the omitted variable bias in selected Turkey case to offer a broader outlook. Secondly, the core contribution of the present chapter is to scrutinize the influence of oil price volatilities on diverse macroeconomic variables, which employs the best available latest data set for the case of Turkey. Thirdly, this chapter utilized the effective technique that Johansen Cointegration and Vector Error Correction Model (VECM) test has been employed to find a relationship between oil prices fluctuations and selected macroeconomics variables.

LITERATURE REVIEW

There is a direct relationship between energy prices and macroeconomic variables. It is of great importance to reveal the sensitivity of macroeconomic variables to unexpected alterations in the supply and demand of the energy sector, to unexpected cuts in energy supply, energy supply prices, energy-saving, and the discovery of new energy resources. Today, the relationships between energy prices and macroeconomic variables such as gross domestic product and employment are examined in many studies in the literature. In other words, the energy prices literature generally treats the impact of macroeconomic variables on energy prices in an empirically framework context (Mukhtarov *et al*., 2020; Asaleye *et al*., 2019; Sağlam and Güresci, 2018; Narayan *et al*., 2014; Kahn and Mansur, 2013; Kilian and Vega, 2011; Tang, 2010; Edelstein and Kilian, 2007; Brown *et al*., 2003).

In this chapter, especially the impact of oil prices on macroeconomic variables was examined. Therefore, similar studies in the literature have been reviewed for different countries. Various studies are scrutinizing the effect of oil prices on macroeconomic variables. Thus, it is classified based on the relationship between oil prices and economic growth, inflation, interest rate, unemployment, and import. Furthermore, there are several empirical papers in the literature on the relationship between oil prices and economic growth. These papers found different results due to the method, time zone, and country they used. Some of the study has found a positive relationship between oil price and economic growth (Mukhtarov *et al*. 2020; Awolaja and Musa, 2017; Akinlo and Apanisile, 2015; Omojolaibi and Egwaikhide, 2013). For instance, Narayan *et al*. (2014) determined that oil prices positively affect economic growth in 16 developing countries and 21 developed countries. Differently, some studies have found that there is a negative relationship between oil prices and economic growth (Van Eyden *et al*. 2019; Aimer and Moftah, 2016; Nazir and Qayyum, 2014; Ghalayini, 2011). In another study investigating the effects of increases in oil prices on the economy, Sadorsky (1999) concluded that the said effects are quite deep, but that economic activities have little effect on oil prices. On the other hand, Brown and Yucel (2002) and Lardic and Mignon (2008), who examined the effect of the change in oil prices on economic activities, concluded that the effect of the increase in oil prices on economic activities is deeper than the effect caused by the decrease in prices.

In the literature, there are also studies examined the relationship between oil prices and inflation. For instance, Tang *et al*. (2010) found that oil prices have a positive effect on inflation in the case of China. Similarly, Qianqian (2011) and Chen *et al*. (2014) stated in their study that when oil prices increase, inflation increases. Unlike these studies, Katırcıoğlu *et al*. (2015) discovered that oil price had a negative impact on inflation. In another study in a similar direction, Zhao *et al*. (2016) indicated that fluctuations in oil prices cause inflation in the Chinese economy in the long run. Additionally, Sağlam and Güresci (2018) emphasized that price inflation is not caused by changes in oil prices in the short term; inflation has a negative impact on oil prices in the long term.

From the studies examined the relationship between oil prices and the interest rate, Tang *et al*. (2010) revealed that oil prices positively affect the interest rate in the case of China. Similarly, Wang and Chueh (2013) showed that interest rates have a positive impact on future crude oil prices, in the context of the US example. In the long term, there is a relationship in which interest rates affect the US dollar, which in turn affects international crude oil prices. As a result, international crude oil prices have a feedback effect on interest rates. With a different perspective, Wei and Guo (2016) discovered that the interest rate responds significantly to oil price shocks. In fact, interest rates decrease substantially in the second and third quarters

after oil shocks. Later the interest rates steadily rise again and lastly converge to the trend level. Therefore, the fall in interest rates caused by oil price shocks is temporary. Arora and Tanner (2013) supported this opinion. Arora and Tanner (2013) argued that the oil price is constantly sensitive to international real interest rates in the short run and it becomes more sensitive to real interest rates in the long term.

Oil prices are effective on unemployment and employment. Developing countries are seriously dependent on oil as an input to the manufacturing sector. Therefore, the increase in oil prices raises the unemployment rate. For instance, Asaleye *et al*., (2019) found in their study that the relationship between oil prices and employment is negative. Similarly, Kahn and Mansur (2013) examined the relationship between energy prices and employment for exact industries. The findings show that the increase in electricity prices increases unemployment. Differently, Dogrul and Soytas (2010) found in their study that oil prices reduce unemployment rates in the long term. In other words, oil shocks transmit oil price increases in Turkey to the labor market. Ahmad (2013) argued in his study that oil prices have a substantial effect on unemployment. It can be accomplished from the outcomes that oil prices can be used to expand the unemployment forecast in the long term.

Finally, the studies between oil prices and imports in the literature are examined. Gorus *et al*. (2019) found that oil imports are sensitive to alterations in oil prices in the long term. The rise in crude oil prices also leads to a growth in energy import prices. Therefore, the Turkish economy suffers from oil price shocks. In addition, the Turkish economy is vulnerable to oil price shocks in the market. Kilci (2019) showed that there is a causal relationship between Brent crude oil prices to energy imports in Turkey. Because energy imports constitute the largest share of the current account deficit and the increase in oil prices increases imports upwards. Differently, Marathe and Guntur (2020) looked at the effect of oil prices on imports for BRICS countries. In the example of Brazil and India, it was determined that crude oil prices and imports share a unidirectional relationship. For Russia, there is a bidirectional relationship between oil prices and imports.

While many studies conducted to date have examined the relationship between selected macroeconomic variables in developed countries, very few studies have addressed developing countries, including Turkey. For instance, Alagoz *et al*. (2017) investigated the effects of oil prices on macroeconomic variables in Turkey, China, South Africa, Mexico, Colombia, Costa Rica, Indonesia, and Kazakhstan. According to the results of the study, a one-dollar increase in the price of crude oil causes an increase of 0.04% on inflation across the countries studied. The increase in crude oil price has a negative effect on the current account balance and affects the current account deficit. In addition, there are studies in the literature on how the stocks related to crude oil prices traded in the Istanbul Stock Exchange are affected by macroeconomic variables. From these studies, Kocabiyik and Fattah (2020)

selected several indices on *Borsa Istanbul* (BIST) that are expected to be related to oil prices, and how these indices are affected by oil and other macroeconomic variables. As a result, it has been determined that the effect of oil prices is quite low, while interest rates and exchange rates have a strong effect on most indices. Akyol and Baltaci (2018) examined the effects of Credit Default Swaps (CDS) premiums, oil prices, and selected macroeconomic variables on the *Borsa Istanbul* 100 index (BIST100). In the long run, CDS premiums, oil prices, inflation rate, real interest rates, monetary expansion, and economic growth have significant effects on the BIST100 index.

In conclusion, it is clear that studies examining the relationship between fluctuations in oil prices and selected macroeconomic variables such as economic growth, inflation, interest rate, unemployment, and import are limited in the Turkish case. In addition, since the studies primarily focus on the relationship between oil prices and economic growth, due importance is not given to the relationship between the fluctuations in oil prices of other selected macroeconomic variables. This study will fill these gaps especially investigating macroeconomic variables affected by oil prices.

DATA AND METHODS

Data

The present chapter analyzes oil prices (OP) effect of selected macroeconomics variables such as economic growth (GDP), inflation (INF), interest rates (IR), unemployment (UN), and imports (IMP) throughout 1990–2020 in case of Turkey. Data were collected from the World Bank database, Turkish Statistical Institute (TUIK), and Central Bank of the Republic of Turkey (CBRT). All variables were taken in logarithmic transformed form. The gathered data were analyzed using the Eviews software program. Information about the variables employed in the analysis is given in Table 1.

Method

In this chapter, it is targeted to reveal the impact of oil prices on economic growth, inflation, interest rate, unemployment, and import by using the VECM approach, impulse response analysis, and variance decomposition tests. In this context, the Augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller, 1981) was first used to test whether the data used in the study are stationary. In the ADF test, the fixed and trend-containing model is considered. The hypotheses are;

H_0 = Variables are not stationary (Variables contain unit root)
H_1 = Variables are stationary (Variables not contain unit root)

Table 1. Variable Description

Symbol*	Variables	Definition
OIL	Oil Price	Brent Oil Price in US dollars per barrel
GDP	Economic Growth (Gross Domestic Product)	GDP per capita (Current US$)
INF	Inflation	% (Percentage)
IR	Interest Rate (Turkish Lira Deposit Interest Rate)	% (Percentage)
UEM	Unemployment	% (Percentage)
IM	Import	Million $

* Variables with natural log transformations are lOIL, lGDP, lINF, lIR, lUEM, and lIM

Then, Johansen's cointegration analysis will be used to determine whether there is a relationship/correlation between the variables (Johansen, 1988). The main regression equation to be used in practice can be expressed as follows.

$$OIL_t = \beta_0 + \beta_1 MACROVARIABLES_t + \beta_2 TREND_t + U_t \quad (1)$$

The MACROVARIABLES series consists of GDP, inflation, interest rate, unemployment, and import. Considering the possibility that the series may contain a trend, the trend variable (TREND) has been added to the model.

Finally, after determining that there is cointegration between the variables, impulse-response analysis, and variance decomposition test were applied under the assumption of Vector Error Correction Model (VECM) to scrutinize the relationship between the variables. The error correction model reveals whether a deviation in the long-run cointegrated series is corrected. This approach investigates how the series moving away from equilibrium approach the mean. In the Error Correction Model (ECM), the lagged value (ECM_{t-1}) of the error terms obtained after the Ordinary Least Squares (OLS) estimation and the differences of the series are revealed. Accordingly, the relevant model can be expressed as follows.

$$\Delta OIL_t = \alpha_0 + \alpha_1 \Delta MACROVARIABLES_t + \alpha_2 TREND_t + \alpha_3 ECM_{t-1} + \varepsilon_t \quad (2)$$

EMPIRICAL RESULTS AND DISCUSSION

In this section, the findings obtained as a result of analyzes are presented in the form of tables and figures. In this beginning, firstly, the outcomes of the ADF unit root test for whether the variables used are stationary or not are presented in Table 2.

Table 2. Findings of ADF Unit Root Analysis

Variables	I(0)		Variables	I(1)	
	t-statistics	Probability		t-statistics	Probability
OIL	-1.2356	0.8844	**Δ OIL**	-4.4358	0.0077***
GDP	-1.0639	0.9187	**Δ GDP**	-5.7163	0.0003***
INF	-1.0240	0.9253	**Δ INF**	-5.0910	0.0016***
IR	-1.9207	0.6190	**Δ IR**	-4.2777	0.0111**
UEM	-2.5143	0.3194	**Δ UEM**	-4.6781	0.0042***
IM	-1.9257	0.6164	**Δ IM**	-6.3053	0.0001***

Notes: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%.

According to Table 2, all variables are not stationary at the I(0) level. When the first differences of the variables are taken, all of them became stationary at the I(1) level. Thus, it can be tested whether there is cointegration between the variables. In the Johansen correlation analysis, the optimal lag number must first be determined. For determining the optimal lag interval in the study, a randomly selected lag interval including oil price, GDP, inflation, interest rate, unemployment, and import variables, and a Vector Auto-Regressive (VAR) model to examine the lag interval were determined. In this context, the lag interval test results obtained are displayed in Table 3.

According to Table 3, the appropriate lag length to be used to test the cointegration was chosen as VAR=0. That is, a VAR model was set up and the appropriate lag length was decided as 0 because four different criteria point in this direction. In addition, the Lagrangian Multiplier (LM) test was also applied to know whether there is an autocorrelation problem in the error terms of the VAR model. The results of the LM test are presented in Table 4.

The H_0 hypothesis of the LM test shows that there is no autocorrelation problem between the variables. According to Table 4, H_0 hypothesis is accepted since the p-value of the fifth lag is greater than 0.05. In other words, there is no autocorrelation problem between the variables. AR roots must be less than 1 to provide the stability and accuracy of the VAR model. In this context, the graph of the inverse roots AR characteristic polynomial is plotted and the result is shown in Figure 1.

Table 3. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	49.74750	NA*	1.58e-09*	-3.240555	-2.952592*	-3.154929*
1	77.05535	40.45607	3.23e-09	-2.596692	-0.580946	-1.997305
2	104.6947	28.66303	9.39e-09	-1.977385	1.766144	-0.864238
3	171.1038	39.35356	4.56e-09	-4.229913*	1.241398	-2.603006

* Specifies lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4. VAR Residual Serial Correlation LM Tests Results

Lag	LM Statistics	Probability
1	32.94297	0.6148
2	44.81666	0.1488
3	47.29172	0.0986
4	49.17625	0.0705
5	42.32404	0.2167
6	39.76817	0.3059
7	28.88789	0.7941
8	48.29265	0.0827
9	49.50990	0.0663
10	27.00562	0.8607
11	36.32206	0.4536
12	45.38180	0.1359

As seen in Figure 1, it is determined that all inverse roots are within the unit circle. Depending on this condition, it is seen that the VAR model ensures the stability condition. In addition to these, the White Test was employed to specify whether there is a problem of varying variance (heteroscedasticity problem) in the model. In the White test, the H_0 hypothesis clarifies homoscedasticity. Results of the White test are presented in Table 5.

Figure 1. Inverse Roots of AR Characteristic Polynomial

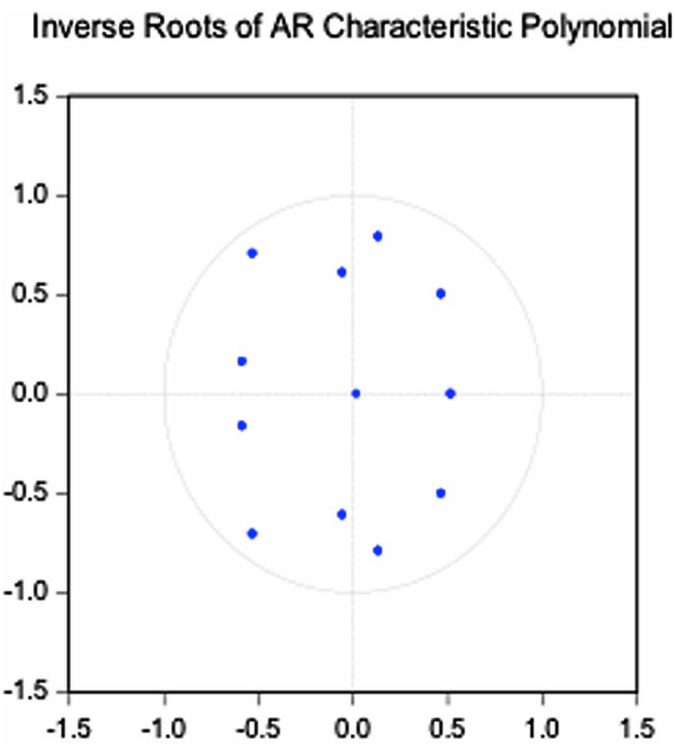

Table 5. Results of White Test

Chi-square	df	Probability (p-Value)
510.6083	504	0.4097

As seen in Table 5, the H_0 hypothesis is accepted since the p-value is greater than 0.05. That is to say, it is determined that there is no problem of varying variance (heteroscedasticity problem) in this model. Johansen's cointegration test was applied to test the cointegration relationship between the variables and the outcomes are shown in Table 6.

According to Table 6, the statistical value of the Trace test for r = 0 at the 5% significance level is greater than the table critical value. It specifies that there is a cointegration (long-term equilibrium) vector between the variables. It also shows that there are 3 cointegration equations at the 0.05 level in the trace test. In other words, there are three cointegrated vectors at the 5% significance level. Therefore, H0 (there is no cointegration between the variables) hypothesis is rejected and it is

accepted that there is a long-term relationship between oil prices and the selected variables at the 5% significance level. Since there is a cointegration relationship between the variables, the VECM model has been applied and results for the VECM residuals diagnostics test are displayed in Table 7.

Table 6. Results of Johansen Cointegration Test

H_0	Eigenvalue	λt_{race}	%5 (0,05)	p-Value
None*	0.754265	124.9879	103.8473	0.0010
At most 1*	0.652156	85.68987	76.97277	0.0093
At most 2*	0.536513	56.12183	54.07904	0.0325
At most 3	0.463040	34.59050	35.19275	0.0580
At most 4	0.345239	17.17922	20.26184	0.1259
At most 5	0.173090	5.321654	9.164546	0.2500

Table 7. VECM Residuals Diagnostics Tests Results

	Chi-square	Probability (p-Value)
X^2_{HTR}	10.6083	0.44
$Q_{AR}(2)$	14.87130	0.24
LM_{SC}	34.97475	0.51

Notes: X^2_{HTR} : Chi-squared statistic for heteroscedasticity test; $Q_{AR}(2)$: Q statistic from testing $AR(2)$ process; LM_{SC}: Lagrange multiplier statistic of serial correlation test

According to Table 7, VECM residuals do not have problems with instability, serial correlation, and heteroscedasticity issues. Therefore, the robustness of the prediction results has been demonstrated by the VECM residuals diagnostics test. To understand the impacts of shocks in oil prices on selected variables, impulse-response analysis was employed. Thus, with the impulse-response analysis, it can be seen which variables are impacted by the shocks in oil prices and how these variables react. The outcomes of the impulse-response test are given in Figure 2.

According to Figure 2, the response of the GDP to the single standard deviation shock to the oil price is positive until it reaches a stable level after the third quarter, and after the fourth quarter it is negative, and its negative effect continues in the following quarters. In other words, although the rise in oil prices caused an increase in the GDP in the first place, it had a negative effect after the fourth quarter. Although inflation

reacts negatively to oil prices in the first place, it gives a positive reaction as of the second quarter. Inflation is not stable in the face of oil prices. The rise in oil prices generally causes a reduction in exports. It shows that interest rates decreased in the first place against oil prices, but increased steadily after the third quarter. While the unemployment figures were at the highest level in the third quarter, they decreased after the oil shocks, while the unemployment figures increased again after the fifth quarter. In general, shocks occurring in oil prices do not have a stable impact on the selected variables. In other words, selected variables against oil prices react as increases or decreases according to periods. Ultimately, a variance decomposition test was also performed to see the effect of oil price on selected macroeconomic variables, and the outcomes are given in Table 8.

Figure 2. The Results of the Impulse-Response Test

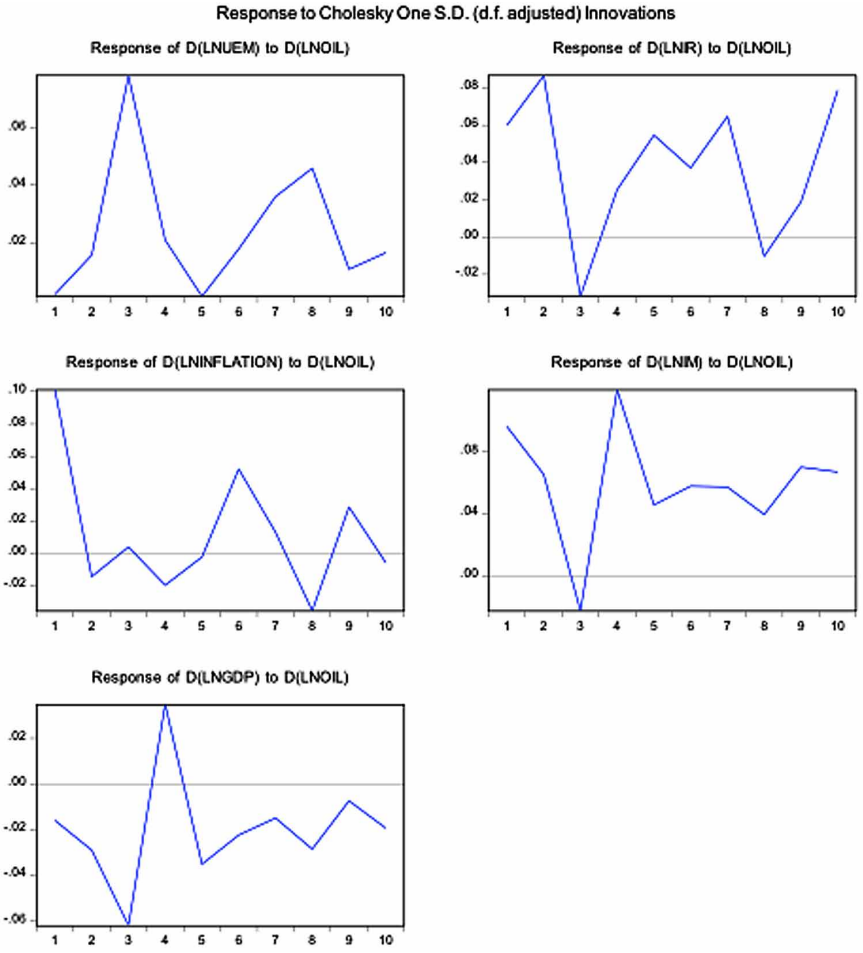

Table 8. Variance Decomposition Test Results

Period	S.E.	D(LNOIL)	D(LNUEM)	D(LNIR)	D(LNINFLATION)	D(LNIM)	D(LNGDP)
Variance Decomposition of GDP							
1	0.203982	0.586049	12.51721	4.236302	8.397877	66.57076	7.691803
2	0.267765	2.136698	18.22049	7.476823	7.724297	57.75309	6.688600
3	0.327402	6.304329	27.94724	7.004088	10.20887	43.46993	5.065546
4	0.351628	7.218810	26.33309	7.170664	9.473480	44.86229	4.941666
5	0.395371	7.035301	35.51644	6.443988	8.239804	38.45915	4.305316
6	0.421580	6.742157	33.92985	5.929724	9.640897	39.02379	4.733581
7	0.429619	6.586956	33.18210	5.632069	9.395889	40.58384	4.619151
8	0.458504	6.461621	36.81462	5.130581	9.398296	37.90340	4.291484
9	0.475777	6.125161	35.72023	5.251683	9.997900	38.32014	4.584889
10	0.487867	6.013827	35.67804	4.974488	9.447599	39.33945	4.546596
Variance Decomposition of Inflation							
1	0.279174	5.861809	1.946667	31.73855	60.45298	0.000000	0.000000
2	0.394092	4.932553	1.632968	31.02806	59.57000	0.223285	2.613140
3	0.502930	4.133480	2.144143	33.68164	57.19671	0.538853	2.305179
4	0.521785	3.694419	1.931786	29.03988	62.05122	0.959128	2.323570
5	0.588783	3.204683	1.683147	36.13837	55.57860	1.370673	2.024523
6	0.636609	3.242008	3.775283	32.51858	56.65985	2.078974	1.725299
7	0.647486	2.795399	5.268698	29.76611	56.59478	3.171363	2.403654
8	0.675207	2.987301	5.165780	30.47512	55.81988	3.189141	2.362770
9	0.697127	2.666602	6.047184	28.86783	57.44023	2.841779	2.136369
10	0.719250	2.475328	6.467574	29.52847	56.48134	2.806712	2.240583
Variance Decomposition of Interest Rate							
1	0.150554	4.604347	0.365223	95.03043	0.000000	0.000000	0.000000
2	0.208039	7.119791	0.925704	54.15975	27.26285	3.734187	6.797717
3	0.254571	4.770780	25.21235	35.34054	17.88231	10.90774	5.886287
4	0.259916	4.669257	26.53755	35.61860	16.93214	10.64936	5.593101
5	0.286893	4.527872	20.90605	37.88260	22.14613	8.871684	5.665664
6	0.308642	4.211605	24.13506	36.25190	19.31405	10.51943	5.567960
7	0.324873	5.067431	23.34459	36.11604	19.27030	10.58165	5.619982
8	0.347739	4.683279	23.28299	36.69259	19.58511	10.01680	5.739234
9	0.357684	4.466150	22.40445	38.72806	18.55890	10.21113	5.631305
10	0.372444	5.393089	21.05090	39.03422	18.86155	9.989945	5.670301
Variance Decomposition of Unemployment							
1	0.276553	0.018463	99.98154	0.000000	0.000000	0.000000	0.000000
2	0.360092	0.577249	82.71797	11.15657	0.694538	3.326756	1.526913

continues on following page

Table 8. Continued

Period	S.E.	D(LNOIL)	D(LNUEM)	D(LNIR)	D(LNINFLATION)	D(LNIM)	D(LNGDP)
3	0.413555	9.805148	77.21319	7.511354	2.217995	2.223468	1.028845
4	0.422741	10.05150	76.89206	7.327589	2.173930	2.556950	0.997974
5	0.450285	8.252212	78.91933	6.196137	1.785789	3.783705	1.062830
6	0.479758	7.463445	79.53935	6.858892	1.922056	3.297374	0.918883
7	0.490660	7.966745	79.40466	6.556526	2.135770	2.992678	0.943625
8	0.503493	8.698701	79.82194	5.795304	2.112899	2.688933	0.882226
9	0.519058	8.312183	80.16777	5.890541	2.129204	2.654248	0.846053
10	0.535788	7.863134	80.95757	5.843434	2.013548	2.510135	0.812178
Variance Decomposition of Import							
1	0.416766	22.33942	44.55119	0.192008	6.707664	26.20972	0.000000
2	0.458979	18.95165	44.00370	7.347229	4.979050	23.90661	0.811761
3	0.501751	13.15617	55.73447	6.949891	7.296966	16.21976	0.642747
4	0.540562	23.03899	48.70450	6.700258	6.688386	14.09982	0.768050
5	0.580542	19.56160	56.89422	5.690935	5.290389	11.49263	1.070223
6	0.645503	19.09105	57.74094	5.023136	7.008782	10.19285	0.943246
7	0.699530	20.16357	56.57540	4.882543	7.264082	10.08199	1.032413
8	0.707315	18.44876	60.28493	4.481673	6.420584	9.074896	1.289158
9	0.768805	19.31210	59.38222	4.265519	7.337371	8.486219	1.216576
10	0.798822	20.25149	59.14476	4.056929	7.212450	8.095152	1.239210

As presented in Table 8, the variance decomposition indicates that approximately 2% of fluctuations in Turkey's economic growth are explicated by a 58% deviation in oil price shock. Furthermore, 2% of the fluctuations in inflation is explained by 86% deviation in oil price shock. The variance decomposition of unemployment shows that the oil price shock explains around 1.8% of the unemployment change. The variance decomposition of interest rate shows that the oil price shock explains about 60% of the interest rate variation. The oil price shock explains about 33% of the import variation.

DISCUSSION

Turkey is a crude oil importing country. Therefore, it is a general opinion accepted by both the public and the government of the country that one of the important reasons for the change in other macroeconomic activities besides economic growth is the increase in oil prices. It is aimed to contribute to the literature by investigating how the changes in oil prices in oil-importing countries affect macroeconomic

activities. As a result of the analysis, the rise in oil prices in the short term has a positive effect on economic growth. When the studies in the literature are examined, Atil *et al*. (2020), one of the studies that find results in the same direction as the findings obtained in the presented study, revealed that oil prices have a positive effect on economic development. Kurihara (2015) examined the relationship between oil prices and economic growth. According to the results, increases in oil prices cause positive economic growth in the United States, European Union, and Japan. Similarly, Mukhtarov *et al*. (2020) found that increases in oil prices positively affect economic growth for oil-exporting Azerbaijan. Contrary, Sodeyfi and Katircioglu (2016) emphasized that oil price has a negative effect on commercial activities in some countries. Bouzid (2012) stated that the increase in oil prices reduces economic growth for oil-importing Tunisia. Some studies have not found any relationship between economic growth and oil prices. For instance, Idrisov *et al*. (2015) found that a steady increase in oil prices cannot affect the long-term economic growth rate. Similarly, Rostin *et al*. (2019) explored that crude oil prices do not affect economic growth in both the short and long term for Indonesia.

When the results of the studies in the literature are evaluated, increases in oil prices affect the economy positively in oil-exporting countries, while increases in oil prices in oil-importing countries have a positive effect on the economy in the short term, but negatively affect the economy in the long term. In other words, the positive effects in developing and oil-producing countries in the short term are temporary.

Another finding is that increases in oil prices have a positive effect on unemployment in the short term. Similarly, Ahmad (2013) showed the significant impact of oil prices on unemployment. In other words, oil prices have a positive effect on unemployment in the long run for Pakistan. Dogrul and Soytas (2010) found that oil prices improve unemployment forecasts for Turkey in the long run, confirming Nusair's (2020) results for the USA and Canada. Senzangakhona and Choga (2015) showed that crude oil prices are positively related to unemployment in the long run for South Africa. It is displayed in the study that unemployment returns to equilibrium in the long run when the price of crude oil changes. Contrary, Kocaarslan *et al*. (2020) indicated that the increase in oil prices causes an increase in unemployment. Cuestas and Gil-Alana (2018) pointed out that there is not much correlation between oil prices and unemployment in the short run. In other words, they revealed that the effect of oil price shocks on the natural unemployment rate proceeds in the same direction so that increases or decreases in oil prices increase or decrease unemployment rates. Trang (2017) found that the effects of the increase in oil prices on unemployment in Vietnam are uncertain.

Lastly, increases in oil prices have an unstable and a volatile effect on inflation, interest rate, and import variables in the long run. While some studies in the literature found a positive relationship between oil prices and inflation, interest rate, and import

variables, some studies found a negative relationship. Various studies reveal that there is no relationship between oil prices and these variables. For instance, Ayisi (2020) found that inflation responds asymmetrically to oil prices in the long run, but not in the short run. Choi *et al*. (2018) examined the impact of fluctuations in global oil prices on domestic inflation for 72 developed and developing countries. According to the results, a 10% increase in global oil inflation increases local inflation by about 0.4 percentage points on average. Similarly, LeBlanc and Chinn (2004) showed that increases in oil prices can have only a modest effect on inflation in the US, Japan, and Europe. In other words, increases of up to 10 percent in oil prices will lead to direct inflationary increases of about 0.1-0.8 percentage points in the USA and EU.

For the interest rate, Arora and Tanner (2013) showed the existence of an inverse relationship between the real interest rate and the real oil price in the long run. Mensi *et al*. (2013) found out important relationships between crude oil prices and interest rates. Also, co-movements between oil price and interest rate variables are particularly vulnerable during periods of anomalous political events and financial 'collapses'. When the relationship between oil prices and imports is examined, Gorus *et al*. (2019) found that oil imports are more sensitive to changes in income than to changes in oil prices in the long run. Marathe and Guntur (2020) revealed that there is a short-run relationship between imports and crude oil for BRICS countries.

As a result, it can be stated that imported crude oil prices have an impact on Turkey's macroeconomic performance. Therefore, both policymakers and businesses in Turkey should not ignore the risks arising from the above-mentioned oil price shocks.

CONCLUSION

Due to the effect of oil price fluctuations on macroeconomic variables, it is a significant issue for countries that import oil and petroleum products. In this context, this chapter examines the effects of oil price fluctuations on economic growth, inflation, interest rate, unemployment, and imports in Turkey. For this goal, the VECM method was employed for the period 1990-2020 years. First of all, the variables were stationarity with the ADF unit root test. Afterward, the Johansen cointegration test was employed to evaluate the long-term relationships between the variables. The findings revealed that there is a long-term relationship between the variables. Due to the cointegration between the variables, impulse-response and variance decomposition tests were performed under the assumption of VECM. According to the findings, the rise in oil prices in the short term has a positive impact on unemployment and economic growth, which are among the selected variables.

However, it is seen that rises in oil prices in the long term have an unstable volatile effect on selected macroeconomic variables.

In conclusion, since Turkey is an oil-importing country, the volatility in oil prices unstable affects macroeconomic variables and the Turkish economy is vulnerable to shocks/volatility in oil prices. Therefore, to ensure energy supply security, Turkey should spread its oil providers, focus on domestic energy resources, and develop advanced technology to raise the usage of renewable energy resources and should also implement energy-saving policies.

DISCLAIMER

The contents and views of this chapter are expressed by the author in her personal capacity. It is not necessary for the Editor and the Publisher to agree with these viewpoints and they are not responsible for any duty of care in this regard.

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KEY TERMS AND DEFINITIONS

Brent Oil Price: Brent oil is the fuel that the markets follow closely and directs the world oil market.

Economic Growth (GDP): Economic growth is a rise in the production of goods and services in an economy.

Import: Import, on the other hand, is the process of purchasing a product produced abroad by buyers in the country.

Inflation: The general rise in the prices of goods and services is expressed as inflation.

Interest Rate: Interest is the price of money loaned. In another definition, when a debt is borrowed over any amount, it is the remuneration process performed while paying the debt.

Macroeconomic Variables: It is expressed as indicators that a country considers to understand its economic reality compared to other countries. Basic macroeconomic data are GDP, inflation, unemployment/employment, interest rate, exchange rate, and imports.

Unemployment: Unemployment is defined as the situation in which some people want to work but cannot find a job in any economy. A person who cannot find a job is called unemployed.