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Article

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The Nexus Between Oil Price Shock and the Exchange Rate in Bangladesh

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ABSTRACT

We examine the nexus between oil price and exchange rate for Bangladesh economy by using annual data covering from 1980 to 2018. Given the stationarity properties, the Johansen cointegration and the ARDL bounds cointegration tests find a long-run cointegrating relationship between the variables. We reveal that oil price granger causes exchange rate in the long-run but not in the short-run. According to DOLS and DARDL methods, an increase in oil price appreciates exchange rate by 0.40% and 0.30%. We argue that the central bank's proper monitoring mechanism is necessary to avoid oil price's adverse effects on the exchange rate.

Keywords: Oil Price Shock, Real Exchange Rate (RER), Cointegration, Causality, DOLS, DARDL, Bangladesh.
JEL Classifications: C15, C19, C22, Q40, Q41, Q43

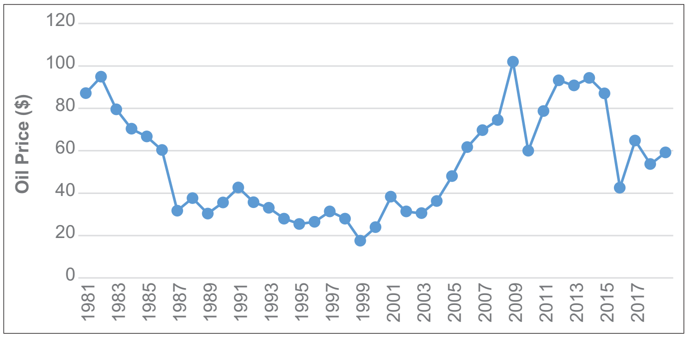
1. INTRODUCTION

As one of the most commuted goods, oil plays a crucial role in sustaining any nation's welfare, economic growth, and social modernisation. (Rahman et al., 2018). Amin (2015) argues that the consequences of the oil price shocks became more prominent after the oil crisis of 1973. Since then, many researchers have analysed the effect of this oil price shock on the global and local economies and found that oil price fluctuation is associated with major world development and gives rise to economic inflation or recession (Hussin et al., 2012). Figure 1 shows how frequently international oil price fluctuates over time from 1980 to 2018.

Oil price shock can affect macroeconomic stability through demand-side and supply-side channels (Amin and Marsiliani, 2015; Fueki et al., 2020). Bangladesh consumes a high volume of imported oil, mainly to support the transport and energy sector; hence, the effect of the fluctuation of oil price is very crucial and demands rigorous attention. The exchange rate, one of the essential macroeconomic indicators, can also affect the economy through different channels. The exchange rate and other macroeconomic indicators like inflation, interest rate, current account deficit, public debt, and trade terms can influence any country's macroeconomic settings. The exchange rate can play a vital role in those countries which are heavily dependent on international trade. Tokuo and Hayato (2016) argued that the shifts in the exchange rate regime in many countries in the 1970s caused a wave of empirical literature on the nexus between the exchange rate and macroeconomy. Figure 2 shows that the real exchange rate scenario of Bangladesh from 1980 to 2018.

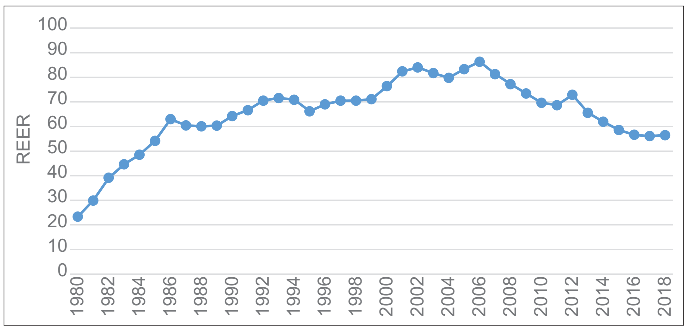
It is argued in the mainstream literature that oil price and macroeconomic soundness are highly correlated (Narayan, 2013). Firstly, any change in oil price can affect GDP, inflation, and interest rate, which are known as important indicators of a country that imports and exports oil. Secondly, any fluctuation in the international oil price influences oil importing and exporting countries' exchange rates with U.S. dollar to change direction. This happens because U.S. dollar labels a vast portion of the

Figure 1: Change in oil price from 1980 to 2018



Source: British Petroleum, 2020

Figure 2: Change in real exchange rate from 1980 to 2018



Source: World Development Indicators, 2020

international price of crude oil. The price of global oil was $42 per barrel in 2005, which increased up to $147 per barrel in July 2008 (Volkov and Yuhn, 2016).

Theoretically, higher oil price increases the cost of imported oil, puts pressure on the exchange rate, and leads to the depreciation of the local currency for the oil-importing country (Berument et al., 2010). If the oil price increases, consumers' purchasing power will decrease, causing a decrease in the demand for non-tradable goods. As the demand for non-tradable goods decreases, it reduces the country's price, which eventually depreciates the currency (Kin and Courage, 2014). These all imply that oil price acts as a crucial variable to determine the currency's strength and variation on currency price.

Many researchers have empirically discussed the linkage between oil price and exchange rates globally; however, it yields inconclusive results. As a transitional country, Bangladesh stiffly depends on oil for the development of the economy. So, it is imperative to know how Bangladesh's exchange rate is affected by oil price shocks. To our knowledge, the relationship between these two variables in Bangladesh's context has not been studied yet. So in our paper, we are going to address the following research questions:

1. Whether there is any long-run and short-run relationships between oil price and exchange rate in Bangladesh?
2. Is there any causality between these two variables?
3. How can oil prices affect the exchange rate of Bangladesh?

We run the Augmented Dickey Fuller (ADF) unit root test and the Dickey Fuller-Generalised Least Squares (DF-GLS) unit root test to check the variables' stationarity. Johansen cointegration and the Auto Regressive Distributed Lag (ARDL) Bounds cointegration tests are done to check the cointegrating relationship between the variables. The Granger causality and the Vector Error Correction Model (VECM) tests are also conducted to detect both the short-run and long-run causal relationship. The Dynamic Ordinary Least Squares (DOLS) and Dynamic Auto Regressive Distributed Lag (DARDL) estimation have been conducted to estimate the long-run coefficients of the variables. Finally, DARDL is also conducted to simulate the counterfactual effects of regressors on the response variables.

We reveal that variables are stationary at first differenced form and cointegrated in the long-run. We also find a long-run causal relationship from oil price to the real exchange rate in Bangladesh. However, in the short-run, no causal relationship is observed. According to DOLS and DARDL results, a 1% increase in oil price decreases the real exchange rate by 0.40 and 0.30%, respectively.

The rest of the paper is organised as follows. Section 2 reviews the literature review; Section 3 discusses the methodology and data. Section 4 highlights the results of the study. Finally, section 5 focuses on conclusion and policy recommendations.

2. LITERATURE REVIEW[1]

Many studies have analysed the nexus between oil prices and real exchange rates around the world. This section aims to briefly go through the existing body of literature sequencing to country and region-specific studies.

2.1. Country-specific Studies

Djebbouri (2018) studies the effect of oil price shock on Algeria's exchange rate because it controls Algeria's economy. He finds that oil price shock harms the Algerian exchange rate in Algeria remarkably. Crude oil prices shock can explain 26.25% of the variation in Algerian Dinar. So, it is recommended to make variations in Algeria's economy through higher direct investment in prime sectors of the economy where oil is not produced.

Trung and Vinh (2011) study the oil price and exchange rate relationship for Vietnam using monthly data from 1995 to 2009. They find a positive effect of oil price devaluation and economic activity. They recommend that by preventing real appreciation of Vietnam's currency, the government can support competitiveness and ensure economic growth. Lastly, they emphasise that it is helpful for the activities of the economy if inflation occurs modestly.

Hussin et al. (2012) analyses the dynamic effects of changes in oil price and macroeconomic variables on Malaysia's Islamic stock market. They use monthly data from January 2007 to December 2011 and reveal that the exchange rate is positively affected by Islamic stock prices. Besides, Islamic stock returns also influence oil prices in Malaysia. Also, oil price also affects the Islamic stock price in the short and long-run, but not vice-versa.

Kilian and Zhou (2019) find that the price of imported crude oil becomes lower if there is an external devaluation of U.S. currency

1 For methodological details, See Table A.1 in the Appendix.

related to its main partners with whom it trades. They also find the shocks of external real exchange rate manage the real value of U.S. currency. Babatunde (2015) reveals that the effect of positive or negative oil price shock on the exchange rate is not symmetric in Nigeria's case. He recommends that structural transformation would save Nigeria's economy from the damage of higher external transmit of affluence during a long period of oil price shocks due to the vast importation of crude oil.

Sharma et al. (2017) study the impact of oil price fluctuation in India's exchange rate. By collecting the daily time-series data from 16th February 2015 to 1st February 2018, they show a unidirectional relation between oil price and exchange rate in India's case. They recommend that India should include variety to its trade of oil to maintain a stable exchange rate.

Kin and Courage (2014) examine how oil prices can influence the nominal exchange rate of South Africa from 1994 to 2012. They find that a 1% increase in oil price is the reason for the 0.12% depreciation of the Rand exchange rate of South Africa. They argue that the reason behind the vulnerability of the South African economy to the oil price changes is their flexible exchange rate system. They recommend that the central bank can obtain a feasible Rand exchange rate by using the interest rate to reduce the exchange rate fluctuation.

Baboli et al. (2018) explore how the sudden fluctuations in the exchange rate and oil price can affect Iran's inflation using annual data covering from 1991 to 2016. The main findings of their study assert that the speedy growth of inflation is taking place in Iran, and one of the most crucial reasons behind this condition is the exchange rate heavily depends on the foreign exchange earnings of oil exports. It is suggested that the government manage oil incomes soundly and prevent the swift change of exchange incomes, which aggravates inflation.

Fratzscher et al. (2014) examine the nexus between the U.S. dollar and oil prices and find that there is a bidirectional relationship between the oil price and the U.S. dollar. They also argue that the equity market returns and risks also influence the oil prices and the U.S. dollar.

2.2. Panel Studies

Using monthly data from 1998 to 2012, Volkov and Yahn (2016) find that in Russia, Brazil, and Mexico, the frequent fluctuation in the exchange rate due to oil price shocks is significant. However, the shock effect is very insignificant in Norway and Canada. It takes more time for the exchange rate of Russia, Brazil & Mexico than of Norway and Canada to achieve the equilibrium which occurs due to shock in oil price.

Tokuo and Hayato (2016) conduct a multi-country analysis for Australia, Canada, Japan, Norway, and the United Kingdom. They show that the structural shocks related to oil price fluctuations are important in explaining Australia's currency (19%) and Japan's currency (35%), while it is relatively insignificant in explaining the fluctuation of the Canadian Dollar (4%) and U.K. pound (2.7%). Norway stands in the middle with 15%.

Ahmed et al. (2017) examine how oil price shocks can influence the key macroeconomic variables for India, Pakistan, Bangladesh, Sri Lanka, and Bhutan. They find that GDP and real exchange rates are cointegrated and cause each other's movement in the long-run. They also reveal that fluctuations in oil prices influence the exchange rate and macroeconomy in five SAARC nations both in the short-run and the long-run.

Narayan (2013) examines whether oil prices can play any role in forecasting the exchange rate returns in 14 Asian countries with a different exchange rate regime. He shows that the Vietnamese Dong experiences future depreciation due to the increased oil price. On the other hand, the scenario is quite the opposite in Bangladesh, Cambodia, and Hong Kong; higher oil prices result in future appreciation in these regions.

3. METHODOLOGY AND DATA

Following Babatunde (2015) and Narayan (2013), we use the real exchange rate as the dependent variable and oil price as an independent variable. The real exchange is used to avoid the effect of any change in the general price level on the exchange rate. We consider the Consumer Price Index (CPI) as a control variable. Hacker et al. (2014) and Branson (1983) point out that a rise in CPI can appreciate the real exchange rate or vice-versa. An increase in CPI can also increase the interest rate and make the interest-bearing assets more attractive. So, the foreign exchange market of an economy starts to observe an increase in demand for the local currency.

$$RER = f(OilPrice^{\vartheta}, CPI^{\mu})$$

The model's functional form can be expressed by equation (1) as a log-linear equation for the time "t." The natural logarithmic transformation of the variables is advantageous because it not only reduces the high level of skewness from the dataset but also expresses the coefficients as elasticity. It is worth mentioning that elasticity measurement is important for policy implications (Amin & Khan, 2020l; Hasanov et al., 2016).

$$LNRER_t = \vartheta LNOP_t + \mu LNCPI_t + \varepsilon_t \quad (1)$$

Where, $LNRER_t$ = log of the real exchange rate, $LNOP_t$ = log of oil price, $LNCPI_t$ =log of CPI, and ε_t = error term. Data on oil price, CPI, and REER range from 1980 to 2018 and collected from the British Petroleum and the World Development Indicators (WDI), respectively.

3.1. Unit Root Test

In the time series analysis, unit-roots can cause unpredictable results. From the graphical and empirical combination of the data, it can be shown that if the mean and variance are both changing in the same manner, there is less possibility of having unit root among variables. However, suppose both the variance and mean are not changing in the same manner. In that case, there is a high possibility of having a unit root among those variables, leading to spurious regression results. We have applied the traditional ADF test to check the variables' stationarity properties to avoid distorted results. Besides, for robustness checks, we have also employed the DF-GLS test.

3.2. Tests for Cointegration

Cointegration tests are designed to inspect non-stationary time series procedures, which essentially contain a mean and a variance that changes with passing time (Amin et al., 2018). This mechanism makes room for estimating the long-run parameters or the equilibriums of such systems that carry variables with unit roots. The Johansen test is a general multivariate concept of the ADF test. This particular generalisation mainly investigates the linear combinations of all the incorporated variables with unit-roots. It has become feasible to evaluate all of the cointegrating vectors due to the Johansen test's presence and proper estimation strategy. If "n" number variables, all with unit roots, are present in the system, then there will be maximum n-1 numbers of cointegrating vectors will be found.

On the contrary, the presence of n number of variables and n number of cointegrating vectors implies that the variables do not hold unit-roots. The reason behind this fact is the cointegrating vectors' being able to be written as the scalar multiples of every single variable alone. The Johansen cointegration test is widely used to test cointegration. This test determines how many independent linear combinations are present in the time series variables set, which generates a stationary process. This test can give the rank of cointegration. For applying this approach, we need to estimate an Unrestricted Vector Autoregression (VAR) as follows.

$$\Delta x_t = \alpha+\theta_1 \Delta x_{t-1} + \theta_2 \Delta x_{t-2} +...+\theta_{k-1} \Delta x_{t-k+1} + \theta_k \Delta x_{t-k} + u_t \quad (2)$$

This equation Δ denotes the difference operator, x is the symbol of an (n-1) number of vectors of non-stationary variables in levels, and u also represents the (n-1) number of vectors of errors that are randomly occurred. The matrix θ holds all the necessary detailed information that is essential to illustrate the relationship between the variables. If the rank of θ appears to be 0, then it can be inferred that the variables are not cointegrated. If rank, which is denoted by r, is 0, then it can be claimed that there is only one cointegrating vector. Lastly, when the scenario is "1<r<n" then it is confirmed that multiple numbers of cointegrating vectors are present. However, as Zhou (2001) mentioned that size distortion in the dataset could lead to spurious Trace, and Eigen tests statics of the Johansen procedure, we have also applied the ARDL Bounds test for cointegration based on surface regressions.

3.3. Granger Causality

The Granger causality test is used to check whether the time series variables provide meaningful insights (Amin and Hossain, 2017). Granger (1969, 1980, 1988) introduced Granger causality, and it has been widely used in empirical literature to check the causation of the variables. Suppose y and x are the concerned variables. In that case, the Granger causality test determines if the former values of y explain the present description of present values of x as per the information in former values of x. If former values of y cannot explain present changes in the values of x, then y does not Granger cause x. Four results are likely to be found in the Granger Causality test, and those are, both of the two variables don't Granger cause each other, y causes x but not vice versa, x cause y but not y don't, and both x and y Granger cause each other.

Two sets of equation have been used for conducting this study

$$x_t=\alpha_o+\alpha_1 X_{t-1} + \alpha_2 X_{t-2}+...+\alpha_i X_{t-i}+\beta_1 Y_{t-1}+...+\beta_i Y_{t-i}+u_t \quad (3)$$

$$y_t=\alpha_o + \alpha_1 Y_{t-1}+\alpha_2 Y_{t-2}+...+\alpha_i Y_{t-i}+\beta_1 X_{t-1}+....\beta_i X_{t-i}+v_t \quad (4)$$

In the case of all likelihood (x, y) series in the group, the F-statistics are the Wald statistics for the joint hypothesis, $\beta_1=\beta_2=\beta_3=\cdots\cdots=\beta_1=0$.

3.4. Vector Error Correction Model (VECM)

Engle and Granger (1987) assert that VECM is an ideal approach to identify the variables' short-run and long-run magnitude. Suppose it is found that a set of variables have one or more cointegrating vectors. In that case, VECM will be a suitable estimation technique that adjusts the changes and variation from equilibrium (Khandker et al., 2018). Causality hypothesising in a multivariate framework can be estimated by the parameters of the following VECM equations:

$$\Delta Y = \alpha + \sum_{i=1}^{m}\beta_i \Delta Y_{t-i} + \sum_{j=1}^{n}\gamma_j \Delta x_{t-j} + \sum_{k=1}^{0}\delta\Delta M^s + \sum_{l=1}^{p}\zeta\Delta N + \theta Z_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta X = \alpha + \sum_{i=1}^{m} b_i \Delta Y + \sum_{j=1}^{n} c_j \Delta x_{t-j} + \sum_{k=1}^{0} d\Delta M^s + \sum_{l=1}^{p} e\Delta N + fZ_{t-1} \quad (6)$$

Here, Z-1 is the error-correction term, which shows the variation of the variables from the long-run equilibrium condition. Error correction term avails Y and X's adjustment from the short-run towards their corresponding long-run equilibrium.

3.5 Dynamic OLS (DOLS)

Stock and Watson (1993) proposed the DOLS methods, a modified version of the OLS approach, to deal with a small sample size. It is a single equation method that is robust, and it also corrects the regressor internality by including lags and leads (Khan et al., 2018). As we have a relatively small sample size, we have applied the DOLS approach to avoid fake assessments. If Y_t is the dependent variable with regressors X_i, t_i=1,2,3…, n then,

$$Yt = \beta_0 + \beta_1 X_{1,t} + \beta_2 X_{2,t} + \ldots + \beta_K X_{k,t} + \sum \alpha_{i\Delta} X_{1,t-i} + \sum \gamma_{i\Delta} X_{2,t-i} + \ldots \sum \delta_{i\Delta} X_{k,t-I+\varepsilon_t} \quad (7)$$

3.6. Dynamic Simulation from Dynamic ARDL (DARDL)

To incorporate the dynamic simulations in our study, we have employed the Dynamic ARDL as stated in Jordan & Phillips (2018). They proclaimed that the traditional ARDL, either ECM or any other forms, might sometimes appear difficult to interpret. Moreover, conventional ARDL fails to demonstrate the short-run, medium-run, and long-run dynamic changes (Amin et al., 2020).

Also, when the motive behind the model specification addresses several kinds of complications in the society, the problems associated with the traditional ARDL get severe. To obtain a satisfactory understanding of the fundamental scenario in a given situation, the dynamic simulation of the ARDL models can play a praiseworthy role than conventional VAR based IRFs.[2]

4. RESULTS AND DISCUSSIONS

Table 1 reports the ADF and DF-GLS statistics for all the variables in their levels and first differenced forms. We reveal that the variables are non-stationary at the level, however, at the first difference for both constant and constant and trend configurations. So, our variables are integrated of order one.

The Johansen Cointegration test reveals a cointegrating relationship among the variables (Table 2). Both the Maximum Eigenvalue and the Trace test confirm that our variables have one cointegrating relationship.

Table 3 shows the F-statistics is well above the upper bound critical values indicating a meaningful long-run cointegrating relationship among the variables. We then move on to the next step and run the Granger causality test to determine the long-run direction of the causality between the variables. Table 4 reveals a unidirectional causality from oil prices to the exchange rate in the long-run. No causal relationship is found in the long-run between the real exchange rate and CPI. We have also incorporated the VECM to determine the short-run direction of the causal relationship among interest variables. The VECM results can be depicted in 5.

The result reported in Table 5 gives a different kind of intuition from the long-run causal direction regarding the real exchange rate and oil price linkage. The VECM results assert no short-run causal relationship between oil price and exchange rate. One of the prime reasons in this regard can be that the effect of energy-related fluctuations[3] may not immediately be seen in the macroeconomic variables due to the time-lag effect (Amin and Khan, 2020). In

2 Please see Jordan and Phillips (2018) for more details on Dynamic Simulation from ARDL model.

3 Energy-related fluctuations refer to all types of changes covering from consumption, price, institutional reform, etc.

Table 1: Stationary properties of the variables

ADF				
Variable	Level		First difference	
	Intercept	Intercept and trend	Intercept	Intercept and trend
LNRER	−1.96	−2.26	−7.28***	−7.40***
LNOP	−2.25	−2.03	−3.37***	−3.47***
LNCPI	3.07	−3.24	−4.12***	−4.87***
DF-GLS				
Variable	Level		First Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
LNRER	−1.65	−1.91	−7.15***	−7.48***
LNOP	−0.76	−1.11	−1.90**	−3.45**
LNCPI	−0.56	−1.33	−1.70*	−4.92***

***, **, and *Refer significance level at 1, 5, and 10%, respectively. Critical values are not reported for the sake of brevity; however, it can be delivered on request

Table 2: Johansen cointegration test results

Trace test					
Null	Alternative	Trace statistic	95% critical value	P-value	Conclusion
r=0	r=1	26.77	29.79	0.10	1 Cointegrating equations at 10% level
r<=1	r=2	4.76	15.49	0.83	
r<=2	r=3	0.09	3.84	0.75	
Maximum eigen value test					
Null	Alternative	Max-Eigen statistic	95% Critical value	P-value	Conclusion
r=0	r=1	22.01	21.13	0.03	1 Cointegrating equation at 5% level
r= 1	r=2	4.68	14.26	0.78	
r= 2	r=3	0.09	3.84	0.75	

Table 3: ARDL bounds cointegration test results

Criteria	Value	10%		5%		1%		P-value	
		I (0)	I (1)	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
Model F-static	4.75	2.32	3.55	3.00	4.46	4.72	6.74	0.01	0.04
Model T-static	-3.56	−1.60	−2.66	−1.97	−3.08	−2.75	−3.04	0.00	0.02

Table 4: Granger causality results

Variable	Null hypothesis	F static	P-value	Conclusion
Causality test statistics between LNRER and LNOP				
LNRER	LNOIL does not cause LNRER	6.80	0.001	LNOIL causes LNRER
LNOP	LNRER does not cause LNOIL	0.10	0.95	
Causality test statistics between LNRER and LNCPI				
LNRER	LNCPI does not cause LNRER	0.13	0.87	No causality
LNCPI	LNRER does not cause LNCPI	2.08	0.14	

Table 5: VECM results

Variable	Null hypothesis	Chi-squared static	P-value	Conclusion
Causality test statistics between LNRER and LNOP				
LNRER	LNOIL does not cause LNRER	3.55	0.28	No causality
LNOP	LNRER does not cause LNOIL	6.16	0.11	
Causality Test Statistics between LNRER and LNCPI				
LNRER	LNCPI does not cause LNRER	0.04	0.83	No causality
LNCPI	LNRER does not cause LNCPI	0.17	0.67	

the case of Bangladesh, due to the floating peg regime[4], the real exchange rate does not change in the concise run due to the oil price fluctuations as it needs time to readjust in the market due to the bureaucratic process.

To understand the magnitude (i.e., elasticity) of the effect of oil price and CPI on the real exchange rate, we have applied DOLS and DARDL long-run estimation techniques (Table 6). The DOLS estimation result shows that if the oil price increases by 1%, the real exchange rate will decrease by 0.40%. In DARDL, we also get a negative and significant coefficient, but with a higher significance level (5%), which is –0.30. It indicates that if the oil price rises by 1%, the exchange rate will drop by 0.30%. However, the coefficient of CPI is not significant at all. So, we highlight that any CPI changes will not change the real exchange rate significantly in Bangladesh.

The long-run estimation result is consistent with Narayan (2013). As Bangladesh is an oil importing country, in the long-run, any increase in the oil price decreases (appreciates) the real exchange rate. [5] We argue that when there is an upsurge in the international oil price, Bangladesh's current account[6] observes a large distortion as net export earnings decreases from the stable (anticipated) value. The net export earning decreases due to higher spending (such as providing huge import subsidy) for importing fossil fuel. Therefore, the real exchange rate needs to appreciate to reduce foreign reserve outflow and improve the non-oil trading scenario.

As DARDL allows us to simulate the counterfactual effects of regressors on the response variable, we have conducted a simulation analysis where counterfactual shocks are given in the oil price to observe the real exchange rate's behaviour. Figure 3 shows that although a negative 1 standard deviation shock increases (depreciates) the real exchange rate, a positive 1 standard deviation shock decreases (appreciates) the real exchange rate. The effects from both of the shocks tend to remain till t=10. From t=11, the effects start to stabilise in the economy.

Novel CUSUM test results of each variable used in the proposed model of the analysis can be seen from Figure 4. The CUSUM test results of each variable show that the plots stay within the boundary of 5 percent critical value, indicating that the model is stable both in terms of systematic and sudden movements. The estimated

Table 6: Long-run estimation results

DOLS		DARDL	
Variables	Long-run coefficients	Variables	Long-run coefficients
LNOP	−0.40* (0.30)	LNOP	−0.30** (0.16)
LNCPI	0.53 (0.44)	LNCPI	0.58 (0.24)
LNRER(-1)	--	LNRER(-1) (ECT)	−0.53***(0.15)
Adj-R^2	0.76	Adj-R2	0.70
J-B	1.27	J-B	2.23
AC	2.94	AC	0.11

***, **, and *Show significance at 1, 5, and 10%, respectively. Standard errors are in Parenthesis. J-B and AC refer Jarque-Bera and Autocorrelation tests. Both tests have been done in the residuals of the regressions. DARDL has been obtained after 5000 simulations

Figure 3: Dynamic simulations

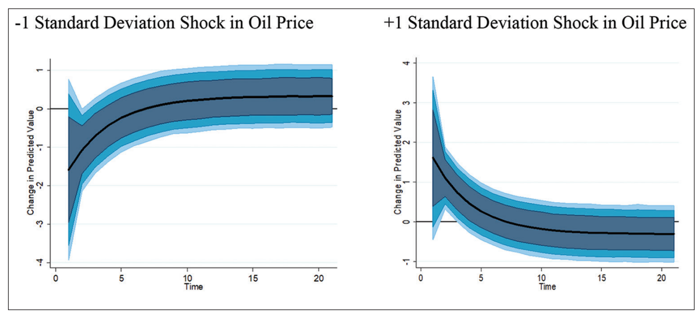
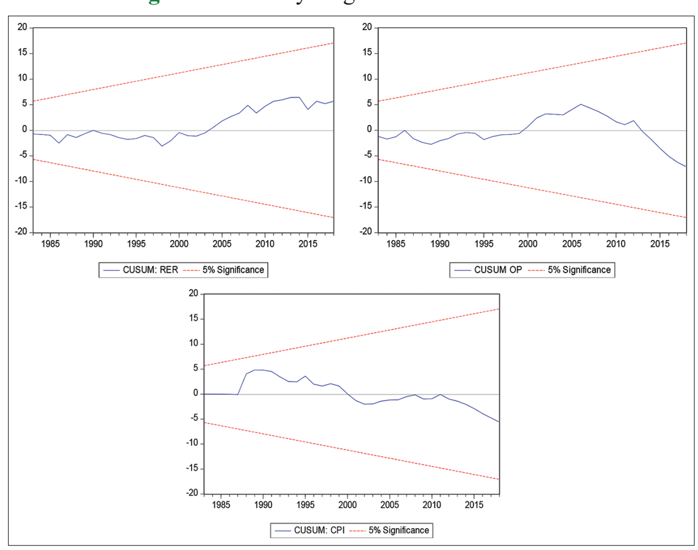


Figure 4: Stability diagnostics of the variables



4 An exchange rate determination approach, where a legislative institution fixes the rate around a certain value. However, the approach still allows small fluctuations, usually within determined ranges, resulting small flexibility in the currency exchange market.

5 Real exchange is calculated as $NER(\frac{PL_{USA}}{PL_{BD}})$. Therefore, negative sign in the regression refers to the appreciation of Taka against USD. For more details, please see Narayan (2013); Javaid (2011); Edwards (1989); World Bank (2019)

6 Current account=Net earnings+Net investment+Cash transfer

model has been also verified with conventional diagnostics tests reported in Tables 6.

5. CONCLUSION

Since the mid-1950s, oil has been started to be considered as the essential source of energy, and it has become a stimulus for the rapid growth of the industrialised nations across the whole world. The frequent fluctuation of oil prices can affect the economy through various macroeconomic channels, and arguably, the exchange rate is the most crucial of all those channels. There is a growing interest in finding out how the oil price can affect the exchange rate and, ultimately, the whole economy.

The motive behind conducting this study has been to explore the linkage between oil prices and the exchange rate in Bangladesh. In this regard, we have considered the time series annual data for 1980 to 2018 and applied recent robust econometric techniques. Upon analysing empirical findings, we argue that an upward trend in the oil price leads to a decrease (appreciation) in Bangladesh's exchange rate in the long-run. On the other hand, oil price has no impact on the real exchange rate in the short-run.

We recommend that the government should adopt optimal policies to minimise oil price shocks' adverse effects to achieve the Sustainable Development Goals (SDGs) in Bangladesh. More focus should be given on minimising the negative consequences of oil price fluctuation towards the macroeconomic variables like the exchange rate. The Bangladesh Bank should closely monitor the oil price so that if there is any positive shock in the oil price, necessary steps can be taken to dissolve the adverse effect on the exchange rate quickly.

Amidst the devastating outbreak of Covid-19, it is forecasted that there is no probability of experiencing any upward movement in the oil price till 2024 (OECD, 2020).[7] Moreover, the oil price has dropped below the average level of the last 5 years due to worldwide lockdown to reduce the spread of COVID-19. Therefore, a portion of the money that is allocated for importing oil will be saved for the next few years. The saved money can be invested in other priority sectors of Bangladesh's economy like health, education, and, most importantly, the social security to improve the living standards as well as achieve overall stability during this pandemic[8].

We like to extend the analysis by including more control variables in this study and conduct a sector-specific analysis for a more robust result. A region-wise comparison can also be made by employing a regression for other South Asian countries.

7 See Economic Outlook 2020. http://www.oecd.org/economic-outlook/june-2020/

8 Please see Amin (2020). https://thefinancialexpress.com.bd/views/reviewing-existing-energy-policy-1596637310

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APPENDIX

Table A.1: Reviewed literature

Authors	Region	Time Period	Methodology	Results
Trung and Vinh (2011)	Vietnam	1995 to 2009	VAR,Cointegration techniques	Oil Price → Economic activity ER →Economic activity (ER has a larger effect than oil price)
Volkov and Yahn (2016)	Canada, Norway, Russia, Brazil and Mexico	September 1998 to August 2012	GARCH-M framework, VECM framework	Significant causality Russia: Oil price→ ER Brazil: Oil price→ ER Mexico: Oil price→ ER Insignificant causality Norway: Oil price→ ER Canada: Oil price→ ER
Hussin et al. (2012)	Malaysia	January 2007 to December 2011	VAR method, Co-integration analysis, Multivariate Granger causality test, Impulse Response Function (IRF)& Variance Decomposition analysis (VDC)	Oil Price→ Islamic stock price (+) (significant) (both SR and LR) ER → Islamic stock Price (-) (insignificant) (SR only)
Kilian and Zhou (2019)	United States	Monthly data from 1973.2 to 2018.6.	Structural VAR	ER → Oil Price (-) (ER ↑→ OP ↓)
Djebbouri (2018)	Algeria	1980 to 2017	Johansen test of cointegration , VECM , VAR ,Impulse response function, Variation Decomposition(VDCs), Augmented Dickey Fuller	Oil Price →ER (-)
Babatunde (2015)	Nigeria	January 1997 to December 2012	Unit roots – Dickey Fuller test, Cointegration test, VAR model	Oil Price →ER (+)
Sharma et al. (2017)	India	16th February, 2015 to 1st February, 2018	Granger Non Causality	Oil Price →ER
Kin and Courage (2014)	South Africa	1994 to 2012	Generalized Autoregressive Conditional Heteroscedasticity (GARCH) test, Augmented Dickey Fuller test, Normality test and Heteroscedasticity test: ARCH	Oil Price →ER (+)
Baboli et al. (2017)	Iran	1991-2016	VAR	Oil price → Inflation because, oil price → ER
Tokuo and Hayato (2016)	Australia, Japan, Canada, UK and Norway	Monthly data of 2009 from Killian index	VAR	Oil price → ER in Australia (by 19%) Japan (by 35%) Canada (by 4%) UK (by 2.7%) Norway (by 15%)
Ahmed et al. (2017)	5 Countries of SAARC	1982 to 2014	Impulse response function (IRF), Forecast error variance decomposition method (FEVDM), Structural vector auto regression (SVAR) and Johansen and Juselius (1990) co integration method	Oil Price →ER
Fratzscher et al. (2014)	United States	Daily data for 2 January 2001 until 19 October 2012	VAR model and Heteroskedasticity	Oil Price ↔ ER
Narayan (2013)	14 Asian countries	1990 to 2012	GLS-based time series predictive regression model	Vietnam: -Oil Price → ER (+) (Oil Price↑→ ER↑) Bangladesh: Oil Price→ER (-) Cambodia: Oil Price→ ER (-) Hong Kong: Oil Price→ ER (-) (Oil Price↑→ ER↓)