



Effect of Oil Price Shocks on Macroeconomic Stability in Indonesia

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ABSTRACT

This study adumbrate the nexus between macroeconomic stability in the ambit of price level or inflation and oil price shocks using yearly data from the Indonesia economy spanning 1960 to 2023. The study leverage on combination of some analyses including FMOL, DOLS, CCR and finds that oil price shocks exert influence on indecision economy from 1970 to 1996 but no significant influence between 1997 and 2022. Exchange rate is major factor to reckoned with for the periods between 1997 and 2022 while the policy of asymmetric effect of oil price shock in the short run paved way for diversification of the economy. The initial response of real GDP, exchange rate, inflation, trade openness to a shock in oil price is positive while interest rate respond negatively.

Keywords: Oil price, Inflation, Real GDP, Interest rate, Trade openness, macroeconomic stability, Indonesia

I. Introduction

Government is relevant in any society for provision and preservation of enabling economic environment where the economic activities strive. One prominent yardstick of measuring economic stability in any country is general price level captured by inflation. Inflation has always been a prominent concern of policy makers and its effects on the government and the governed are taken as paramount concern of all and sundry. As a yardstick of measuring economic stability over time, a persistent upward rise in general price level will definitely exert an asymmetric effects on government policy and people way of life over time to shape their expectation of their value of money.

Meanwhile, oil price shocks could be positive in the ambit of surge or hike in oil price. It could be negative in the purview of plunge, diving or decrease in oil price. The associated short run effects and the long run impacts of the unexpected price divergences varies significantly and astronomically between countries that depend extensively on oil or petroleum earnings for their foreign reserve or

foreign earning and exchange conservation. The ends results are often asymmetrical depending on the economy's peculiarities and profile most especially the economy synergy of possibility coupled with her export portfolio combination.

Besides, the expressed dichotomy between the short run effects and the long run impacts are also function of policy responses packages put in place to address the divergences in prices and swiftness in response mechanism without prejudice to lag polarization and dimension. Some economies may be at mercy of exogenous oil price gyration induced only from outside the system while other economies count the price shocks as blessing to replenish the economic profile generally. Those economies that use petroleum export as complement to other vibrant export commodities always grab the golden benefit of changes in prices of oil as time of adjustment mechanism is very swift, prompt if not even instantaneous. The positive spill over effects are often tailored to economic diversification to shift the frontier of the economic fortune, economic growth and development consistently.

Meanwhile, study of Jubril and Halace (2019) has revealed that the sudden hike in oil process are often associated with real output increase or growth. Money supply increase is not unconnected with oil price surge with minimal or infinitesimal upward trend in the real effective exchange rate but downward trend in inflation rates and short run interest rates.

Going forward, the Indonesian economy kicked started her passion for economic growth and development in 1960 on rough terrain with feeble economic indicators profile. Inflation rate was astronomical inform of treble digit. In 1966, inflation profile dovetailed to 1136% macrotrend (2024). Bank Indonesia BI (2013).

Again, the Indonesian economy had hydra headed economic challenges to combat with. The population profile of the country in 1966 was 103,561,105 at annual growth rate in population put at 2.38% at the same year. Macrotrends (2024). Besides, one is only tempted to go on voyage of discovery to scrutinise what could be the data of life



expectancy in Indonesia economy in 1960 compared to her counterpart country in that year and what is the asymmetrical position in 2024. The data depicted life expectancy of Indonesia and Nigerian economies in 1960 to be 46.32 years at growth rate of 1.36% and 36.73 years at growth rate of 1.280% respectively. These data however become 72.50 years with growth rate of 0.240% and 56.05 years with growth rate of 0.550% respective in 2024 Macrotrend (2024).

The study on effects of oil price shocks on macroeconomic stability in the ambit of inflation can be utilized in economic analysis or use as abstraction of economic model to shift new frontier of knowledge in order to appreciate the nexus of oil price shocks on macroeconomic stability in general. Above all, the remainder of the paper is fragmented where the second section anchors the literature review on the nexus of oil price shocks and macroeconomic stability with special concentration on inflation. In sequence, the third section presents the data and methodology employed in the research. Section four is devoted to the empirical outcome and finding while the last section or the fifth section presents conclusion, suggestion as well as policy implication in general.

II. LITERATURE REVIEW

Theoretical literature review are replica with myriads theories on linkage of oil price shocks and macroeconomic stability. The challenges mooted in the theoretical underpinning the nexus of oil price shocks and macroeconomic stability hurled and sparked a lot of empirical studies which illuminated the marginal area of gaps.

Yusuff and Abdul-Latif (2013) employed an ARDL Bound test to investigate the effects of world oil prices changes on Economic growth and Energy Demand in Malaysia for the period between 1975 and 2000. The study found that there was a long run relationship between economic growth, energy demand and employment in the long run.

Degiamakis et al (2018) investigate whether oil prices and stock markets move in opposite direction or in tandem. The study employed analytical survey and reviewed plethora studies to arrive at their findings. The study found three types of asymmetric specification which are positive and negative oil price returns, scaled oil price increases and decreases, and the third is net oil price increase.

Adeleke et al (2019) carried out their study on crude oil price shocks and macroeconomic performance in African's oil-producing countries. The study employed a panel structural vector autoregression model and found that structural inflation always accompany sharp plunge in oil prices more

than monetary inflation as both investment and outputs dwindled astronomically. The study concluded among other that Dutch disease is not unconnected with Africa's oil producing countries, and that inflationary behaviour is not symmetric to asymmetric oil price shocks.

Baek and Choi (2020) carried out their study in the ambit of fluctuations in crude oil prices. The thrusts of their paper are on the symmetric and asymmetric effects on crude oil price fluctuations in relation to Indonesia. They employed non-linear autoregressive distributed lag (ARDL) mechanism with objective of testing the effects of crude oil process fluctuations. The findings of the study states that the oil price shocks have asymmetrical effects on the real exchange of the Indonesian economy in the long run. The study then concluded that there is asymmetrical effects of oil price shocks in the long run while symmetrical effect prevails in the short run.

Moreso, Darmawan et al (2020) premised their empirical study on the effect of crude oil price shocks in Indonesia stock market performance. The authors utilized vector error correction model (VECM) to study the nexus between Brent crude oil price and the seven stock market indices. They found that crude oil price shocks affect the Indonesia stock market performance directly via co-integration mechanism.

Wang et al (2020) employed a time-varying parameter vector autoregressive popularly tagged as VAR model to study the impacts of oil price shocks on China's economy. They found the downward trend in the impacts of oil price shocks on China's economy since 1997. They also discovered that the response of real output to be higher and long lasting compared to that of inflation.

Gong et al (2021) employed structural vector autoregressive model (SVAR) with Bayesian estimation method to examine the dynamic effects of international oil price shocks on macroeconomics fluctuation. They found that oil price shocks constraints on economic output more than oil supply and aggregate demand, and recommended that government subsidies alleviated the impacts on energy intensive industries compared to others

Chen (2022) employed Structural Vector Autoregressive (SVAR) model to study the inflationary effects of oil prices and justified same based on the study of (Van Huellen (2020)), (Baumeisto and Hamilton 2019), (Ederington et al 2020), (Herera and Rangaraju 2020), (Zhou 2019). The paper identified and isolated three categories of shocks, the aggregate demand shock, the oil supply shock, and the oil market specific demand shock. The study found that the largest oil



price pass through is as a result of oil supply shock, and recommended that there is needs to disentangle demand and supply shocks in the crude oil market.

Kim and Vera (2022) examined the effect of oil price fluctuation on the US economy. The authors employed SVAR procedure and found oil supply shocks to have a negative effects on the USA real GDP. The degrees of responses are taken to be asymmetrical, aggregate demand shocks as well as oil market specific shocks seemed to present positive effect on price.

Hwang and Kim (2023) investigate the effect of the state dependent on crude oil price shocks on the US aggregate economy. The authors employed a smooth transition Vector Auto Regression model and Lagrange Multiplier (LM) test to study the effects of normalized supply and demand shocks in the global oil market. The study found that structural shocks in the oil markets conditional on recessions have higher and greater persistent in the ambit of contractionary impact on macroeconomics variables.

Baseline Model

$$\ln \text{RGDP} = \alpha_0 + \alpha_1 \ln \text{Poil} + a_2 \text{INFR} + a_3 \text{INTR} + a_4 \ln \text{EXR} + a_5 \ln \text{TOP} + e_1$$

VAR Model

$$\ln \text{RGDP} = \alpha_0 + \alpha_1 \ln \text{Poil} + a_2 \text{INFR} + a_3 \text{INTR} + a_4 \ln \text{EXR} + a_5 \ln \text{TOP} + e_1$$

$$\ln \text{POIL} = \beta_0 + \beta_1 \ln \text{RGDP} + \beta_2 \text{INFR} + \beta_3 \text{INTR} + \beta_4 \ln \text{EXR} + \beta_5 \ln \text{TOP} + e_2$$

$$\text{INFR} = \varphi_0 + \varphi_1 \ln \text{RGDP} + \varphi_2 \ln \text{Poil} + \varphi_3 \text{INTR} + \varphi_4 \ln \text{EXR} + \varphi_5 \ln \text{TOP} + e_3$$

$$\text{INTR} = \psi_0 + \psi_1 \ln \text{RGDP} + \psi_2 \ln \text{Poil} + \psi_3 \text{INFR} + \psi_4 \ln \text{EXR} + \psi_5 \ln \text{TOP} + e_4$$

$$\ln \text{EXR} = \Omega_0 + \Omega_1 \ln \text{RGDP} + \Omega_2 \ln \text{Poil} + \Omega_3 \text{INFR} + \Omega_4 \text{INTR} + \Omega_5 \ln \text{TOP} + e_5$$

$$\ln \text{TOP} = \lambda_0 + \lambda_1 \ln \text{RGDP} + \lambda_2 \ln \text{Poil} + \lambda_3 \text{INFR} + \lambda_4 \text{INTR} + \lambda_5 \ln \text{EXR} + e_6$$

Logarithms of Real Gross domestic product is represented by ($\ln \text{RGDP}$), logarithms of price of oil ($\ln \text{POIL}$), Inflation rate (INFR), interest rate (INTR), logarithms of exchange rate (EXR) and logarithms of trade openness ($\ln \text{TOP}$).

Sources of Data Collection

The study basically premised on secondary data and data were collected from World Bank publications to guarantee the authenticity of data. Data on oil price were collected from World Bank publication, OPEC publication of various years. Data on real GDP were gathered from World Bank publication of various years. Data on exchange rate, interest, inflation, trade openness were also gathered from World Bank publications of various years confirmed by the Bank of Indonesia, Bank Indonesia (BI) of various years to guarantee the accuracy and authenticity of the data utilized in the study.

Ahmed et al (2023) employed combination of three analyses of VAR model, time-varying, VAR analyses, and time varying model with robustness to investigate the relationship between inflation, oil prices and economic activity in the UK. They found Brent crude oil shocks to be the fastest in responding to hike in inflation compared to other variables. The authors concluded that impact of inflation shocks is prominent in the first quarter but wanes in the long run.

III. Data and Methodology of the Study

This section anchored methodology, specification of model, sources of data collection, and techniques evolved in the study.

3.1 Specification of Model

The model leveraged on group equation specified as follows:

3.2 Methodology of the Study

This study leveraged on Sequel to the determination of the necessary unit root tests adumbrated above the Fully Modified Least Squares (FMOLS), Dynamic Least Squares (DOLS) and Canonical co-integrating Regression (CCR) were employed and the study is fragmented or broken down into two compartments of period spanning from 1970-1996 and 1997 – 2022 for simplification of reference and comparison in simplicity. The study also use the VAR model and computed the impulse response function. Test for Stationarity of the data were conducted using combination of methods such as Augmented Dickey Fuller (ADF), Philip Person (P-P), KPSS tests for the presence of unit root tests.

IV. PRESENTATION OF EMPIRICAL RESULTS



This aspect of the study anchored the presentation of empirical result of the study. The aspect starts from the analysis of time series properties of the variables employed for the analysis and estimation. This of course developed out of necessity to guarantee and ascertain the specification and estimation authenticity and accuracy.

Analysis of Unit Root Test

The analysis also depicted that only inflation and the interest rate are 1 (0) or stationary at the level. The other variable are not stationery at the

level which prompted us to carry out the unit root test and determine whether there is possibility of long run relationship between the variable or whether the variable are co-integrated. Judging from the background of stationarity of only two variables out of six variables at level where only inflation and interest rate are 1 (0) and others four variable are not 1(0), the conduct of unit root test for all variables of real GDP, price of oil, exchange rate, inflation rate, interest rate and trade openness become a child of necessity. The study therefore employed ADF. P-P, KPSS as presented in the table one.

Table 1

Unit Root Test

	ADF	Co-integration order	P-P	Co-integration order	KPSS	Co-integration order
LEVEL						
Intercept	5% = -2.918778					
LOG(RGDP)	0.478716		-0.001373		0.783374	
LOG(Exchange Rate)	-2.162863		-1.912812		0.729442	
Inflation	-3.562738	I(0)	-3.391382	I(0)	0.187322	I(0)
Interest Rate	-5.653687	I(0)	-5.663165	I(0)	0.763807	I(0)
Oil Price	-1.580251		-1.580251		0.146642	
Openness	-2.422270		-2.649527		0.148509	
Intercept and Trend	5% = -3.498692					
LOG(RGDP)	-1.853683		-1.407495		0.209397	
LOG(Exchange Rate)	-3.082764		-3.083654		0.122631	
Inflation	-4.173568	I(0)	-3.398368		0.132527	I(0)
Interest Rate	-6.426837	I(0)	-6.400144	I(0)	0.062655	
Oil Price	-1.592357		-1.747948		0.132109	
Openness	-2.328897		-2.573614		0.082966	
FIRST DIFFERENCE						
Intercept	5% = -2.922449					
LOG(RGDP)	-3.340689	I(1)	-5.583111	I(1)	0.147860	I(1)
LOG(Exchange Rate)	-5.469982	I(1)	-9.359540	I(1)	0.122631	I(1)
Inflation	-7.415835	I(1)	-15.76256	I(1)	0.500000	I(1)
Interest Rate	-4.863497	I(1)	-39.66743	I(1)	0.380654	I(1)
Oil Price	-5.919125	I(1)	-5.852161	I(1)	0.094254	I(1)
Openness	-7.639817	I(1)	-7.635333	I(1)	0.082966	I(1)
Intercept and Trend	5% = -3.504330					
LOG(RGDP)	-3.460340	I(1)	-5.642911	I(1)	0.095302	I(1)



LOG(Exchange Rate)	-5.406542	I(1)	-9.220819	I(1)	0.138812	I(1)
Inflation	-7.351885	I(1)	-15.54637	I(1)	0.500000	I(1)
Interest Rate	-4.772711	I(1)	-39.07946	I(1)	0.282734	I(1)
Oil Price	-5.112333	I(1)	-5.788282	I(1)	0.086657	I(1)
Openness	-7.585385	I(1)	-7.581157	I(1)	0.053700	I(1)

At 5% the criteria is -2.9 22 449 which is yardstick of determination of stationarity at 5%.

The test revealed that ADF, P, P and KPSS results support the unit root hypotheses and that the null hypotheses are accepted for all the series. All the variable are integrated of order 1(1). This confirmed that the variables are stationary at first difference popularly described as contained above.

Analysis of Result and Comparison between the Periods

Based on the results obtained from the three techniques of Fully Modified Least Squares (FMOLS) Dynamic Least Squares (DOLS), Canonical Co-integrating Regression (CCR) and using log RGDP as Dependent variable from period 1970 – 1996 the follows are observed. Exchange rate is significant explanatory variable of real GDP judging by the result of FMOLS and CCR. Exchange rate is quoted as 0.5357 and 0.5422 which are significant at 1% under FMOLS and CCR based on the period of 1970 to 1996. By concise interpretation, 1 unit change in real GDP will lead to 0.5357 and 0.5422 variation in GDP or 53% and 54%

respectively influence on the real GDP. The coefficient is also positive suggesting a direct relationship between exchange rate and real GDP. Inflation rate is not significant based on the result of the three methods. At the level of interest rate, it is significant at 10% under FMOLS and negative. It is also significant under DOLS and is quoted as - 0.0484. It is significant at 5%. This suggests indirect relationship between real GDP and interest rate. Oil price shock is not significant throughout the three techniques. However, trade openness is significant at 5% under FMOLS and at 10% under CCR for the case of Indonesia between 1970 and 1996. From Table 3, the result under 1997 – 2022 is presented.* The exchange rate is significant under the three techniques and quoted as 0.5731 significant at 1% under FMOLS, 0.8554. It is significant at 5% under DOLS and 0.2999. It is significant at 1% under CCR for Indonesia between 1997 and 2022. Interest rate is not significant throughout from 1997 – 2022 based on the results from the three techniques. Also, inflation is significant under FMOLS at 10%. It is significant at 1%. under DOLS, CCR quoted as 0.0854. 0.0064, and 0.00862 respectively.

Table 2

Period: 1970 - 1996

Dependent Variable: LOG (RGDP)

	Fully Modified Least Squares (FMOLS)	Dynamic Least Squares (DOLS)	Canonical Cointegrating Regression (CCR)
	Indonesia	Indonesia	Indonesia
Variable	Coefficient	Coefficient	Coefficient
LOG Exchange Rate	0.5357***	0.2978	0.5422****
Inflation Rate	-0.0046	-0.0116	-0.0045
Interest Rate	-0.0126*	-0.0484**	-0.0169
LOG Oil Price	0.0564	0.1019	0.0814
LOG Openness	0.6593**	0.6052	0.5776*
C	19.7851***	22.109***	20.029***
R-squared	0.9592	0.9980	0.9573



Adjusted R-squared	0.9490	0.9848	0.9466
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Note * = 10 % , ** = 5% , and *** = 1 % significant kevel.

Table 3
Period: 1970 – 2022 Dependent Variable: LOG (RGDP)

	Fully Modified Least Squares (FMOLS)	Dynamic Least Squares (DOLS)	Canonical Cointegrating Regression (CCR)
	Indonesia	Indonesia	Indonesia
Variable	Coefficient	Coefficient	Coefficient
LOG Exchange Rate	0.5370***	0.4200***	0.5311***
Inflation Rate	-0.0101*	-0.028***	-0.0113
Interest Rate	-0.0036	-0.0160	-0.0043
LOG Oil Price	0.0854	-0.0064	0.0862
LOG Openness	-0.2638	-0.803***	-0.2606
C	23.092***	26.734***	23.140***
	0.9410	0.9773	0.9401
Adjusted R-squared	0.9346	0.9616	0.9339

Note * = 10 % , ** = 5% , and *** = 1 % significant kevel.

However, oil price is not significant at all under FMOLS, DOLS. The co-efficient is positive and suggest that 1% variation in the dependent variable will lead to amount of co-efficient changes based on the figures of independent variables from 1997 – 2022 under the three techniques. Trade openness is significant under the three techniques at 1% and it is quoted as -0.803. Above all, the R^2 of 0.9410, 0.9773 and 0.9401 also confirm goodness of fit and quasi total caption of the independent variables on dependent variable.

A calm examination of the results in both cases indicates that the effects of oil price shocks on macroeconomic variable has asymmetric effects in Indonesia under the two periods the second period of 1997 to 2022 indicates that oil price as variable is not significant at all under the three techniques adopted. In specific term, oil price accounted for about 0.0854 under FMOLS, - 0.0064 under DOLS and 0.0862 under CCR which is approximately 8% positive, - 0.01% and 0.9% respectively for the variations in dependent variable or real GDP during the period of 1997 – 2022 using FMOLS, DOLS and CCR

respectively. These results can be juxtaposed with that of similar report during the years spanning the periods of 1970 – 1996. The inevitable conclusion is that oil price shocks was not an issue or not significant or major variable or factor to be reckoned with in Indonesia as a prime harbinger of variation in real GDP and the policy makers need to formulate robust policy to garner best opportunity from the proceeds of other resources devoid of oil price shocks whether positive or negative most especially in the ambit of diversification of the wind fall from the proceeds.

V. Conclusion

This study has established firmly that the oil price shocks exert major impact on the economy of Indonesia during the period 1970 to 1996 and no significant influence during the period 1997 to 2022. The effects are asymmetric over 1970 to 1996 but symmetrical between 1997 and 2022. The policy makers have to pay serious attention and formulate vibrant policy that will make the economy achieve utilization of wind fall proceeds from oil price shocks



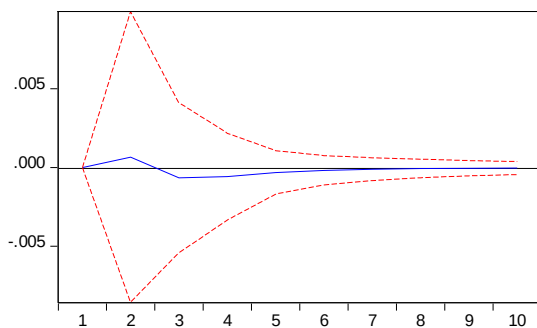
per excellent and to benefit from the synergy of possibility. The policy maker in Indonesia will also need to augment the other resources apart from oil and oil proceeds which is no longer an issue between 1997 and 2022. Meanwhile, the area of recommendation could be study in bi countries

comparison over the same gestation of time to appreciate the position of other countries with similar experience and how those countries garnered the opportunity from oil price shocks and to learn some lesson from such achievements where applicable.

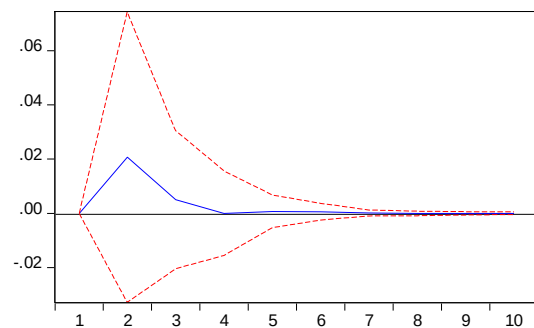
INDONESIA Shock in Global Oil Price

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

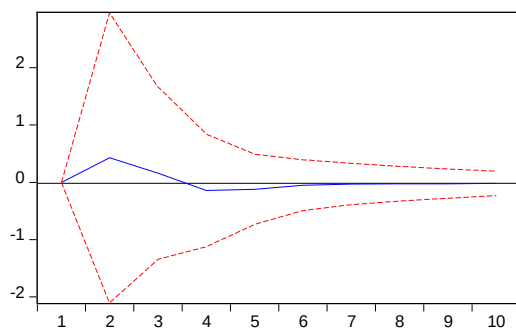
Response of DLOG(RGDP) to DLOG(OIL_PRICE)



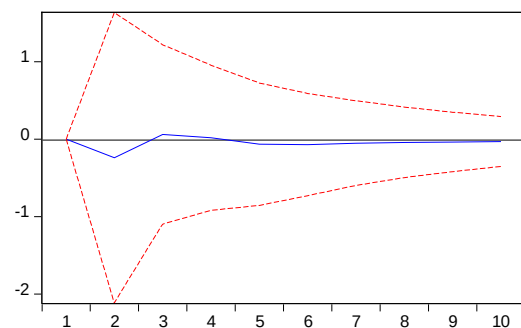
Response of DLOG(EXCHANGE_RATE) to DLOG(OIL_PRICE)



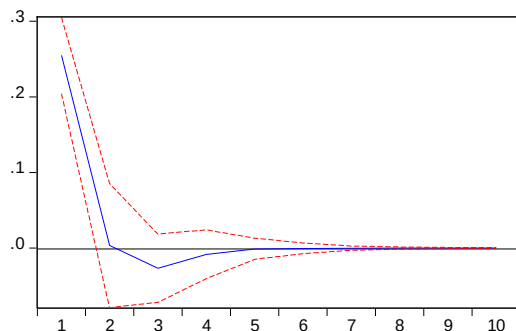
Response of INFLATION to DLOG(OIL_PRICE)



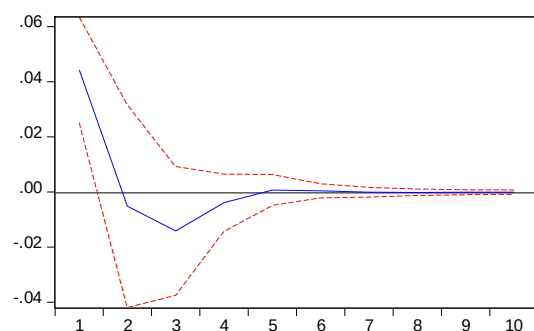
Response of INTEREST_RATE to DLOG(OIL_PRICE)



Response of DLOG(OIL_PRICE) to DLOG(OIL_PRICE)



Response of DLOG(OPENNESS) to DLOG(OIL_PRICE)





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