



An Empirical Study on Short Term and Long-term Consequences of Crude Oil on Economic Wellbeing of Indonesia by Applying Autoregressive Distributed Lag Model

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ABSTRACT

Oil has been one of the primary wellsprings of Indonesia's revenue, either from government spending plan or balance of payments purpose of perspectives. Because of supply and demand of oil on the planet market, prices of oil, either ICP, Brent UK, or WTI, had been decay of late. Oil prices and economic wellbeing are essential markers to see the achievement of Indonesia's improvement execution. The utilization of oil as the world's fundamental energy source when all is said in done and Indonesia specifically is driven by industrialization. The more ventures, the more prominent the energy resources required. In a similar setting, economic wellbeing will likewise expand oil demand. Oil has a strategic nature and is a vital ware that influences the world economy. Both oil exporters and merchants are probably going to feel the impacts of oil price advancements. Oil prices dropped pointedly since June 2014 finishing a 4 year time of relative price strength. The size and speed of decay has been noteworthy yet not remarkable. This exploration plans to analyze the impact of crude oil prices on economic wellbeing in Indonesia. Data on crude oil prices and economic growth are yearly time series data stretching from 1987 to 2016. The aftereffects of co-integration tests demonstrate that there is no long-term connection between crude oil prices and economic wellbeing. In any case, the estimation of the autoregressive distributed lag (5.0) model demonstrates that in the short term, there is the impact of crude oil prices toward economic wellbeing.

Keywords: Crude Oil, Oil Price, Growth, Autoregressive Distributed Lag Model, Indonesia

JEL Classifications: E31, A10

1. INTRODUCTION

Oil is one of the nation's fundamental wellsprings of wage, both as assessment revenues, just as oil revenue sharing, and different revenues acquired by the legislature. In spite of the fact that state revenues from oil keep on declining after some time, reliance on oil revenues is still vast. Diminishing in revenues from oil is because of changes in oil prices and economic emergencies, which have positive and negative effect on economic wellbeing. The long-term sway on economic wellbeing from oil prices, trade rates, and emergencies contains some data that is helpful in foreseeing

the future economy (Yusuf, 2015). The debilitating of crude oil prices was predominantly because of the declining demand of crude oil in Asian nations because of the progressing economic emergency. The development of global crude oil prices activated by the emergency in oil-delivering areas, the state of local oil prices extraordinarily influences Indonesia's economic growth, since oil prices are to a great extent determined by demand and supply. So also, economic wellbeing affects oil prices (Taguchi and Li, 2018).

Crude oil prices can influence economic wellbeing and growth through changes in prices of generation. The expansion in crude

oil prices can cause inflation. The government of a nation will lead monetary approach by raising loan fees to decrease inflation. An expansion in loan fees would then be able to lessen the estimation of venture which at last influences gross domestic product (GDP) or economic wellbeing and growth.

Oil has been one of the principle wellsprings of Indonesia's revenue, either from the government spending revenue perspective in terms of tax or non-tax revenue or from the balance of payments perspective in terms of export revenue (Tambun et al., 2018). It is likewise the fundamental source to back the government subsidy on the domestic utilization of gas.

Oil isn't just economic commodity yet in addition political commodity; vacillations of its price couldn't just be clarified by supply and demand factors. For example, the economist put its feature as "Sheikhs versus Shale," an extraordinary drop oil price marvel toward the finish of 2014 and mid 2015 ("Sheikhs v shale," 2014). The OPEC kept the oil production in normal volume even the world was overflowed by oil from shale oil innovation. By keeping the volume, they planned to pull down the oil price accordingly it will stop shale oil production because of its costly production cost. Notwithstanding the OPEC intends to keep the price stable, the OPEC acted opposite on expanding oil supply because of the shale oil. This activity effectively dropped something like 150 billion of greater expense oil investment in 2015 and more slices to come 1 year from now which could affect oil supply later on ("Abnormally Normal," 2015).

The decrease in oil prices will result in two things. Initially, the decrease in oil lifting focuses by oil companies, both foreign companies and national companies. Oil companies will be hesitant to deliver, on the grounds that prices are not or less gainful. Second, the decrease in oil prices will directly affect declining government revenues (Daeng, 2016).

The improvement of Indonesia's oil export esteem additionally changed, which will in general lead to an expansion in the estimation of its exports. The most elevated increment happened in 1998 with an advancement level of 160.31%, while the greatest diminishing was in 1999 with an estimation of 33.04%. The decrease in oil exports is an after effect of the government's absence of attention in the oil division, however the expansion in prices has made the estimation of oil exports increment (Mustika, 2015).

From price perspectives, the price of oil has varied for quite a few years. In 1973, because of the Arab oil ban, the oil price shoots up. In 1986, be that as it may, the oil price started to descend and after that tumbled down rapidly because of the abundance of supply, among others. From the 1990s forward, the oil price has been balanced out. In 2008, the oil price went down because of the Lehman brothers emergencies, where the decrease keeps proceeded until after 2014 (Tampubolon and Setyoko, 2019). Because of the movement of supply and demand of oil on the planet market, the oil price has been gone down so much that practically all business analysts said that the economy of developing nations would be stagnated without knowing when the price will recover.

The awry impact of rising oil prices and the decrease in the total economy gives the subject for scientists about the component of the business cycle. Asymmetry of oil price fluctuations against GDP causes straightforward instrument impacts that were at first wanted to be developed, for example, contractions and extension in the accessibility of resources, there is a move in profitable limit or the impact of inflation moving total demand. Instability and unclear connection between oil prices and GDP, the particular of changes in oil prices should be analyzed, as determinations for changes in GDP, changes in oil prices and other economic factors (Jones et al., 2004).

Mehrara and Oskoui (2007) have dissected the sources of economic fluctuations for USA and oil exporting nations, for example, Iran, Saudi Arabia, Kuwait, and Indonesia. By utilizing a structural VAR technique, creators recognized four structural shocks: supply, oil price, genuine demand, and ostensible demand shocks. They demonstrate that oil price shocks speak to the primary source of yield fluctuations in Saudi Arabia and Iran, however not in Kuwait and Indonesia. Different examinations have dissected the connection among energy and economic growth. In any case, this relationship is seen through energy consumption as opposed to oil price movements.

From the economic writing, there are a few mechanisms clarifying how the oil price blocks the economy. In the supply side shock, the job of oil price is as an info factor to the production. The declining in oil supply will hamper the profitability and swings to reduce genuine compensation wellbeing and growth. On the off chance that wages sticky descending, the economy will decrease and prompt rise unemployment and create further decrease in the economy. In demand side, rising in oil price will shift purchasing power from oil-importing-nations to oil-exporting-nations. This wonder will support the consumer demand in oil exporting nations and the other way around in oil importing-nations. In any case, as a net, the impact is declining in consumer demand and it prompts expanding in world saving. Additional saving will in general make loan fee lower and push investment higher and lead to unaltered GDP. Be that as it may, the effect of fall in consumption will prompt declining of GDP (Brown and Yücel, 2002).

Besides, the oil price impact isn't just by expanding and diminishing impact, yet in addition unpredictability impact, especially in oil importing nation. The vulnerability in oil price as fundamental production factor makes investors will in general postpone their new investment until the price increasingly steady (Bernanke, 1983). What's more, companies will in general hold selecting new employees until the condition moderately steady (Hamilton, 1988).

From copious looks into, it is generally acknowledged that the oil price has negative effect to macroeconomic indicators. In any case, since the government's endeavor to alleviate the destructive effects by its fiscal and monetary arrangement, determining the exact effect become increasingly troublesome. What's more, some observational investigations contended that giving fuel subsidy was successful to alleviate the negative effects. Reference (Jbir and Zouari-Ghorbel, 2009a) discovered that the hurtful effect of

oil price in Tunisian economy was transmitted to fuel subsidy (which was intermediary by budget deficit). Moreover, fuel subsidy in Thailand likewise discovered diminishing the antagonistic impact of oil price instability to the economy (Rafiq et al., 2009). In any case, unique end found by (Plante, 2014) that for both oil-exporting-nations and oil-importing-nations; rather than relieving the antagonistic effect, the fuel subsidy could hamper the total welfare over the long haul. Along these lines, the job of fuel subsidy in easing the harmful effect of oil price still questionable.

Elements that impact oil prices in a general sense follow commodity price movements determined by demand and supply. The variables that impact both of these will influence world oil prices, both in short and long term (Tiwari et al., 2013). Despite the fact that these variables can't be estimated effectively, in light of the fact that the market is worldwide and there are numerous uncertainties, appraisals can be made by watching the most recent improvements.

2. REVIEW OF LITERATURE AND HYPOTHESIS DEVELOPMENT

In view of the observational explores, oil price can be estimated utilizing various approaches. Notwithstanding the way that different approaches had been created, there is no precise method to quantify the oil prices. Diverse analysts utilized distinctive approaches. For example, Iwayemi and Fowowe (2011), Farzanegan and Markwardt (2009) and Cunado and De Gracia (2005) connected all estimation techniques as expressed above so as to get a progressively extensive outcome. Notwithstanding, a few analysts (Al-Mulali and Sab, 2012; Al-Mulali and Sab, 2011) still stick with the rudimentary approach, while the others (Omojolaibi and Egwaikhide, 2014; Singh and Issac, 2018) just estimated the oil price by utilizing the GARCH model.

Concentrate on impact of crude oil prices toward economic growth has been completed by numerous specialists. Chai et al. (2015) examined the impact of oil prices toward economic growth in nations: China, US and Japan. They utilized the asymmetric co-joining model to break down quarterly information extending from 1992 to 2013. Test outcomes demonstrated that oil prices just influenced economic growth in China and Japan. Yusof and Latif (2013) inspected the impact of oil prices on economic growth in Malaysia utilizing information that stretched out from 1966 to 2006. The autoregressive distributed lag (ARDL) model was utilized to test these impacts. The test outcomes demonstrated that oil prices influenced the economic growth in the short term.

Since the finish of fuel subsidy job still questionable, this study endeavored to address this issue. So as to do as such, this examination picked Indonesia to be the case study. Indonesia fills in as legitimate case because of certain reasons. To begin with, it speaks to a nation which gave very tremendous measure of subsidy (Mourougane, 2010). Second, Indonesia had transformed it fuel subsidy approach after Asian emergency, so it is conceivable to test the distinctive policies in a single nation. At long last, Indonesia was a one of a kind cases which change its status from a

net-oil-exporting-nation to a net oil-importing-nation (BP - British Petroleum, 2013; O-IEA, 2015).

Oil prices are affected by economic elements from the supply side, for example, production and imports, just as from the demand side, for example, consumption and exports. Similarly, as with the effect of the downgraded dollar, monetary forms and oil prices are exchanged universally, which affect more expensive rates so makers endeavor to keep up the economic estimation of the oil sold (Wonyra, 2018). Oil production patterns are against GDP as government revenues from the oil and gas sector to economic growth. Oil production changed somewhere in the range of 1970 and 1971 from 41.2% to 19.1% in 1972 and 21.4% in 1979. A negative growth rate of 30.9% happened in 1981 (Ibrahim, 2008).

There are now a few explores about the effect of oil price to Indonesia's economy. Reference (Abeyasinghe, 2001) examined the effect of oil price to a few Asian nations including Indonesia. For oil exporting nations, for example, Malaysia and Indonesia, the principal sway was sure to the economy however secondary effect from exchanging with partner nations was negative and outnumber past effect. Along these lines, the net effect was negative. The second literature by (Mehra and Oskoui, 2007) analyzed the effect of oil price to four prominent oil-exporting-nations; Saudi Arabiya, Iran, Indonesia and Qatar. The effects were diverse among the nations; for the nations which have contributed their pay to oil saving foundation (Qatar) and forced prudent monetary and fiscal approach (Indonesia), the fluctuation in oil price did not have any huge impact on their GDP. The outcome was complexity to the next two nations.

Hypothesis₁: The variables related with crude oil are stationary
Hypothesis₀: The variable related with crude oil are stationary against.

3. RESEARCH METHODOLOGY

3.1. Research Methodology or Procedure

Oil prices are assumed to be exogenous variables that can affect economic wellbeing and growth in Indonesia. Therefore, the model used to examine the effect is a model of ARDL developed by Pesaran and Shin (1999) and Pesaran et al. (2001). The ARDL model with independent variables is OIL and the dependent variable is GRO, as follows:

$$GRO_t = C_1 + \delta_1 t + \sum_{i=1}^p \alpha_{1i} GRO_{t-i} + \sum_{i=1}^q \beta_{1i} OIL_{t-i} + \varepsilon_{1t} \quad (1)$$

The notations of $C_1, \delta_1, \alpha_{1i} (i=1,2\dots p), (j=0, 1\dots, q)$ are the parameters of the regression condition, and p and q are the period of time lag. ε_{1t} is repetitive sound residual which has autonomous distribution, homoscedastic, and regularly distributed. The ARDL model (1) is typically composed ARDL (p, q) where the free factor OIL and GRO subordinate variable are thought to be stationary at the dimension. The term of stationary is frequently called as incorporated of request $d, I(d), d \geq 0$.

On the off chance that the factors of oil prices and economic wellbeing and growth is coordinated of request 1, $I(1)$ or one of

these factors are I (1) or I (0), and furthermore co-incorporated, at that point the impact of oil prices on economic growth must be tried with error correction models, as follows:

$$D(GRO_t) = C_2 + \delta_{2t} + \theta EC_{t-1} + \sum_{i=1}^{p-1} \alpha_{2i} D(GRO_{t-i}) + \sum_{j=0}^{q-1} \beta_{2j} D(OIL_{t-j}) + \varepsilon_{2t} \quad (2)$$

In which $C_2, \delta_2, \alpha_{2i} (i=1,2\dots p-1), \beta_{2j} (j=0, 1\dots, q-1)$ are the parameters of the regression condition while ε_{2t} is white noise. EC_{t-1} is an error correction variable, and $D(GRO)$ is the primary distinction type of the GRO variable where $D(GRO)=D(GRO)=GRO_t-GRO_{t-1}=GRO-GRO(-1)$.

In light of the necessities of the ARDL (p, q) model, there are a few testing steps that must be produced to inspect the results of crude oil prices on economic wellbeing and growth. The initial step is to test the order of factors integration. The integration request test utilized is the augmented dickey-fuller (ADF) test, and the Phillips-Perron (PP) test. The ADF test was created by Dickey and Fuller (1979), and the PP test was created by Phillips and Perron (1988). The ADF test utilizes a t-ratio statistic, and the PP test utilizes PP-statistics. The plan of the ADF test hypothesis and the PP test are H_0 : The variable related with crude oil are stationary against. H_1 : The variable related with crude oil are stationary.

The second step is to test the co-integration between crude oil prices and economic wellbeing and growth. This progression is done if the price of crude oil or economic growth are coordinated at a similar order I (0) or I (1) or the two factors are not quite the same as the order of integration. The co-integration test utilized is the ARDL bound co-integration test, with the condition:

$$D(GRO_t) = C_3 + \delta_3 t + \sum_{i=1}^{p-1} \alpha_{3i} D(GRO_{t-i}) + \sum_{j=0}^{q-1} \beta_{3j} D(OIL_{t-j}) + \phi_1 GRO_{t-1} + \phi_2 OIL_{t-1} + \varepsilon \quad (3)$$

In which $C_3, \delta_3, \alpha_{3i} (i=1,2\dots p-1), \beta_{3j} (j=0, 1\dots, q-1)$ are the parameters of the regression condition $\phi_k (k=1,2)$ are the parameters of the regression condition, and ε_{3t} is repetitive sound. ARDL bound co-integration test with co-integration condition in (3) necessitates that nobody of the factors is process I (2), and does not require an integration order test. Be that as it may, in this examination, the integration order test stays set up in the initial step to guarantee that one of the crude oil prices or economic wellbeing and growth does not belong to process I (2). Next, the ARDL bound co-integration test utilizes F-statistics or Wald-statistics. The theory formula is $H_0: \phi_1=\phi_2=0$ (there is no co-integration) in opposite to $H_1: \phi_1 \neq \phi_2 \neq 0$ (there is co-integration). The test criteria are H_1 acknowledged whether the estimation of statistic test is higher than the critics estimation of upper bound I(1), and H_0 is acknowledged whether the statistic esteem test is lower than the critics value of lower bound I(0).

The third step is to appraise the ARDL model. The estimation venture of the ARDL model starts with the determination of the length of the time lag p and q dependent on the data criteria. Independency checking (autocorrelation), homoscedastic, and normality of residuals are additionally done. Autonomous test

Figure 1: Crude oil from marginal wells in Indonesia



utilizes Lagrange multiplier (LM) test, homoscedastic test utilizes ARCH test, and normality test utilizes Jarque Berra test.

3.2. Time Period

This study utilizes yearly time series data in the period 1987 to 2016. Time series data comprises of Dubai crude oil prices, and gross domestic local item per capita (GDRP) in South East Sulawesi Province, Indonesia. GDRP is an intermediary of economic wellbeing. The price unit of crude oil is USD/barrel, while the GDRP unit is IDR.

3.3. Sources of Data

Dubai's oil price data source is the United States Bank St. Louis. The GDRP data source is the South East Sulawesi statistical center. Besides, Dubai crude oil prices are expressed with OIL, while economic growth is expressed with GRO. OIL and GRO are normal logarithms.

4. RESULTS AND DISCUSSION

At initial a data unit root test or integration order test I(d) was first performed. The estimations of the ADF test statistics and the PP test are condensed in Table 1. The stationary test results from the two tests demonstrate that the price of crude (OIL) is stationary at the main distinction, or coordinated of order 1, I (1). Meanwhile, economic growth (GRO) is stationary at the dimension. In this way, the time series of crude oil prices is I (1) process, while the time series of economic growth is I (0) process.

The second step is to test the co-integration between the price of crude oil and economic growth utilizing the ARDL bound cointegration test. The statistical values of the co-integration test are given in Table 2. By looking at test statistic values (2.307) and the values of lower critics bound I (0) and upper bound I (1), it is inferred that the price of crude oil and growth economy isn't co-incorporated. That is, the price of crude oil and economic growth don't have a long-term relationship in the period 1987-2016.

Since the price of crude oil and economic growth are not cointegrated, the third step is to appraise the ARDL model in the main contrast. This progression starts with determining the time

Figure 2: Indonesia’s crude oil: Exports from 1995 to 2016

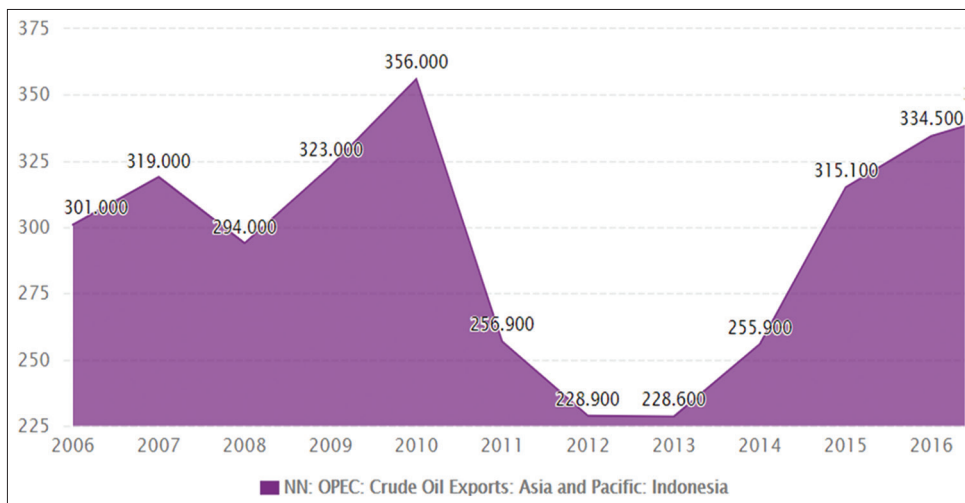


Table 1: Unit root test

Variable	ADF test statistics		PP test statistics	
	Constant without trends	Constant and trends	Constant without trends	Constant and trends
<i>OIL</i>	-1.2583	-2.3374	-1.2705	-1.4653
<i>D (OIL)</i>	-4.9117*	-4.8611*	-4.9226*	-4.8720*
<i>GRO</i>	-0.1602	-6.3398*	-3.5231**	-1.5911
<i>D (GRO)</i>	-5.8992*	-3.1151	-5.5289*	-10.6470*

*** are significant at 1%, 5%, ADF: Augmented dickey-fuller, PP: Phillips-Perron

Table 2: ARDL bounds test

Number of sample (T)	Number of explanatory variable (k)	F-statistics	Critical value (%)					
			I (0)			I (1)		
			1	5	10	1	5	10
30	1	2.3017	10.615	7.36	6.01	11.65	8.265	6.78

Critical values are extracted from Table in Appendix of Narayan (2005). ARDL: Autoregressive distributed lag

lag. In view of the AIC data criteria, it was discovered that the time lag for oil price is 0, and the time lag for economic growth is 5. In this way, the evaluated ARDL model is the ARDL (5.0) model in the primary distinction. The estimation consequences of the ARDL (5.0) model are given in Table 3. All factors engaged with the ARDL (5.0) model including the steady and patterns are 1% noteworthy. Along these lines, in the short term, there is the impact of crude oil prices on economic growth. This end is substantial, on the grounds that the classical assumption necessities of the ARDL (5.0) model as normality, independence (autocorrelation), and homoscedastic are satisfied.

The finding in this study is that there is a short-term impact of crude oil prices on economic wellbeing and growth.

The finding of this study isn't in accordance with the discoveries of Berument et al. (2010). The contrast between the aftereffects of this study and the discoveries him can be brought about by contrasts in cultural, socio-political and economic conditions he directed research in Venezuela, while this study is completed in South East Sulawesi, Indonesia.

Since the economic wellbeing and growth of Indonesia is influenced by the price of crude oil, the Indonesia government

Table 3: ARDL (5.0) model's evaluation

Constant and variable independent	Coefficient	t-statistics	P
<i>C</i>	1.0812	6.7800	0.0000
@Trend	-0.0359	-5.2768	0.0001
<i>D (GRO (-1))</i>	-0.0957	-3.7817	0.0015
<i>D (GRO (-2))</i>	-0.1078	-4.3392	0.0004
<i>D (GRO (-3))</i>	-0.1348	-5.7041	0.0000
<i>D (GRO (-4))</i>	-0.0926	-3.9554	0.0010
<i>D (GRO (-5))</i>	-0.0685	-2.9793	0.0084
<i>D (OIL)</i>	-0.5235	-4.1541	0.0007

needs to use the energy sources of crude oil claimed as effectively as could reasonably be expected. Hence, the obtainment and usage of oil can't make inflation as a boundary economic wellbeing and growth (Hussain et al., 2019).

The stationary test outcomes demonstrate that the price of crude oil is I (1) process, while net local domestic item per capita is I (0) process (Johari et al., 2018). The co-integration test results demonstrate that in the period 1987 to 2016, crude oil prices and economic wellbeing and growth were not co-incorporated (Sinaga et al., 2019). That is, over the long haul, there is no connection between crude oil prices and economic wellbeing and growth.

Besides, in view of the estimation aftereffects of the ARDL (5.0) model it was discovered that, in the short term, there was an impact of crude oil prices on economic wellbeing and growth.

5. CONCLUSION

Earlier observational investigations have reported the hurtful impacts from oil price to macroeconomic factors in numerous nations, from little to huge economies, from oil-exporting-nations to net-oil-importing-nations and from created to developing nations. Be that as it may, the job of fuel subsidy to pad the impacts still unclear.

The motivation behind this study is to inspect the impact of crude oil prices on economic wellbeing and growth in Indonesia. The data utilized are yearly time series data comprising of: World crude oil prices and gross domestic regional product per capita that extend from 1987 to 2016. Net domestic regional product per capita is an intermediary of economic wellbeing and growth. Thusly, the effect of the adjustments in oil prices on the Indonesian economy can diminish by bringing down the reliance on oil as a critical source of revenue, regardless of the decrease of the commitment of oil to the pay throughout the years. Indonesia has been changing itself from a net oil exporter to a net oil importer since 2005; consequently, the oil revenue estimated as the level of the aggregate GDP has diminished by about half from 1990 to 2005 and represent under 1% in 2015.

It is suggested that the Indonesian government be engaged with the administration of oil and oil reserves are progressively diminishing, while oil use is expanding. Identified with economic wellbeing and growth so as to remain and dependably be improved later on, for further analysts to think about microeconomic factors. The Indonesian government needs to make obtainment effectiveness policies and utilization of crude oil to lessen inflation. By stifling inflation, economic wellbeing and growth is relied upon to increment.

Research needs to additionally examine the effect of oil price changes on GDP and inflation. Occasions that happened in Indonesia, for example, its change from a net oil exporter to a net oil importer and the deregulation of fuel subsidy arrangement should all the more unequivocally consolidate into the examination. At the point, the further research consolidating such occasions would improve our comprehension of the impact of changes in oil price and help educate approach better.

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