Changes in Demand and Supply of the Crude Oil Market During the COVID-19 Pandemic and its Effects on the Natural Gas Market

Indupurnahayu[1]*, Edhie Budi Setiawan[2], Lira Agusinta[2], Ryan Firdiansyah Suryawan[3], Prasadja Ricardianto[2], Mustika Sari[2], Sri Mulyono[4], Reza Fauzi Jaya Sakti[2]

[1]Universitas Ibn Khaldun, Bogor. Indonesia, [2]Trisakti Institute of Transportation and Logistics, Jakarta, Indonesia, [3]STP Aviasi, Jakarta, Indonesia, [4]Daarul Qu'ran Institute, Indonesia. *Email: indupurnahayu@uika-bogor.ac.id

ABSTRACT

As a source of revenue for the state budget and a source of energy (particularly fuel) to drive various sectors of life, the oil and gas industry plays an important role in the Indonesian economy. The purpose of this study is to analyse the effect of crude oil prices on natural gas during the Covid19 Pandemic in Indonesia. The research method used is an explanatory method using the real price decomposition of crude oil introduced recently by Kilian (2009). This study develops four variables for the oil and natural gas market through a structural vector autoregressive model (SVAR). Based on the results of the analysis, hence some evidence is found that the crude oil market affects the natural gas market in Indonesia through a combination of changes in demand and not through changes in oil supply during the Covid-19 pandemic. The uncertainty of oil supply due to the Covid-19 pandemic has made the oil market shift to the natural gas market and increased the price of natural gas as the main substitute for oil. Meanwhile, changes in demand in Indonesia during the Covid19 Pandemic affected crude oil and gas prices, causing similar fluctuations in oil and gas prices.

Keywords: Crude Oil Prices, Natural Gas Prices, Demand, Supply
JEL Classifications: P41, P28, P43

1. INTRODUCTION

Almost evenly across the globe, the negative effects were felt by one of the worst health crises in a century. Referring to several economic indicators that show the global economy is entering a recession scenario, according to some observers, the global economy is currently under the greatest pressure since The Great Depression in the 1930s; business slowly and unsupplied soaring. The COVID-19 pandemic has caused significant changes in the pattern of energy fuel supply and demand, particularly crude oil prices which have fallen since early 2020 from around the $ 60/ barrel zone to briefly move around the $ 15 / barrel zone as a result of the economic contraction. caused by the pandemic (Sukarno et al., 2015).

According the US Energy Information Administration (EIA), world fuel consumption has indeed begun to show a significant downward trend since the fourth quarter of 2019, and was then exacerbated by the impact of COVID-19 and continued until the first quarter of 2020 and is predicted to reach its deepest point in the first quarter. -ii 2020 (Sembiring and Krisna, 2019).

The scheme to restrict the mobility of citizens which led to the implementation of a lockdown policy has been reported to have been implemented in 187 countries and territories. Despite their different coverage, the number of activities from various sectors with crude oil as the driving force, such as those in the transportation, manufacturing, and industrial sectors, has fallen dramatically almost everywhere. This also prompted a statement

from the EIA to the market to prepare for the lowest level of oil demand in the last 25 years (Marchetti and Palahí, 2020).

Based on its report, EIA estimates that global consumption in Q1 2020 will fall by 5.6 million barrels per day compared to the same period for 2019. For 2020 as a whole, the magnitude of the decline in this first timeframe provides EIA's basis for estimating that Global oil consumption will fall by 9.3 million BPD this year to an average of 90.5 million BPD, effectively correcting the consumption growth rate recorded over the past decade (Chiaramonti and Maniatis, 2020).

During an uncertain period for the spread of COVID-19, the price of crude oil has been hit again by geopolitical issues from the emergence of major tensions between some of the world's largest oil producers which sparked a price war.

The price war was triggered by Russia's reluctance expressed at the occasion of the OPEC + alliance meeting to engage in an agreement on a proposed reduction in oil production to mitigate the impact of the threat level of demand from the COVID-19 pandemic. Saudi Arabia then announced unexpected discounts of $ 6 to $ 8 per barrel for its consumers in Europe, Asia, and the United States in hopes of putting financial pressure on Russia's sustainable production of crude oil to become less profitable (Marchetti and Palahí, 2020).

As a result, on March 9, 2020, the price of crude oil closed down more than 20% in a single trading session and recorded the sharpest decline for any commodity since the 1991 Gulf War. equity market and the financial market.

Nonetheless, the good news is gradually coming after Trump has firmly intervened in the situation and issued threats against OPEC leaders, Saudi Arabia with oil tariffs and other steps if they don't fix the market oversupply problem. The pressure from the US domestic oil industry was the background for Trump's intervention. Last week's four-day marathon negotiations resulted in an agreement reached by all members to reduce production by 9.7 million barrels per day for May-June.

Alongside the deal, OPEC + said it hopes producers outside the group, such as the United States, Canada, Brazil, and Norway, to cut production levels by 5% or 5 million barrels per day. This decision is considered historic as it was recorded as the largest reduction in oil production ever, and some analysts hope it will slowly help restore the oil industry from falling into an even more serious situation than it is currently facing.

The oil and gas industry plays an important role in Indonesia, as a source of revenue for the state budget and contributing to the local economy in areas where oil and gas exploration, production, refining, and distribution activities take place. Also, the biggest role of the oil and gas industry is to provide energy (especially fuel) which is used to power various sectors of life throughout Indonesia. Many studies have investigated the relationship between crude oil and natural gas. Their main result is to find the answer to this question whether the prices of crude oil and natural gas are related or not.

The impact of Covid-19 has hit various aspects of human life, including the oil and gas industry. Restrictions on human movement directly result in a decrease in demand for fuel. The impact of Covid-19 also concerns various other matters in the oil and gas industry.

2. IMPACT ON THE GLOBAL OIL AND GAS INDUSTRY

Analysts project that the biggest effect of the lockdown conditions as a result of the spread of COVID-19 related to global crude oil demand will occur in the second quarter of 2020. After that, it will gradually start to recover until 2021 which is in line with global economic expectations by the International Monetary Fund (IMF) due to the recovery and normalcy of business activities in several sectors such as transportation, manufacturing, industry, and others (Kingsly and Henri, 2020).

The OPEC + production cut agreement in May/June aims to push restrictions on global crude oil supply, to have the effect of reducing the buildup of crude oil stocks. Also, the action initiatives of the four G20 member countries (China, India, Korea, and the United States) that have offered their strategic storage capacity to the industry temporarily park crude oil stocks that the market does not yet want (Boden et al., 2016).

Based on this, some analysts are still optimistic that the combination of cutting crude oil production by OPEC + member countries and the initiation of the G20 members are expected to provide positive sentiment on global crude oil prices until the second half of 2020. Until in the end, in the medium term, the threat is increasingly the disruption of the global crude oil supply and demand structure in the middle of the year will be slightly dampened and markets return to more normal conditions (Naifar and Al Dohaiman, 2013).

Although world crude oil prices have experienced frequent increases and decreases, even within large ranges, the phenomenon of oil prices selling below the US $ 0 as in the case of WTI is the first to occur. It can also be seen in the picture that oil prices throughout 2020 continue to slide down. The price of oil, which was sold at Minus the US $ 37.63, is a new phenomenon that is difficult for many to understand (Hooijer et al., 2006).

However, the decline in oil prices was not only due to the impact of Covid-19 but also due to "conflicts" within the oil industry itself. The dispute, particularly within the producer group, started by Saudi Arabia and Russia, over an agreement on how much crude oil should be produced (Chiaramonti and Maniatis, 2020).

3. METHODOLOGY

The method used in this research is the mix method. The quantitative approach is research using numerical data (numbers). This research is classified as explanatory research. It was conducted in Indonesia Province, with the Central Statistics Agency (BPS) timeframe, namely from 2018-2020. The type of data used in this

research is secondary data obtained from the Central Statistics Agency website and official agencies such as publications from the Central Statistics Agencies at the regional (District) and provincial levels. The analysis method used in this research is multiple regression models, and panel data with the help of Eviews 9, panel data (pooled data) or what is also called longitudinal data is a combination of cross-section and time-series data.

Systematically, the multiple regression model and the panel data can be explained as follows equation (1):

Where:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e \tag{1}$$

Y: Natural Gas Market
X_1: Demand
X_2: Supply
X_3: Crude Oil Prices
α: Constant
$\beta_1, \beta_2, \beta_3$: Regression coefficient
e: Error term.

SVAR is used in qualitative approach in ths study to model the relationship between crude oil prices and natural gas prices to examine the effects of various types of crude oil shocks on natural gas. Our model is based on monthly data for zt = (Δprodt, reat, rpot, rpgt), where Δprodt represents the percentage change in global crude oil production, reat is an index of real economic activity, rpot is the actual oil price, and rpgt refers to the real price of natural gas (Nick and Thoenes, 2014). In the reduced-form representation, our model is denoted as equation (2):

$$z_t = \cdot + \sum_{i=1}^{p} B_i z_{t-i} + e_t \tag{2}$$

where e_t is the vector of reduced-form errors. We estimate the reduced-form VAR model using the least-square method, which is used in the structural VAR model. The model in its structural VAR representation is written as equation (3):

$$A_0 z_t = - + \sum_{i=1}^{p} A_i z_{t-i} + \varepsilon_t \tag{3}$$

where ε_t is the vector of serially and mutually uncorrelated structural errors. We postulate a recursive structure for our model, A^{-1} such that the reduced form errors e can be written according 0−1 t to:$e_t = A_0 \varepsilon_t$.

4. RESULT AND DISCUSSION

Multiple linear regression analysis is an analytical tool used to determine the effect of the dependent variable. The estimation result of numerous regression used in this study is multiple regression with the expected effect weight model in Table 1.

The results of the calculation on the multiple regression coefficients obtained the following equation (4):

Labor absorption growth = −4.148027 + 3.714864 (X1) + 6.010411 (X2) − 7.037948 (X3) (4)

Based on equation (4) shows that based on the regression results, the constant is equal to–4.148027. This value means that if the demand (X1), supply (X2), crude oil prices (X3) changes, the development of labor absorptiogas natural gas market in Indonesia is–4.148027. If economic growth in the primary sector increases by 1%, then natural gas market gain will increase by 3.714864%. If the Supply increases by 1%, the natural gas market growth will increase by 6.010411%. If the tertiary sector's economic development rises by 1%, the absorption of labor will decrease by 7.037948%. A statistical t-test is a test tool used to partially determine the independent variable's effect on the dependent variable. Following are the results of the statistical t-test.

Based on the estimation results above, the results can be explained. Table 2 shows the Demand variable has a positive and significant direction of the relationship, which is seen from the probability value of 0.000 or less than the significant level of 0.05%. This means that the Demand variable has an influence on natural gas market in Indonesia Province. Table 2 shows that the Supply variable has a positive and significant direction of the relationship, which is seen from the probability value of 0.000 or less than the significant level of 0.05%. This means that the supply variable has an influence on natural gas market in Indonesia Province. Table 2 shows that the crude oil prices variable has a negative and significant direction of the relationship, which is seen from the probability value of 0.0144 or less than the significant level of 0.05%. This means that the Crude Oil Prices variable influences labor absorption in Indonesia Province.

The statistical f test is used to simultaneously determine the independent variable's effect on the dependent variable. Following are the results of the statistical f test:

Based on Table 3, which shows that the probability value of the f-test statistic of 0.000012 is less than the significant level of 0.05, it can be concluded that the economic growth of the primary, secondary and tertiary sectors has a significant effect on natural gas market in Indonesia Province.

The coefficient of determination (R2) is an indicator used to determine the percentage change in the dependent variable caused by the independent variable.

Based on Table 4, the coefficient of determination (R2) is 0.815056; this indicates that the percentage of economic growth variables in the primary, secondary and tertiary sectors on natural gas market is 81.5056%.

In choosing the panel information regression version, three fashions are to be utilized in figuring out which version is quality

Table 1: Multiple regression results with fixed effect weight

Variable	Coefficient	Probability
Constant	–4.148027	0.7663
Demand	3.714864	0.0000
Supply	6.010411	0.0000
Crude oil prices	–7.037948	0.0144

Source: Processed E-views 9

Table 2: Statistical t-test results

Variable	T-statistics	Prob	Significant level	Information	Direction of relationships
Demand	5.470531	0.0000	0.05	Significant	Positive
Supply	5.636567	0.0000	0.05	Significant	Positive
Crude oil prices	−2.629764	0.0144	0.05	Significant	Negative

Source: Processed E-views 9

Table 3: F statistical test results

F statistic	6.885997
Probability	0.000012

Source: Processed E-views 9

Table 4: Determination coeficin results (R2)

R-squared	0.815056
Adjusted R-squared	0.696692

Source: Processed E-views 9

to be used in estimating the panel information. The three forms of techniques are the Common Effect version, Fixed Effect version, and Random Effects version. One kind needs to be decided on for use in the panel information regression equation of the three fashions. This regression was accomplished in 14 districts/towns in Indonesia Province from 2013 to 2015. The regression analysis outcomes showed that the variable of the number one-quarter increase in part had a subtle and widespread impact on the rise of natural gas market in Indonesia Province. Based on the test outcomes accomplished using the Eviews nine information processing device program, the coefficient of the number one-quarter variable is 3.714864. The t-statistic probability is 0.0000, which is smaller than the widespread stage used ($\alpha = 0.05$). The hypothesis that the increase in the number one quarter affects the rise in natural gas market is accepted. The correlation between the number one quarter and the increase in natural gas market is correlated with the variable coefficient value. If the rural quarter has extended by 1%, then the natural gas market increase will boom through 3.714864%.

Based on the analysis with SVAR, an impulse response to changes in oil supply, aggregate demand shocks, oil-specific demand shocks, and natural gas price shocks in oil production, real activity, real oil prices, and real natural gas prices is obtained. All of our surprises are normalized. The VAR error reduced form of the model is based on a recursive wild bootstrap design with 2000 replicates (Gonçalves and Kilian, 2004).

Responding to changes in demand during Covid19, the results of the study illustrate that positive changes in aggregate demand led to a statistically significant increase in oil and gas prices for several months. An unexpected increase in global aggregate demand caused the oil price to rise to its highest level during the first 3 months, and after that, the price of oil began to fall to its original amount. Meanwhile, the global aggregate demand shocks led to a gradual increase in natural gas prices for around 12 months; after that, the price of natural gas fell in a period of almost 2 months. Therefore, the increase in oil prices occurred faster than the increase in natural gas prices (Nct, 2020).

COVID-19 has also caused demand for petroleum to fall sharply, but not badly for natural gas demand. This can be explained

as follows. First, the very sharp decline in fuel consumption is for transportation activities (gasoline, diesel oil for passenger vehicles, avtur for airplane engines) while the use of natural gas for transportation is very small compared to fuel. On the other hand, the use of natural gas for households (for cooking and heating) is greater than that for fuel, while during the social distancing or lock-down period, the use of natural gas in households increases. Second, because it is not as easy to stop the production and distribution of natural gas as doing these things for petroleum. The distribution of natural gas requires special infrastructure (pipes, LNG ships, etc.) which are inflexible compared to the transportation of crude oil and fuel which is easier to do. Third, in the Gas Sales & Purchase Agreement there is usually an agreement regarding the TOP (take or pay): consumers will still get their natural gas shipments, or have to pay for it even though the gas is not delivered. In response to global aggregate demand shocks, the results of this study show almost the same results as shown (Zamani, 2016) for the price of oil. However, the effect of aggregate demand shocks on oil production differs from yield (Zamani, 2016).

In general, the zone of global crude oil price movement after experiencing a sharp decline that occurred until the beginning of the second quarter of 2020 as a result of COVID-19, and persisted into the second quarter before prices began to gradually increase until a balance between the supply and demand structure is reached. Also, in the short term projection, crude oil supply which will increase as a result of the postponement of the production cut decision agreed between OPEC + until next May can become a reference for current market players. Thus, these two factors are predominantly predicted by the market to keep global crude oil prices at their lowest average until the first half of 2020. Amid the current uncertainty and high volatility markets, hence the players can only expect an increase in the slope and the opportunity to take advantage of the fluctuations in global crude oil prices in trading WTI crude oil futures products. In petroleum trading for the last 1 month, the WTI oil futures contract was traded in a price range of 17.31 - 29.13 US dollars per barrel (Kingsly and Henri, 2020).

The impact of COVID-19 on industry and global oil and gas also applies to Indonesia. With the implementation of the PSBB (large-scale social restrictions) policy in various regions in Indonesia, the trips made by the community have decreased dramatically. As a result, the demand for fuel in the country fell by 35%, with avtur experiencing the highest decline, namely 45%. This is the decline in demand for fuel to reach the lowest point in Indonesia's petroleum history. Tourism and transportation were the sectors that were hardest hit. The paralysis of tourism and transportation has stifled demand for fuel in Indonesia. Furthermore, the research results show that an unexpected increase in the specific demand for oil has an effect on real activities since its occurrence; real

activity increased rapidly over the 2 month period, which was statistically significant. Then, it started to diminish (Rao, 2020).

The price of crude oil on the world market is based on supply and demand. Because the corona outbreak has halted most of the economic activity and citizens' activities, the oil demand has dropped dramatically and thus the price on the stock market. Companiesordering less fuel, airlines stop buying fuel because their planes don't fly, public fuel consumption is also shrinking as more people stay at home and don't use their vehicles. Oil purchase contracts on the world market vary. Some transactions are made for the future, which is called futures transactions. It is a type of contract that allows both the buyer and the seller to set a specific date at a later date by which the purchased oil must be delivered by the seller to the buyer, at a price that is fixed at the time the transaction is made. The holder of this transaction certificate can also trade the contracts on the stock market.

The results of this study can be concluded that the impact of Covid-19 on the oil and gas industry globally, and for the case of Indonesia. After studying the problems faced, several recommendations were proposed to mitigate the impact of Covid-19 on the Indonesian oil and gas industry (Chiaramonti and Maniatis, 2020).

Indonesia's recent crude oil production in the range of slightly above 700,000 barrels per day is much lower than when it reached its peak in 1977 with the production of 1.7 million BPD - when domestic fuel demand was still very low. However, until now the government still relies on revenue from petroleum and uses the amount of production and the price of Indonesian oil as a reference in making the APBN. The decline in production and lower oil prices still have a significant impact on the APBN profile.

The gap between the decline in domestic oil production and the increase in consumption that has occurred so far has been resolved by increasing imports of both crude oil and petroleum products. The continued expansion of oil imports (in addition to the weakening of the rupiah against the dollar) continues to widen Indonesia's balance of payments deficit. Imports are still growing because "the government is expanding the premium fuel market into assignment fuels in Java, Madura, and Bali as well as increasing the Premium quota in 2018". Fuel consumption in 2018 suddenly increased by 13.5 percent, reaching 80.5 million kiloliters. In fact, during 2010-2017, the national fuel consumption did not grow, the average was around 70 million kiloliters.

Although in many countries the price of fuel has fallen due to the impact of the Covid-19 pandemic and the dispute over oil production between Saudi Arabia and Russia until now the price of fuel that Pertamina sells to consumers at gas stations (public refueling stations) has not changed., or haven't been taken down. Pertamina provides a limited 50 percent discount only for online ojeg drivers. There is also a plan for Pertamina to provide a 30% discount on fuel prices to the public for purchases during the month of Ramadan 2020.

Other fuel selling companies, such as Shell in Indonesia, have not lowered the retail price of their fuel sales either. In comparison,

since the COVID-19 pandemic broke out, Malaysia has seen several reductions in fuel prices, making the country the lowest selling price of fuel in all ASEAN countries.

Not lowering the fuel sales price, of course, does not directly mean "increased revenue" for the fuel selling company (in the case of Indonesia, Pertamina is the main player), because at the same time there was also a significant decrease in sales volume, and in addition to that the company also still have to maintain assets (including labor) from up-to-date and refining activities whose productivity has decreased. However, to answer the demands of some people who want to reduce fuel prices, the question of transparency regarding revenues and costs incurred by state oil SOEs as a result of the COVID-19 pandemic needs to be put forward to the wider community.

Based on an understanding of the impact of COVID-19 on the conditions of the oil and gas industry globally, and the problems that have developed in the oil and gas industry in Indonesia as a result of the same, we propose several policy recommendations as below (Widyastuti and Nugroho, 2020).

- Starting to focus production activities on fields with "economic" value only in the current very low oil price conditions. Although this action will have an impact on reducing production targets as previously set (in the RPJMN, APBN, and Company Work Plan), this action is economically justified, also considering that at the same time there is a decline in demand for fuel. Very big in the country
- Exploration projects and preparation of production facilities can be considered to be postponed first, given that the supply chain of these activities is experiencing disruption which hinders the achievement of project delivery targets
- Taking advantage of low world oil prices, build "strategic reserves" in Indonesia. This can be done by utilizing old field wells that are not producing as storage for imported crude oil. Tanks that are in refineries or depots, or other facilities in Indonesia, can be used to accommodate fuel stocks which are used to extend BBM reserves in Indonesia. The development of strategic reserves aims to increase Indonesia's energy security
- Oil refinery operations can be adjusted according to the level of decreasing fuel demand. If necessary, some refineries, especially those that are inefficient, are temporarily suspended and are used for maintenance
- Activities to support the Major Project for Refinery Development and Development in the 2020-2024 RPJMN are still being carried out, but are limited to the preparation of various kinds of agreements needed, negotiations, etc., and postponing procurement and construction activities first
- Recalculating the economics of the Major Project for the Development of Renewable Energy, Green Fuel Based on Palm Oil in the RPJMN 2020-2024
- The selling price of fuel should not be lowered. This is because falling demand has contributed to lowering oil revenues (both to companies and the Government's share) while several funds are still needed to finance the overheads of decreased production and refining activities. Discounts can be given

to small consumers such as ojol drivers and small industry players. Also consider that, if there is a surplus from fuel sales, it can be donated to the Government, because during the COVID-19 pandemic the Government needed very large funds, especially for the Social Safety Network (Social Safet Net) program. Transparency and good communication are urgently needed in making public policies regarding fuel prices.

5. CONCLUSION

COVID-19 caused demand for petroleum to fall sharply, but not badly for natural gas demand. This can be explained as follows. First, the very sharp decline in fuel consumption is for transportation activities (gasoline, diesel oil for passenger vehicles, avtur for airplane engines) while the use of natural gas for transportation is very small compared to fuel. On the other hand, the use of natural gas for households (for cooking and heating) is greater than that for fuel, while during the social distancing or lock-down period, the use of natural gas in households increases. Second, because it is not as easy to stop the production and distribution of natural gas as doing these things for petroleum. Natural gas distribution requires special infrastructure (pipelines, LNG ships, etc.) which are inflexible compared to the transportation of crude oil or BBM which is easier to do. Third, in the Gas Sales & Purchase Agreement there is usually an agreement regarding the TOP (take or pay): consumers will still get their natural gas shipments, or have to pay for it even though the gas is not delivered. The impact of the economic boom within side the number one zone showed a giant and tremendous impact on Gas supply in Indonesia in 2018-2020. This is due to the fact economic boom within side the number one zone is a zone that absorbs a whole lot of exertions, and the humans of Indonesia by an extensive work within side the agricultural area. Moreover, the economic boom's impact within the secondary zone showed a giant and tremendous effect on Gas supply in Indonesia in 2018-2020. This is because the commercial area gives excessive wages so that humans pick to work within side the secondary zone. Furthermore, the economic boom's impact on the tertiary site showed giant and adverse effects on Gas supply in Indonesia in 2018-2020. This is because the tertiary zone is the handiest capable of increase in city and strategic areas.

Based on the conclusion, it is recommended that the Indonesia Government should make policies that prioritize labor-intensive Gas supply because the skills of the labor in Indonesia have not adapted to technological tools. Therefore, the three main sectors can be positively proportional to jobs in Indonesia. Furthermore, the Indonesia Government should make policies that prioritize the balanced growth of the three main sectors so that the three main sectors' growth can have a positive effect on Gas supply in Indonesia. Also, the Government should continue to increase investment and export volume from year to year, especially the investment that can absorb labor and, at the same time, boost economic growth in Indonesia.

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