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The Impact of Certain Price of Natural Gas Policy on Indonesia's Economy

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Abstract

The Indonesian national industry has experienced a slowdown in growth and decrease in competitiveness, allegedly caused by the high price of natural gas. Therefore, the government intervened by implementing Certain Price of Natural Gas Policy (Harga Gas Bumi Tertentu), a policy that facilitates industries to obtain gas at lower prices through the issuance of Presidential Decree Number 121 of 2020 concerning Natural Gas Pricing. This study aims to analyze the impact of the policy on the national economy by considering the decline in state revenues as a consequence of the reduced price of natural gas for industry. Using the Computable General Equilibrium (CGE) model, analyses were carried out on various economic indicators. This study finds a decline in GDP for 0.076% in the short-run and an increase in GDP for 0.004% in the long-run. Furthermore, household income, in both rural and urban areas, decreases from 0.1 to 0.2% in both short and long-run. For industries that use gas intensively, the price reduction increases sectoral output and labor, and reduces commodity prices.

Keywords: Natural Gas Prices, Policy, Impact Analysis, CGE
JEL classification: A20, C68, H27, H30

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1. Introduction

Economic globalization requires industry to contribute to the global value chain. World Bank (2017) stated that the average contribution of countries that develop their industrial sector to the world economy is 17%. As part of the global value chain, Indonesia contributes more than 20% (i.e. 20.5%), one of the highest after China (28.8%), South Korea (27%), Japan (21%) and Germany (20.6%). Domestically, the contribution of industrial sector to Indonesian economy is 19-20%. Despite its contribution, both domestically and globally, this sector is not free from various problems, such as growth and competitiveness. Ministry of Industry (2020) stated that, in 2017, industrial growth was 4.33%, lower than the national economic growth of 5.07%. The growth declined further in 2018 to 2.87%, lower than the national economic growth of 5.17%. In addition, the industry must also face challenges related to low raw material supply, inadequate infrastructure, lack of skilled experts, pressure from imported products, and so on. High production costs put pressure on the industry and increase output prices, making Indonesian products low in competitiveness. One of the components suspected of exerting too much pressure on the industry is the natural gas price for the industry.

Ministry of Industry (2020) in press stated competitiveness is the difference between the prices of certain imported products and the prices of domestic products at certain gas price ranges. Positive competitiveness means that the price of domestic products is relatively cheaper compared to the price of imported products. Various problems related to natural gas prices are experienced by several natural gas-based industries such as the fertilizer, petrochemical, ceramics, and glass industries. The problem experienced by the fertilizer industry is the high natural gas price. As gas consumes 70% of the production costs, the commodity's economy is being questioned. The same thing is experienced by the petrochemical industry, in which the need for natural gas places 70% of the cost structure. The same situation occurs in the ceramics and glass industry, where the high price of natural gas results in low production utilization. As a comparison, in the oleochemical industry, an industry that uses gas intensively, gas prices contribute 50% in product processing (about 10-12% gas prices contribute) and oleochemical derivative products (about 30-38% gas prices contribute). For the industries mentioned earlier, gas does not only contribute as a raw material but also uses a large amount of energy in producing products and derivative products, so that gas becomes a sizeable part of their cost structure. Whereas in industries that do not use gas intensively, for example the textile industry, the role of gas only reaches 5-10% in the component of production costs.

The government has recognized the problem of natural gas prices for industry in Indonesia. Because natural gas is an important production component, its pricing must not be handled by market mechanisms. The presence of the government is necessary to intervene. Keynes (1936) stated that government intervention in the economy is necessary to restore market effectiveness. Certain Price of Natural Gas Policy as a form of government intervention was designed to encourage industrial growth and to overcome competitiveness problems. Therefore, the government must encourage the acceleration of economic growth through the development of domestic industry. With the consideration of increasing industrial growth and competitiveness, Indonesian President Joko Widodo gave directions to reduce natural gas prices for the industry. The government intervened in the natural gas price for industry by issuing Certain Price of Natural Gas Policy, a policy that facilitates industries to acquire natural gas at lower prices, which is regulated in Presidential Decree Number 40/2016 which states that the maximum price for natural gas for seven industrial sectors i.e. fertilizer, petrochemical, oleochemical, steel, ceramics, glass, and rubber glove industry is USD 6 per MMBTU (Million Metric British Thermal Unit). Furthermore, taking into account the principle of justice and policies on accelerating economic growth, the government revised Presidential Decree Number 40/2016 by issuing Presidential Decree Number 121/2020. In this latest regulation, the government opens opportunities for all industrial sectors to participate in obtaining natural gas at lower prices.

Certain Price of Natural Gas Policy is an incentive given by the government to industry to reduce production costs and to increase production capacity. With a higher production capacity, the government is optimistic that Certain Price of Natural Gas Policy can have a multiplier effect on the economy in forms of upgrades in the number of labors, output, product competitiveness, and, on a macro level, GDP and household. Policy changes in the form of natural gas price reduction will result in changes in the structure of production costs. This will increase production activity because the amount of output generated from the production process will be affected. The output increase will enhance the performance of other industries that do not intensively use natural gas. Here the multiplier effect occurs, and it increases the demand for production factors and labor. Ultimately, all increases in output and employment will increase GDP and household income, indicating an improvement in the economy.

However, the government still has to face problems regarding mechanisms to be applied to reduce gas prices, which is calculated from the reduction of the government's share of natural gas sales, i.e. the non-tax state revenues from

natural gas. This was done so as not to disrupt the revenue of oil contractors (KKKS), the oil-and-gas partnering contractors (i.e. the upstream gas prices). This will indirectly lead to budgetary adjustments to government programs, which will ultimately affect both industry and household. In the end, natural gas price reduction and state revenue reduction will have a net impact on economy.

Numerous studies on natural gas price policy have been carried out. Several literature studies discuss gas price policies made by the government in the form of incentives. Wang & Lin (2014) found that gas incentives can reduce the negative impact of market failures. Fattouh & El-Katiri (2012) found that gas price incentives provided by the government can reduce production costs. Lin & Li (2021) found that price reforms have been effective in reducing price distortions. Goncharuk (2015) found that natural gas prices affect the level of investment in gas-intensive industrial sector. Ambya et al. (2020) found that the allocation of subsidies for natural gas prices affects the use of natural gas to expand output for economic growth. Orlov (2015) found that rising domestic gas prices increases economic efficiency. Furthermore, Orlov (2017) also found that the increasing gas prices in Russia has a significant negative impact on poor households. Zhang et al. (2017) found that a natural gas price increase causes an increase in the consumer price index and a decrease in GDP. He & Lin (2017) found that a natural gas price increase can reduce carbon emissions, increase CPI, and reduce GDP. Nugroho & Amir (2018) found that, on a macro basis, providing incentives in the form of lower natural gas prices can increase GDP by 0.12% -0.13%. In sectoral perspective, natural gas price incentives for industrial sectors can reduce production costs, so that the output prices become more competitive. Hutagalung et al. (2020) examined the macro impact using CGE and assessed the micro impact using net back value on natural gas price adjustments. Previously, Hutagalung et al. (2017) found that natural gas price policy had been applied by the government to address social and economic problems.

Studies on natural gas price policy in Indonesia is crucial. The strategic position of natural gas as energy sources and commodities that increase state revenues needs to be taken into account if the government wants to prioritize natural gas as capital in industrial development which can further drive in economy. There are only a few studies that address current issues regarding natural gas price bases and economic data. In addition, previous research in Indonesia that calculated the impact of reduced gas prices using the CGE model did not consider reductions in state revenues and used SAM data that was quite old, which is SAM data 2008, so that it could not adequately represent the current condition of the Indonesian economy.

The objective of this research is to analyze the impact of Certain Price of Natural Gas Policy on Indonesia's economy in the form of natural gas price reduction shock using Gross Domestic Product (GDP) and household income as the macroeconomic indicators and sectoral prices, output, and labor as the microeconomic indicators. Apart from that, to get the net impact, this research also carried out shock in the form of the decrease state revenue as a compensation that must be borne by the government as a result of the decline in natural gas prices to get a net impact on the economy. The scope of this research is Certain Price of Natural Gas Policy in Presidential Decree Number 121/2020. This study uses the Computable General Equilibrium (CGE) model with the database of SAM 2019. The research is limited by the normal economic structure, which does not include the Covid-19 pandemic shock. The author's consideration of using the CGE model is because the CGE model is an economic model to simulate how sectors in the economy respond to changes or shocks that occur such as changes in prices, policies and other factors that affect the market. The Certain Price of Natural Gas Policy is economy-wide in nature, in that the decline in industrial natural gas prices will cause changes in the economy with a wider scope so that it is more appropriate for this policy analysis to be carried out using the CGE model approach.

This research is expected to contribute to (1) modifying Social Accounting Matrix (SAM) by bringing out sectors that are relevant to the research objectives and (2) making empirical analyses through the use of a Computable General Equilibrium model. In addition, because most of past studies only focus on economic impacts without taking into account compensation and only measure macro impacts without any analysis on how policies can affect industry competitiveness, this research (3) specifically examines the impact of natural gas price shocks on various economic indicators by considering the decline in state revenues resulting from the implementation of the Certain Price of Natural Gas Policy. Further, this research also contributes in (4) providing numerical simulation on measurable impacts that can be used by the government to project their measures, either maintaining or ceasing Certain Price of Natural Gas Policy either in sectoral or comprehensive manner. Therefore, this research also (5) helps the government optimize the absorption of natural gas for domestic needs by providing references in preparing policies regarding natural gas in Indonesia.

2. Research Method

This study adopts the Indonesian Inter-Regional Static comparative standard CGE model (IRSA Indonesia 5) developed by Resosudarmo et al. (2011) and which have been applied by Hartono et al. (2017), Aissa & Hartono (2016) and Sobri, Hartono, & Lestari (2020). This model is run using the General Algebraic Modeling System (GAMS). The CGE IRSA Indonesia 5 model assumes that Indonesia has an open economy and the model contains equations that describe all payment flows summarized in the SAM database. The systematic equations referred to represent the behavior of all economic agents such as consumers, producers and market clearing conditions in the economy in the presence of a natural gas reduction shock which is divided into 5 (five) equation blocks, including: (1) production block which reflects the production structure (Fig. 1); (2) consumption blocks that reflect the behavioral structure of households and other institutions; (3) export-import block which reflects the state's decision to export/import goods and services; (4) the investment block which reflects the decision to invest in the economy and the demand for goods and services used in the formation of new capital; (5) market clearing block, which reflects market clearing conditions for labour, goods and services in the economy.

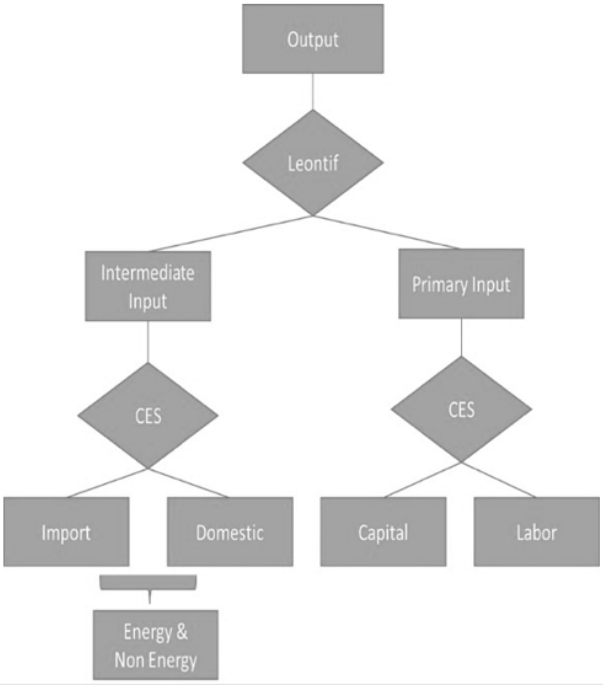


Figure 1. Production Block CGE Standard Model Structure (Aissa & Hartono, 2016)

Figure 1 shows production blocks on the standard model of CGE. There, capital and labor are summed using Constant Elasticity Substitution (CES) to form composite inputs, that is the combination of energy and non-energy inputs to produce gross domestic output using the Leontief Function. According to this function, if one of the available inputs increases, the production level does not necessarily increase because it is assumed that all production inputs remain at the same proportion level. The substitution mechanism is influenced by CES, a parameter used to obtain a realistic response to price changes. Furthermore, CES is also used when the demand cost of primary factors is minimized, so producers will substitute

composite inputs, both in capital and in labor, any of which requiring relatively lower costs.

The author's consideration of using CGE model, is because: (i) CGE are the analytical tool or model that helps analyze impacts that are influenced by market/sector linkages Arrow (2005), (ii) Certain Price of Natural Gas Policy is a new policy, which is very appropriate when analyzed using the forward-looking CGE, and (iii) CGE accommodates price variable adjustments and accommodates structural changes in the economy.

In studies using CGE, the main data needed is Social Accounting Matrix (SAM) data. The latest SAM data for Indonesia is the 2008 data of SAM, and it is still relevant until now. According to Anas (2019), this is because the SAM multiplier is based on the Average Spending Propensity (AEP), which found not to differ much from the 1975 data of SAM and 2008 SAM AEPs. It also means that the Indonesian economy has not changed much. But in this study, we tried to use more updated data of SAM. This study uses the 2019 data of SAM which was compiled based on the 2016 input-output data which has been updated to the 2019 version using RAS, as done by Hartono et al. (2020). According to Hartono & Resosudarmo (2008), SAM is an economic balance sheet in the form of a matrix that records all economic transactions between agents, between sectors within an institutional block, and between sectors within a block of production factors in an economy. According to Hartono (2002), SAM contains information about social structures in the economy, for example the distribution of household income based on socio-economic groups. SAM in this study consists of three endogenous balance blocks; they are production factor block, institutional block, and production sector block; they constitute the 66 production sectors (Appendix 1).

Furthermore, to facilitate a better analysis on the impact of Certain Price of Natural Gas Policy on sectoral output and labor, the results of the simulation were aggregated from 66 to seventeen sectors (as used by Statistics Indonesia) and then specifically detailed for the manufacturing industry as seen in Table 1.

Table 1. Classification of the Seventeen Sectors

No	Description
1	Agriculture, forestry, and fishery (FCROP, FOREST & FISHER)
2	Mining and Excavation (MINING)
3	Refinery Industry (REFINERY)
	Chemical Industry (CHEMI)
	Rubber Industry (RUBBER)
	Non Metal Mining Industry (NONMET)
	Basic Metal Industry (BASMET)
	Manufacturing Industry, other than the five above (MANUF)
4	Electricity and gas provision (ELEC & GAS)
5	Water provision, waste management, and recycling (WATER)
6	Construction (CONSTRUCT)
7	Wholesale and retail trade, motor vehicle maintenance (TRADE)
8	Transportation and warehousing (TRANS & WAREH)
9	Accommodation and food and beverage (HOTEL & RESTO)
10	Information and communication (INFOKOM)
11	Financial and Insurance service (BANK & INSUR)
12	Real Estate (ESTATE)
13	Company services (COMPSER)
14	Governmental administration, defense, and compulsory social insurance (ADMIN)

No	Description
15	Education service (EDUC)
16	Health service and social activities (HEALTH)
17	Other services (OTHSER)

Source: BPS RI (2020), reprocessed data.

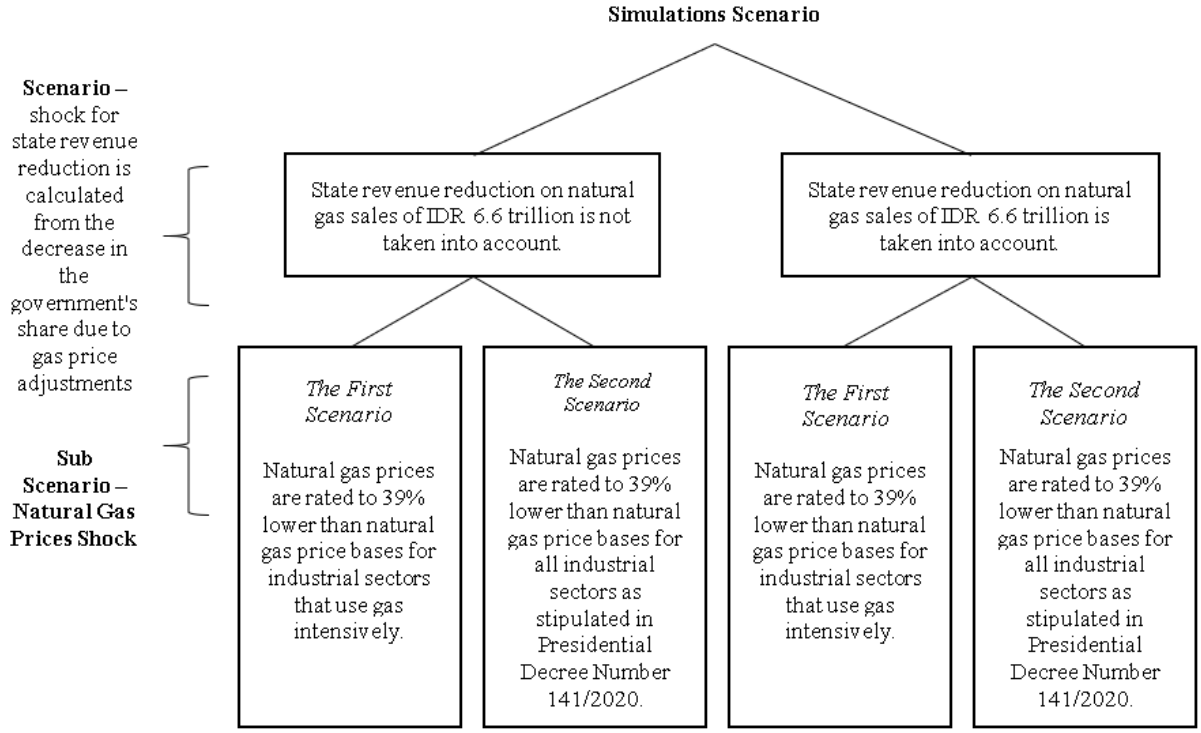


Figure 2. Simulation Scenario

For the record, for sectors which intensively use gas, the manufacturing industry sector was segregated into (1) refinery industry, (2) CHEMI industry, i.e. chemical industry representing fertilizer, petrochemical, and oleochemical industry, (3) RUBBER industry, (4) NONMET industry, i.e. non-metal mining industry representing ceramics and glass industry, (5) BASMET industry, i.e. base metal industry representing iron and steel industry, and (6) other manufacturing industries. These six industrial groups are examples of industries that use natural gas intensively both as raw material and fuel. However, in this study, the authors will focus on 4 industrial groups regulated in Presidential Regulation Number 40/2016, namely the chemical industry, rubber industry, non-metal mining industry and base metal industry.

There are two main scenarios carried out to analyze the impact of the decline in natural gas prices as stipulated in the Certain Price of Natural Gas Policy. The first scenario is simulation without taking into account the decline in state revenue, then the second scenario is simulation that takes into account the decline in state revenue as compensation for falling natural gas prices. Then each scenario is followed by the first sub-scenario in the form of implementing Certain Price of Natural Gas Policy that only apply to the gas-intensive industry (as stipulated for the first time in Presidential Decree Number 40/2016) and the second sub-scenario in the form of implementing Certain Price of Natural Gas Policy that apply to all industries as stipulated in Presidential Decree Number 141/2020. Furthermore, the amount of shock was acquired by calculating the weighted average of natural gas price reduction using the

price basis of USD 6 per MMBTU which has been adjusted according to the Certain Price of Natural Gas Policy allocation for each industry as stipulated in Presidential Decree Number 40/2016. The acquired shock value is 38.99% (rounded up to 39%). The amount of shock for state revenue reduction is calculated from the decrease in the government's share due to gas price adjustments as mentioned in the 2021 LKBUN report, i.e. USD 463 million or IDR 6,622 billion. To facilitate the simulation, the shock was rounded up to IDR 6.6 trillion or IDR 6,600 billion. Therefore, the simulation scenario that will be used in this study at Figure 2.

The simulation in this study also considers short-run and long-run scenarios. In the short-run period, the factors of production are endogenous, it can change the amount of input (capital and labor) that will be used so that it is possible for labor to be unabsorbed and there is no transfer of factors of production to other sectors. Meanwhile for the long-run setting, the factors of production are exogenous, it is assumed that full employment or all labor has been absorbed and it is possible for the transfer of factors of production (capital & labor) between sectors (Aissa & Hartono, 2016).

3. Results And Discussion

3.1 Results

In the CGE model, the simulation will lead to interactions between industrial sectors and between economic agents towards a new balance. The macroeconomic variables in the simulation results are a benchmark for identifying a new balance of a condition following certain shocks. For the record, for the first scenario, the simulation was conducted on six industrial sectors in SAM 2019; they are (1) othref, products of other refineries; (2) foodbev, food and beverage industry, (3) chemi, chemical industry, (4) rubber, rubber industry; (5) nonmet, mineral goods industry other than metal; and (6) basmet, base metal industry. For the second scenario, the simulation was carried out to all 66 sectors.

3.1.1 Simulation Results Without State Revenue Shock

The simulation results, as shown in Figure 3, show that there is a positive impact from the natural gas price reduction shock in both scenarios in the short-run and in the long-run; the highest positive impact score is in the short-run. Further, in the short-run, the second scenario has the highest positive impact score, namely 0.034%, while the impact on the first scenario is 0.02%. In the long-run, both scenarios provide positive impact scores, but they are very small, below 0.001%. This illustrates that in the short-run if the natural gas price reduction policy is applied to all sectors it will have a multiplier impact on industrial sectors other than intensive gas users to participate in increasing their output and in total will generate the largest increase in GDP. This finding is in line with the findings of Nugroho & Amir (2018) who found that providing incentives in the form of reduced gas prices caused an increase in GDP of 0.12% -0.13%. In addition, this finding is also indirectly in line with the findings of Orlov (2017) and Zhang et al. (2017) who found that an increase in gas prices will reduce GDP.

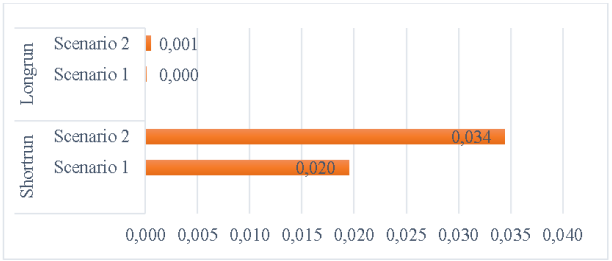


Figure 3. Impact of Certain Price of Natural Gas Policy on GDP

Source: GAMS simulation result, reprocessed data.

Figure 4 shows the impact of Certain Price of Natural Gas Policy on household income. The simulation results show that the average positive impacts from natural gas price reduction shock were found in both scenarios, in both short and long-run; the biggest impact is in the short-run. The average positive impact scores are 0.1% in the short-run and 0.08-0.1% in the long-run; they are felt by urban households of decile 1 to 10 in the second scenario. Rural population will experience an average income increase of 0.01-0.08% in the short-run and 0.002-0.07% in the long-run. Based on the simulation results, the biggest impact of Certain Price of Natural Gas Policy will be felt

by households in the short-run if the natural gas price reduction policy is applied to all sectors (the second scenario). The highest average impact of household income increase will be felt more by urban households compared to rural households. However, in the long-run, the positive impact of the policy on household income will not be quite significant. The results of a similar analysis are in line with the findings of Nugroho & Amir (2018) which found that a decrease in gas prices would have an increasing impact on households by 0.35% -0.36%.

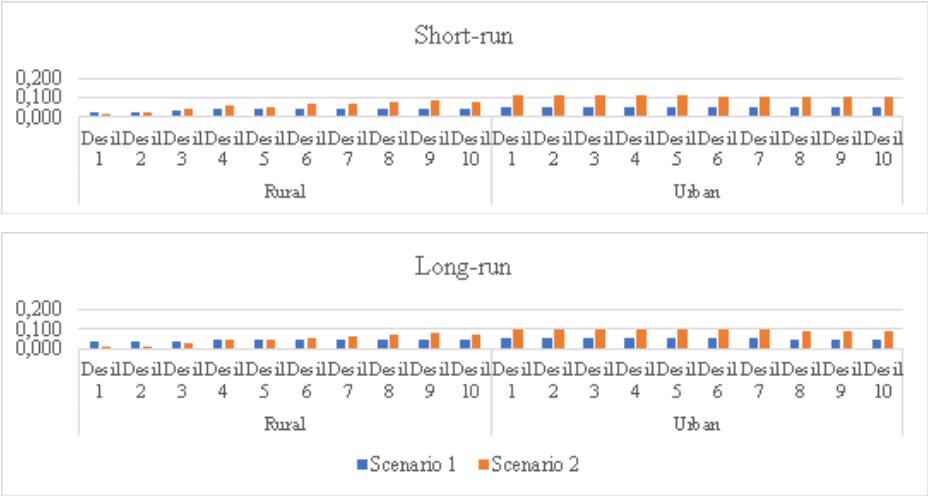


Figure 4. Impact of Certain Price of Natural Gas Policy on Household Income

Source: GAMS simulation result, reprocessed data.

Table 2. Impacts of Certain Price of Natural Gas Policy on Sectoral Output and Labor

No	Description	OUTPUT				LABOR			
		Short-run		Long-run		Short-run		Long-run	
		Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2
1	Fcrop, Forest & Fisher	0.011	0.020	-0.003	-0.014	0.023	0.043	0.000	0.000
2	Mining	0.006	0.014	-0.026	0.028	0.020	0.053	-0.009	0.045
3	Refinery	0.011	0.032	-0.035	-0.030	0.061	0.180	-0.026	-0.002
	Chemi	0.234	0.255	0.434	0.419	0.802	0.871	0.438	0.438
	Rubber	0.138	0.179	0.198	0.206	0.336	0.438	0.201	0.222
	Nonmet	0.133	0.156	0.115	0.111	0.275	0.322	0.119	0.124
	Basmet	0.209	0.236	0.416	0.436	0.745	0.845	0.419	0.449
	Manufa	0.019	0.081	-0.015	0.014	0.046	0.200	-0.020	0.034
4	Elec & Gas	0.025	0.656	0.013	0.798	0.129	3.622	0.031	0.862
5	Water	0.051	0.138	0.093	0.236	0,000	0,000	0.000	0.000
6	Construct	0.032	0.046	0.013	0.000	0.065	0.093	0.012	0.003
7	Trade	0.042	0.088	0.036	0.055	0.075	0.157	0.044	0.084
8	Trans & warehouse	0.028	0.076	-0.001	0.023	0.050	0.107	0.004	0.041
9	Hotel & Resto	0.016	0.041	-0.029	-0.047	0.025	0.066	-0.020	-0.018
10	Infokom	0.011	0.033	-0.030	-0.029	0.031	0.097	-0.016	0.015
11	Bank & Insur	0.021	0.053	-0.001	0.011	0.046	0.112	0.012	0.053

No	Description	OUTPUT				LABOR			
		Short-run		Long-run		Short-run		Long-run	
		Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2
12	Estate	0.009	0.033	-0.039	-0.026	0.034	0.132	-0.020	0.034
13	Compser	0.002	-0.024	-0.029	-0.076	0.005	-0.066	-0.013	-0.025
14	Admin	-0.125	-0.513	-0.175	-0.543	-0.176	-0.721	-0.156	-0.484
15	Educ	-0.054	-0.250	-0.088	-0.271	-0.074	-0.338	-0.072	-0.224
16	Health	-0.011	-0.083	-0.030	-0.107	-0.019	-0.141	-0.007	-0.036
17	Othser	0.029	0.096	-0.005	0.040	0.040	0.133	-0.001	0.054

Source: GAMS simulation results, reprocessed data.

Table 3. Impacts of Certain Price of Natural Gas Policy on Commodity Prices

Commodity Price	*Short-run*		*Long-run*	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
CHEMI	-0.106	-0.103	-0.210	-0.198
RUBBER	-0.058	-0.060	-0.095	-0.089
NONMET	-0.462	-0.492	-0.465	-0.486
BASMET	-0.085	-0.081	-0.183	-0.180

Source: GAMS simulation result, reprocessed data.

The simulation results show that the average positive impacts of natural gas price reduction shock in both scenarios were present in the short-run, but not in the long-run. Based on Table 2, the highest positive impact score will be felt if the second scenario is applied in the short-run. Here the highest output increases are produced by electricity and gas provision industry (0.65%), followed by chemical industry (0.25%), and base metal industry (0.23%). The output increase has become the multiplier effect for other sectors that also experienced an output increase. For instance, the electricity and gas provision sector will have multiplier effects on sectors that use electricity and gas. Then, the base metal industry, which represents the iron and steel industry and is known as the "mother of industries", has an important role in supplying the raw material needs of other industrial sectors, such as construction and transportation equipment, which are also affected by the output increase. Along with the increase in output, labor also increased, in which the highest increase was on electricity and gas provision (3.6%), followed by chemical industry (0.87%), and base metal industry (0.84%). This increase in labor is in line with the findings of Nugroho & Amir (2018).

The problem with natural gas prices begins with the decline in the competitiveness of the industry, especially those which use gas intensively. Based on the definition of competitiveness according to the Ministry of Industry (2020), competitiveness is the comparison between commodity prices in a certain gas price range compared to prices of similar products imported from abroad. A positive number indicates that a commodity has competitiveness. Thus, the identification of the effect of natural gas price reduction was carried out only on commodity prices in industries which intensively use gas. The industries in this regard are (1) chemical industry (chemi), (2) rubber industry (rubber), (3) non-metal mining industry (nonmet), and (4) base metal industry (basmet). The impact of Certain Price of Natural Gas Policy on sectoral commodity prices is shown in Table 3. The simulation results show that commodity prices in general are decreasing, with the highest decrease in the second scenario. In the short-run, the decline in commodity prices was 0.103% in the

chemical industry, 0.060% in the rubber industry, 0.492% in the non-metal mining industry, and 0.081% in the base metal industry. In the long-run, the decline in commodity prices was 0.198% in the chemical industry, 0.089% in the rubber industry, 0.4866% in the non-metal mining industry, and 0.180% in the base metal industry. Based on the simulation results, commodity prices of the industry are decreasing. The decline in commodity prices is an indication that natural gas price reduction is an important factor in reducing production costs, which in turn lowers output prices. Lower commodity prices will make the industry more competitive.

3.1.2 Simulation Results With State Revenue Shock

This section describes the simulation results of natural gas price reduction shock accompanied by a state revenue reduction shock that applies two scenarios. The scenarios being compared are the same scenarios applied to the previous simulation. The difference is in the simultaneous addition of a state revenue shock of IDR 6.6 trillion and a natural gas price reduction shock. This is done to simulate Indonesia's economic situation if the natural gas price reduction is carried out with a compensation mechanism from state revenues. The sectors that are given a shock are the same as the previous simulation. Figure 5 is the simulation result of natural gas price reduction shock on GDP with the addition of state revenue shock.

The simulation results show that the negative impact of natural gas price reduction shock on both scenarios was present in the short-run. In the short-run, the second scenario has the smallest negative impact of -0.076%, while in the long-run, the second scenario has the largest positive impact of 0.004%. In the long-run, both first scenario and second scenario increase GDP by 0.004%. This shows that natural gas price reduction which is compensated by state revenue reduction has a negative impact on GDP in the short-run and a positive impact on GDP although not too significant in the long-run. This means that the state revenue reduction will determine the final value in forms of net GDP decrease. The decrease indicates that the Certain Price of Natural Gas Policy is being applied by a compensatory mechanism, i.e. the decline in non-tax state revenues from natural gas, was not able to boost the performance of the national economy, instead it reduced it.

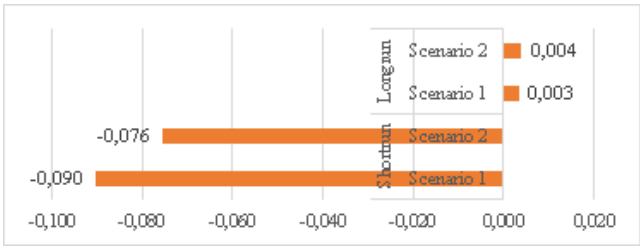
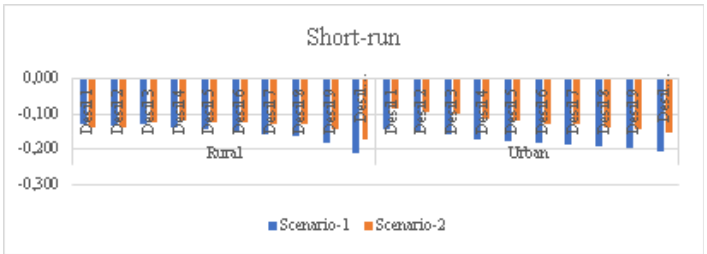


Figure 5. Impact of Certain Price of Natural Gas Policy on GDP (with the addition of state revenue shock)

Source: GAMS simulation result, reprocessed data.



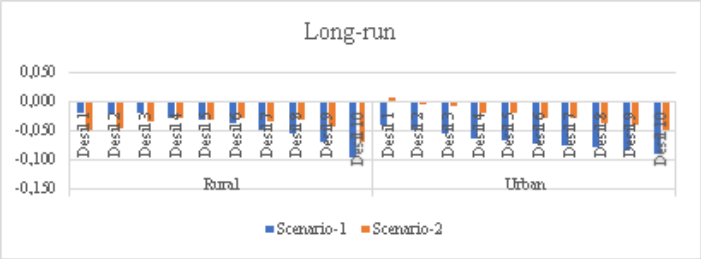


Figure 6. Impact of Certain Price of Natural Gas Policy on Household income (with the addition of state revenue shock)

Source: GAMS simulation result, reprocessed data.

Table 4. Impact of Certain Price of Natural Gas Policy on Sectoral Output and Labor (with the addition of state revenue shock)

No	Description	OUTPUT				LABOR			
		Short-run		*Long-run*		*Short-run*		*Long-run*	
		Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2	Scen 1	Scen 2
1	Fcrop, Forest & Fisher	-0.024	-0.015	0.006	-0.004	-0.050	-0.030	0.002	0.002
2	Mining	-0.003	0.005	0.161	0.214	-0.010	0.022	0.168	0.222
3	Refinery	-0.033	-0.013	0.051	0.055	-0.182	-0.065	0.082	0.106
	Chemi	0.224	0.244	0.590	0.575	0.768	0.836	0.620	0.619
	Rubber	0.147	0.189	0.375	0.384	0.360	0.461	0.400	0.421
	Nonmet	0.045	0.067	0.133	0.129	0.092	0.139	0.156	0.161
	Basmet	0.196	0.224	0.623	0.642	0.700	0.799	0.644	0.673
	Manufa	-0.033	0.029	0.046	0.075	-0.084	0.069	0.062	0.116
4	Elec & Gas	-0.093	0.533	-0.010	0.774	-0.392	3.056	0.090	0.921
5	Water	-0.174	-0.088	-0.131	0.012	-1.038	-0.524	-0.024	0.164
6	Construct	-0.072	-0.059	0.012	-0.001	-0.147	-0.119	0.015	0.007
7	Trade	-0.012	0.033	0.101	0.120	-0.022	0.060	0.150	0.190
8	Trans & warehouse	-0.082	-0.040	0.008	0.029	-0.202	-0.099	0.054	0.097
9	Hotel & Resto	-0.108	-0.084	-0.029	-0.047	-0.175	-0.135	0.016	0.019
10	Infokom	-0.104	-0.081	-0.057	-0.056	-0.302	-0.237	0.017	0.049
11	Bank & Insur	-0.083	-0.052	0.010	0.022	-0.177	-0.112	0.079	0.120
12	Estate	-0.027	-0.003	0.031	0.043	-0.108	-0.010	0.132	0.186
13	Compser	-0.168	-0.194	-0.102	-0.149	-0.461	-0.531	-0.016	-0.028
14	Admin	-0.896	-1.280	-0.853	-1.221	-1.259	-1.798	-0.756	-1.085
15	Educ	-0.580	-0.773	-0.450	-0.633	-0.785	-1.046	-0.371	-0.522
16	Health	-0.330	-0.402	-0.243	-0.320	-0.562	-0.682	-0.126	-0.154
17	Othser	-0.127	-0.060	-0.013	0.032	-0.176	-0.084	0.010	0.065

Source: GAMS simulation result, reprocessed data.

Table 5. Impacts of Certain Price of Natural Gas Policy on Commodity Prices Labor (with the addition of state revenue shock)

Commodity Price	*Short-run*		*Long-run*	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
CHEMI	-0.154	-0.151	-0.297	-0.284
RUBBER	-0.095	-0.097	-0.176	-0.170
NONMET	-0.534	-0.564	-0.560	-0.581
BASMET	-0.115	-0.110	-0.274	-0.271

Source: GAMS simulation result, reprocessed data.

Figure 6 shows the impact of Certain Price of Natural Gas Policy on household income. The simulation results show that the average negative impacts of natural gas price reduction shock on both scenarios were present in both short and long-run; the highest negative impact is in the short-run. Lower state revenues reduce government spending. This of course affects people's income. For example, if state revenues fall by IDR 6.6 trillion, and the money was supposed to be allocated for expenses that stimulate household income increase, household income and purchasing power will decrease, resulting in lower community welfare.

Table 4 shows the impact of Certain Price of Natural Gas Policy on sectoral output and labor. The highest output increase is in the second scenario in the long-run. The highest increases are 0.774% in the electricity and gas provision sector, 0.642% in the base metal industry, 0.575% in the chemical industry and 0.384% in the rubber industry. In the short-run, the highest output increases are 0.533% in electricity and gas provision, 0.244% in chemical industry, 0.224% in base metal industry, and 0.189% in rubber industry. In addition to the gas-intensive sectors, negative output is experienced by almost all sectors. This is probably due to the fact that the multiplier effects on sectors that get the positive impact are no higher than the net state revenue reduction. Similar to output, labor has impact figures that are not much different. The highest labor increases are 3.056% in electricity and gas provision, 0.83% in chemical industry, 0.79% in base metal industry and 0.461% in rubber industry. In the long-run, the highest positive impacts are in electricity and gas provision (0.92%), base metal industry (0.67%), chemical industry (0.61%), and rubber industry (0.42%). In addition to the gas-intensive sectors, the negative impacts on labor are also identified in all sectors.

Table 5 shows the simulation results of the impact of Certain Price of Natural Gas Policy on commodity prices. The simulation results show that commodity prices in general are decreasing. The highest decline in commodity prices was in the second scenario, namely when natural gas price reduction was given to all industrial sectors, in both short and long-runs. In the short-run, the decline in commodity prices was 0.151% for the chemical industry, 0.097% for the rubber industry, 0.564% for the non-metal mining industry and 0.110% for the base metal industry. In the long-run, the decline in commodity prices was 0.284% for the chemical industry, 0.170% for the rubber, rubber and plastics industry, 0.581% for the non-metal mining industry, and 0.271% for the base metal industry. The simulation results show that commodity prices in these industries are decreasing. This is an indication that natural gas price reduction is an important factor in reducing production costs, which in turn lowers output prices. With lower commodity prices, the industry becomes more competitive. The simulation results also mean that the state revenue shock does not reduce the impact of Certain Price of Natural Gas Policy on commodity prices because the decline in commodity prices resulting from the simulation is related to the outputs of the industrial sector which intensively uses gas.

4. Conclusions

This study attempts to empirically analyze the impact of government policies, i.e. natural gas

price reduction for industry, on the economy in the aggregate. The focus of this research is the impact of natural gas price reduction for industry on economic indicators such as GDP, household income, sectoral output and labor, and commodity prices. This research is based on Certain Price of Natural Gas Policy which was initially limited to certain industrial sectors and expanded to all industrial sectors. Furthermore, because the mechanism of natural gas price reduction is compensation for reduced state revenues from natural gas sales, two main scenarios are applied to see the net impact of the policy; the scenarios are natural gas price reduction without considering state revenue reduction and natural gas price reduction by considering state revenue reduction. Next, in the said main scenarios, two sub-scenarios will be compared in the model; they are as follows. The first scenario is that the natural gas price is 39% lower than the natural gas price bases for industrial sectors which intensively use gas, and the second scenario is that the natural gas price is 39% lower than the natural gas price bases. for all industrial sectors as stipulated by Presidential Decree Number 141 of 2020.

In general, for the scenario that does not include state revenue reduction shock, the highest average increase occurs when the second scenario is implemented, namely when the natural gas price reduction policy or Certain Price of Natural Gas Policy is applied to all industrial sectors as stipulated in Presidential Decree Number 141 2020. From a macroeconomic perspective, Certain Price of Natural Gas Policy will improve the performance of the national economy if it is applied to all industrial sectors; this is marked by an increase in GDP in the range of 0.034% in the short-run. Then, household income increased by 0.055% in rural areas and 0.106% in urban areas in the short-run, and 0.045% in rural areas and 0.086% in urban areas in the long-run. In sectoral regard, the simulation results show that the highest values in the short-run are in the increase of output and labor. The highest output increase is 0.6% in electricity and gas provision and 0.2% in the chemical manufacturing industry (which represents the fertilizer, petrochemical and oleochemical industries which use gas intensively both as raw material and energy). The increase of labor is 3.6% in electricity and gas provision, 0.87% in chemical industry, and 0.84% in base metal industry (which represents iron and steel industry). In the industrial sector, lower gas prices can cut production costs, so industries that use gas intensively can lower their commodity prices. The lowest decline in commodity prices occurred in the non-metal mining industry, i.e. 0.49% in the short-run and 0.48% in the long-run. The non-metal mining industry is a representation of the ceramics and glass industry. The findings from the simulation results carried out in this study are in line with the findings of Nugroho & Amir (2018), i.e. positive impact on GDP, household income, and sectoral output. This findings also corresponds to the transmission of changes in reduced gas prices in the economy. How this policy changes in the form of natural gas price reduction will result in changes in the structure of production costs, then increase production activity because the amount of output generated, then the output increase will enhance the performance of other industries. The multiplier effect occurs, and it increases the demand for production factors and labor, then ultimately, all increases in output and employment will increase GDP and household income, indicating an improvement in the economy.

Furthermore, the simulation results from scenarios involving a state revenue decrease shock, in general, show that natural gas price reduction has a negative impact on macroeconomic indicators such as GDP and household income. This is marked by a decrease in GDP by 0.076% in the short-run and an increase in GDP by 0.004% in the long-run. Income decreases by 0.1-0.2% in both rural and urban households, in both short and long-run. This matter presumably because the net impact of the decline in natural gas prices is not greater from a decrease in state revenue. Furthermore, on the household income variable, the negative impact on average in the short and long-run length. This is presumably due to a decrease in revenue countries that are compensating for the decline in gas prices will have an effect on adjustment of the state budget so that it will indirectly give a 'blow' to the welfare of

the household. For the sectoral impacts, positive impacts are still being felt in the industrial sectors which intensively use gas. This is shown by the positive impact on output in the long-run in electricity and gas provision by 0.774%, in base metal industry by 0.642%, in chemical industry by 0.575%, and in rubber industry by 0.384%. The positive impacts on labor in the long-run are 3.056% in electricity and gas provision, 0.83% in chemical industry, 0.79% in base metal industry, and 0.461% in rubber industry. The reduction in gas prices provides flexibility for the industry to reduce production costs. This makes industrial output cheaper and more competitive. The commodity prices of most industries that use gas intensively are decreasing; the low decrease is in the non-metal mining industry by 0.56% in the short-run and 0.58% in the long-run. This industry represents ceramics and glass industries that use natural gas intensively for energy.

In both simulations, both without and taking into account state revenue shows that the impact of decreasing natural gas prices are directly proportional to the decline in commodity prices in the sector intensive use of gas. This indicates that the decline the price of natural gas as an input factor has quite an impact on activity industrial production in question, so that the industry can produce output which are more accompanied so that the price offered by the industry becomes higher cheap. In general, the objective of this study, which is to measure the economic impact of the Certain Price of Natural Gas Policy implementation, has been achieved. However, based on the results in general show the magnitude of the impact is not too big.

Certain Price of Natural Gas Policy, on the one hand, can increase the industry, however, on the other hand, the results of simulation, it reduces state revenue which has a negative impact on the economy. Overall, this policy had a negative, albeit small, impact on the economy, as shown by the decreasing GDP and household income. Thus, the government needs to review this policy so that they return its sectoral application as stipulated in Presidential Decree Number 40 of 2016 in order to reduce pressures against state revenues. Certain Price of Natural Gas Policy is able to cut production costs so that it can produce lower commodity prices in industries which use gas intensively. This indicates that Certain Price of Natural Gas Policy is able to increase the competitiveness of those industries. Should the government wish to keep Presidential Decree Number 121 of 2020, they must pay attention to the efficient consumption of natural gas by industry for optimal usage. In addition, so long the applicability of Presidential Decree Number 121 of 2020, they must continue to evaluate the performance of the industrial sector. In the end, when the industry has been able to increase production capacity, the government needs to reconsider and re-evaluate the amount of incentives for natural gas price reduction so that the industry can adapt to the normal price of natural gas.

It is very likely that Certain Price of Natural Gas Policy is detrimental to the country. The natural gas price with its high volatility is very risky to be compensated with natural gas price reduction for the industry. State's revenues might drop considerably when natural gas prices are high, in addition to the potentials of problems for local governments due to the falling amount of Revenue-Sharing of natural gas producing regions. Thus, the government needs to ensure the availability of state revenues and to evaluate the potential of projected tax revenues to be received from the industrial sector. In addition, as the government's commitment to Governmental Decree Number 79/2014 concerning National Energy Policy which states that natural gas is development capital, the use of natural gas to fulfill national interests must be supported by the development of good energy infrastructure which can reduce the price of natural gas for industry as end users in the future.

The government has chosen to lower the price of natural gas for industry through Certain Price of Natural Gas Policy. The simulation results show that the Certain Price of Natural Gas Policy provides a relatively small magnitude change in aggregate economic growth. So, they need to be more proportional in seeing the problems faced by the industry. Encouraging industrial growth for competitive products cannot be simply done by

issuing Certain Price of Natural Gas Policy. The government needs to review factors other than natural gas prices that can drive industrial growth.

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7. Appendix

Appendix 1: Classification of Production Sectors

No	*Sector Classification*	No	*Sector Classification*	No	*Sector Classification*
1	Crop Agriculture	23	Non-PSO LPG	45	Gas Provision and Ice Production for Seven Sectors
2	Agriculture of Seasonal and Annual Horticultural Crop and Others	24	Coal Industry	46	Water Provision, Waste Management, and Recycling
3	Seasonal and Annual Plantation	25	Food-and Beverages Industry	47	Construction
4	Animal Husbandry	26	Sugar	48	Wholesale & Retail Trade
5	Forestry and Wood Cutting	27	Processed Fish	49	Railway Transport
6	Fisheries	28	Tobacco Processing Industry	50	Land Transport
7	Natural Oil	29	Textile and Attire Industry	51	Sea Transport
8	Natural gas	30	Leather, Leather Goods, and Footwear	52	River, Lake, and Crossing Transport

No	*Sector Classification*	No	*Sector Classification*	No	*Sector Classification*
9	LNG	31	Timber, Wood and Styrofoam, and Bamboo and Rattan Matting Industry, and similar goods	53	Air Transport
10	Geothermal Energy	32	Paper, Paper Goods, Printing, and Recording Media Reproduction	54	Warehousing & Transport Supporting Service, Mail & Courier Service
11	Coal and Lignite Mining	33	Chemical Industry, Pharmaceutical & Traditional Medicine	55	Accommodation Service
12	Metal Ore Mining	34	Rubber Industry, Rubber & Plastic Goods	56	Food and Beverage Catering
13	Mining and Other Excavation	35	Non-Metal Mining Industry	57	Private Information and Communication Service
14	Other Refinery Products	36	Base Metal Industry	58	Commercial Bank
15	Premium	37	Industry of Metal Goods, Computer, Electronic, Optical, and Electrical Appliances	59	Insurance and Pension Funds
16	Kerosene	38	Industry of Machinery Other Tools Not Included in Other Types	60	Services of Other Financial Institutions
17	Diesel Engine Fuel	39	Transport Vehicles	61	Real Estate
18	Bio-Diesel Engine Fuel	40	Other Manufacturing Industries, Maintenance Service & Machinery and Appliance Installation	62	Company Services
19	Bio-Diesel Engine Fuel Industry	41	Electrical Power	63	Governmental Administration, Defense, and Compulsory Social Insurance
20	Pertalite	42	GEO	64	Private Education Services
21	Pertamax	43	Hydro	65	Private Healthcare Service and Social Activities
22	LPG PSO (3 Kg)	44	Gas Provision & Ice Production	66	Other Private Services

Source: BPS RI (2020), reprocessed data.