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The Investment of Upstream Oil and Gas in Indonesia

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Abstract

Direct investment is expected to be a source of financing for the current account deficit in Indonesia's Balance of Payments. One of the contributors to the current account deficit is the oil and gas trade balance. Therefore, this study will focus on direct investment in the upstream oil and gas sector. This study will examine the impact of implementing regulations related to restrictions on costs that can be claimed to the government and economic factors that include prices and costs per unit of oil and gas on the upstream oil and gas investment. The study was conducted using micro data from 33 oil and gas companies in Indonesia, with a data period 2005-2018. The analysis model used is panel data regression. Empirical results show that the implementation of regulation as well as price per unit (lag-2) have a significant and positive correlation to the upstream oil and gas investment. While operational cost per unit (lag-2) have a significant effect with a negative correlation after the implementation of the regulation.

Key words : upstream oil and gas investment, price, cost per unit, regulation.

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INTRODUCTION

Based on the release of Indonesia Balance of Payments (BOP) statistics in Quarter III 2019 of Bank Indonesia in November 2019, the Current Account noted a deficit of 2.7% of Gross Domestic Products (GDP), the amount was less than the previous quarter's deficit of 2.9% of GDP. The increase in the current account deficit was mainly supported by the goods trade surplus, particularly the non-oil and gas trade balance. Meanwhile, the oil and gas trade balance showed a deficit, despite a decline. On the other hand, the services and the primary income balance was a component that also persistently contributed a deficit.

As commonly known, Indonesia is an oil and gas exporter as well as importer, even since 2011 Indonesia have become a net oil and gas importer country. The oil and gas trade balance deficit showed an ascending trend, although it happened to improve in 2015, while in 2018, the oil and gas trade balance deficit reached around USD 12 billion (Indonesian Financial Statistics - Bank Indonesia).

The enlargement of oil and gas trade balance was highly supported by the amount of domestic oil consumption needs. In 2018, the oil production was 808.5 thousand barrels per day, while the consumption was around 1.8 million barrels per day (based on katadata.co.id with the initial data from BP Global Company). To meet this need, the government decided to import the oil product. The amount of oil product import was also reinforced by the limited capacity/ ability of domestic refineries in processing the crude oil into oil products. Therefore, it encouraged the government to develop and build new refineries (website of tempo.co.id, "The Energy Tenacity from Oil Refineries")

Indonesia crude oil production experienced descending trends. Based on data of Special Task Force for Upstream Oil and Gas in September 2019, the production of crude oil was 750.5 thousand barrels per day or was less than 2018. This decrease was in line with the oil and gas investment that experienced descending trends around USD 10 billion in 2017 which in 2013/2014 reached the investment around USD 20 billion. In this way, in 2019 the target of upstream oil and gas investment was USD 15 billion.

In relation to Indonesia's Balance of Payments (BOP) and foreign investment particularly Foreign Direct Investment (FDI), the financing is urgently necessary for balancing the Current Account deficit. This issue is strengthened by Falianty's study (2017) related to the dynamics of Balance of Payments (BOP) or Indonesia's Balance of Payments. Accordingly, Falianty (2017) conveys that FDI is the best instrument to finance the deficit of Current Account since it is a long-term investment and it has lower volatility (variance coefficient of 0.873) than portfolio investment (variance coefficient of 1.196) and other investment (variance coefficient of 3.950). However, in both short and long term, FDI is also proved as one of current account deficit boosters through import improvement and investment income, both in the form of dividend or reinvested earnings. The result of this study also can be an important input for policy maker in managing current account deficit.

The upstream oil and gas investment is not only needed to maintain and increase the production, but also to develop the refinery and discover new oil and gas reserve to support national oil and gas tenacity. The decline in oil and gas investment is in line with oil proven reserved descending trends. In 2014, the oil proven reserved of Indonesia was around 3.6 billion barrels which was lower than Malaysia around of 3.8 billion barrels. In 2017, its

descending trend continuously occurred around 5.0 billion barrels to 3.2 billion barrels.

Ministry of Energy and Mineral Resource stated that per January 2018, the number of Indonesia natural gas reserve was around 135.55 trillion standard cubic feet (TSCF). This number also covered gas proven reserved as well as the potential one. The reserve of natural gas has reached 99 TSCF or around 73% of reserve total. Meanwhile, the rest was the potential reserve that needs to be explored to prove and gain (The IPA Convex, 2019).

Considering the important role of investment to finance current account deficit, in November 2018, the government (Coordinating Ministry of Economic Affairs) issued the 16th Economic Policy Package (EPP) aimed to improve foreign investor interest to invest in Indonesia. The EPP includes 3 items, including the enlargement of industrial field that receives tax holiday, rule relaxation related to Negative List of Investment, and foreign exchange management of natural resource export result (mining, plantation, forestry, and fishery).

Unfortunately, to several parties especially oil and gas industrial doers, the regulation issued by government has not been optimal to support the investment climate in Indonesia. In 2016, the result of 8th Price Waterhouse Cooper (PWC) survey on several Indonesia oil and gas companies showed that the investors expected harmonization of oil and gas regulation issued by several related ministries (including Ministry of Energy and Resource, Ministry of Economy, and Ministry of Industry) and the certainty related to the validity of contract and its prolongation of oil and gas.

Regulation that is believed to enable the effect of the investment of oil and gas is government regulation of the Republic of Indonesia on non-recoverable operating cost or government regulation cost recovery, namely Government Regulation No. 79 Year 2010 concerning about cost recovery and treatment of income tax in upstream oil and natural gas. Based on this regulation, the operational costs cover exploration, exploitation, and other cost related to oil and gas management. From these cost components, there are 24 cost details that are not refundable or reimbursement from the government. The cost recovery restriction is considered as one of the declining factors of oil and gas investment in Indonesia.

Since 2014, the world oil price is on descending trends from around USD 104 per barrel in 2013 to USD 96 per barrel in 2014, then continuously decreased in 2018 around USD 51 per barrel (website Special Task Force for Upstream Oil and Gas Business Activities). The price of oil is positively correlated with the investment decision applied by the company. On one hand, the increase price is followed by the increase in oil and gas investment (Patria & Adrison, 2015; Brown et al., 2018) and vice versa. On the other hand, the increase price of oil and gas also has negative effect on investment in general since the increase price will lead to the increase on other costs as well as uncertainty factors, thus it has negative correlation with investment (Omitogun, et al., 2018; Chen et al., 2017; Phan et al., 2018).

Further, the restriction of cost recovery that can be claimed to government indirectly effects the increase in operational cost taken by the contractor company. The increase cost will implicate to the lower profit rate, hence it negatively correlates to investment decision (Reiss, 1990).

From regulatory side, government regulation cost recovery can give positive and negative impact depending on assumption or view of company toward the regulation. The implication of special tax provision on the company has positive roles toward investment (Cox & Wright, 1976). Meanwhile, the state tax imposed on the oil and gas companies has an impact on descending investment (Brown, et al., 2018). In addition, the fewer regulation that restrict the economic activities will positively impact on investment (Karutaro and Biekpe, 2013; Lerskullawat, 2017).

Based on the preliminary explanation, the researchers analyzed the effect of the implication of cost recovery limitations regulation (Government Regulation No. 79 Year 2010). Additionally, the researchers also analyze the influence of economic factors including oil price, operational cost of oil and gas management, and other factors related to the performance of upstream oil and gas investment. This study is expected to be able to contribute to literatures, especially investment due to limited literature concerning about investment, especially on oil and gas sector and micro side of company.

Generally, upstream oil and gas management is divided into 2 types of contract between the government and contractor or investor, namely concession and contract systems. In concession system, contractors have exclusive rights to carry out oil and gas exploration and exploitation activities for current period. In this system, all cost and profit become the right of contractor. The government only gets royalty that is usually calculated with current percentage from gross revenue. Furthermore, the contract concept is divided into Production Sharing Contract (PSC) and service contract (Lubiantara, 2012. Oil and Gas Economy).

PSC involves huge roles of contractor at the initial stage of oil and gas management. Contractors cover all cost used during oil and gas exploration and exploitation activities. If a company has started the production, the contractor will get cost recovery from government which is usually in form of goods or in kind of oil and gas. In service contract system, cost recovery is cash or not in kind. Countries that use concession system are Bolivia, Russia, United Kingdom (UK), and United State of America (USA), while those that use PSC are Aljazeera, Kazakhstan, Vietnam, Malaysia, and Indonesia. Venezuela used service contract system.

The management of oil and gas in Indonesia refers to Law of oil and gas namely Law Regulation No. 22 Year 2001 about oil and natural gas. Based on this Law, the activity of upstream oil and gas is an effort that concentrates on oil and gas exploration and exploitation activities. The contract of upstream oil and gas effort is carried out with cooperation contract system. The cooperation scheme underwent several changes. Before 2001, the contract of oil and gas management used PSC. PT Pertamina as the authority holder of oil and natural gas mining becomes government representation.

Since 2001 after the enactment of Law No. 22 Year 2001, the form of the management of upstream oil and gas business has been done with cooperation contract method. This contract is done between Business Entity or Fixed Business Entity and the government that is represented by Implementation Entity or BP Migas. Nowadays, the entity is managed by SKK Migas (regulated in Government Regulation No 9 Year 2013).

Further evolution of upstream oil and gas business management activities is gross split method. The cooperation form of this method is regulated in Ministry of Energy and Mineral Resource Regulation (*Permen ESDM*) number 8 Year 2017 concerning about Gross Split

Production Sharing Contract. This method is believed as the very first method in the world. In this method, all operational costs become contractor's responsible, and no more cost recovery.

Oil and gas investment is defined as all of expenditure used during oil and gas exploration and exploitation activities. This expenditure covers capital expenditure and non-capital expenditure. In general, this definition has been in line with the definition of investment in Indonesia which is administrated by Investment Coordinating Board. Based on Law Regulation No. 25 Year 2007 about investment, investment is all forms of investment both performed by domestic investor or foreign investor to conduct a business in Indonesia. Then, the investment monitoring is completed through Investment Report (LKPM). This report informs that the value of investment includes fixed capital and working capital.

The component of expenditure of upstream oil and gas investment in Indonesia is divided into 4 types (Lubiantara, 2012 and *SKK Migas*), namely: i) administrative expenditure that covers licensing cost and the right to conduct exploration and exploitation, ii) exploration expenditure that includes all cost related to oil and gas finding activities including seismic, geology, and geophysics expenditure, iii) development expenditure in field, and iv) production expenditure that is related to oil and gas elevation to the surface. Operation cost is usually charged in the current year. Each expenditure component (except administrative expenditure) can be tangible and intangible costs. Tangible cost expenditure will be capitalized or depreciated, meanwhile intangible cost will be directly charged in the current year.

In general, investment is an activity by using or allocating the source of funds to gain profit or refund in the future. Investment is also defined as company's expenditure to buy capital goods and production equipment in order to improve the goods and service production ability in economy. Investment is divided into 3 types namely business fixed investment or called as neo-classical investment, residential investment, and inventory investment.

According to neo-classical model, investment (additional of capital inventory) is related to marginal production of capital and capital cost that include interest rate and depreciation. Investment decision depends on whether a business is profitable or not. Mathematically, neo-classical investment theory is formulated as follows.

$$\text{Profit Rate} = \text{Earning} - \text{Cost}$$
$$= MPK - (PK/P)(r+\delta) \quad (1)$$

Where: MPK is Marginal Production of Capital is additional output that is produced with one unit capital addition; PK is capital purchase price; P is the current price of capital (or inflation); r is interest rate; and δ is depreciation.

Neo-classical investment theory is generally in accordance with Tobin Q investment theory. This theory is often used for investment in capital market or share market. The ration of Tobin Q theory is the comparison between market value from occupied capital and replacement cost of occupied capital. Investment decision depends on whether the Q value is more or less than 1. If $Q>1$, it means market value of occupied capital is more than the current capital cost. Therefore, investor will increase the investment. Conversely, if $Q<1$, so the investor will not increase the investment. Market value gains more than 1 occurs if the company records the profit, in other words the acceptance value is more than its cost.

Particularly in oil and gas sector, investment model (number of drilled well) developed by Patria & Adrison (2015) is illustrated as if production is notated as the function of W (the number of drilled well) and Z (geological variable), so Y = F (Z,W) = $W^{\alpha}Z^{\beta}$. Meanwhile, the cost function is notated as: C = $\phi_w W + \phi_w Z$, in which ϕ_w is input cost. The final equation related to function of number drilled well (W) is as follows.

$$W = \left(\frac{pe^{st}.\alpha.Z^{\beta}}{\phi_w} \right)^{\frac{1}{1-\alpha}} \quad (2)$$

From the model, there is a positive relation between W and p or the price is directly proportional (positive). Meanwhile W and ϕ_w or the cost is inversely proportional (negative).

Then, the integration of geological factors and economic factor gained the following equation:

$$W_{it} = \alpha_i + \underbrace{\beta_{2i} D_{O_{i,t-1}} + \beta_{3i} D^2_{O,t-1} + \beta_{4i} D_{G_{i,t-1}}}_{\text{Geological Variables}} + \underbrace{\beta_{5i} D^2_{G,t-1} + \beta_{6i} S_{C_{i,t-1}}}_{\text{Geological Variables}} + \underbrace{\beta_{7i} Of_{i,t-1} + \beta_{8i} Reg_i}_{\text{Geological Variables}} + \underbrace{\beta_{9i} \ln P_{t-1} + \beta_{10i} \ln Sp_{it-1} + e_{it}}_{\text{Economic Variables}} \quad (3)$$

D_O is lag of discovery size of oil and D_G is lag of discovery size of gas; Sc is lag of success rate; of is lag of offshore location; Reg is dummy region; P is lag of oil price, and S is lag of input price (spending per well). The model uses lag to illustrate the potential endogeneity.

There are several factors that influence inflows of foreign direct investment in a country. Based on the result of preliminary studies, in general factors that influence inflow (FDI) are economic growth of a country that is reflected on gross domestic product indicator (Ong, et al., 2018), trade openness of a country (Gozgor & Guris, 2015), inflation (Azzam, 2015), and exchange rates (Gunes & Cambagozlu, 2016). The influences of those factors are different in each country depending on condition and characteristics of the country.

However, those preliminary studies were generally conducted to find out the factors that influence investment in national level or aggregate. Yet, there were few studies conducted to analyze the factors that influence investment activities in firm individual level, especially for oil and natural gas industry sector which is generally more specific and different with investment in non-oil and gas sector.

Based on the previous studies of investment at individuals or firm levels, the researchers gained some information that influences investment decisions as follows:

Output price and operational cost (Reiss, 2990; working paper by Hvozdyk & Blackman, 2010; Patria & Adrison, 2015; and Brown, et al., 2018). These studies show that output price has a positive correlation with investment, while operational cost has a negative correlation. Additionally, in Hvozdyk & Blackman (2010) mention that production costs factor has a positive and significant correlation with the average of finding and development cost. However, after being interacted with dummy variable of international oil companies (IOC), the cost variable turns into a negative and significant correlation. In Patria & Adrison (2015), the operational costs taken over by spending per well (lag) have a negative and insignificant effect. After spending per well variable being interacted with working region, the result of regression is negative yet significant. This happens due to trade off in oil and gas working area management. In west working area, the mature field has low spending per well and gives low oil and gas output as

well. Conversely, east area which is mostly emerging field with considerable oil and gas potential has high spending per well and gives high oil and gas output.

Casi and Resmini (2010) confirmed that location (agglomeration) surely influences the investment. In west Europe, the development of manufacture sector investment follows developed agglomeration intra-sectoral pattern, while for service sector follows intra-sectoral consideration. Meanwhile for east Europe countries, the investment development of multinational enterprises (MNEs) goes along the consideration of inter-sectoral spilovers.

From regulatory side, Cox & Wright (1976) suggest the role of special tax provision in oil and gas sector toward investment. The relation of special tax is positive and significant on oil and gas investment taken over by stock of oil proven reserve change. Unfortunately, the study does not give further explanation the type of special tax. Again, Mahbud, et al. (2019) in their study about the influence factors of FDI in energy sector argue that the provision related to contract and governments' commitment to apply it becomes the main factor for investor in determining the investment in a sector.

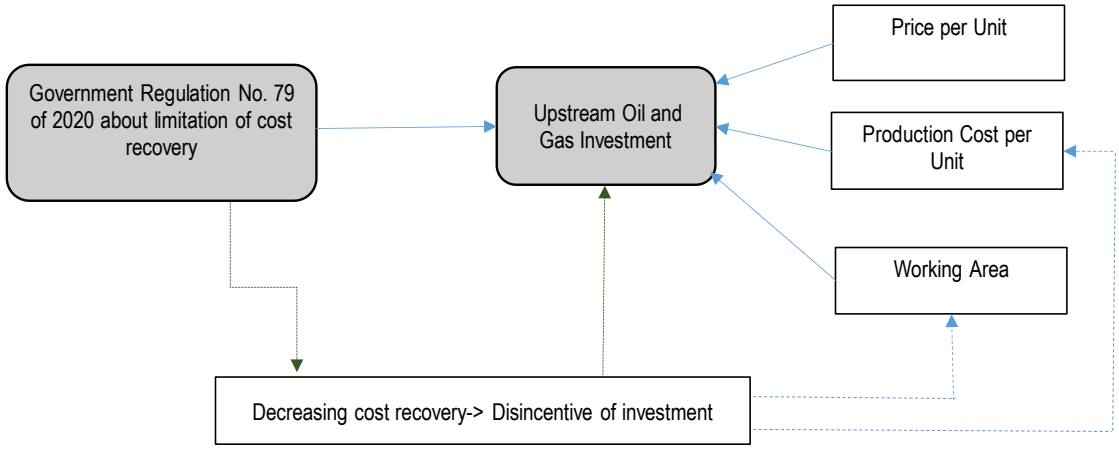
METHOD

Based on literature review the researchers developed a research model to observe the relationship between the impact of implementation regulation on non recoverable cost and economic factors which cover output prices, and unit costs to the upstream oil and gas investment in the following hypotheses: 1) Upstream oil and gas investment is influenced by oil prices per unit with a positive correlation (Reiss, 1990; Hvozdyk & Blackman, 2010; Patria & Adrison, 2015; and Brown, et.al, 2018). 2) Upstream oil and gas investment is influenced by production costs per unit with a negative correlation (Reiss, 1990; Hvozdyk & Blackman, 2010; Patria & Adrison, 2015). 3) Upstream oil and gas investment is influenced by the impact of implementation government regulation cost recovery. The relationship between those variables may be either positive or negative (Cox & Wright, 1976; Brown, et.al., 2018; Mahbud, et.al, 2019). 4) Upstream oil and gas investment is affected by the location of oil and gas working area with a positive correlation (Casi and Resmini, 2010).

In developing a model, the researchers referred to Patria & Adrisons economic factors model (2015). This model was combined with the dummy variables related to government regulation cost recovery. The effect of government regulation variable was indirectly observed by its interaction to other variables.
The model used in the study was as follows:

$$Y = \beta_0 + \beta_1 BO_{t-i} + \beta_2 PO_{t-i} + \beta_3 IC_{t-i} + \beta_4 DP + \beta_5 DP*DR + \beta_6 DP*BO_{t-i} + \varepsilon_{it} \quad (4)$$

Y is the upstream oil and gas investment inflow; BO_{t-i} is the production costs per unit in the previous year period; PO_{t-i} is the price of oil and gas output per unit in the previous year period; IC_{t-i} is ICP oil prices in the previous year (ICP price variable was used as a support for the oil and gas output price variable); DP is a dummy variable related to the implementation of government regulation cost recovery; and DR is a dummy variable related to the Location of the Oil and Gas Working area; DP*DR is the interaction between the dummy variable of the implementation of government regulation cost recovery with the dummy variable of location of the working area; DP * BO_{t-i} is the interaction between dummy of government regulation cost recovery and oil and gas management cost per unit.



Source: Writers, processed from many informations

Figure 1. Conceptual framework of study

Working area variable was used as an interaction variable with regulation variable to see any differences in the effect of different work areas. This variable did not stand alone due to singular matrix factors. In relation to unit cost, the researchers examined differences that appeared in changes in the influence of unit cost variable on upstream oil and gas investment after the implementation of cost recovery government regulation. To do so, this study employed quantitative approach, and data panel statistical regression method using Eviews software.

The dependent variable used in this study was the investment of upstream oil and gas from oil and gas contractors that operate in Indonesia, and have entered commercial production or exploitation stage. Also, these contractors have been in a contract with the Indonesia government before 2005.

The investment value of upstream oil and gas included fixed capital (capital expenditure), and working capital (non-capital expenditure). Based on a cooperation contract or PSC, the fixed capital of this business would be depreciated based on the economic life and the oil and gas contract life. Meanwhile, some of costs that can be claimed to the government (in accordance with Government Regulation No. 79 of 2010), and will become a component of the current period operational costs.

There were two kinds of variable used to measure output price variable, namely weighted average price/ WAP of oil and gas, and ICP crude oil price in USD per barrel. In details, WAP price is the combination (weighted) prices of oil and gas commodities. Meanwhile, the crude oil price of ICP is a benchmark price that is regulated by the government in every month, and used as a reference in calculating cost recovery as well as the government's profit sharing that further will determine the assumption of the amount of expenditure in the State Budget (APBN).

The operational costs in oil and gas management or known as cost per barrel of oil or USD per barrel is the whole costs that can be claimed to the government divided by the amount of oil produced. The current oil and gas operational costs covered production costs, and depreciation of the fixed capital that has been expended in the previous period.

Government regulation cost recovery started to implement since 20th of December 2010. Therefore, the dummy variable of government regulation valued (1) for the period after 2010. This variable was intended to observe whether the cost recovery government

regulation significantly influenced the upstream oil and gas investment in Indonesia.

Generally, the location of oil and gas working area is divided into three regions. Region 1 covers Central Sumatera (Sumteng) working area, Natuna, and North Sumatera (Sumut). Region 2 covers South Sumatera (Sumsel) working area, and Java. The last, region 3 consists of Kalimantan and eastern Indonesia. As commonly known, region 3 contains emerge field areas so they have got different investment characteristics and prices compared to the other two regions that have grown as mature fields. Therefore, in this model the dummy variable of working area valued (1) for region 3. It was aimed at observing any investment characteristics differences in different work areas.

The study was conducted at micro level or using the individual data of oil and gas companies with the data period of 2005-2018. The panel data of 33 companies in 3 regions or working areas were analyzed. These samples encompassed 31% of the total upstream oil and gas companies that have stepped on exploitation stage, and been registered by SKK Migas until 2018.

RESULTS AND DISCUSSION

Once the data were collected, they were analyzed using Eviews-9. To obtain stationary and smooth regression, the original data were converted into logarithm format. This analysis showed that lag two (t-2) of upstream oil and gas investment that was influenced by independent variable (prices and production costs) two years before was the optimum lagging data. The duration of lag depended on a large amount of funds used in oil and gas investments that was not easily fulfilled in a short term.

Furthermore, the above lag duration might also be caused by the formulation of crude oil price that is determined every year, but started its period in the middle of the year. For example, the Decision of the Ministry of Energy and Mineral Resources No.1907/K/12/MEM/2018 on Indonesia Crude Oil Price Formula for the Period of July 2018 to June 2019. This decision was used as a reference in setting oil prices for the period of July 2018 to June 2019.

Tabel 1. Descriptive Research Sample

Variables	Unit	Sample Description				
		Maximum	Minimum	Mean	Median	Std. Deviation
Upstream oil and gas investment	Million USD	3,206.00	1.00	279.58	71.00	521.40
Cost per unit	USD per boe (barrel of oil equivalent)	94.00	2.00	26.49	21.00	20.73
Weighted Average Price	USD per barrel	128.00	10.00	61.46	55.00	27.05
ICP price	USD perbarrel	113.00	40.00	75.86	69.50	23.91

Source: writers, processed using Eviews 9 - panel data regression module.

According to the description of total sample, it was known that the sample mean gained greater value than the median. It shows that the sample tended have positive frequency distribution (right-skewed). In addition, the sample disaggregation within different period of observation is served as follows:

Table 2. The Descriptive Research Sample between Periods

Periods	Upstream Oil and Gas Investment		Cost per Unit		Weighted Average Price		ICP Price	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
2005	176	68	16	9	39	39	54	54
2010	280	86	25	19	64	67	79	79
2018	212	50	26	23	55	58	67	67

Source: Writers, processed from sample data

The variables of upstream oil and gas investment and unit costs (or costs per boe) gained right-skewed frequency distribution for the periods 2005, 2010, and 2018. This description was in line with the distribution of the total sample. Meanwhile, the variable of weighted average price gained normal distribution for the period 2005, and a bit left-skewed for the period 2010, and 2018. Further, the variable of ICP oil prices obtained normal frequency distribution.

Based on the results of regression using eviews9, the researchers found that the best model was Fixed Effect Model (FEM). Even so, the regression results of FEM was also relatively consistent with the results of Random Effect Model (REM) test in general.

In accordance with the findings, the researchers gained information that the cost per unit of the previous two periods of oil and gas management did not significantly effect the activity of upstream oil and gas by having negative coefficient. These insignificant results were probably because the amount of cost per unit calculated from the cost recovery value received by the oil and gas contractor companies were strongly affected by the government's decisions related to cost recovery calculation. Therefore, this variable was not considered as the main factor for companies in investing their funds for the upstream oil and gas activities. It is similar to Patria & Adrison's study (2015) which states that cost per unit (spending per well) does not contribute significant effect.

Table 3. Summary of Regression Results

Dependent variable: Log of Upstream OG Investment		
Variables	Koef	t stat
C	2.22	0.36***
log of cost per unit	-0.08	0.08
log of WAP	0.31	0.13**
log of ICP	0.27	0.13**
DummyPP	0.35	0.21*
DummyPP*DummyRegion	0.19	0.12*
DummyPP*log of cost per unit	-0.19	0.07***

Source: Results of regression, processed

Note:

1) Significance information: *** p <0.01; ** p <0.05; and * p <0.10;
2) The discussion of the findings was based on FEM regression results as the chosen model or the appropriate one;
3) DW tables were for n 33 and variable (k) 6: DL = 1.0670; DU = 1.8999;
4) DW test value was 1.2108.

The findings indicate positive and significant effect between the output price of the previous two years and the investment of upstream oil and gas. This positive relationship occurred in both weighted average price and ICP price. 1% increase in the weighted average price in the previous two years would increase the upstream oil and gas investment of 0.31%. Meanwhile, 1% increase in ICP oil prices in the previous two years would increase the upstream oil and gas investment of 0.27%. These results indicate that the investment elasticity was inelastic (E < 1). Since the nature of oil and gas industry requires large management costs for both operations and technology procurement, its needs cannot be fulfilled in the short term.

The positive correlation results are in line with the hypothesis and previous studies (Reiss, 1990; Hvozdyk & Blackman, 2010; and Patria & Adrison, 2015). Similarly, it is in accordance with economic theory related to company motives for maximizing profit. The higher the price level, the greater expectation of profit will be, so the investment interest is motivated.

The dummy variable of the implementation of the government decisions concerning cost recovery limitation significantly influenced the oil and gas investment with positive correlation. It means that the implementation of government regulation cost recovery played a role as an incentive for oil and gas contractor companies, so it increases the value of investment. Accordingly, after the government regulation was decided the oil and gas investment increased 0.35% to 2.57% (= 2.22% + 0.35%). This fact was supported by the value of elasticity of oil and gas investment on the effect of government regulation implementation that was inelastic, namely 0.35 (E < 1). It was the biggest among other variables. However, it took time for the government regulation to affect the investment of upstream oil and gas.

Incentive factors of the implementation of government regulation cost recovery consisted of tax incentive that is aimed at encouraging the increase in oil and gas production, such as exemption from customs, and taxes in the framework of goods import for exploration and exploitation activities (article 38 paragraph b, Government Regulation No. 79 year 2010). Further, the results of this study are in line with research conducted by Cox & Wright (1976).

Regulations improvement to support investment climate has also been done by the government, such as by issuing one-stop licensing provisions through the Online Single Submission (OSS). The improvement can also be seen from the rank of ease of doing business in Indonesia that is gradually improving. In 2017 Indonesia was in the 72nd place, improving from the previous year in 91st place. However, in 2018 the position dropped to 73rd place, and in 2019 the position remained the same (World Bank website)

The interaction between cost per unit of the previous two years and dummy implementation of cost recovery government regulation resulted significant estimation and negative correlation on the upstream oil and gas investment activities. It was because the initial amount spent by contractors in managing oil and gas was not entirely replaced by the government, so it affected investment decisions in the next periods.

In relation to recoverable cost limitation, to improve the investment interest in oil and gas sector, the government through Government Regulation No.27 year 2017 revoked several kinds of costs that was initially not claimable became claimable, such as costs for environmental and surrounding societies development during exploitation period; transactions that do not go through a tender

process in accordance with statutory provisions except in certain cases; and interest recovery incentives. This revocation was expected to increase number of oil and gas investment in the future.

The estimation results of the interaction between dummy implementation of government regulation variable and dummy region obtained positive and significant correlation on the upstream oil and gas investment. It means that the implementation of government regulation cost recovery in the eastern Indonesia working area of oil and gas (region 3) contributed positive effect on the upstream oil and gas investment activities. This implementation in region 3 would also increase the investment by 0.19%

The coefficient of cost recovery government regulation effect increased from the initial value of 2.57% (derived from $\beta_0 + \beta_4$; or 2.22% + 0.35%) to 2.76% ($\beta_0 + \beta_4 + \beta_5$; or 2.22% + 0, 35% + 0.19%). It might be because the implementation of government regulation in emerging field provided more certain amount of oil and gas investment costs that will be replaced by the government, so the oil and gas management can receive incentive. In line with general effect of government regulation implementation, the government regulation implementation in eastern Indonesia working area also gave inelastic elasticity effect by 0.19%.

CONCLUSION

This study intended to identify and analyze the effect of the implementation of cost recovery government regulation, and the effect of economic factors that covered price per unit and costs per unit of the previous periods on the activities of the upstream oil and gas in Indonesia. The study used data sample of 33 oil and gas contractor companies that have been already in production stage or been at the exploitation stage in Indonesia (covering 31% of total oil and gas contractor companies at exploitation stage in 2018), within the period of 2005-2018.

The findings showed that the price of oil and gas in the last two years had positive and significant effects on the activities of the upstream oil and gas investment, while the operational costs in the last two years contributed no significant result. However, these operational costs gained significant effect with a negative correlation when being interacted with the variable of cost recovery government regulation. In relation to the positive and significant correlation of price and the upstream oil and gas investment, the government is suggested to make policies concerning competitive prices that encourage the activities of the upstream oil and gas investment. For more, in dealing with the variable of costs per unit, after the implementation of government regulation cost recovery, the contractor companies are expected to manage their investment activities more efficient so that the total costs can be controlled and increase their profit.

The implementation of cost recovery government regulation resulted positive and significant effect on the activities of the upstream oil and gas investment. Similarly, this government regulation implementation also worked the same in eastern Indonesia working are (region 3) that it provided more positive and significant effect on the investment of the upstream oil and gas in Indonesia. In terms of regulation, the implementation of the government regulation could give a legal certainty related to kinds of cost that would be replaced by the government or kinds of incentive to receive by the contractor

companies for making a conducive climate for investment.

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