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GOVERNMENT REGULATION 79/2010 BOOSTER OR RESISTOR ON INDONESIAN OIL AND GAS FIRM'S PRODUCTIVITY ?

(AN EMPIRICAL ANALYSIS)

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ABSTRACT

The purpose of this paper is to perform an in-depth analysis of a strict liability law, Indonesia Government Regulation No 79/2010. The enactment of new oil and gas law brings a new chapter for oil and gas reform in Indonesia. The new tax law serves as a foundation for the work of cost recovery in order to maintain the stability of government revenue, which will provide a solid basis for oil and gas businesses in the long run. This idea comes up from the best practice in the oil and gas business that extraction of oil which means "There are better, cleaner, more efficient ways to extract and produce oil and gas" (http://www.earthworksaction.org). I look at the relationship between oil lifting, tax revenue, cost recovery, and Indonesia Crude Price (ICP). I find that there is significant relationship between these three variables, in other words the tax revenue collected by the government, cost recovery given to the Contractors, also the ICP will give impact to the oil and gas productivity.

This paper also briefly explains the externalities and socio-environmental cost which might arise as a result of oil and gas extraction. I conclude that GR 79/2010 has a significant impact on oil and gas productivity. Thus, I suggest that Government of Indonesia must be effectively making better regulation in the sense of removing ambiguity on its application. Moreover, it should also encourage oil and gas companies' willingness to fairly disclose an oil spill.

KEYWORDS: oil and gas regulation, taxation, incentives, cost recovery, government revenue, oil spill, externalities.

I. INTRODUCTION

1. Background

Indonesian regulation of the oil and gas industry began in 1960 when the first oil and gas law, Government Regulation Number 44/1960 (GR 44/1960), was introduced to regulate the extraction of oil and gas in Indonesia. Initially, oil and gas companies, which were privately run, had a lot of capital, including technology that was not possessed by the Government of Indonesia at that time. This law was followed by the introduction of the Producing Sharing Contract (PSC) system, a contract between the Government of Indonesia and the oil and gas contractors to share risks and costs and eventually the profit if the wells have already produced oil (lifting). In this kind of sharing system, which is known as a cost recovery system, all the costs expensed by the oil and gas contractors are totally reimbursed by the Government of Indonesia. This kind of privilege brought these oil and gas companies to deliberately extract the oil and gas without control from Government of Indonesia. Moreover, in the

PSC signing, Perusahaan Pertambangan Minyak a (PERTAMINA) was appointed as Government of Indonesia's representative to negotiate with the oil and gas contractors regarding the profit, production, cost recovery, rate, and amount of tax that will be paid to Government of Indonesia. Even though Government of Indonesia or PERTAMINA has made this PSC to be favorable to Indonesia's financial side, the negotiation still became burden to Indonesia's fiscal system in terms of increasing amount of cost recovery system which must be reimbursed by the Government of Indonesia each year.

In 2002, under Indonesia Laws number 22/2001 of Oil and Gas, the Indonesia Executive Body in Upstream oil and Gas Management (BP MIGAS) succeeded PERTAMINA as the Government of Indonesia's representative to negotiate with the oil and gas contractors regarding the amount of oil gas production and also cost recovery. Nevertheless, the formation of this new government agency did not directly improve oil and gas tax policy. Government of Indonesia must inevitably rely on the oil and gas companies to fill in the gap of oil's scarcity but there was no positive return for Indonesia State Revenue (APBN) until Government Regulation Number 79/2010 was released on December 2010. There are some restrictions which must be followed by oil and gas contractors in this new regulation making them feel agitated because it can effect to the reduction of their business profits in the long run. On November 2012, as mandated in Indonesia President Regulation Number 95/2012, BP MIGAS was disbanded and replaced by The Special Task Force for Upstream Oil and Gas Business Activities Republic of Indonesia (SKK MIGAS). This agency will be responsible for managing the upstream oil and gas business based on Production Sharing Contract with oil and gas firms (contractors), so that the extraction of natural resources owned by Government of Indonesia, will give benefits and optimal state revenues to the state and for the prosperity of Indonesian people.

2. Literature Review

There are various literatures describing the factor of new tax laws or policies related to the oil and gas businesses (for example Maria et al., 2012; Wirl, 1991; Sovacool, 2009; Heutel, 2012; Bosquet, 2000; Cologni et al., 2013; Bornhorst et al., 2009). However, there are four most relevant papers that review the effect of new tax laws on the oil and gas firms' productivity and also point out better management of oil spill resulted from the oil and gas extraction activity. Wolfson and Koopmans (1996) proposed model that energy tax would reduce world-wide energy consumption. They dan Gas Bumi Negar introduced the traditional General Equilibrium Models (GEMs) which explore links within an existing set of markets, locating the substitution and income effects of a price change in one particular market. In support of this idea, Kaiser (2007) introduces the meta-modeling process in oil and gas that will affect the amount of royalty earned. He wants to make inference based on the percentage of royalty and/or tax collected from oil and gas contractor. He concludes that if the royalties and taxes collected by the government are discounted at a higher rate, the contractor take and economic measures of the field will increase. Similar to previous opinions, Banovac et al. (2009) introduce the model of algorithm for analyzing the regulatory background context and required regulatory mechanism functions. They illustrate the regulatory mechanism in applying energy policy step by step, from licensing to customer protection. They explain that theoretically, regulatory system can be considered a closed dynamic system. They conclude that the efficiency of regulatory mechanism is of great importance for energy activities regulation. In addition to Banovac et al., Newberry (2005) proposes that energy policy would be necessary when applying rates on subsidized fuel based on the case of OPEC cartel. He concludes that taxing the fuel is not necessarily needed if the government wants to subsidize the fuel, even though there is a stricter regulation behind its policy. On the other hand, Brätland (2004) points out that since Santa Barbara's oil spill tragedy in 1969, most oil spills happen in connection with transportation of crude oil rather than with offshore production operation. Moreover, no serious accident has occurred in connection with exploration and production since the increase of prevention technology has become part of standard universal of practice. He concludes that environmental externalities give rise to the dispute, but the fact of government ownership fundamentally accounts for discord. Rules of tort law can be enforced so that when offshore petroleum exploration and development activities cause invasive damage to property owners, the developer responsible for the damage is held strictly liable for making restitution.

3. Comparative Analysis Regarding The Effect of Regulation Shock: Lesson from Developing Countries

There are several reasons why this specific research is selected, among others:

a. Strict regulation will tend to increase the economic growth of one's country. In most developing African countries, for example, Nigeria (Okpanachi, 2011) and Libya (Balhasan, et al., 2013), the strict regulation is considered

b. useful to avoid the poor management of oil revenues of the past. Both of the research showed that applying fiscal regulation on oil and gas firms would maximize their profit values and solid structure of "good faith" practices in oil and gas businesses;
c. Moreover, the implementation of new fiscal regulation in certain country per se sometimes does not align with the decline of oil production and/or the increase or the decrease of the oil prices. In the case of Sudan (Abdalla, et. al., 2013), the environmental issues are more vibrant as the Libya National Oil Company (LNOC) had lack of attention on this.

The treatment of fiscal regulation on Oil and Gas Businesses on three developing countries are summarized in Table I below.

Table I.: The Effect of the Introduction New Regulation to Oil and Gas Businesses

Country	Treatment to Oil and Gas Businesses	
	Previous Regulation	New Regulation
Nigeria	The past regulation was covered with many corruptive actions, such as "illegal bunkering"-theft of crude of pipelines, etc.	The environmental issues and law-enforcement in oil and gas businesses are addressed in the new regulation.
Libya	EPSA I, EPSA II, EPSA III, EPSA IV: All of these regulations mandated the profit split between Libyan Government (First Party-FP) and Foreign Oil Company (Second Party-SP), were seen to provide unequal share between the two parties.	Proposal to new regulation (ongoing): The additional investment is proposed in several fields that also shares risk to both parties. The new regulation does not interfere the oil production.
Sudan	The previous regulations were not updated, for example, the legal framework, improving the capacity building of the concerned institutions, and enhancing the role of public participation.	The new regulation adopts the environment conservation and sustainable utilization of natural resources. Again, not a single phrase contradict with the "good faith" of oil and gas practices.

4. Oil Wells Characteristics in Indonesia

Oil wells in Indonesia are categorized as old wells because they have been long extracted for decades without any preservation. For example, the oil wells located in Bunyu and Cepu are the most productive well reserves in Indonesia, according to the PERTAMINA website (www.pertamina.com). The Bunyu wells, which is operated by PT PERTAMINA since 1961, for example, has the potential of oil sources as of 7,400 Barrels Of Day (BOD) and expected to be fully operated on 10,000 BOD by 2013. The Cepu wells like Bunyu at Blora, Central Java, operated by ExxonMobil, are currently operating at up to 765,000 BOD. Nevertheless, not all the wells have the same features. For example, Peciko wells, the productivity of oil and gas decrease from 2000 to 2011 as shown on Figure 1 below.

operated by Total E&P Indonesie in East Kalimantan, are operating at 43,000 BOD. These differences are mostly because of the porosity, depth, and the capacity of the oil extracted from the oil wells. Other oil and gas firms, ConocoPhillips, INPEX of Japan, and Chevron Corp. have had the Block B (Natuna Sea) license extended to 2028 from 1998. The block, under exploration since 1968, has two matured oil fields and 16 gas fields in various phases of production and development. These overview of oil reserves' condition are essentially meant to show that this situation is also the one of main causes of the reduction of oil and gas production in Indonesia. Thus, these factors can also be the exogenous factor to answer the question why the oil lifting or

As mentioned by President of Republic of Indonesia at Indonesia Petroleum Association's (IPA) annual convention on 2006 (Gurdip Singh (www.offshore-mag.com - Penn Well Publishing Co.), 2006), that the oil companies must work together with to overcome the problems faced by the sector and they could tap potential source deposit such as Cepu, Papua, South Sumatera, Sulawesi, and East Kalimantan. The Government of Indonesia has also provided several incentives such as value-added tax reimbursement, exploration taxation, and incentives for marginal oil fields and more improved oil and gas regulation. The Government of Indonesia's effort to attract new investment is intended to deal with the high oil price, rising domestic demand, and rejuvenate oil and gas industry. The oil and gas industry, on the other hand, would like to see a new partnership between regulators and investors and support for the development of domestic capital market as a source of debt and equity funding for local participants.

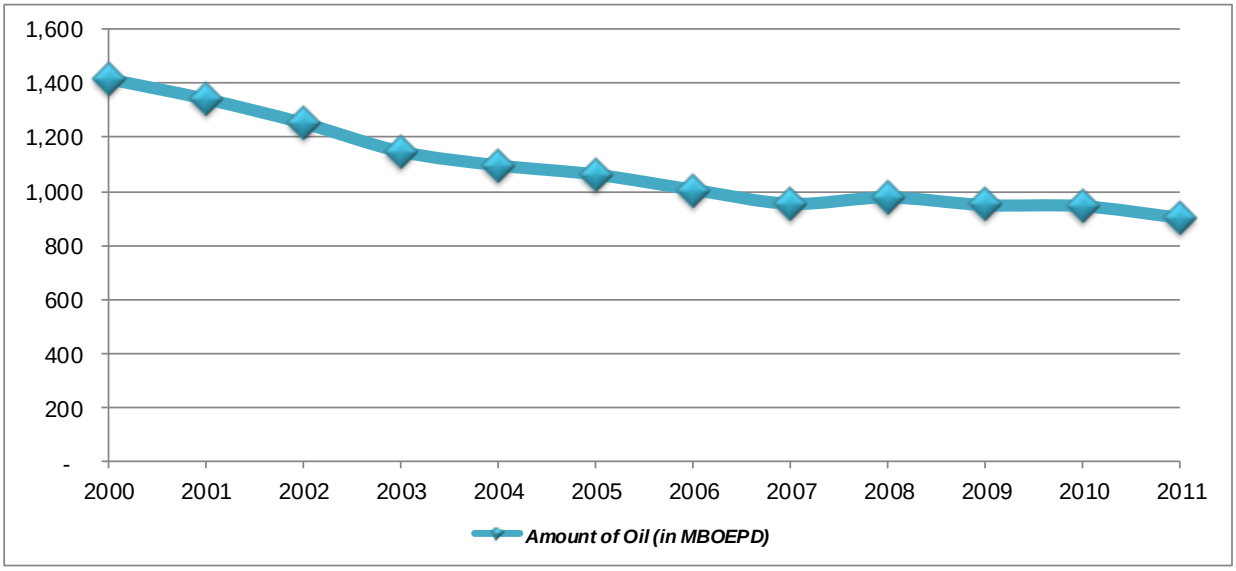
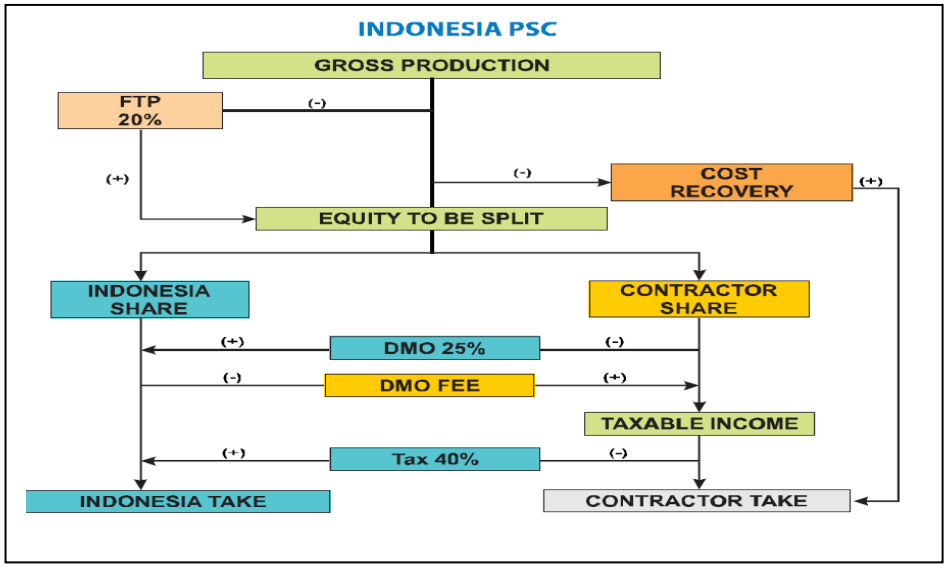


Figure 1.: Indonesia Oil Production Trend 2000 – 2011

5. Production Sharing Contract (PSC) Scheme

Figure 2 : Indonesia Production Sharing Contract



Production Sharing Contract (PSC), as stated earlier, is Indonesia's original oil and gas contract that has been now widely used throughout the world. Initially, it was introduced by one of the Indonesia's founding father, Mr. Soekarno. It is called *paron* which is basically the traditional form of splitting the management function among the farmer and the land's owner and usually bound by a contract. If there is a profit, they will spit it in two and this is very similar to PSC. It is a contract or in other similar forms between Government of Indonesia and oil and gas contractors in oil and gas exploration and exploitation that aimed for the welfare of Indonesian people in particular. It also determines the amount of cost recovery which can be given back to the contractors. The mechanism of cost recovery in Indonesia is calculated and split to Government of Indonesia's share and Contractor's share. In these two scenarios, the Cost Recovery (*CR*) is capped on 40% of Lifting (*L*) that the Contractor may receive. They can be calculated from Figure 2 that:

For the Government of Indonesia's (Indonesia) take (85% from the Equity To be Split (ETS)) is calculated as follows:

$$0.85 * (0.8\ L - CR) + 0.25\ L + 0.4\ (-0.13L - 0.15\ CR) \quad (1)$$

$$\text{Government of Indonesia's take } (CR, L) = -0.91\ CR + 0.878\ L \quad (2)$$

For the Contractor's take (current fiscal year) is 15% from the Equity To be Split (ETS)) and calculated as follows:

$$(0.6 * (0.15 * (0.8\ L - CR) - 0.25\ L) + CR \quad (3)$$

$$\text{Contractor's take } (CR, L) = 0.91\ CR - 0.078\ L \quad (4)$$

$$\text{and the current constraint is } CR \leq 0.4\ L \Leftrightarrow CR - 0.4\ L \leq 0 \quad (5)$$

These two calculations result in different percentages of each final result (Government of Indonesia's Take and Contractor's take) relative to the ETS. Government of Indonesia's Take is effectively 70% and Indonesia Take is approximately 30% net after the tax in average estimate. The reason this calculation arises is to give the explanation which the cost recovery plays important role to calculate the tax revenues in oil and gas industry in Indonesia.

6. Government Regulation Number 79 / 2010 (GR 79/2010)

The GR 79/2010 was enacted on December 30, 2010 and consists of thirty eight articles, which mostly contains a mechanism of disbursement of cost expensed by oil and gas, particularly in articles 13, that regulates the summary of which costs are and are not allowed to be deducted from the operating Income. These also replace and add some allowable cost from seventeen items to twenty four items as stated by Law No 22/2001 and the Ministry of Energy and Mineral Resources Regulation No 22/2008. As a result, oil and gas contractors will not deliberately expense the unnecessary cost which then costs the Government in a large amount from the State Budget. Previously, all expenses claimed by contractors and which have been approved by the Oil and Gas Executive Body (BP MIGAS), must be reimbursed by Government of Indonesia, including the personal expenses, such as golf and other entertainment costs. Moreover, in connection with the content of GR 79/2010, as stated on Article 7s paragraph 1 that "Contractor will recover operating costs incurred in accordance with work program and budget that has been approved by the Head of Executive Body, after contract area is in commercial production." Subsequently, on paragraph 3, states that "in the event that the contract area as referred to in paragraph (1) does not produce commercially, all operating costs incurred shall become the risk and fully borne by contractor." This paragraph, however, has been a heavy burden since PSC was introduced in 1960's. PSC mechanism, was initially made in order to establish a win-win solution with the government regarding the revenue sharing from oil and gas production. As already mentioned, cost recovery system demands the financial transparency from these oil and gas firms to expense the costs which are really incurred during their development and exploration phases of extraction and approved by Head of the Executive Body. The non-recoverable

operating costs in Article 13 have been fully considered to be "hybrid" model which incorporates the type of costs from several different regulations in oil and gas industry, and expect to establish the "good faith" principle in oil and gas businesses. The aforementioned non-recoverable costs are not reimbursed by the Government of Indonesia and/or deducted to the oil and gas firms' net revenue even though they have already been in production phase. This treatment is different than the costs which are unrecovered because of deferral purpose. These costs, according to the explanation of Article 20 Paragraph 1 Letter c, are defined as "part of operating costs balance that have not been recovered at the beginning of the year, so that it can be recovered during current year in accordance with transfer of title of oil and/or gas from the government to contractor."

The main clauses in each Article on GR 79/2010 as the improvement of Ministry of Energy and Mineral Resources Regulation No 22/2008 (MEMRR No 22/2008) and other similar regulations such as Income Tax Laws No 36/2008 are summarized on Appendix.

7. Externality

Externality is defined as an activity of one entity that affects the welfare of another entity in a way that is outside the market mechanism (Rosen and Gayer, 2008). Unlike effects of that are transmitted through market prices, externalities adversely affect economic efficiency. It is not trivial to determine the effect of externality to community when it comes to decide whether it is pure public goods. This can be viewed on the Figure 3 of cost and benefit analysis, where in the case of polluters and the affected community, the polluter will gain from producing more output (Q-pollution) as long as their Marginal Benefit (MB) exceeds Marginal Cost (MC) meanwhile the affected community become worse off at increasing rate. On the other hand, when output is cut from Q_1 to Q^*, the polluter losses the difference between the MB and MPC curves for each unit of production between Q_1 to Q^*. At the same time, however, the affected community will become better off because of the decrease of polluter's output. The little "triangle" between the MB and Marginal Social Cost (MSC) represents this effect which makes the Q^* is the efficient output.

Externality can be produced by firms as well as consumers. Let us see this in the case of oil and gas firms. The oil and gas firms who produce output will act the same way in terms of efficiency and can determine prices that exceed their Marginal Cost. As long as a firm owns resources, its price, its price reflects the value for alternative uses, and the resource is therefore used efficiently (at least in the absence of any other "market failures"). Externality can be positive or negative depending on gain or loss received by the affected community. The surrounding community adjacent to the extraction sites, would probably be the one who suffers the most if these oil and gas firms negatively react to the environment, such as the case of oil spills and other environmental issues (illegal logging, landslide, forest fires, etc.).

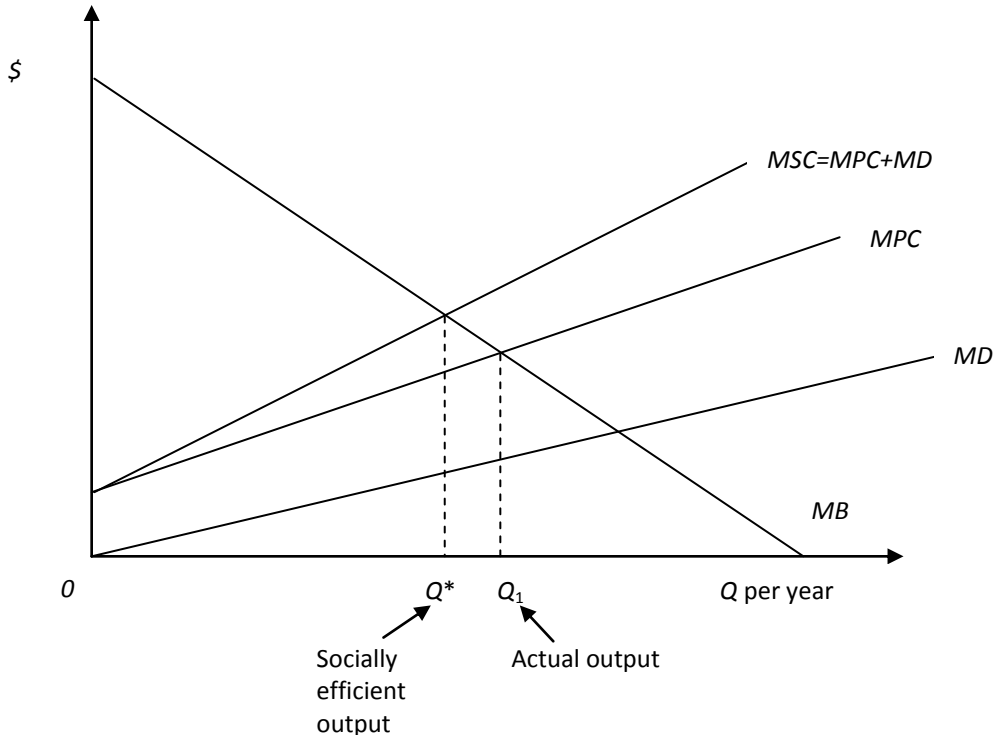


Figure 3: An externality Problem (Rosen and Gayer, 2008)

The energy pricing on externality is introduced by Wirl (1993). It is the total external cost to society that might arise in energy extraction, which show the model as follow:

$$\max_{q} u(q) - Pq \qquad (7)$$

and

$$u' = P$$

which u is the consumer surplus that is maximized toward the $P = p$ *(import price)* $+ \tau$ *(tax)* which the government impose to internalize the external cost and this will be multiplied by the consumer demand, thus this results in the First Order Condition (F.O.C) of $u' = P$ or marginal utility equals the consumer price of commodity.

When the energy is taxed, it theoretically reduces the negative externality, such as external cost caused by monopoly or oil spill. This indicates that at the certain amount, tax can be treated as emitter which can be made socially optimum by social planner. In particular, when a good generates a negative externality, too much of it is produced relative to the efficient output. Pigovian tax, discussed later in this paper, is one of tools that has been widely used to alleviate this issue.(6)

II. MATERIALS AND METHODS

The data source in this paper is derived from BP MIGAS (now SK MIGAS) and Indonesia Ministry of Energy and Mineral Resources (MEMR) using time-series data from 2008 to 2012. There are 60 data from January to December and consist of oil lifting, cost recovery, state revenue from oil and gas, and Indonesia Crude Price (ICP) which is tabulated monthly and it will be regressed the data using interaction between independent variables. This data will be analyzed with two steps, first before the implementation of the GR 79/2010 (year 2008 to 2010 data) and, second after the implementation of the GR 79/2010 (year 2010 to 2012 data).

As econometrically analyzed, the linear model is described as follows:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + P X_4 + u \qquad (8)$$

where:

Y = oil and gas productivity (**oill**)

X_1 = cost recovery (**costr**)

X_2 = state revenue (APBN) from oil and gas firms (**taxr**)

X_3 = Indonesia Crude Price (ICP-**icp**)

X_4 = dummy variable, 0 = before 2010 implementation and 1= after the implementation

Thus, before the introduction of dummy variable (which is P = 0), the equation is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + u \quad (9)$$

and after the introduction of dummy variable (i.e. P = 1), the equation is:

$$Y = \beta_1 + \beta_2 X_1 + \beta_3 X_2 + \beta_4 X_3 + X_4 + u \quad (10)$$

The result is interpreted by making two observed factors that effect on oil productivity (**oill**), before 2010 (from 2008 to 2010) and after 2010 (2011 to 2012). I code the implementation before 2010 as 0 and after 2010 as 1 otherwise. The interested coefficient of X4 is observed to see the related impact of the implementation period to the oil production.

The hypothesis proposed is:

Ho: P= 0 or There Is No Impact of New Oil and Gas Taxation Laws On Oil And Gas Companies' Productivity

Ha: P ≠ 0 or There Is Impact of New Oil and Gas Taxation Laws On Oil And Gas Companies' Productivity

III. RESULTS

1. Empirical Results

The research estimation is made on three independent variables to see the inferences between the New Tax Laws to the productivity of oil and gas firms. The regression is focused on oil and gas productivity, cost recovery, state revenue from oil and gas firms. The statistics table is as described in Table II. The result of the regression is as follows:

Table II.: Descriptive Statistics

Variable	*Obs*	*Mean*	*Std. Dev*	*Min*	*Max*
Date	60	30.5	17.46425	1	60
Oil	60	927.1645	99.12707	727.07	1,471.56
taxr	60	5,708,200	3,364,082	-3,117	$1.45*10^7$
costr	60	9,269.888	585.1903	8,258.13	9862.55
Icp	60	.8892265	.2624623	.393766	1.477812

The resulted model is estimated to be:

$$\underset{}{\textbf{oill}} = \underset{(1.15)}{(3.09*10^{-6})\ \textbf{taxr}} - \underset{(0.46)}{0.0156967\ \textbf{costr}} + \underset{(0.65)}{21.79202\ \textbf{icp}} - \underset{(1.90)}{84.00916\ \textbf{P}} + \underset{(3.36)}{1,069.24} \quad (11)$$

Here, the introduction of the dummy variable will determine the slope of the regression model, and also means that in terms of the implementation before the new tax laws (denoted by 0), the model will be in its static model and after the implementation of the new tax laws (denoted by 1) will result in negative significant value as stated is -84.009.

In order to see if there is interaction between independent variables, the last model of the estimator is shown in Table III, Model 1 is run without dummy variable, Model 2 is run with dummy variable, and Model 3 is the multiplier between dummy variable and the other independent variable. In Model 3, three new variables are introduced, which are *td* (variable *taxr* x *dummy*), *cd* (variable *costr* x *dummy*), and *id* (variable *icp* x *dummy*). Next, the regression is done with all these three interactions with the result equation as follows:

$$\textbf{oill} = (3.02*10^{-6})\ \textbf{taxr} - 0.002\ \textbf{costr} + 44.566\ \textbf{icp} + 615.113\ \textbf{P} - 0.075\ \textbf{cd} + 1.32*10^{-6}\ \textbf{td} + 923.026 \quad (12)$$
(0.70) (0.03) (0.95) (1.13) (1.23) (0.25) (2.24)

$$\textbf{oill} = (2.78*10^{-6})\ \textbf{taxr} - 0.017\ \textbf{costr} + 20.675\ \textbf{icp} - 108.315\ \textbf{P} + 8.18*10^{-7}\ \textbf{td} + 19.253\ \textbf{id} + 1{,}080.173 \quad (13)$$
(0.68) (0.43) (0.50) (0.52) (0.15) (0.09) (2.98)

$$\textbf{oill} = (4.00*10^{-6})\ \textbf{taxr} - 0.003\ \textbf{costr} + 34.927\ \textbf{icp} + 623.447\ \textbf{P} - 0.092\ \textbf{cd} + 154.953\ \textbf{id} + 937.306 \quad (14)$$
(1.36) (0.06) (0.73) (1.15) (1.51) (0.82) (2.23)

The interaction result, as shown above, indicates different result on dummy variable coefficient. The dummy variable is negative when the interaction between ***taxr*** and ***icp*** is placed, but turns out to be positive when the interaction between ***costr*** and ***taxr*** also ***costr*** and ***icp*** are executed. The student's *t*-values are also bigger than the critical value (*p*-value) for the latter, which also explains that oil productivity (***oill***) is not significantly affected by cost recovery variable, thus accepting *Ho* would be appropriate. In other words, there is no impact of GR 79/2010 to the oil productivity when cost recovery takes place, this will be discussed further on **Discussion** section.

Nonetheless, from the 3 models observed, all of the student's *t*-values are significance; it also means that putting this interaction into the models is correct.

2. Hypothesis testing

The hypothesis testing is conduct to see if there is significance result between the application of the New Tax Laws and the productivity of Oil and Gas firms. Under the null hypothesis, the heteroskedasticity test will be used, using the White Test.

The interpretation of this data is that the variability of our estimator is small as stated that using χ^2 with 13 degrees of freedom the result is 11.12 (White's test) which is bigger than p-value of 0.6010. This approves that rejecting the null hypothesis that there is significant impact of new oil and gas taxation laws to oil and gas firms' productivity. This can be also seen from the Figure 3 that variability of the oil data is so high as it is scattered above and below the straight line.

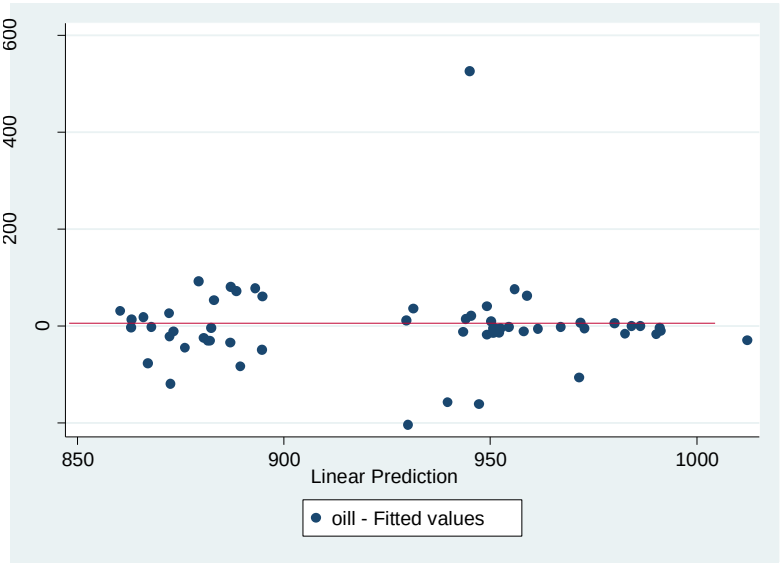


Figure 3: Predicted value of oil production and the real oil production

The student's *t*-value of the dummy variable (P) from the OLS robust regression is -1.90, which is smaller than the *p*-value of 0.063, which also means that the decision to reject the null hypothesis is correct.

IV. DISCUSSION

1. Analysis of GR 79/2010

There have been a lot of regulations dealing with oil and gas industry since its discovery in early 1900's. Most of these regulations dealing with the core of oil and gas industry per se, for example the oil upstream and downstream distribution and the oil price set regulation yet only a few regulations dealing with the government revenue from oil and gas business. The GR 79/2010, is one of the few regulations that raise the issue government revenue from oil and gas sectors, particularly with the tax revenue. There are 4 main components that constitute the GR 79/2010, i.e. the regulation of oil lifting (article 9), requirement for cost recovery (article 12 and 13), calculation for income tax from upstream oil and gas production (article 25 and 26), and the regulation for Indonesia Crude Price (ICP) setting (article 21, 22, and 23) as an exogenous factor.

This model shows that implementation of the new tax laws (Government Regulation No.79/2010-GR 79/2010) highly impact on the oil and gas firm's productivity. As stated earlier, this model attempts to see the impact of new tax law after its implementation in 2010. Oil lifting as a dependent variable is chosen because it is considered as the key indicator of the firm's success in maintaining the production. Then, it is important to disaggregate the oil lifting into 3 representative variables, i.e. tax revenue; cost recovery; and Indonesia Crude Price (ICP), which in the last 4 years (2008-2012) affect the oil and gas productivity. As mentioned by Kaiser (2007), that royalty or tax revenue takes into effect on oil productivity. The rest of two variables, cost recovery and ICP have been taken into account by Government of Indonesia as indicator to APBN.

Let us proceed the discussion from the interaction results given, which are regression with variable ***cd***, ***td*** and ***id***. As mentioned earlier, there are different interaction results when variable ***cd*** (variable ***costr*** x variable dummy (**P**)) takes place, which are when regression using ***cd*** and ***id***, also ***cd*** and ***td***. In the two cases, negative coefficient value of dummy variable meaning that this variable really gives no impact to the oil productivity. Thus, it also implies that no matter how significance the amount of cost recovery given by Government of Indonesia, it should not affect the oil lifting This is true in terms of unrecoverable costs, costs that cannot be recovered because it does not meet criteria of reimbursement by Government of Indonesia. Oil and gas companies or contractors, who commit to bear the risk of business at the early stage of exploration or even at the development stage, shall not count on cost recovery for financing their business. Moreover, there is necessity to make inference based on this result, that the rest two variables, which are ***taxr*** and ***icp*** also bring effect to the equation. The variable ***td*** (***taxr*** x variable dummy (ʒ)) and ***id*** (variable ***icp*** x variable dummy (ʒ)) are giving the identical result as the second model (Model 2) in terms of negative coefficient. Thus, it implies that tax revenue and Indonesia Crude Price (ICP) in line with the concluded hypothesis or accepting the alternative hypothesis (Ha). Finally, again, dummy variable is introduced to see the effect of the policy on productivity changes. The result, as well as the hypothesis testing, reveals that this implementation of tax laws is significantly affecting the oil productivity (dummy coefficient of -84.009). The negative sign included here, implies that inverse effect occurs in this situation. The oil lifting, which can be seen from the equation, is inversely related only to the cost recovery but otherwise, linearly positive with the tax revenue and ICP. The interesting part is that cost recovery is the key component of the GR 79/2010, which are supposed to be an advocate of oil productivity but the result is the opposite. ICP, in this case, acts as the exogenous factor relative to the world price. As already stated above, dummy variable turns to negative when interaction of ***costr*** takes place. This may raise a question for the reader, what is wrong on with this variable? It can be said that it is necessary for GR 79/2010 to regulate the criteria of the reimbursable cost (i.e. cost recovery) that can be given back to the oil and gas contractors because the regression concludes the opposite result. The criteria can be found on Article 13 (see GR 79/2010 on Appendix). This interpretation also means that the absence of cost recovery effect does not necessarily reduce the rigorous function of GR 79/2010. Proceed to the discussion of variable ***taxr*** and ***icp***, there are two important points to note. First, the GR 79/2010 regulates the tax rate that must be paid by the contractors (stated on article 25 paragraph 6). All this time, oil and gas contractors depend on the rate listed on PSC, thus, "regulation shock" would affect them. All of these confirm with Wolfson and Koopmans' (1996) idea that "energy tax would reduce world-wide energy consumption" (p. 61). There are three formulas used to calculate the taxable income is as follows (Article 9 paragraph 2, 3, and 4):

a. Taxable income in terms of PSC's income:

ti_1 = *oil and gas lifting – First Tranche Petroleum (FTP) – cost recovery - DMO + DMO Fee*

b. Taxable income in terms of Service Contract's income:

ti_2 = *Government service fee + oil lifting*

c. Taxable income in terms of other than PSC's income:

ti_3 = *uplift + income from participating interest*

The taxable income is, then, multiplied by the tax rate to determine the amount of tax revenue from oil and gas sector. It is probably peculiar when observing the coefficient of ***taxr***, eventhough it is linearly related to oil production, the number is very small (i.e. $3.09*10^{-6}$). One possible reason is that the production is relatively slow for the 5 years of observation. On the other hand, the amount of cost recovery increases every year, this will reduce the amount of taxable income as stated on 3 a) above. Secondly, in addition to the discussion, ICP as an exogenous variable; maintain its "independent" relative to other independent variables. It is considered to be a complement variable which also indirectly affects the oil and gas production. It can be explained as follows that ICP is affected by five internationally traded crudes, which are Minas (Indonesia), Tapis (Malaysia), Gippsland (Australia), Dubai (UAE), and Oman. The ICP price setting per se involves the interdepartmental process consists of Ministry of Energy and Mineral Resources (MEMR), Ministry of Finance (MoF), SKK MIGAS, not to mention oil and gas contractors. Furthermore, the ICP setting is conducted after knowing the actual amount of production. Thus, interaction with variable ***icp*** in our estimation results in positive coefficient, meaning linear to oil production. Lastly, the dependent variable ***oill*** (lifting) will be briefly explained. The oil lifting here is defined by the amount of crude oil and gas which is sold and split on the custody transfer point (article 1 number 5). It becomes the focal point of my research since it indicates the success factor of oil exploration. The main factor that contributes to decreasing oil production is the capacity of the oil wells, which are mostly dominated by old wells. Investment factor is also considered by the government to enhance the oil production by giving incentives such as tax and import duty incentives but still, the oil production has not shown better performance. Government of Indonesia decide to revitalize the so called "sleeping field" which is still spread across the nation and encourage the oil and gas firms to actively explore even though they have already been in production stage, because this is one requirement for extending their contract. Nevertheless, eventually, Government of Indonesia as the policymaker must fully maintain its control on oil extraction as this contribute to the tax revenue.

It is recalled from Banovac et al's idea that the efficiency of regulatory mechanism is of great importance for energy activities regulation. Thus, the similar suggestion to the policy maker is that they must be extra careful in defining the wording in the GR 79/2010 as this determines the oil and gas firms' action in the future and eventually affect the tax revenue.

As the discussion develops to whether or not a policy will change the behavior of oil and gas companies, this paper will focus on how a tax regulation can be effectively applied when externalities can be internalized. This can be achieved when marginal benefit of applying this regulation exceeds the marginal costs borne by the companies. The issue arises from the Wirl's idea to internalize external cost of energy extraction by applying appropriate tax. It will be discussed briefly related to the possibility for inducing Pigovian Tax into GR 79/2010.

Oil and gas firms, as business entities, set their goals for maximizing profits through exploration and exploitation activities. Most of their activities are located at remote areas and offshores. There is no doubt that excess production such as oil spill often happens during the oil exploration and affect badly the surrounding population. The incidence of the Deepwater Horizon oil spill involving big oil company, such as British Petroleum at Gulf of Mexico in 2010, reveals the world's awareness, the importance of better management of oil waste. Currently, many oil and gas companies like Chevron, Inc. apply the "Deepwater" into their system to prevent the same incident occurs in the future. As Brätland (2004) mentioned that prevention technology has become part of standard universal of practice since Santa Barbara's oil spill tragedy in 1969. The pressure from international community for green environment makes these oil and gas companies follow the universal regulation to maintain the good faith principle in their businesses.

On the other hand, in relation to the energy pricing, Wirl (1993) proposed the formula to internalize the external cost, then maximizing the utilities in energy extraction by imposing tax into

the equation. He concludes that tax can be treated as emitter which can be made socially optimum by social planner or Government of Indonesia. He also mentioned that in order to cover associated externalities, taxation of energy will affect the suppliers' pricing decision. On the other hand, he introduced the imposing of Pigovian Tax, will, not only internalize previously external cost but even lower import prices. From this point of view, the proposal of the Pigovian Tax into GR 79/2010 is as summarized below.

Table III. : The Regression Result

Dep. Var	oill (Model 1)	oill (Model 2)	oill (Model 3) interactions with		
			(cd & td)	(cd & id)	(td & id)
taxr	1.78×10^{-6}	3.09×10^{-6}	3.02×10^{-6}	4.00×10^{-6}	2.78×10^{-6}
	(0.65)	(1.15)	(0.70)	(1.36)	(0.68)
costr	-0.051	-0.016	-0.002	-0.003	-0.017
	(2.73)**	(0.46)	(0.03)	(0.06)	(0.43)
icp	-65.489	21.792	44.566	34.927	20.675
	(2.82)**	(0.65)	(0.95)	(0.73)	(0.50)
dummy		-84.009	615.113	623.447	-108.315
		(1.90)	(1.13)	(1.15)	(0.52)
td			1.32×10^{-6}		8.18×10^{-7}
			(0.25)		(0.15)
id				154.953	19.253
				(0.82)	(0.09)
cd			-0.075	-0.092	
			(1.23)	(1.51)	
_cons	1,446.942	1,069.240	923.026	937.306	1,080.173
	(9.70)**	(3.36)**	(2.24)*	(2.23)*	(2.98)**
R^2	0.10	0.19	0.21	0.21	0.19
N	60	60	60	60	60

Note: *p<0.05; ** p<0.01

2. Concept of Pigovian Taxes (Plausible Clause Addition to GR 79/2010)

Pigovian tax acts as an excise or charge imposed on the output of a polluter in an amount equal to the marginal social damage, specifically, the marginal negative externality or marginal external cost at the efficient output level. The concept of Pigovian tax comes from the idea of reducing negative externalities of oil pollution. As stated by Bernard E. Herber (1997) in his article from Journal of Environment & Development, Vol. 6 No 2, June 1997, that "internalize the externalities of oil spills from ocean going tankers constitutes such an international public choice problem." Pigovian tax effects could take effect in these situations:

a. Oil prices increase as a result of the tax;
b. Higher oil prices reduce oil consumption depending on the relevant price elasticities;
c. Decrease of oil consumption reduces the risk of oil spill externalities, thus helping to internalize them.

Comparative analysis using Pigovian Tax shows that GR 79/2010 does not specifically include tax on reducing oil spill in the cost structure. This regulation merely mandates the tax related to the firm's income-generated cost. However, the inevitable rise in oil price, at least, makes the awareness of policy regulator or social planner in Indonesia on bringing the GR 79/2010 to higher level for solving this problem. Even though the Indonesian government will not impose higher tax on gasoline to alleviate or compensate the effect of negative externalities, which has been reflected in the Indonesia Value Added Tax (VAT) regime, a strict management of oil and gas distribution still needs extra attention to keep a sustainable production of oil. The corresponding taxes (e.g. pigovian tax or other similar taxes, if necessary) must also meet with the goal of Indonesian energy policy which is, again very complicated since the policy itself is determined politically by the Government of Indonesia. For example, recently, Indonesia government has plans to establish "green economy" by replacing the fossil energy by the year 2025 with 25% of energy mix "eco-friendly" resources such as bioenergy or biomass or it is

well-known as Indonesia energy vision 25/25. However, this plan seems too good to be true, since the Government of Indonesia's revenue still depends on oil and gas sector which are the major contributors of Indonesia APBN. So, the Government of Indonesia must have significant plans on energy policy, or otherwise, there is no guarantee that imposing Pigovian-like taxes in Indonesia oil and gas industry, will eventually fix the effect of negative externalities.

V. CONCLUSION AND POLICY IMPLICATION

As shown above, the analysis of this paper shows that in general the new tax laws statistically impact the productivity of the oil and gas firms. In this paper, it is suggested that more effective regulation mechanism must be maintained by Government of Indonesia to give better service to the society. On the other hand, oil and gas firms should comply with applicable oil and gas regulation as they maintain the oil and gas production regardless any new regulations interfere in their operations. In terms of tax regulation, Government of Indonesia must consider what the business's needs in the long run. Moreover, the data collected in this research need to be further tested more reliable in terms of the limited amount of data which consist of only 60 samples. This can be subject to future research by more competent researchers. Not to mention, the incentive issue which is not raised in this paper, as stated by Balhasan, et. al. (2013), that exemption on investment-related taxes for foreign oil companies, such as custom duties, also increase productivity of oil and gas company.

Specific suggestion addressed to the policy maker, among others, is to intensively oversee the procurement of oil and gas businesses, to make sure that all the assets needed for extractive industry, particularly in exploration stage are well-managed.

As for the externality effect, the concept of Pigovian Tax can be implemented in GR 79/2010 to encourage oil and gas firms participating for clean energy. Finally, as Miguel de Cervantes, the 16th century Spanish Novelist, said "Truth may be stretched, but cannot be broken, and always gets above falsehood, as does oil above water."

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APPENDIX

Diffrence Between the Old Regulation (MEMMR No 22/2008 and Related Regulations) and The New Regulation (Article 13 GR No 79/2010)

	MEMRR No 22/2008 and Similar Regulations (Before GR No 79/2010)	GR No 79/2010
1.	Costs charged or disbursed for personal interest and/or families of employees, management, participating interest holders, and shareholders.	Unchanged
2.	Administrative sanctions in the form of interests, fines, and increase as well as criminal sanction in the form of penalties associated with the implementation of laws and regulations in taxation and claims or fines arising out of contractor's fault due to willful misconduct or negligence.	Unchanged
3.	Depreciation of goods and equipment used in operations but not owned by the state.	Unchanged
4.	Incentives, payment of pension fund, and insurance premium for personal and/or family interests of expatriate employees, management, and shareholders.	Unchanged
5.	Costs for legal consultants that are not directly associated with petroleum operations under cooperation contract.	Unchanged
6.	Costs for tax consultants.	Unchanged
7.	Marketing costs for oil and/or gas of contractor's share, except for marketing costs of natural gas that were approved by Head of Executive Body.	Unchanged
8.	Representative costs, including dining costs under any label or form, except if it is accompanied with a list of recipient nomination and recipient's tax identification number.	Unchanged
9.	Costs for environment and community development during exploitation period.	Unchanged
10.	Costs for technical training for expatriates.	Unchanged
11.	Personal income tax of employees borne by contractor or paid as tax allowance and income tax that required to be deducted or collected on third party income borne or grossed up by contractor.	Unchanged
12.	Procurement of goods and services and other activities not in line with fairness principles and good engineering practices, or exceeding the value of authorization for expenditures approval by 10% of such expenditures authorization.	Unchanged
13.	Excessive surplus materials due to a mistake in planning and purchasing.	Unchanged
14.	Book value and operating costs of assets that cannot be operated as a result of contractor's negligence.	Unchanged
15.	Transactions which: a. cause loss to the state	Unchanged

	MEMRR No 22/2008 and Similar Regulations (Before GR No 79/2010)	GR No 79/2010
	b. without a tender process in line with the laws regulations except for certain circumstances c. is not in line with applicable rules and regulations.	
16.	Bonus paid to the government.	Added
17.	Costs incurred prior to contract signing.	Added
18.	Interest recovery incentive.	Added
19.	Commercial audit costs.	Added
20.	Depreciation on fixed assets with useful life of more than 1 (one) year is calculated based on declining balance during useful life by applying depreciation rate on the net book value and at the end of useful life the remaining net book value will be depreciated.	Added
21.	Depreciation starts at the month such asset is placed into service.	Added
22.	For tax calculation purposes, Directorate General of Tax determines the costs during exploration stage period on annual basis for the oil and gas upstream business activities after receiving recommendation from Executive Body.	Added