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Mediating Role of Oil Production in Non-Tax State Revenue Determinants

Wahyu Suryo Majid[1]✉, [2]Mohammad Raung Yuniar Effendy

[1]Master of Accounting Study Program, Perbanas Institute

[2]Directorate General of State Assets Manager, Ministry of Finance, Indonesia

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Abstract

This study aims to analyze the effect of the Indonesian Crude Price (ICP) and upstream oil and gas state-owned assets on oil non-tax state revenue from the oil and gas sector, with oil production considered as a potential mediating variable. Using the Vector Autoregression (VAR) model, the study examines short-run relationships through Granger causality and t-statistics, as well as long-term contributions via Forecast Error Variance Decomposition (FEVD). The results show that the ICP has a positive and statistically significant effect on oil non-tax state revenue. In contrast, upstream oil and gas state-owned assets and oil production do not exhibit significant short-run effects. Moreover, oil production does not function as a mediator in the relationship. Nonetheless, FEVD results suggest that the ICP and oil production make meaningful long-term contributions to oil non-tax state revenue, indicating underlying structural links not captured by short-run causality. These findings highlight the importance of managing oil price fluctuations and designing fiscal structures that are responsive to global oil market dynamics.

✉ Corresponding author:

Address: Jalan Perbanas, Kuningan, Setiabudi, Jakarta Selatan, Jakarta

E-mail: wahyusuryomajid@gmail.com

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INTRODUCTION

The elected President of the Republic of Indonesia, Prabowo Subianto, has established the Medium-Term National Development Plan (RPJMN) for 2025–2029 through Presidential Regulation Number 12 of 2025. This RPJMN outlines the vision, mission, and programs of the elected president and vice president following the 2024 General Election. It encompasses national development strategies, general policies, ministerial and cross-ministerial programs, regional and interregional policies, and a macroeconomic framework. One of the national priorities in this RPJMN is political, legal, and bureaucratic reform aimed at creating a transparent, effective, and accountable government.

Fiscal aspects—such as increasing state revenue, optimizing expenditure, and addressing related issues—are also included as part of this national priority. A key objective is to optimize state revenue based on economic potential while maintaining a favorable investment climate. This goal is supported by comprehensive fiscal reform, efficient government spending, diversification of revenue sources, and the development of innovative financing mechanisms.

State revenue is a focal point of this priority, with efforts directed at increasing both tax and non-tax revenues. As non-tax state revenue has largely been sourced from natural resources, intensification efforts will be undertaken to reduce dependency on these resources. This direction is reinforced in the macroeconomic targets for 2025–2029, where the government adopts an adaptive fiscal policy to meet development goals, accelerate revenue and expenditure growth to drive economic expansion, maintain a balanced primary budget, reduce fiscal deficits, and achieve healthier debt levels to ensure fiscal stability and sustainability. From the non-tax state revenue perspective, the policy direction emphasizes reforming natural resource revenue management, optimizing dividends from state-owned enterprises, utilizing state assets more effectively, and leveraging technology and information-based services.

Natural resource non-tax state revenue has accounted for the most significant percentage of total non-tax state revenue in recent years compared to other sectors. According to the 2023 Central Government Financial Statements, natural resource non-tax state revenue contributed 41.50% of the total non-tax state revenue in 2023, amounting to IDR 254.2 trillion. In 2022, it accounted for 45% of the total non-tax state revenue, amounting to IDR 268.77 trillion. Several types of non-tax state revenue fall under the natural resource category, including revenue from crude oil, natural gas, mineral and coal mining, forestry, fisheries, and geothermal resources. In recent years, except for 2023, oil and gas revenue has contributed the largest share of natural resource non-tax state revenue. For example, in 2022 and 2021, oil and gas revenues accounted for 55% and 64% of total natural resource non-tax state revenue, respectively.

Given its strategic importance, the oil and gas sector plays a crucial role in generating both tax and non-tax state revenue. According to Law Number 22 of 2001 on Oil and Gas, oil and gas are recognized as non-renewable strategic natural resources and national assets under state control. This control is exercised through government-appointed mining authorities. Such a governance structure forms the foundation for optimizing upstream oil and gas activities—primarily through the Production Sharing Contract (PSC) system—with the goal of maximizing state revenue.

Pudyantoro (2012) explains that the business model for the oil and gas sector is designed from the perspective of the government as the ultimate mining authority. This means that the business model is embedded within fiscal policy and regulatory frameworks. Managing oil and gas resources through a contract-based system implies that exploration and exploitation activities are governed by legally binding agreements. Unlike licensing or concession systems, where the government's involvement in operational strategy is minimal, the contract-based approach ensures greater government oversight of investment decisions, operational costs, and revenue sharing.

Pudyantoro (2019) also highlights that the production-sharing contract model, which includes cost recovery mechanisms, has proven to generate higher revenues for the state. Under a licensing or concession model, state revenue is typically derived from royalties and taxes, ranging from 10% to 35% of total sales. In contrast, under the production-sharing model, the government's revenue share reaches approximately 55% to 65% of total sales (in cost recovery schemes). In addition to the production-sharing mechanism, the government receives revenue from signature bonuses, first-tranche petroleum, domestic market obligations, production bonuses, and other non-tax state revenue streams.

Several key indicators influence the amount of state revenue generated from the oil and gas sector. Various reports and articles indicate that fluctuations in crude oil prices significantly affect non-tax state revenue from oil and gas, particularly the Indonesian Crude Price (ICP). In a press conference on the 2023 Energy Sector Performance and the 2024 Work Program, the Director General of Oil and Gas at the Ministry of Energy and Mineral Resources (ESDM) stated, "In 2023, the ICP was higher than in 2021, and non-tax state revenue followed a similar trend." Non-tax revenue tends to move in line with ICP fluctuations.

This statement is supported by various domestic and international studies examining the impact of crude oil prices on state revenues. Research by Abimanyu (2016) found that oil prices—including ICP, West Texas Intermediate (WTI), and United Kingdom Brent—positively and significantly impacted government revenue from the oil and gas sector. Similarly, Stella et al. (2019) found that changes in oil prices significantly and positively affected government revenue from Nigeria's oil and gas sector.

Indonesia's upstream oil and gas industry has undergone a shift in energy resource utilization, as indicated by the decline in crude oil production since 1994, which contrasts with the increasing production of natural gas. This trend suggests that natural gas is becoming an alternative energy source, potentially reducing Indonesia's reliance on oil in the future.

Production and lifting are two distinct yet interrelated concepts in the oil and gas industry. Oil production refers to the volume of oil and natural gas extracted from underground or seabed reservoirs through production wells over a specific period.

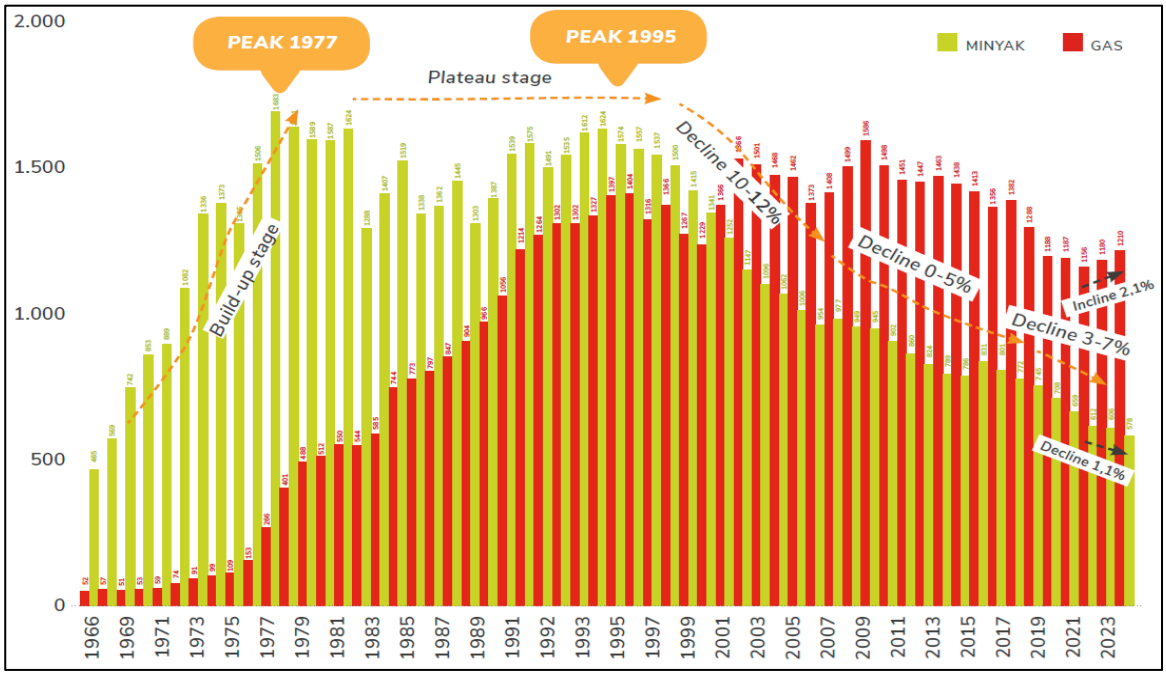

Figure 1. Development of Indonesian Oil and Gas Production
Source: SKK Migas Annual Report, 2023

This process involves extraction methods, which can be natural (using reservoir pressure) or artificial (using pumps, gas injection, or water injection techniques). Meanwhile, lifting refers to the volume of crude oil and natural gas successfully transported to the designated delivery point within a specific period, typically measured based on the volume available for sale or delivery to buyers. Lifting represents the amount of crude oil and gas that has been commercially allocated, as it excludes losses or quantities used for operational needs.

Wetzstein (2013) defines a firm as any economic entity utilizing land, labor, and capital inputs to produce goods and services. Capital inputs encompass all physical and financial assets used in production. In upstream oil and gas activities, as regulated under Article 78 of Government Regulation Number 35 of 2004 on Upstream Oil and Gas Business Activities, all goods and equipment directly used and purchased by contractors become state-owned assets. These assets, classified as upstream oil and gas state-owned assets under Minister of Finance Regulation Number 140/PMK.06/2020, represent key capital inputs in upstream oil and gas operations.

In practice, the state-owned upstream oil and gas assets are used to support the core activities in the upstream oil and gas business, namely oil production. Oil production refers to the amount of oil successfully extracted from a reservoir, serving as one of the key outputs of upstream oil and gas operations. The production scale, which ultimately affects gross revenue, directly impacts the government's share within the production-sharing contract scheme. Under the cost recovery production-sharing contract scheme, the government's share typically reaches 85% of the equity to be split. In the gross split scheme, the government's share is around 53% for crude oil and 51% for natural gas production, as regulated under the Minister of Energy and Mineral Resources Decree Number 230.K/MG.01/MEM.M/2024. These base split figures may be adjusted based on variable components and progressive elements evaluated by SKK Migas.

Based on the issues previously discussed, the researcher presents the following conceptual framework for this study.

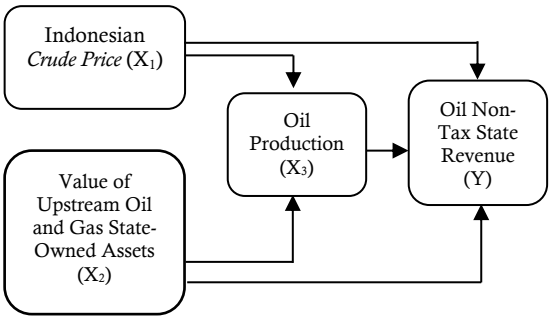

Figure 2. Conceptual Framework

Based on this theoretical foundation and supported by prior empirical research, this study proposes the following hypothesis:

The relationship between Indonesian Crude Price (ICP) and oil production is an essential aspect of economic analysis, as fluctuations in oil prices can influence investment decisions in the oil industry, ultimately affecting oil production levels. Research conducted by Strom and Pescatori (2014) states that "a global flow demand shock …, raising the real oil price and stimulating oil production on impact." This study indicates that a surge in global demand causes an increase in real oil prices, directly stimulating higher oil production. Additionally, several studies have examined the relationship between crude oil prices and investment decisions, ultimately affecting production levels. Baumeister & Kilian (2016) found that declining oil prices lead to a reduction in oil-related investments. Furthermore, falling oil prices also result in lower employment in the oil industry. Thus, the following hypothesis is formulated based on prior research findings:

H_1: ICP has a positive and significant effect on oil production.

The relationship between upstream oil and gas state-owned assets and oil production can be understood through Cobb-Douglas production theory, which states that output is influenced by capital, labor, and technology. If capital increases, such as through investment in new equipment, oil and gas production should also increase.

However, the law of diminishing marginal returns suggests that when only capital increases without proportional improvements in labor (L) or technology (A), the resulting increase in output declines over time. Technological advancements and workforce skill improvements must accompany capital expansion to ensure optimal production growth. Since oil production is the output variable, additional upstream oil and gas assets should theoretically increase production. Since no previous research has specifically examined the relationship between upstream oil and gas state-owned assets and oil production, this hypothesis is developed based on theoretical principles:

H_2: Upstream oil and gas state-owned assets have a positive and significant effect on oil production.

As reported in Central Government Financial Statements, oil non-tax state revenue holds a significant value and represents a large proportion of total non-tax state revenue from natural resources. Crude oil is classified as a strategic and non-renewable natural resource, requiring state control over its ownership, as stipulated in Law Number 22 of 2001. This law mandates that business entities or permanent establishments engaged in upstream oil and gas activities must pay taxes and non-taxes, including the state's share, government levies, and various bonuses.

Various reports and articles indicate that ICP is one of the key parameters influencing government revenue from the oil and gas sector. Previous research by Abimanyu (2016) found that oil prices—including ICP, West Texas Intermediate (WTI), and United Kingdom Brent—positively and significantly impact government revenue from the oil and gas sector. Similarly, Stella et al. (2019) concluded that fluctuations in oil prices significantly and positively affect government revenue from Nigeria's oil and gas sector.

Abbas et al. (2024) examined the impact of crude oil price changes on Yemen's economic growth using an ARDL approach. Their results indicated a significant positive relationship between oil price fluctuations and short and long-term economic growth. Given that nearly 70% of Yemen's government revenue is derived from the oil sector, the study suggests that oil price changes have a direct fiscal impact. These findings support that oil prices are critical in shaping government revenue in oil-dependent economies. Based on this evidence, the following hypothesis is proposed:

H_3: ICP has a positive and significant effect on oil non-tax state revenue.

Applying Cobb-Douglas production theory, where output is influenced by capital, labor, and technology, an increase in capital—such as investment in new equipment—should lead to higher oil production. Consequently, increased oil production is expected to raise oil non-tax state revenue, as government revenue is derived from the production and sale of crude oil through mechanisms such as the state's share, bonuses, and various types of oil-related non-tax state revenue. Since no previous research has specifically analyzed the relationship between upstream oil and gas state-owned assets and non-tax state revenue, this hypothesis is developed based on theoretical observations:

H_4: Upstream oil and gas state-owned assets have a positive and significant effect on oil non-tax state revenue.

The Indonesian government applies a production-sharing contract system to regulate upstream oil and gas activities, as Law Number 22 of 2001 outlines. This contract system ensures that exploration and exploitation activities are structured to maximize state benefits, with revenue-sharing mechanisms designed to enhance government earnings. Higher oil production increases gross revenue, which is the basis for calculating the government's share. Research conducted by Fan & Zhu (2010) and Zhu et al. (2015) demonstrates that firms with higher production levels have greater potential to generate increased revenues. Based on this rationale, the following hypothesis is formulated:

H_5: Oil production has a positive and significant effect on oil non-tax state revenue.

Several recent studies have used VAR and similar econometric models to examine how oil price changes affect macroeconomic and fiscal indicators in different countries (Meylani & Prasetyo, 2023; Srivani & Elvinta, 2024; Abbas et

al., 2024; Omarova et al., 2024; Raouf, 2021). These studies show that international oil prices strongly impact inflation, government spending, and economic growth. However, most do not explore the intermediate factors that explain how oil prices affect government revenue. In particular, little research includes domestic oil production as a mediating variable between oil prices and non-tax state revenue, especially in developing oil-producing countries like Indonesia. This study aims to fill that gap by using a VAR model with post-2016 data and by including oil production as a dynamic variable better to understand its influence on government oil and gas revenue.

Additionally, there has been no research on whether upstream oil and gas state-owned assets influence oil non-tax state revenue through oil production activities. This study is expected to be the first to investigate the impact of upstream oil and gas state-owned assets on oil non-tax state revenue.

RESEARCH METHOD

This study uses a quantitative approach with path analysis. Indonesian Crude Price (ICP) and upstream oil and gas state-owned assets are independent variables, while oil non-tax state revenue is the dependent variable. Additionally, oil production is a mediating variable in the relationship between ICP and upstream oil and gas state-owned assets with oil non-tax state revenue. The data used in this study is secondary data obtained from various sources, including the Central Government Financial Statements, SKK Migas Performance Reports, Indonesian Statistics (BPS), and other sources such as articles and news reports. Since Central Government Financial Statements was first introduced in 2004 as part of the implementation of Law Number 17 of 2003 on State Finance, the data collected spans from 2004 to 2023.

The statistical method used in this study is the Vector Autoregression (VAR) model. VAR is applied to analyze the dynamic relationship among all variables in the system, allowing each variable to be treated as both dependent and independent over time. Granger causality tests are employed to examine short-run predictive relationships between variables. At the same time, the t-statistics from the VAR coefficients are used to assess the direction and significance of short-run effects. In addition, the Forecast Error Variance Decomposition (FEVD) is conducted to evaluate the relative contribution of each variable's shock to the forecast error variance of other variables over a 10-period horizon. The potential mediating role of oil production is explored descriptively through the VAR framework by examining whether oil production transmits the effect of ICP and upstream oil and gas state-owned assets to oil non-tax state revenue. This study's statistical tests and estimations are performed using EViews 13 software.

RESULTS AND DISCUSSION

In time series analysis, testing for stationarity is an important initial step to ensure reliable results. Stationary data has consistent statistical properties, such as a constant mean and variance over time. If the data is non-stationary, it may lead to inaccurate or misleading conclusions. In this study, the author uses the Augmented Dickey-Fuller (ADF) test to examine the stationarity of the variables. If needed, differencing is applied to transform the data before proceeding with further analysis using models such as VAR or VECM.

Table 1. Summary of Stationery Test Results

Variables	*p-value*	sig. value	Decision
X_1	0,0128	$\alpha = 0,10$	Stationer
X_2	0,0008	$\alpha = 0,10$	Stationer
X_3	0,0483	$\alpha = 0,10$	Stationer
Y	0,0659	$\alpha = 0,10$	Stationer

Source: Data Processed, 2025

The tests were performed on the first-differenced forms of each variable, incorporating both a trend and an intercept in the test equation to account for possible deterministic components. The resulting p-values for all variables were below the 10% significance threshold, indicating that each series achieves stationarity after first differencing. Consequently, the variables are classified as integrated of order one [I(1)],

justifying the application of further procedures such as Johansen Cointegration Testing and Vector Error Correction Model (VECM) estimation.

The Johansen cointegration test examines whether a long-term equilibrium relationship exists among non-stationary time series variables integrated in the same order. A VAR-based framework is applied to identify the number of cointegrating vectors using trace and maximum eigenvalue statistics, which are the basis for selecting a VECM when cointegration is found.

Table 2. Summary of Johansen Cointegration Test Results

Variables	ECT Coef.	t-statistic	sig. value	Decision
X_1	-0,0001	-1,553	$\alpha = 0,10$	Not significant
X_2	-0.4800	-1.406	$\alpha = 0,10$	Not significant
X_3	0,0000	0,0840	$\alpha = 0,10$	Not significant
Y	0,0552	0,4640	$\alpha = 0,10$	Not significant

Source: Data Processed, 2025

The Johansen cointegration test results indicate no statistically significant cointegrating relationship among the variables, as neither the trace nor the maximum eigenvalue statistics exceed the critical values at the 10% significance level. This suggests that although the variables are individually non-stationary, they do not move together in the long run. Consequently, the appropriate modeling approach is to use a Vector Autoregressive (VAR) model based on the first-differenced data, which captures the short-run dynamics without assuming a long-term equilibrium not supported by the data.

The VAR stability test evaluates whether the estimated Vector Autoregression (VAR) model is dynamically stable. Stability is essential to ensure that shocks to the system gradually dissipate over time rather than amplify uncontrollably. This is evaluated by examining the inverse roots of the autoregressive characteristic polynomial. If all roots lie within the unit circle, the model satisfies the stability condition and is considered appropriate for further analysis, such as impulse response functions and variance decomposition.

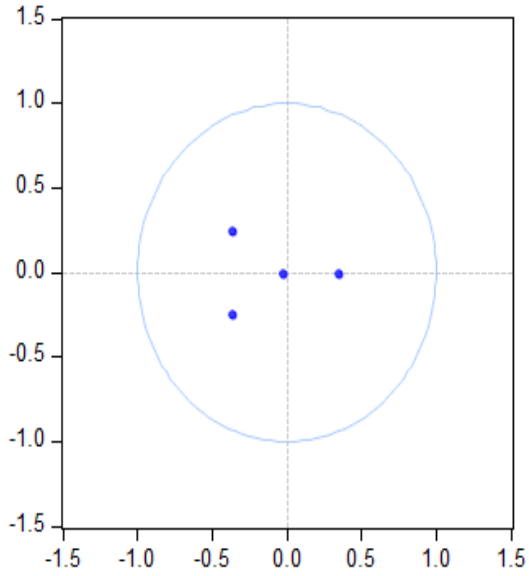

Figure 2. Inverse Roots of AR Characteristic Polynomial
Source: Data Processed, 2025

The inverse roots of the autoregressive (AR) characteristic polynomial are located strictly inside the unit circle, as illustrated in the figure. Each blue dot represents a root; none lie on or outside the circle's boundary with radius one. This graphical result confirms that the VAR model satisfies the condition for dynamic stability. A stable VAR model ensures that shocks to the system dissipate over time rather than amplify, allowing for reliable interpretation of impulse response functions, forecast error variance

decomposition, and Granger causality. Therefore, the estimated VAR(1) model is deemed appropriate for further dynamic time series analysis.

The VAR Granger causality test analyzes short-run relationships between variables by checking whether past values of one variable help predict another. In this method, a variable is said to Granger-cause another if its lagged values significantly improve the explanation of the dependent variable. This test helps identify the direction of influence among time series variables within the VAR framework.

Table 3. Summary of VAR Granger Causality Test Results

(Oil Production as a Dependent Variable)			
Variables	p-value	sig. value	Decision
X_1	0,3933	$\alpha = 0,10$	Not significant
X_2	0,5119	$\alpha = 0,10$	Not significant
(Oil Non-Tax State Revenue as a Dependent Variable)			
X_1	0,0612	$\alpha = 0,10$	Significant
X_2	0,7897	$\alpha = 0,10$	Not significant
(Oil Non-Tax State Revenue as a Dependent Variable)			
X_3	0,5940	$\alpha = 0,10$	Not significant

Source: Data Processed, 2025

While the Granger causality test evaluates whether one variable provides statistically significant predictive power over another, it does not reveal the specific direction or magnitude of influence. Therefore, examining the t-statistics of each lagged variable in the VAR model is essential to complement the Granger test results, as it allows for a more detailed understanding of each relationship's sign, size, and short-run impact.

Table 4. Summary of T-Test in the VAR Model Results

(Oil Production as a Dependent Variable)				
Variables	**Coef.**	**t-statistic**	**Direction**	**Decision**
$X_1(-1)$	-0,399	-0,6351	Negative	Not significant
$X_1(-2)$	-0,440	-0,6896	Negative	Not significant
$X_2(-1)$	-0,000	-0,2387	Negative	Not significant
$X_2(-2)$	0,000	1,1521	Positive	Not significant
(Oil Non-Tax State Revenue as a Dependent Variable)				
$X_1(-1)$	1.762,800	1,6548	Positive	Significant
$X_1(-2)$	-2.415,975	-1,1072	Negative	Not significant
$X_2(-1)$	-0,975	-1,3253	Negative	Not significant
$X_2(-2)$	0,019	1,1568	Positive	Not significant
$X_3(-1)$	329,060	0,8797	Positive	Not significant
$X_3(-2)$	-739,599	-1,1464	Negative	Not significant

Source: Data Processed, 2025

The VAR estimation results reveal that most lagged variables do not exhibit statistically significant short-run effects, as indicated by t-statistics below the critical threshold of 1.645 at the 10% significance level. For instance, ICP does not significantly affect oil production, with both lag-1 and lag-2 coefficients being negative and t-statistics of -0,63513 and -0,68966, respectively. Similarly, upstream oil and gas state-owned assets variables show no significant influence on oil production or oil non-tax state revenue, with inconsistent directions and low t-statistics across

lags. In contrast, only the first lag of ICP on oil non-tax state revenue shows a positive and marginally significant effect (t = 1,65488), suggesting that oil prices may have some short-run impact on state revenue. Overall, most variable interactions in the model are not statistically significant in the short term, highlighting limited dynamic responses within the observed period.

Based on the results of the analysis, the discussion on hypothesis testing is as follows:

The p-value for Structure 1 based on the VAR Granger Causality Test result, which examines the relationship between ICP and oil production, is 0,3933, larger than 0.10. This indicates that ICP does not significantly influence oil production. Thus, based on the result of the t-test in the VAR model, the direction of the coefficient for ICP on oil production is negative, meaning that an increase in ICP leads to a decrease in oil production. This result contradicts previous studies, which found that lower oil prices reduce investment in oil-related activities and decrease oil production. Based on this explanation, H_1 is rejected.

The p-value for Structure 1 based on the VAR Granger Causality Test result, which examines the relationship between upstream oil and gas state-owned assets on oil production, is 0,5119, larger than 0.10. This indicates that upstream oil and gas state-owned assets do not significantly influence oil production. Thus, the VAR estimation results show that the influence of state-owned oil and gas assets on oil production is statistically insignificant in the short run. The coefficient of the first lag of the oil and gas state-owned assets variable is -0,000 with a t-statistic of -0,2387, while the second lag yields a coefficient of 0,0001 with a t-statistic of 1,1521. Both t-values fall below the critical threshold of 1,645 for a 10% significance level, indicating no meaningful short-term effect. Additionally, the direction of influence is inconsistent across lags, further weakening the evidence for a systematic relationship between assets and production. These results suggest that upstream oil and gas asset changes do not significantly drive oil production fluctuations within the observed period.

This finding contradicts the Cobb-Douglas production theory, which states that a capital increase should lead to increased output. This anomaly may arise because upstream oil and gas state-owned assets are directly utilized in upstream business activities, whose outputs generate gross revenue, a portion of which accrues to the government.

This is most likely due to two factors. First, the oil wells owned by the oil and gas contractors are aging wells, making them less effective in extracting oil from the ground. This aligns with a statement made by the Minister of Finance in 2016, as quoted on *esdm.go.id*, which noted that one of the causes of declining oil production is the aging oil wells. Second, the negative relationship between the upstream oil and gas state-owned assets and oil production may be caused by inconsistencies in the reporting standards. First, the recording of upstream oil and gas state-owned assets in the central government financial statements from 2004 to 2008 was still based on values in rupiah, converted using the Central Bank of Indonesia's middle exchange rate as of the financial reporting date, considering that the contractors in US dollars recorded these assets. This differs from the recording starting in 2009, which used values based on inventory and valuation results.

Secondly, land data was not included in the calculation of the total upstream oil and gas state-owned assets reported in the Central Government Financial Statements from 2004 to 2008, and inventory data was not included in the calculation of the total upstream oil and gas state-owned assets reported in the Central Government Financial Statements from 2007 to 2008.

Then, upstream oil and gas state-owned assets data in the 2009 Audited Central Government Financial Statements balance sheet decreased drastically. This was because the data presented only included land that had been inventoried and appraised. Non-land assets and inventory were not presented because they had not yet been inventoried and appraised, their cost recovery value had not been identified, and they had not been transferred to the government.

Another cause of inconsistency in the reporting standards is that some upstream oil and gas state-owned assets had been inventoried and appraised but were not presented in the 2010 Central Government Financial Statements balance sheet due to the presence of unused wells, the accuracy of the exchange rate still being traced, questionable subsequent expenditures, and the fact that the Audit Board of Indonesia had not yet audited them.

There are provisions regarding asset classification as regulated in Minister of Finance Regulation Number 207/PMK.05/2022 on Accounting and Financial Reporting Guidelines for Upstream Oil and Gas State-Owned Assets. It states that the assets presented in the Central Government Financial Statements balance sheet are those acquired since 2011 and those acquired up to 2010 that have been inventoried and appraised. As a result, there are still assets that have not been presented in the balance sheet and are only disclosed in the notes to the financial statements, as they do not yet meet the classification criteria for inclusion in the balance sheet.

Based on the explanation above, there is a high possibility that the value of upstream oil and gas state-owned assets presented in the Central Government Financial Statements balance sheet does not fully reflect the upstream oil and gas state-owned assets used by oil and gas contractors in upstream oil and gas business activities. Therefore, based on the explanation above, H_2 is rejected. The probability value for Structure 2, in this case, the relationship between the ICP variable and the oil non-tax state revenue variable, is 0.0612 based on the Granger Causality Test. The value indicates that past values of ICP significantly improve the prediction of oil non-tax state revenue in the short run. This finding aligns with economic theory, which posits that fluctuations in global oil prices directly affect government revenues from the oil and gas sector, particularly through royalties and production-based levies. This result reinforces previous research while clarifying the statement issued by the Ministry of Finance and the Ministry of Energy and Mineral Resources (ESDM) that ICP is one of the parameters in determining the amount of state revenue from oil and gas.

In the VAR model, the first lag of ICP has a positive coefficient of 1.762,800 with a t-statistic of 1,6548, which is marginally significant at the 10% level, further supporting the short-run influence of oil prices on state revenue. Although the second lag of ICP yields a negative coefficient and is not statistically significant (t = -1,1072), the overall result reinforces that ICP has a meaningful short-term impact on oil non-tax state revenue. The direction and magnitude of the significant coefficient suggest that rising oil prices are associated with increased government revenue from the oil and gas sector. Based on this explanation, H_3 is accepted.

In this case, the probability value for Structure 2, the relationship between the upstream oil and gas state-owned assets variable and the oil non-tax state revenue variable, is 0,7897 or greater than 0,10. This implies that past values of the asset variable do not significantly improve the prediction of oil non-tax state revenue in the short run. This finding contrasts the predictions of the Cobb-Douglas production theory, which states that any capital increase should lead to an increase in output, in this case, revenue.

Similarly, the VAR estimation shows no significant short-term effect of assets on oil non-tax state revenue. The coefficient for the first lag of the asset variable is -0,975 with a t-statistic of -1,3253, and the second lag yields a positive coefficient of 0,019 with a t-statistic of 1,1568. Both values fall below the critical t-value of 1,645, indicating a lack of statistical significance. Moreover, the inconsistent direction of the coefficients across lags further weakens the argument for a systematic or stable relationship. These results suggest that, in the short run, changes in oil and gas state-owned assets do not play a decisive role in influencing oil-based non-tax revenues. Similar to the explanation in point 2, this appears to be an anomaly, as upstream oil and gas state-owned assets are used for upstream oil and gas business activities, with its output being oil production, which ultimately affects oil non-tax state revenue. Based on this explanation, H_4 is rejected.

In this case, the probability value for Structure 2, the relationship between the oil production variable and the oil non-tax state revenue variable, is 0.5940 or greater than 0.10. This indicates that past oil production values do not provide statistically meaningful information for predicting oil non-tax state revenue. In other words, no short-run predictive relationship can be confirmed between production levels and government oil revenue within the tested time frame.

Consistent with the Granger test, the t-test results from the VAR model also show that oil production does not significantly influence oil non-tax state revenue in the short run. The first lag of oil production has a positive coefficient of 329.060 with a t-statistic of 0.8797, while the second lag shows a negative coefficient of -739.599 and a t-statistic of -1.1464. Both values are below the 10% significance threshold, and the inconsistent direction across lags further weakens the evidence for a stable or systematic relationship. These findings suggest that oil production changes do not significantly directly affect non-tax state revenue from oil in the short term.

The findings of this study reveal that oil production does not have a statistically significant effect on oil non-tax state revenue, suggesting that short-run fluctuations in production volumes may not directly translate into fiscal contributions. This result contrasts with the findings of Omarova et al. (2024), who emphasized that increased oil production in Kazakhstan—driven by major upstream projects—has significantly contributed to the country's economic development and fiscal performance over time. The divergence may reflect differences in institutional efficiency, asset management, and the fiscal regimes applied to oil production between the two countries. Based on this explanation, H_5 is rejected.

Forecast Error Variance Decomposition (FEVD) is used in VAR modeling to determine the relative contribution of each variable's shock to the forecast error variance of other variables in the system over time. Unlike the Granger causality test, which focuses on short-run predictive relationships, FEVD provides insight into the dynamic interdependence of variables by quantifying how much fluctuations in a particular variable can be attributed to shocks and in other variables across multiple periods. This method is particularly useful for identifying which variables have the most substantial long-term influence within a system of economic indicators.

Table 5. Summary of FEVD Test Results

Variables	ICP (%)	Oil Production (%)	Upstream Oil and Gas State-Owned Assets (%)	Oil Non-Tax State Revenue (%)	Total
ICP	62,33	18,06	11,28	8,32	100
Oil Production	25,57	43,54	9,56	21,32	100
Upstream Oil and Gas State-Owned Assets	21,24	31,08	36,64	11,04	100
Oil Non-Tax State Revenue	34,27	23,26	6,66	35,81	100

Source: Data Processed, 2025

The FEVD results indicate that fluctuations in the ICP are primarily explained by its shocks, contributing 62.33% of the variation at the 10th forecast horizon. Oil production contributes 18.06%, upstream oil, and gas state-owned assets fluctuations account for 11.28%, and oil non-tax state revenue contributes 8.32%. These findings affirm that ICP remains predominantly exogenous in the system, with limited but non-negligible influence from domestic production and fiscal components. The results affirm the global nature of crude oil pricing and acknowledge moderate domestic factors that may interact with price movements over time.

Oil production is explained to the largest extent by its historical shocks, accounting for 43.54% of the forecast error variance at horizon 10. ICP contributes 25.57% of the variation, while

oil non-tax state revenue and upstream oil and gas state-owned assets values contribute 21.32% and 9.56%, respectively. These findings highlight the central role of oil prices in influencing production levels, suggesting that global price movements are a key driver in domestic production dynamics. Additionally, the contribution of oil non-tax state revenue implies the presence of a feedback mechanism, where revenue considerations may also affect production activities.

A combination of influences explains fluctuations in upstream oil and gas state-owned assets. The largest share comes from the upstream oil and gas state-owned assets variable itself (36.64%), followed by oil production (31.08%) and ICP (21.24%). Oil non-tax state revenue contributes a smaller portion of 11.04%. These results suggest that while asset accumulation is partly self-driven, it is also significantly influenced by upstream production activities and global oil prices. The asset value is, therefore, not only an outcome of accounting decisions but also reflects operational and market conditions within the oil and gas sector.

The forecast error variance decomposition reveals that a relatively balanced mix of shocks explains oil non-tax state revenue. ICP contributes 34.27%, the variable itself 35.81%, oil production 23.26%, and upstream oil and gas state-owned assets 6.66%. This indicates that oil non-tax state revenue is sensitive to global price movements, production volumes, and, to a lesser extent, changes in asset values. The nearly equal contributions from ICP and its past values suggest that oil non-tax state revenue responds dynamically to external price shocks and internal fiscal patterns, confirming its systemic position in the oil and gas revenue framework.

This study examines the potential mediating role of oil production in the relationship between upstream oil and gas state-owned assets and oil non-tax state revenue and between ICP and oil non-tax state revenue. Mediation, in this context, refers to the mechanism by which a change in an independent variable influences the dependent variable indirectly through its effect on a third variable. Although formal mediation analysis commonly uses regression-based path models, this study explores mediation qualitatively and dynamically through the VAR framework by assessing the statistical relationships and variance contributions among the relevant variables.

The VAR estimation results and Granger Causality Tests provide limited support for oil production as a mediating variable. First, neither ICP nor upstream oil and gas state-owned assets variables show statistically significant short-run effects on oil production, as indicated by low t-statistics and high p-values in the Granger tests. Similarly, the direct influence of oil production on oil non-tax state revenue is not statistically significant in the short run. These findings suggest that the necessary conditions for mediation namely, significant relationships from the independent variable to the mediator and from the mediator to the dependent variable are not satisfied based on conventional causality and coefficient testing.

However, the FEVD results offer additional perspective by highlighting the long-run contribution of each variable to the system. ICP contributes 25.57% to the variation in oil production and 34.27% to oil non-tax state revenue, while oil production contributes 23.26% to oil non-tax state revenue. Although the short-run pathways are statistically insignificant, these long-run contributions suggest that oil production may still play an indirect and systemic role in transmitting the effects of ICP to oil non-tax state revenue. Nevertheless, since both direct and indirect effects are not statistically significant in the VAR model, the study concludes that oil production does not serve as a mediator in the strict statistical sense. However, its structural role within the system may still be economically relevant.

CONCLUSIONS

This study investigates the impact of Indonesian Crude Price (ICP) and upstream oil and gas state-owned assets on oil non-tax state revenue. The Vector Autoregression (VAR) approach examines oil production as a potential mediating variable. The findings reveal that ICP has a positive and marginally significant short-run

effect on oil non-tax state revenue, as indicated by both the Granger Causality and t-statistics results. In contrast, upstream oil and gas state-owned assets do not significantly affect either oil production or oil non-tax state revenue in the short run. Oil production also does not significantly influence oil non-tax state revenue, and no short-run causality is identified from either ICP or upstream oil and gas state-owned assets toward oil production.

The mediation test through the VAR framework confirms that oil production does not serve as a statistical mediator between ICP or upstream oil and gas state-owned assets and oil non-tax state revenue. This is due to the absence of significant causal and direct relationships necessary to establish mediation, as shown by the Granger and t-test results. However, the Forecast Error Variance Decomposition (FEVD) analysis highlights that, in the long term, ICP plays a dominant role in explaining variations in oil production and non-tax state revenue. At the same time, oil production contributes meaningfully to the variance in oil non-tax state revenue. These long-run dynamics suggest structural interdependence among the variables, even though short-run statistical mediation is not supported.

Overall, this study concludes that while ICP remains a critical determinant of oil non-tax state revenue in the short term, the role of upstream oil and gas state-owned assets appears limited, potentially due to inconsistencies in asset valuation and reporting. Despite its central operational role in the sector, oil production does not act as a mediating channel under the VAR framework used in this study. These findings emphasize the need for enhanced asset management transparency and more detailed production data to improve fiscal forecasting accuracy. Future research may benefit from applying structural equation modeling (SEM) or panel VAR techniques to capture short- and long-term effects comprehensively.

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