The Asian Journal of Professional and Business Studies

ANALYSIS OF DETERMINANTS AND POLICIES OF INDONESIAN COAL EXPORTS

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ABSTRACT

This study aims to analyze in depth the development of coal prices, production, exchange rates and exports for the period 2005-2024, to determine and analyze the Indonesian government's policy in setting coal export quotas through the Domestic Market Obligation (DMO) mechanism and to analyze in depth the influence of prices, production and exchange rates on Indonesian coal exports for the period 2005-2024. The analytical methods used in this study are qualitative and quantitative. The analytical tool used is multiple linear regression. The results of the study show that during the period 2005-2024, the average development of international coal prices in the period 2005-2024 was 10.71 per cent per year. Then the average development of coal production during 2005-2024 was recorded at 10.19 per cent per year. On average, the annual development of the exchange rate was recorded at 3.03%. The average annual development of coal exports reached 6.87. Indonesia's coal export quota policy, through the Domestic Market Obligation (DMO), is essentially a compromise strategy between national interests and the interests of the mining industry. By requiring a minimum of 25% of production for domestic needs, the government ensures a stable energy supply for PLN (State Electricity Company) and industry, albeit lower than international prices. DMO has proven vital to maintaining national energy security, electricity tariff stability, and state revenues. The success of this policy depends heavily on consistent government oversight, company compliance, and the adaptation of the national energy system to global market dynamics and the sustainable energy transition. Multiple linear regression results indicate that prices, production, and the exchange rate have a positive and significant impact on Indonesia's coal exports from 2005 to 2024.

Keywords: *Price, Production, Exchange Rate, Coal Exports.*

1. INTRODUCTION

International trade plays an important role in the economic growth of a country. According to Adam Smith, through trade, the world's resources can be used efficiently and can maximise global welfare (Mankiw, 2013). International trade plays a significant role in supporting a country's economic growth. International trade activities include exports and imports.

Exports are the sale of goods and services produced domestically and purchased by foreigners, while imports are the purchase of goods and services produced abroad for domestic needs. Exports and imports affect the production activities or output of domestic producers, which in turn affects Indonesia's economic growth, making exports and imports key components of economic growth (Suryanto & Kurniati, 2022).

Economists argue that in addition to capital accumulation and technological development, there are other factors that play an important role in a country's economic growth, such as population, labour, openness to international trade, and government policy (Yossinomita et al., 2024). International trade consists of exports and imports of goods or services. Exports are activities of selling goods or services in a country's national territory, based on the Free On Board (FOB) price. The calculation of exports is done by multiplying the value of the goods (according to the export notification) by the exchange rate (Kartikasari, 2017). Exports are one of the indicators that can influence the rise and fall of a country's economic growth (Ginting & Kartiasih, 2019; Maulana & Kartiasih, 2017; Setiawan et al., 2020).

External factors also received attention. Research by Wahyu Ida Nurcahyaningsih & Rahayu (2022) showed that Japan's GDP per capita had a greater influence on export demand than coal prices. Setiawan et al. (2020) highlighted the existence of a national energy policy (RUEN) that restricted exports, thereby impacting economic growth. Suseno & Haryadi (2013) even estimate that coal reserves will only last for around 30 years if exports continue to increase. From a macro perspective, research by Azizah & Soelistyo (2022) reveals that the real GDP of the destination country, population, real exchange rate, and adoption of renewable energy also influence Indonesia's coal exports. Ditya (2022) adds that the exchange rate does not always have an impact, while global coal prices have a positive effect, and national income and interest rates have a negative impact on export performance.

According to the Central Statistics Agency, Indonesia's coal exports have increased over the past five years. In 2020, Indonesia's coal exports amounted to 341,547 thousand tonnes, down by 33,388 thousand tonnes or 8.9% from 2019. In 2021, Indonesia's coal exports increased again to 345,453 thousand tonnes and continued to increase to 379,705 thousand tonnes in 2023 (BPS, 2023). According to the Ministry of Energy and Mineral Resources (ESDM), coal export prices have fluctuated over the past five years. In 2019, the price of coal was USD 77.89/tonne, while in 2020 it fell by USD 19.72/tonne or 25%. From 2021 to 2022, coal prices rose to USD 276.58 per tonne, and in 2023, coal prices fell from the previous year to USD 201.15 per tonne. (BPS, 2023).

According to the Central Statistics Agency (BPS), coal production has fluctuated over the past five years. In 2019, coal production amounted to 616,154 thousand tonnes. In 2020, coal production decreased from 2019 to 565,640 thousand tonnes. From 2021 to 2023, coal production increased from the previous year to 775,181 thousand tonnes (BPS, 2023). According to Bank Indonesia (BI), the exchange rate of the Rupiah against the USD has fluctuated over the past five years. In 2019, the exchange rate of the Rupiah was Rp. 14,075. In 2020, the exchange rate of the Rupiah increased to Rp. 14,499. In 2021, the exchange rate of the Rupiah decreased to Rp. 14,240. From 2022 to 2023, it increased to Rp. 15,178. (BI, 2023).

A number of studies on coal exports in Indonesia show that the main factors influencing exports are exchange rates, international coal prices, production, and the economic conditions of the export destination countries. Rahmawati's (2011) study emphasises that the rupiah exchange rate and production volume have a significant effect on Indonesia's coal exports to Japan. Dewi (2018) found similar results, namely that coal prices, exchange rates, and the GDP of the destination country have a positive effect on exports, while Aulia (2017) asserts that exchange rates and world coal prices are significant, but production has no real effect. Meanwhile, Hanif's (2023) research found different results: the exchange rate does not always have a significant effect, but production, benchmark coal prices, and world oil prices do have a real effect on export value. Previous studies have produced conflicting results regarding whether there is an impact or not. Therefore, this study will analyse the influence and impact of Indonesia's coal export policy on other sectors.

In general, these findings show consistency in that coal prices and the rupiah exchange rate are dominant factors influencing exports, although different results emerge in certain periods or contexts, particularly those related to domestic demand and national energy policy. These mixed findings indicate that the dynamics of Indonesian coal exports are shaped not only by market factors such as production, prices, and exchange rates, but also by institutional and policy interventions. This study contributes by integrating Indonesia's Domestic Market Obligation (DMO) policy as a structural policy context explaining coal export behaviour over a long-time horizon (2005–2024), a dimension rarely emphasised in prior econometric export studies.

2. LITERATURE REVIEW

2.1. International Trade Theories

The mercantilist theory was criticised by classical figures such as David Hume and Adam Smith. Adam Smith stated that the prosperity of a country is not only measured by its possession of precious metals such as gold and silver, but also by its Gross Domestic Product (GDP) and its contribution to international trade in the form of exports and imports. Therefore, to increase Gross Domestic Product (GDP), the government must reduce its interference in economic activities, thereby creating free trade between countries. This free trade will then create more competition and encourage each country to specialise in products based on its absolute advantages. This product specialisation will spur higher productivity and efficiency, which will ultimately lead to an increase in Gross Domestic Product (GDP), resulting in prosperity in that country (Krugman, 2015).

The theory of absolute advantage was first proposed by Adam Smith in the late 18th century. Adam Smith stated that a country can be said to have an absolute advantage over another country if it can produce goods and services that cannot be produced by other countries. Thus, a country that can produce a commodity in much greater quantities than other countries can be said to have an absolute advantage over that commodity. In this theory of international trade, a relationship between two countries can occur if each country specialises in a commodity in which it has an absolute advantage and exchanges it for another commodity in which it has an absolute disadvantage (Salvatore, 2014). In the theory of absolute advantage, every country will benefit from international trade by specialising in production. In this case, a country exports if it has an absolute advantage over another country in a particular product and imports a product when it does not have an absolute advantage.

According to the law of comparative advantage, if a country is less efficient in producing a commodity or has an absolute disadvantage compared to another country, there is still a basis for mutually beneficial trade between the two countries, namely by specialising in the production and export of commodities with the smallest absolute disadvantage and importing commodities with the largest absolute disadvantage. The following are some criticisms of classical theory according to (Salvatore Dominick, 2014), including the following:

1. Classical theory is still static in nature, so it cannot explain the dynamic process of growth.
2. International trade will actually cause inequality between poor countries and developed countries.
3. International trade causes the terms of trade of developing countries to decline.

This theory was first proposed by Eli Hecksher in 1919 and later developed by Bertil Ohlin in 1933 (Darwanto, 2004). According to the Heckscher-Ohlin theory, international trade can occur because of differences in opportunity costs between one country and another. Differences in the opportunity cost of a product can occur due to differences in the amount or proportion of production factors possessed by each country. In this case, the Heckscher-Ohlin theory analysis uses a two-curve approach, namely, isocost (equal total production costs) and isoquant (equal total products).

According to Salvatore Dominick (2014), there are three basic assumptions of the Heckscher-Ohlin theory, as follows:

1. Trade only occurs between two countries.
2. Each country produces two types of the same goods.
3. Each country uses two types of production factors (labour and machinery) in different proportions.

2.2.   Supply Theory

Supply is the quantity of goods offered at a certain price and at a certain time (Arsyad, 2014). Supply is related to provision and sales. Thus, supply is the quantity of goods and services available for sale at various price levels and situations. Supply is defined as a schedule or curve that shows the various quantities that producers are willing and able to produce and offer in the market at each possible price level during a certain period (Wijaya, 2015).

Meanwhile, according to Samuelson & Nordhaus (2014), the law of supply states that the higher the price, the more goods or services producers are willing to offer. Supply is influenced by various factors, including production costs, technology levels, price expectations, and the number of sellers in the market. Thus, supply is not only a price phenomenon but also the result of the interaction of various economic variables that influence producers' decisions.

The theory of supply in economics explains the relationship between the price of a good or service and the quantity of goods or services that producers are willing to offer during a certain period. According to Mankiw (2014), supply is the quantity of goods or services that producers are willing and able to sell at various price levels. In general, the law of supply states that when prices rise, the quantity of goods supplied will increase, while when prices fall, the quantity of goods supplied will decrease. This occurs because price increases provide an incentive for producers to increase production, while price decreases reduce producers' motivation to sell more goods. Supply is influenced by various factors, not only price, but also production costs, technology, prices of other related goods, future price expectations, and the number of sellers in the market (Sukirno, 2016). Thus, supply theory plays an important role in explaining market mechanisms and determining the equilibrium of prices and quantities that occur.

2.3.   Export Theory

According to Asbiantari et al. (2016), in Santoso & Artha (2021), export is the activity of removing goods from a customs area. The customs area is the territory of the Republic of Indonesia, which includes land, waters and airspace above it, as well as certain places in the Exclusive Economic Zone and Continental Shelf where customs laws apply. Export goods are goods that are removed from the customs area. An exporter is a person who carries out the activity of removing goods from the customs area. An export customs notification is a statement made by a person in order to fulfil customs obligations in the field of exports in the form of writing on a form or electronic data. The form and content of the export customs notification are determined by the Minister of Finance c.q.

Exports are activities that bring trade surpluses to countries aiming to increase their foreign exchange reserves, particularly developing countries such as Indonesia. Export activities involve the production of goods/services by one country and their consumption by another country through a system of trade involving transportation outside the borders of the producing country (Steinhauser et al., 2020). The greatest benefits of participating in export activities are expanding employment opportunities, increasing foreign exchange for the country, and, of course, opening up a wider market for goods and services. One of the factors that determines the success of a country's exports is the comparative level of goods traded by the exporting country. According to Krugman & Wells (2015), export supply is influenced by international prices, domestic production costs, and currency exchange rates. The higher the international price of a commodity compared to the domestic price, the greater the incentive for producers to sell abroad because the profits obtained are higher than selling in the domestic market.

2.4.   Production Theory

Production is a process of transforming input into outputs, which includes the purpose of producing outputs and the characteristics inherent in them. A person needs another party to produce a product that he or she needs. This is because there are more and more diverse needs and limited resources available to produce goods or services. Production is also an activity of creating wealth through the utilisation of natural resources by humans. Therefore, humans are required to carry out the production process in order to meet their physical and spiritual needs (Rahmadani, 2020). (Sri Martha Ayuningsih, 2011) found in her research that a partial increase in production has a significant positive effect on export volume. When production increases, the availability of goods domestically increases, so that the supply of goods at home and abroad also increases. This is what causes export volume to increase when production increases.

2.5.   Exchange Rate Theory

The exchange rate is defined as the comparison of the values of two different currencies. The exchange rate is based on two concepts, namely the nominal concept, which measures the difference in currency prices and indicates the amount of a country's currency required to obtain a certain amount of another country's currency, and the real concept, which measures the competitiveness of a country's export commodities in the international market (Halwani, 2005). Based on research by Wahyudi and Anggita (2015) and Carolina and Aminata (2019), the real exchange rate indicates the purchasing power of domestic output by trading partner countries. In the study by Muharami and Novianti (2018), it is explained that the real exchange rate has a negative effect on the export value and volume of exporting countries. If the exchange rate of an exporting country depreciates, the export value and volume of that country will increase. Meanwhile, for importing countries, if there is an appreciation of the exchange rate that causes the price of foreign products to become more expensive than in exporting countries, importing countries will increase their demand for exports from other countries that have relatively cheaper prices. This statement is also in line with the research conducted by Abidin et al. (2013).
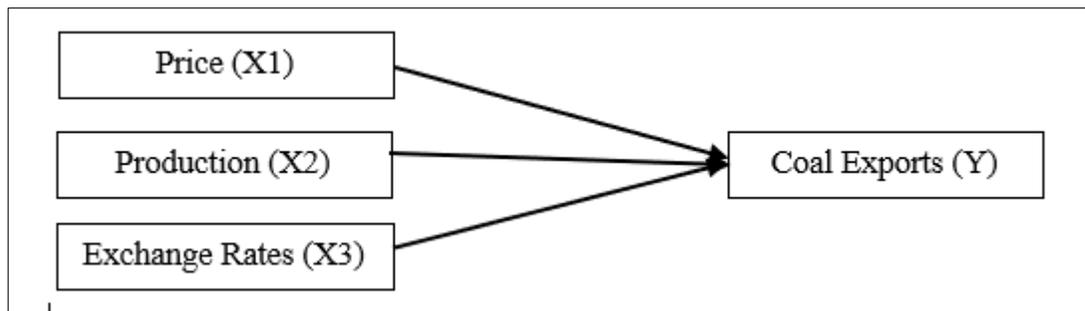
2.6.   Hypothesis

Figure 1: Conceptual Framework

H1= Price, production, and exchange rate significantly affect Indonesian coal exports.

3. METHODOLOGY

The type of data used in this study is secondary data in the form of time series for the period 2005–2024, obtained through literature studies, documents, and official sources from the Central Statistics Agency (BPS), the Ministry of Energy and Mineral Resources (ESDM), and Bank Indonesia. The variables used include Indonesian coal exports, coal prices, coal production, and exchange rates. To answer the research objectives, several analytical methods were used. First, the development of coal export volume was calculated using the development formula (Anto, 2013). Second, qualitative descriptive analysis was used to examine the Domestic Market Obligation (DMO) policy implemented by the government.

Third, the effect of price, production, and exchange rate on coal exports was analysed using multiple regression with a model.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

Hypothesis testing was conducted using the F-test to examine the simultaneous effect of independent variables on the dependent variable, the t-test to examine the partial effect of each independent variable, and the coefficient of determination (R^2) to determine the extent to which the variation in the dependent variable can be explained by the independent variables. With this approach, the study is expected to provide a comprehensive overview of the factors that influence Indonesian coal exports in terms of development, policy, and economic factors. The empirical results are interpreted within the institutional constraint imposed by Indonesia's Domestic Market Obligation (DMO) policy.

4. FINDINGS AND DISCUSSION

4.1. Development of Coal Prices, Production, Exchange Rates and Exports in Indonesia for the Period 2005-2024

During the period 2005–2024, the average growth rate of international coal prices was 10.71 per cent per annum. This figure indicates sharp fluctuations from year to year, meaning that coal prices tend to be volatile. The average annual growth rate of coal production during 2005–2024 was recorded at 10.19 per cent. This figure indicates significant growth despite fluctuations. On average, the annual exchange rate growth was recorded at 3.03%, which means that the rupiah tended to weaken against the US dollar during that nearly two-decade period. The average annual export growth reached 6.87%, which shows that despite some years of decline, coal exports generally continued to grow positively.

4.2. Indonesian Government Policy in Setting Coal Export Quotas through the Domestic Market Obligation (DMO) Mechanism

Indonesia's coal export quota policy does not directly take the form of figures limiting export volumes, but rather through the Domestic Market Obligation (DMO) mechanism. The essence of the DMO is the obligation of mining companies to supply at least 25% of their approved annual production plan in the RKAB to the domestic market. With this obligation, companies cannot simply export their entire production because a portion must be allocated to the domestic market. The implication of this policy is the emergence of an 'indirect export quota, which is the volume of exports remaining after domestic obligations have been met. This mechanism confirms that the government places national energy interests as a top priority over export profits.

The government began implementing the DMO policy in 2009 through Law No. 4 of 2009 concerning Mineral and Coal Mining. Under this regulation, mining companies are required to meet a portion of their coal production for domestic needs before exporting. The DMO figure generally ranges from 20–25% of total national production. The aim of this policy is to ensure the availability of coal for steam power plants (PLTU) and domestic industries.

The legal basis for the DMO policy was then reinforced through ESDM Ministerial Decree 267.K/MB.01/MEM.B/2022, which not only regulates the percentage of obligations, but also the monthly reporting mechanism, administrative sanctions, and the compensation fund formula. Companies are required to report their domestic supply realisation every month, no later than 10 days after the reporting period ends. If a company fails to meet its DMO obligation, it is required to pay compensation funds calculated based on a formula that takes into account the Reference Coal Price (HBA) and coal quality. This sanction aims to ensure that companies continue to contribute to national energy security even if they do not physically supply domestically. In fact, if non-compliance continues, the government has the right to impose sanctions in the form of export restrictions or bans.

A real precedent occurred in January 2022 when the government imposed a total ban on coal exports for a month because PLN's supply was threatened with depletion. This extreme decision shows that the DMO policy has serious consequences that can have a global impact. On 1 January 2022, the government, through the Ministry of Energy and Mineral Resources, imposed a month-long moratorium on coal exports. This was done because PLN's coal supply was critical, with only a few days' worth remaining. This drastic measure was taken so that mining companies would prioritise their DMO obligations and give priority to domestic supply. Although this policy sparked protests from exporters and importing countries (such as Japan, South Korea and the Philippines), this emergency policy demonstrated the government's commitment to maintaining national energy security.

Through Minister of Energy and Mineral Resources Decree No. 1395 K/30/MEM/2018, the government has set the selling price of coal for domestic consumption at USD 70 per tonne specifically for PLN power plants. This policy was introduced because international coal prices have risen to over USD 100 per tonne, meaning that without a special price, PLN could face significant cost increases and higher electricity tariffs. This policy simultaneously reduces exporters' profits but ensures domestic supply.

Since 1 March 2025, the pricing policy has been strengthened by setting the HBA as the floor price for all transactions. This means that export sales prices cannot be lower than the HBA announced by the government every two weeks. This policy is important because previously there were frequent instances of under-invoicing, whereby companies reported export sales prices lower than market prices in order to pay lower royalties and taxes. With the HBA rule as the lower limit, state revenue from the coal sector is expected to be more optimal. However, this rule does not change the special price for domestic supply, so dual pricing remains in effect. This dual pricing is often criticised for creating distortions, but on the other hand, it is an important instrument for keeping domestic electricity tariffs and energy costs under control.

Quantitatively, Indonesia's coal production target for 2025 is around 739.7 million tonnes, with a DMO allocation of around 239.7 million tonnes. Export potential is estimated at 650 million tonnes, although the realisation in the first half of 2025 shows that DMO supply has only reached 104.6 million tonnes or 43.6% of the target. This figure shows that there is still a gap between the target and the realisation, which could potentially prompt the government to tighten supervision. In such circumstances, the Director General of Mineral and Coal could designate certain companies to increase domestic supply. Another risk that arises is export restrictions if DMO realisation continues to lag.

The government has strengthened regulations by imposing strict sanctions on companies that do not meet DMO requirements, ranging from temporary export bans and revocation of export licences to financial penalties. For example, in 2022, dozens of coal companies were banned from exporting because they failed to meet their domestic supply obligations. The aim is to ensure that the DMO discipline is properly implemented and not just a formality. The government then evaluates export quotas based on domestic demand and global price trends.

For mining companies, the DMO policy poses a dilemma. On the one hand, they gain certainty in the domestic market, albeit at lower prices. On the other hand, more lucrative export opportunities remain open once the DMO obligation has been fulfilled. Some companies choose to pay compensation rather than supply physical goods due to quality or logistical distance issues. However, this compensation option cannot be used continuously because the accumulation of fines can lead to the risk of export bans. From the company's perspective, compensation costs become a kind of 'shadow price' for non-compliance, which ultimately reduces export margins.

For the government, the main challenge is supervision. The monthly reporting system is prone to manipulation if it is not accompanied by field verification. In addition, the quality of coal produced does not always meet domestic needs, often leading to disputes between suppliers and PLN. The government is trying to close this gap by strengthening inter-agency coordination, establishing a more stringent compensation formula, and conducting annual evaluations of company compliance.

From an energy policy perspective, DMO is a vital instrument for maintaining national energy security. As the main consumer of coal, PLN requires stable supply and controlled prices so that electricity tariffs do not burden the public or

the state's finances. If all production is allowed to flow to exports, PLN will have difficulty obtaining supplies, and the government will be forced to provide greater energy subsidies. Thus, DMO is not only related to the mining sector but also directly affects macroeconomic stability, inflation, and people's purchasing power.

However, this policy is not without criticism. Some circles argue that DMO distorts the market and reduces the attractiveness of investment in the mining sector. Global investors prefer liberal markets without price intervention. In addition, the dualism of domestic and export prices has the potential to create illegal arbitrage practices, such as smuggling or export document manipulation. Another challenge is environmental sustainability. With production targets remaining high, Indonesia faces pressure to reduce carbon emissions in line with its energy transition commitments.

Overall, the coal export quota policy through the DMO mechanism can be understood as a compromise strategy. The government is trying to balance national interests in the form of energy security, electricity price stability, and state revenue with the interests of mining companies that want to maximise export profits. The success of this policy depends on three main factors: consistent government oversight, company compliance, and the ability of the national energy system to adapt to global market dynamics. With Indonesia's strategic role as the largest coal exporter, this policy not only has implications for the domestic economy but also sends an important signal to the global energy market.

4.3.   The Effect of Price, Production and Exchange Rate on Indonesian Coal Exports for the Period 2005-2024

Overall Test (F-Test)

The F test is used to determine whether the independent variables collectively influence the dependent variable. The test was conducted using a significance level of 0.1 (α = 10 per cent). To test the simultaneous effect of the independent variables, namely price, production and exchange rate, on the dependent variable, namely coal exports in Indonesia, the F-statistic test was used, as can be seen in the SPSS 27 output in the ANOVA table below:

Table 1
Results of the F-Statistic Test

	ANOVA^a					
	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96980856679345296.000	3	32326952226448432.000	29.734	.000^b
	Residual	17395168769532998.000	16	1087198048095812.400		
	Total	114376025448878288.000	19			
	a. Dependent Variable: Y					
	b. Predictors: (Constant), X3, X1, X2					

Source: data processed, 2025

Based on the regression results, the significance obtained is 0.000, where the probability value is less than 0.1. This means that Ho is rejected and H1 is accepted, which can be interpreted as the independent variables (price, production and exchange rate) simultaneously having a significant effect on the dependent variable (coal exports) in Indonesia during the period 2005-2024.

Partial Test (t-test)

Statistical testing is a partial test that aims to determine whether each regression coefficient is significant or not to the dependent variable, assuming that the other variables are constant. To see the results of each dependent variable tested partially with the t-test in detail, the regression coefficients for each variable can be seen in Table 2, which shows the following results:

Table 2

Multiple Linear Regression Results

	COEFFICIENTS [a]						
	Unstandardized Coefficients		**Standardized Coefficients**			**Collinearity Statistics**	
Model	**B**	**Std. Error**	**Beta**	**t**	**Sig.**	**Tolerance**	**VIF**
(Constant)	244128712.114	4748494.641		5.141	.000		
X1	287863.500	126503.837	.274	2.276	.037	.656	1.525
X2	.514	.079	1.338	6.517	.000	.225	4.435
X3	10937.450	5804.180	.352	1.884	.078	.272	3.676
	a. Dependent Variable: Y						

Source: data processed, 2025

Price Variable

The test results yielded a sig value of 0.037, which is less than 0.1, meaning that Ho is rejected and H1 is accepted, indicating that international coal prices have a positive and significant effect on coal exports in Indonesia. Thus, the hypothesis stating that prices affect coal exports in Indonesia from 2005 to 2024 is correct and proven.

Production Variables

The test results yielded a sig value of 0.000, which is less than 0.1, meaning that Ho is rejected and H1 is accepted. This means that coal production in Indonesia has a positive and significant effect on coal exports in Indonesia. Thus, the hypothesis stating that production has an effect on coal exports in Indonesia from 2005 to 2024 is correct and proven.

Exchange Rate Variable

The test results obtained a sig value of 0.078, where the probability value is less than 0.1, meaning that Ho is accepted and H1 is rejected, meaning that the US$ exchange rate has a positive and significant effect on coal exports in Indonesia. Thus, the hypothesis stating the effect of the exchange rate on coal exports in Indonesia in 2005-2024 is correct and proven.

Determination Coefficient Test (R2)

Determination coefficient (DC) analysis is used to see how much the independent variables affect the dependent variable, expressed as a percentage. As shown in the following table:

Table 3.
Results of the R2 Square Test

MODEL SUMMARY[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Wastos
					R Square Change	F Change	df 1	df 2	Sig. F Change	
1	.921[a]	.848	.819	3297268 6.39489	.848	29.734	3	16	.000	.717

a. Predictors: (Constant), X3, X1, X2
b. Dependent Variable: Y

Source: data processed, 2025

Table 3 above shows that the model summary indicates an R2 value of 0.848. This value indicates that price, production and exchange rate affect coal exports simultaneously (overall) by 84.8 per cent, with the remaining 15.2 per cent being influenced by other variables outside the model.

4.4   Discussion

The positive effects of price, production, and exchange rates on Indonesian coal exports should be understood within the Domestic Market Obligation (DMO) framework, which limits exportable surplus despite favourable market conditions. Although higher prices, increased production, and a weaker exchange rate provide strong incentives to export, the DMO policy acts as an institutional constraint by requiring a fixed portion of output to be allocated to domestic needs.The results of the study show that international coal prices have a positive and significant effect on coal exports in Indonesia during the period 2005-2024. These findings are in line with research conducted by Dewi (2018), Anthonius (2018), Safitri & Hartati (2020) and Selindo et al. (2018), which states that prices have a partial effect on coal exports. The impact of prices on coal exports in Indonesia during 2005–2024 was due to significant differences between international prices and domestic prices regulated by the government through the DMO mechanism. Data shows that the average growth in coal exports during 2005–2024 was 6.87% per annum, with considerable fluctuations in certain years. When international prices surged, such as in 2008 when global demand increased, Indonesia's export volume also increased despite domestic allocation obligations. This indicates high elasticity to global prices, where companies are more inclined to increase exports due to much greater profits compared to domestic sales at a benchmark price of £70–90 per tonne. However, the existence of lower domestic pricing policies also creates limitations, as companies must divide their priorities between meeting DMO and taking advantage of export opportunities. The impact was evident when exports declined in 2014–2016, when global prices weakened, reducing companies' incentives to export in large volumes.

In addition, global price fluctuations also affect the competitiveness of Indonesian exports compared to those of other countries. For example, during the 2011–2013 period, when international prices were relatively stable at above USD 100 per tonne, Indonesian coal exports increased to 381 million tonnes in 2013. However, in 2014–2016, there was a decline in export volume to 311 million tonnes due to a decline in global prices, which reduced demand from major importing countries such as China and India. Mining companies preferred to hold back production or focus on the domestic market, as high production costs were not commensurate with weakening international market prices. This situation shows that global coal prices have a direct relationship with the attractiveness of exports, where a downward trend in prices automatically reduces Indonesia's exports. In other words, price is the main indicator that influences the behaviour of exporters, both in increasing and holding back sales to foreign markets.

The price factor also greatly determines the government's policy on coal exports, especially through the Domestic Market Obligation (DMO) mechanism. When global prices rose sharply to USD 300 per tonne in 2022, the government continued to ensure that domestic needs were met at a price of USD 70–90 per tonne. However, companies were still encouraged to export because the profit margins in the international market were much higher. This drove export growth in 2022 by 4.24% and continued to increase until 2024 with a volume of 405 million tonnes. However, the existence of a special domestic pricing policy prevented a larger surge in exports, as part of production had to be allocated to the domestic market at lower prices. This situation illustrates how global prices and domestic policies interact in determining Indonesia's coal export volume. The higher the international price, the greater the incentive to export, but this is still limited by DMO regulations and domestic prices set by the government. Thus, price is a variable that not only influences the behaviour of exporters but also forms the basis for the government in regulating the balance between national economic interests and global market opportunities.

The results of the study show that production has a positive and significant effect on coal exports in Indonesia during the period 2005-2024. These results are reinforced by studies conducted by (Safitri & Hartati, 2020), (Rahmwan, 2019) and (Pratama, 2016), which state that production has a positive and significant effect on coal exports. The influence of production on coal exports in Indonesia during 2005-2024 can be explained by the fact that supply availability is a major factor in determining export volume. Based on the data, Indonesia's coal production has continued to increase significantly, from 149.6 million tonnes in 2005 to 836.2 million tonnes in 2024, with an average growth of 10.19% per year. This surge in production has enabled Indonesia to export in large quantities, even making it the world's largest exporter of thermal coal. Export volume also shows an upward trend, from 129 million tonnes in 2005 to 405.7 million tonnes in 2024, despite experiencing a decline in 2015–2016 and 2020 due to global factors and domestic policies. The relationship between production and exports is very clear: the higher the production, the greater the export potential, as domestic demand is relatively stable and most of the production is directed to the international market.

In addition, increased production has created a supply surplus that cannot be fully absorbed by the domestic market. With a Domestic Market Obligation (DMO) of 25% of annual production, mining companies still have considerable scope to channel their surplus production to the export market. For example, in 2018, production reached 557.9 million tonnes, while exports were recorded at 343.1 million tonnes, or more than 60% of total production. This shows that large production capacity provides high flexibility in meeting global demand. Conversely, when production declined, such as in 2015 (405.8 million tonnes) and 2020 (565.6 million tonnes), export volumes also declined because companies had to continue prioritising allocation for domestic needs. In other words, exports are highly dependent on the availability of production after domestic obligations have been met.

The results of the study show that the exchange rate has a positive and significant effect on coal exports in Indonesia during 2005-2024. These results are in line with the findings of studies conducted by Dewi (2018), Safitri & Hartati (2020), and Alfariz Iqbal Barasyid (2023), which concluded that the exchange rate has a significant effect on coal exports.

The exchange rate has a significant impact on coal exports in Indonesia during the period 2005-2024 because fluctuations in the rupiah against the US dollar affect the competitiveness of export products in the international market. When the rupiah weakens against the dollar, the value of export receipts in rupiah becomes higher even though international coal prices remain unchanged. For example, in 2013, the exchange rate rose sharply to Rp12,128 per US$ or weakened by 26.04% from the previous year, and coal exports increased to 381.3 million tonnes, far greater than in 2012 at 347.5 million tonnes. This condition shows that mining companies are encouraged to increase exports when the rupiah depreciates, because the profits they earn in rupiah are greater. Conversely, when the rupiah strengthened in 2009 to Rp9,353 per US$, or appreciated by -14.15%, even though production increased significantly to 228.8 million tonnes, exports only rose moderately because the profit incentive from the exchange rate difference decreased. Thus, a weakening of the rupiah generally encourages an increase in export volume, as it provides additional margins for businesses in the coal sector.

In addition, fluctuating exchange rates affect mining companies' export policies and strategies. In 2015, when the rupiah weakened to Rp13,726 per US$ or rose 10.89% compared to the previous year, coal exports reached 328.3 million tonnes despite a decline in national production. This indicates that the depreciation of the rupiah encouraged companies to

maintain their export performance despite limited supply, as profits in rupiah were greater. A similar situation was seen in 2022 when the rupiah exchange rate weakened to Rp15,652 per US$, an increase of 10.25% from 2021, with coal exports rising to 360.1 million tonnes from 345.4 million tonnes in the previous year. This phenomenon confirms that the exchange rate is a major driver of exports, as companies seek to maximise foreign exchange earnings when the rupiah is under pressure. Conversely, when the exchange rate is stable or strengthening, as in 2010–2011 when it averaged below Rp9,500 per US$, the increase in exports is relatively more moderate because the additional profits from the exchange rate are smaller. Therefore, a weakening exchange rate provides greater motivation for exporters to increase sales volume to international markets.

5. CONCLUSION

The results of the study show that during the period 2005–2024, the average growth in international coal prices was 10.71 per cent per annum. Meanwhile, the average growth in coal production during 2005–2024 was recorded at 10.19 per cent per annum. On average, the annual exchange rate growth was recorded at 3.03%. The average annual growth in coal exports reached 6.87%. The coal export quota policy in Indonesia, through the Domestic Market Obligation (DMO) mechanism, is essentially a compromise strategy between national interests and the interests of the mining industry. By requiring a minimum of 25% of production to be supplied for domestic needs, the government ensures that energy supplies for PLN and industry are maintained at stable prices, albeit lower than international prices. DMO has proven vital for maintaining national energy security, electricity tariff stability, and state revenue. The success of this policy is highly dependent on consistent government oversight, company compliance, and the adaptation of the national energy system to global market dynamics and the transition to sustainable energy. The results of multiple linear regression tests indicate that price, production, and exchange rates have a positive and significant effect on coal exports in Indonesia during the period 2005-2024.

This study has limitations, namely, analysing the effect of coal export policies on prices, production, and exchange rates. The aim of this study is to conduct an in-depth analysis of the development of coal prices, production, exchange rates, and exports for the period 2005-2024. The results of this study will serve as a consideration and reference for other researchers and the government in formulating policies on coal exports.

6. ACKNOWLEDGEMENT

7. CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in the paper.

8. AUTHOR CONTRIBUTION STATEMENT

Haryadi contributed to the conceptualisation, research design, and writing of the original draft.
Nurhayati contributes to providing guidance in writing
Siti Hodijah contributes to providing guidance in writing

All authors have read and approved the final version of the manuscript.

9. ETHICS STATEMENT

This research was conducted in accordance with the ethical standards of the **Master of Economics, Faculty of Economics and Business, Jambi University** and adhered to the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the **Jambi University**. All participants were informed about the purpose of the study and provided

written informed consent prior to participation. Participants' privacy and confidentiality were strictly maintained, and data collected were used solely for academic purposes.

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