Jurnal Perencanaan Pembangunan:
The Indonesian Journal of Development Planning
Volume VI No. 1 - April 2022/Page: 37 - 53
https://doi.org/10.36574/jpp.v6i1.243
Article

Export Taxes and Trade Pattern: Case from the Indonesian Mineral Industry

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Submitted: 2022-01-04 | Accepted: 2022-04-22 | Published: 28th April 2022

Abstract

The Indonesian government adopted mineral export taxes by imposing a high tariff on raw materials while waiving tariffs on processed products. Tariffs decreased following the progress of refinery plant construction. Based on the fixed effects panel regression at the commodity-country-pair level, this study finds that the export taxes system negatively reduces raw material export while increasing processed mineral export. Tariff stratification on mineral commodities distorts trade patterns, affecting business orientation in upstream and downstream sectors. Furthermore, tier tariff significantly elevates the export quantity of downstream products compared to flat export taxes, directly proportional to export value. Export contraction of raw materials resulted from tier tariff slightly lower than the flat type but with a higher exports performance of processed products. The shifting phenomena to the value-added industry indicate an effort for export taxes evasion. This finding is reinforced by the massive investment inflow in the mineral processing sector. Meanwhile, the exporter manufacturing industry positively correlates with the export performance of processed products and a negative direction with raw material, which aligns with the main finding.

Keywords: export taxes; tariff stratification; mineral trade; value-added.

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I. Introduction

As non-renewable natural resources, mining products play a vital role in international trade because these commodities become an embryo of the global supply chain. Even though mining products do not account for a significant portion of international trade, these commodities are critical for modern economic development. Inadequate supply of mining products in the international market will significantly affect the economy within this sector and derivative industries (Butt & Siregar, 2013).

High dependency on raw minerals, particularly in industrialized countries, creates mineral products as precious commodities. Certain minerals merely can be found in a few countries because their distribution is determined by the geological formation (Porter, 2016). Uneven distribution of mineral reserves strengthens the country's comparative advantage, which is rich in mineral resources. Consequently, mineral commodities are prone to be utilized as political instruments in global competition (Bleischwitz, 2010).

Export restrictions become standard practice in international trading with several forms, including export taxes, tariff-rate quotas, or export subsidies (Beckman *et al.*, 2019). In recent years, export taxes adoption signified an increasing trend (Piemartini, 2004). The absence of prohibition export taxes in international trade regulation, as well as loopholes in quantitative restrictions exceptions for policy objectives, were driving this upward trend (OECD, 2010; WTO, 2014)

In Indonesia, export taxes policy has been adopted since 1980.[1] To prevent over-exploitation and promote value-added industries, the Indonesian government introduced a new export taxes system for raw mineral products not processed domestically in 2014 (Prasetyo, 2018). The government utilized two types of tariffs divided into flat and tier tariffs. Tier tariff ranging from 0-7.5% is charged for the non-processed product such as iron ore, copper concentrate, lead ore, manganese ore, rutile concentrate, titanium concentrate, and zinc ore in 2014. A flat tariff of 10% was imposed for low-grade nickel ore and washed bauxite commodities in 2017 (MOF, 2014; 2017).

Mining industry has been an essential part of the Indonesian economy, contributing 11.52% of Indonesia's exports in 2020 (Trademap, 2021). Indonesia's primary mineral products such as copper, nickel, tin, iron, and aluminum ranked among the top 10 worldwide trading during 2010-2020. Specifically, the mining industry accounts for approximately 22% of global nickel exports and 15% for bauxite (ibid).

Against this background, this study attempts to assess the impact of the export taxes policy in the mineral sector on export performance in Indonesia. Theoretically, the cascading tax system decreases the exports of raw material products while increasing the exports of value-added processed products. Furthermore, this study will empirically investigate how the tax system changes the composition of Indonesian mineral exports.

By estimating the tax system's impact on exports, this study will provide quantitative estimates essential in evaluating and planning a trade policy. Moreover, this study can reveal the exact mechanism of the tax system affecting exports by estimating three equations, including export value, export quantity, and export price as dependent variables separately. Further, this study considers the impact of various tariff structures on export performance, acknowledging that different export tax systems affect export performance and price differently.

[1] The Indonesian government has adopted a policy of imposing export taxes on natural resources since 1980. This policy was first implemented for timber log products to control raw materials export and develop the downstream industry. As a result, Indonesia became the largest producer of plywood products globally in the 1990s (Thee, 2009). This success inspires the Indonesian government to implement export taxes for other commodities such as palm oil, cocoa, leather, and mineral commodities.

In estimation, this study utilizes a comprehensive dataset at the country level for each mineral product compiled from export data at the loading port. Moreover, this study applies a gravity model to the dataset in which export value, export quantity, and export price are regressed against export taxes and control variables.

The export taxes benefit the domestic industry by securing the supply of raw materials and providing indirect subsidies for downstream industries (Waschik & Fraser, 2007; Gourdon *et al.*, 2016). However, export taxes deteriorate the competitiveness of local products by increasing export prices (Hasan *et al.*, 2001). Imposing export taxes will reduce export supply and increase the export price. On the other hand, the export taxes do not necessarily increase the price. If a country is small with a negligible export share in the world market, export taxes cannot affect the world price (Beckman *et al.*,2019; Korinek, 2019). Further, the association between market power and the price depends on various conditions, including commodities type, substitution products, and counterpart reaction (Piemartini, 2004).

Regarding this literature, this study will provide empirical results of export taxes by investigating the impact of export taxes on raw minerals in the upstream mining industry and downstream industry simultaneously. Thus, this study can provide the overall impact of the export taxes in nurturing the mineral processing industry in Indonesia. The result can shed some light on the export taxes literature because the export taxes in the Indonesian mineral sector is implemented at an unprecedentedly large scale covering almost every commodity in the sector. The comprehensive dataset compiled over the industry can provide an overall picture of how the export taxes system realigns the Indonesian mineral industry.

Several studies discuss the effect of export taxes on natural resources and primary products, but these studies are mainly concerned with agriculture and livestock sectors (Warr, 2001; Hasan *et al.*, 2001; Jakfar, 2001; Waschik & Fraser, 2007; Rifin, 2014; Yudyanto & Hastiadi, 2018; Beckman *et al.*, 2019; Devadoss *et al.*, 2019; Fitawek & Kalaba, 2019). A few studies discuss the impact of export duty on mineral products empirically. These include a study about tin products (Yusoff, 1990), rare earth (Mancheri, 2015), and nickel products (Prasetyo, 2018).

Those studies find that export taxes increase export prices and promote value-added downstream industries. The effect of export taxes on the price might differ between the mineral and agricultural sectors. The mineral product's demand side is more inelastic than the supply side, and the mineral does not have any substitution product in the short run. Furthermore, mineral commodities require more capital-intensive mining and processing activities.

In this regard, this study adds empirical insight into the export taxes and natural resource literature from the Indonesian mineral sector. To our best knowledge, this study will be the first study empirically investigating export taxes in the Indonesian mineral sector. This paper is organized as follows: Section 2 explains the data and methodology. Section 3 discusses empirical results, and Section 4 concludes the study.

II. Data and Methodology

2.1 Data

This study compiles export data for each mineral product at the country level from related ministries and agencies within the Indonesian government. Furthermore, this study also collects macro-level data from international standard sources such as the Organization for Economic Co-operation and Development (OECD), International Trade Center (ITC) Trademap, CEPII, World Bank, and London Metal Exchange. The unit of mineral commodities analysis is basic minerals subject to export taxes and their derivative products exempted from the export taxes.

Specifically, this study obtains export data at the loading port and destination pair basis from the Ministry of Trade Republic of Indonesia (MOT). Afterward, the export data are aggregated at the country level for each mineral commodity in the 6-digit harmonized system (HS) code. Meanwhile, export prices are estimated using the quantity-to-export-value ratio.

Export tax rates are obtained from the Ministry of Finance Republic of Indonesia (MOF). Export value excludes export taxes because the data is collected in free on board (FOB) format, quietly different from imports, usually reported in the cost, freight, and insurance (CIF) template. The Ministry of Investment (MOI) provides the inflow of foreign direct investment (FDI) segregated based on the mining and metal sector. Meanwhile, the minimum content of products exported is extracted from the Ministry of Energy (MOE).

Dataset consists of a product-level panel covering 198 importing countries from 2001 to 2020. In estimation, standard bilateral trade statistics such as export value, export volume, and export price become the variables of interest, treated as endogenous variables. All variables are in the natural logarithm, except dummy variables for export taxes, minimum grade, and year 2014.

Finally, trade data at the country level are combined with macrolevel and internal data from the following sources: (i) World Bank for the manufacturing industry, (ii) CEPII for distance, (iii) London Metal Exchange for the metal price, (iv) Ministry of Finance for export taxes, (v) Ministry of Investment for inflow FDI, and (vi) Ministry of Energy for the minimum content requirement. Export tax rate consists of ad-valorem tariff for each HS-6-digit code observed since 2014.

2.2 Summary Statistics

A total of 25,014 observations of export at country-level in 6-digit HS code were aggregated, divided into 1,398 observations of raw material and 23,616 observations of the downstream product. Unit of analysis consists of base minerals: aluminum, chromium, copper, iron, lead, manganese, nickel, titanium, zinc, and their derivative products, including scrap and slag. Mineral base products, which are still in raw materials, are subject to export duties, whereas downstream products are exempt from these taxes.

Table 1 presents all of the variables used in regression analysis. Endogenous variables include export value (V_{EXP}), export quantity (Q_{EXP}), and export price (P_{EXP}). Meanwhile, control variables consist of manufacturing exporter (MAN_{EXP}), manufacturing importer (MAN_{IMP}), distance (DIST) as a proxy of trade cost, inflow foreign direct investment (FDI), London metal exchange (P_{MET}), grade (GRD), the business cycle (D_{CYC}), and dummy 2014 (D2014) for the starting period of export taxes implementation.

Table 1. Variable, Data Source, and Basic Statistics

Variable	Description (Unit)	Source	Mean	S.D.	N
Export value (V_{EXP}) Export volume (Q_{EXP}) Export price (P_{EXP})	Export value (US$), export quantity (Ton), and export price (US$/ton)	Ministry of Trade, ITC Trademap	4.330 4.479 0.826	13.430 6.310 3.778	25,014 16,507 16,069
Export Taxes Rate (TAX)	Export taxes rate applied for each mineral commodity (%)	Ministry of Finance	2.072	01.027	25,014
Distance (DIST)	Relative distance among countries (km)	CEPII	8.500	0.337	25,009
Manufacturing Sector (MAN)	Manufacturing, value added (% of GDP)	World Bank	3.175 2.648	0.215 0.061	25,014 23,399
FDI Inflow (FDI)	Inflow foreign direct investment in mining and metal sector (US$ Million)	Ministry of Investment	13.430	0.160	25,014
Metal price (P_{MET})	Metal price which published by London Metal Exchange (US$/ton)	London Metal Exchange	6.310	0.049	25,000
Minimum grade (GRD)	Minimum grade of the export product (%)	Ministry of Energy	3.778	2.072	25,014
Dummy tier Tariff (D_{TIER})	Dummy for tier tariff of export taxes	Ministry of Finance	0.215	6.310	25,014
Dummy flat Tariff (D_{FLAT})	Dummy for flat tariff of export taxes	Ministry of Finance	0.061	3.778	25,014
Dummy cyclicality (D_{CYC})	Dummy for the peak period of metal price	London Metal Exchange	0.160	0.027	25,014
Dummy for 2014 (D_{2014})	Dummy for the entry into force of export taxes policy	Ministry of Trade	0.049	0.337	25,014

Notes: All ministries belong to the government of Indonesia. S.D. denotes standard deviation. N denotes the number of observations.

Nickel ore and bauxite (essential components to form aluminum alloys) are subject to fixed-rate export taxes of 10%. Meanwhile, the tier tariff varies from 0% to 7.5% and is charged for iron, copper, manganese, zinc, lead, titanium, and chromium products. These tariffs will be adjusted based on the progress of processing plant construction. The charging rate will be lower as the plant's construction progresses. Table 2 depicts the average change of export value, quantity, and price classified by raw material commodities and processed products (value-added).

Table 2. Average Export Performance across Commodity Group

Commodity	Tax Rate	Raw Material 2001-2013	Raw Material 2014-2020	Raw Material Rate of Change	Value Added 2001-2013	Value Added 2014-2020	Value Added Rate of Change
Aluminum	10	303,879	199,775	-34	653,464	809,050	24
		(16,275)	(9,475)	(-42)	(270)	(879)	(226)
		(0.019)	(0.021)	(13)	(2.421)	(0.920)	(-62)
Chromium	0-7.5	826	0	-100	84	41	-51
		(32)	(0)	(-100)	(0.024)	(0.014)	(-39)
		(0.026)	(0)	(-100)	(3.484)	(2.908)	(-183)
Copper	0-7.5	3,455,110	2,822,987	-18	1,839,902	1,836,881	0
		(2,051)	(1,347)	(-34)	(298)	(311)	(4)
		(1.685)	(2.096)	(24)	(6.174)	(5.905)	(-4)
Iron	0-7.5	124,750	49,281	-60	655,612	2,733,832	317
		(5,952)	(2,804)	(-53)	(1,038)	(2,830)	(173)
		(0.021)	(0.018)	(-16)	(0.632)	(0.966)	(53)
Lead	0-7.5	2,377	14,153	495	5,078	18,603	266
		(15)	(12)	(-18)	(2)	(8)	(232)
		(0.158)	(1.140)	(624)	(2.131)	(2.354)	(10)
Manganese	0-7.5	8,069	814	-90	57	29	-48
		(79)	(3)	(-97)	(0.192)	(0.014)	(-93)
		(0.103)	(0.298)	(190)	(0.295)	(2.092)	(609)
Nickel	10	552,050	280,877	-49	1,153,638	2,556,348	122
		(16,957)	(12,238)	(-28)	(81)	(98)	(20)
		(0.033)	(0.023)	(-30)	(14.197)	(26.230)	(85)
Titanium	0-7.5	630	143	-77	1,105	509	-54
		(10)	(11)	(10)	(0.062)	(0.063)	(2)
		(0.061)	(0.013)	(-79)	(17.815)	(8.078)	(-55)
Zinc	0-7.5	1,594	18,840	1,082	6,444	15,267	137
		(10)	(31)	(225)	(5)	(10)	(88)
		(0.168)	(0.610)	(264)	(1.249)	(1.572)	(26)
Other	0	43,496	76,292	75	1,226,941	1,399,236	14
		(218)	(420)	(93)	(95)	(74)	(-22)
		(0.200)	(0.182)	(-9)	(12.919)	(18.862)	(46)
Total		4,492,781	3,463,165	-23	5,542,324	9,369,796	69
		(41,584)	(20,127)	(-52)	(1,790)	(4,210)	(135)
		(0.108)	(0.172)	(59)	(3.096)	(2.226)	(-28)

Source: Author's calculation.

Notes: Each entry in one commodity row shows the average export performance of each group. The first line represents the export value in thousand US$. The second line (in brackets) shows the export quantity in thousand tons, and the third line (in brackets) exhibits the export price in thousand US$/thousand tons. Tax rate and rate of change are in percent (%).

The number of observations at the commodities level varies significantly due to intermittent changing regulations, particularly for nickel, aluminum, and chromium products. For example, nickel contributed to the most significant observation in 2013, one year before implementing the export ban. Then, nickel ore exports jumped sharply from 2017 to 2019 after reopening exports for low-grade types. On the other hand, in 2014, there was a significant drop in export given the transition period of implementation of export taxes policy which requires a slight adjustment from the private entities to meet the minimum processing requirement as stipulated in the Minister of Trade regulation number 4 of 2014 (figure 1).

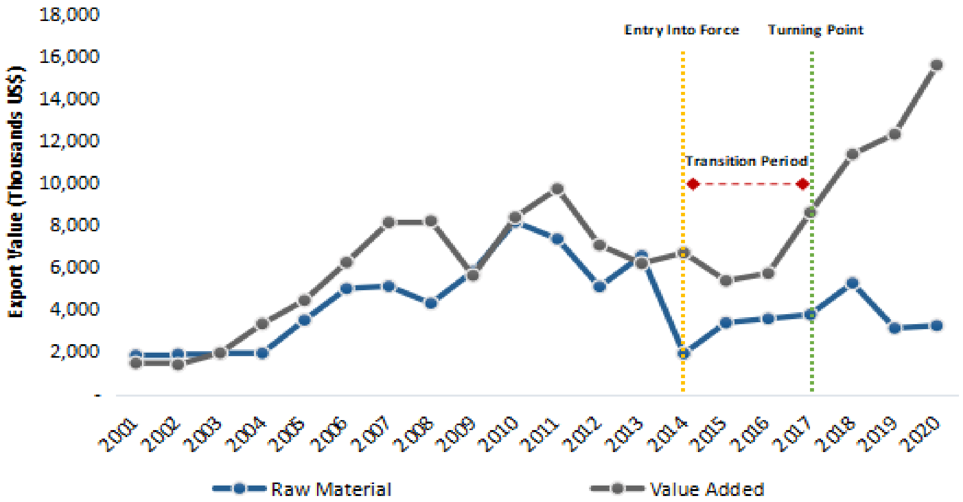

Figure 1. Mineral Export Performance by Commodities Types

Source: Author's calculation.

The graph depicts the time gap in absorbing the shifting supply from exports to domestic industries. On the other hand, domestic demand has been relatively stable for a couple of years because the new processing plant is still under construction. Consequently, the domestic industry cannot fully absorb the excess supply and adjust the capacity production.

Although profit margins were marginalized due to export taxes, reducing export quantity was carried out to balance the cash flow and gain additional capital for manufacturing refinery plant investment. Firms still generate profit even though export taxes impose their product. The signal from the imposition of export taxes was captured positively by economic agents when viewed from the massive investment inflow in mining and metal industry sectors. This changing behavior has become a driving factor for the increasing production capacity of downstream mineral products, leading to rising exports performance.

The average export value of raw materials decreased by 23 percent after introducing the export taxes policy. However, this loss can be compensated by increasing export value from value-added products, showing export orientation transformed towards downstream products. The highest proportion change for value-added products was recorded for iron, followed by lead, zinc, nickel, aluminum, and other commodities (slag and scrap)—more than half of Indonesia's mining commodities' export value derived from iron-nickel products. The increase in exports of value-added products was dominated by the ferronickel and nickel pig iron products with a minimum grade of 4%, lead unrefined with a minimum grade of 90%, zinc unwrought with a minimum grade of 90%, and aluminum oxide with a minimum grade of 90%.

On the other hand, the average export quantity of raw material contracted by 52 percent, while value-added products experienced an expansion of 135 percent. Typical with export value pattern, the highest increasing export quantity was accounted for lead downstream products at 232 percent, followed by aluminum (226 percent), iron (173 percent), zinc (88 percent), nickel (20 percent), copper (4 percent), and titanium (2 percent).

Chromium and manganese commodities experienced a decline in the raw material commodity and the downstream product, considering that this product is generally used as an alloy mixture in the metal-making process.

Surprisingly, the export value for lead and zinc commodities has increased significantly since implementing the export taxes policy. Apart from being driven by price increase due to limited supply in the international market, the massive development resulting from the battery industry's booming effect generates high demand for these raw materials. Lead and zinc are well-known as the primary components in the manufacturing of lithium batteries.

2.3 Methodology

This study utilizes a gravity model commonly used to evaluate trade policy. This model estimates the impact of the export taxes on the trade performance without considering the economic welfare (Hason & Tinbergen, 1964; Anderson, 1979; Bergstrand, 1985; Helpman *et al.*, 2008; Chaney, 2008). The basic formula of the gravity model can be described as follows:

$$EXP_{ijct} = K\frac{GDP_{it}\ GDP_{jt}}{DIST_{ij}} \quad \text{......(1)}$$

EXPlicit measures the export value in US$ or the volume of exports in kg for commodity c for declarant country i with partner j at time t. GDPit represents the GDP of the exporter while GDPjt control measures the GDP of partners. DISTij is a proxy of the distance between two countries.

In estimation, this study adopts a modified model Solleder (2013), which considers a similar approach in applying structural gravity estimation to tax rates dataset at the product level. However, our estimation equation is modified as follows:

$$LnEXP_{ijct} = \beta_0 + \beta_1 LnMAN_{it} + \beta_2 LnMAN_{jt} + \beta_3 LnDIST_{ij} + \beta_4 TAX_{ict} + \beta_5 LnFDI_{ict} + \beta_6 LnPMET_{ct} + \beta_7 GRD_{ic} + \beta_8 DCYC_{ct} + \beta_9 D2014_{ct} + \varepsilon_{ij} \quad \text{......(2)}$$

$$LnEXP_{ijct} = \beta_0 + \beta_1 LnMAN_{it} + \beta_2 LnMAN_{jt} + \beta_3 LnDIST_{ij} + \beta_4 DTIER_{ict} + \beta_5 DFLAT_{ict} + \beta_6 LnFDI_{ict} + \beta_7 LnPMET_{ct} + \beta_8 GRD_{ic} + \beta_9 DCYC_{ct} + \beta_{10} D2014_{ct} + \varepsilon_{ij} \quad \text{......(3)}$$

In the equation (2) and (3), this study uses EXPijct as the dependent variable in different forms, including the value of exports, export volume, and export price for commodity c for declarant country i with partner j at time t. TAX denotes the tax rate as the key independent variable, while D_{TIER} and D_{FLAT} represent the tier and flat tariffs dummy, respectively.

The coefficient of interest is β4, representing the elasticity of exports for the export taxes. The critical distinction between equations (2) and (3) lies in the TAX variables included. The exogenous TAX in equation (2) captures the effect of the export tax rate, whereas dummy variables D_{TIER} and D_{FLAT} in equation (3) capture the effect of the specified type of tariff on export performance.

In terms of the control variables, MANjt measures the manufacturing industry of the partner country as a percentage of gross domestic product (GDP), and MANit represents the manufacturing industry of the exporting country, Indonesia. This study does not use GDP as a proxy to measure buyers' production and purchasing power for mineral products. More accurately, the manufacturing sector reflects the economic size closely related to trading mineral products. A country with a high manufacturing value trades more mineral products than a lower manufacturing value country. Importing countries with high manufacturing capacity possess a higher ability to absorb the mineral product.

Moreover, the selection of manufacturing variables will eliminate the potential endogeneity problems owing to reverse causality between exports and GDP, considering that the mineral sector accounts for a large portion of Indonesia's GDP formation. In the meantime, export and import activities were not directly related to the manufacturing sector.

Distance is a component of trade resistance related to transportation costs. The farther the distance between countries, the higher the transportation costs. Trade openness is a proxy that measures a country's ability to exchange freely as an economic agent in international markets. FDI inflow increases when exports of raw mineral products are restrained from securing the minerals. Thus, FDI inflow substitutes partner country's imports for Indonesian mineral products.

The grade level of various commodities (GRD) significantly influences private entity decisions in determining their export orientation. The higher the minimum level limit set by the authority, the smaller the tendency to export. Finally, to determine whether metal price fluctuations have cyclicality issues, this study inserts the D_{CYC} variable to identify the peak period of 10 metals price, reflecting stock conditions in the international market.

III. Results and Discussion

A fixed-effect model is used in this study to estimate the impact of various types of export taxes on export value (V_{EXP}), export quantity (Q_{EXP}), and export price (P_{EXP}) on raw material exports and downstream product exports separately. Export taxes will impact the export value chain by changing export prices throughout the value chain. Therefore, this study will reveal how export taxes affect export value. Furthermore, by mirroring the tariff imposed on raw materials and pairing them with their derivative products, this study estimates the effect of export taxes on the downstream sector.

Table 3 presents estimation results regarding the effect of export taxes on export value (V_{EXP}), export quantity (Q_{EXP}), and Export price (P_{EXP}) separately for raw mineral products and base metal products. Estimations on raw mineral products are provided in Model (1), (2), and (3), while base metal products are delivered in Model (4), (5), and (6). Thus, regressions of the export value (V_{EXP}), the export quantity (Q_{EXP}), and the Export price (P_{EXP}) equations are paired for the two product groups. By this, this study can investigate how the export taxes on the upstream raw minerals affects export composition across the value chain of the Indonesian manufacturing industry.

Export tax coefficients are significantly negative for endogenous variables of V_{EXP} and Q_{EXP} for the raw material products [see Model (1) and (2)]. One percent increase in the export taxes reduce export value (V_{EXP}) and export quantity (Q_{EXP}) by 0.148 and 0.142 percent, respectively. The coefficients reflect the elasticity of export taxes to the export value and export volume because all those variables are in the logarithmic form.

In contrast, export taxes coefficient estimates for base metal products are significantly positive [see Model (4) and (5)]. It is worth noting that the tax is levied not on the base metal products themselves but their upstream mineral products. Base metal products are not subject to export taxes. One percent increase in export tariff on the upstream products increased export value (V_{EXP}) and export quantity (Q_{EXP}) by 0.011 and 0,012 percent, respectively.

Estimations show that the export taxes change the export composition from raw mineral products to base metal products owing to tax evasion. These findings indicate a shifting export orientation from raw materials to processed products, aligning with the policy's objective of imposing the export taxes. It is worth noting that the raw mineral sector absorbs the blunt of export taxes as its effect is mitigated in affecting the base metal sector. This indication can be observed by comparing the absolute size of coefficient estimates between the two sectors. Direct subsidy to the downstream base metal sector could be more effective if the policy objective is only to promote the sector.

Table 3. Export Taxes and Production Value Chain in the Indonesian Mineral Industry (Fixed-Effect Model)

Exp. Var.	Model (1) V_{EXP} (ln)	Model (2) Q_{EXP} (ln)	Model (3) P_{EXP} (ln)	Model (4) V_{EXP} (ln)	Model (5) Q_{EXP} (ln)	Model (6) P_{EXP} (ln)
TAX	-0.148***	-0.142***	-0.000	0.011**	0.012**	0.001
(%)	(0.046)	(0.052)	(0.010)	(0.005)	(0.005)	(0.005)
MAN_{EXP}	-2.053**	-2.277**	-0.292	0.551**	0.391	-0.206
(ln)	(1.019)	(1.143)	(0.225)	(0.240)	(0.244)	(0.229)
MAN_{IMP}	0.104	0.457	-0.011	0.200**	-0.011	-0.024
(ln)	(0.690)	(0.731)	(0.155)	(0.094)	(0.095)	(0.095)
DIST	1.291	3.986*	-2.109***	3.615	1.172	3.601***
(ln)	(2.482)	(2.293)	(0.530)	(2.222)	(1.645)	(1.168)
FDI	0.241***	0.173*	-0.008	0.061***	0.011	0.048***
(ln)	(0.079)	(0.088)	(0.017)	(0.020)	(0.020)	(0.018)
P_{MET}	0.124	-0.091	0.161***	0.347***	0.125***	0.265***
(ln)	(0.180)	(0.203)	(0.039)	(0.033)	(0.034)	(0.031)
GRD	0.020**	0.008	0.004*	0.004***	0.004***	0.001
(%)	(0.010)	(0.011)	(0.002)	(0.001)	(0.001)	(0.001)
D_{CYC}	0.141	0.142	-0.004	-0.084**	-0.057	-0.024
	(0.154)	(0.174)	(0.034)	(0.038)	(0.039)	(0.036)
D_{2014}	-0.700***	-0.482	-0.033	-0.066	-0.195***	0.061
	(0.266)	(0.308)	(0.061)	(0.057)	(0.058)	(0.053)
Constant	-7.327	-29.443	20.348***	-37.094*	-12.186	-33.364***
	(22.895)	(21.196)	(4.892)	(20.421)	(14.884)	(10.238)
Fixed dummy	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,294	1,276	1,208	22,087	16,551	13,771

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Linear regressions models are estimated using fixed effects and continuous variables are logarithmic.

Regarding control variables, coefficient estimates of the manufacturing industry in the exporting country (MAN_{EXP}) are significantly negative for the raw mineral sector. This result is consistent with the hypothesis that the development of the local manufacturing industry will reduce exports of raw mineral products. The high ratio of the manufacturing industry in Indonesia denotes the country's high capacity for absorbing raw mineral commodities to meet the demand for domestic industry. As a result, the exports of raw minerals will decrease. However, coefficient estimates of trade partner's manufacturing industry (MAN_{IMP}) are in the opposite direction but insignificant. Thus, the trade partner's manufacturing sector is not systematically associated with Indonesian mineral exports.

On the other hand, for the base metal products, coefficient estimates of the Indonesian manufacturing industry (MAN_{EXP}) and trade partner's manufacturing industry (MAN_{IMP}) are significantly positive in the export value (V_{EXP}) regression but insignificant in the export quantity (Q_{EXP}) regression. These results show a positive correlation between Indonesia's manufacturing industry and its export value. The deepening of the Indonesian manufacturing sector occurs significantly around the developing mineral processing industry. Importing country's manufacturing (MAN_{IMP}) also positively increases the export value of Indonesian base metal products. Partner countries might import high-value base metals more as the countries climb the world supply chain to occupy a more sophisticated production part in the world supply chain in the manufacturing industry.

Coefficient values of the inflow of FDI are significantly positive for the raw material sector, with an estimate of 0.241 for export value (V_{EXP}) and 0.173 for export quantity (Q_{EXP}). These results indicate that FDI inflows in the mineral sector are positively associated with exports and imply that importers are FDI countries. Regarding the base metal sector, coefficient estimates of FDI inflow are significantly positive in the export value (V_{EXP}) regression but insignificant in the export quantity (Q_{EXP}) regression. One percent increase in FDI inflow increases export value by 0.061 percent. These findings support the initial hypothesis that the inflow of FDI in the primary metal industry transforms the export orientation of the Indonesian mineral industry toward high-value processed metal products by increasing the export value. This fact can be observed from a significantly positive influence of FDI inflow on the export price (P_{EXP}). In the export price regression, one percent increase in FDI inflow escalates the terms of trade by 0.048 percent.

In the raw mineral sector, distance coefficient estimates are insignificant for export value (V_{EXP}), significantly positive for export quantity (Q_{EXP}), and significantly negative for the export price (P_{EXP}). The insignificance of export value (V_{EXP}) reflects that importing countries of Indonesian raw minerals are dispersed globally without a discernible pattern. The positive coefficient on export quantity (Q_{EXP}) indicates an increase in export quantity as the distance traveled increases, lowering transportation cost, which is substantial for mineral products. The negative association between distance and P_{EXP} results from exporters' attempts to compensate for higher transportation costs with a lower export price to meet the price competition. Meanwhile, distance has no significant effect on export value (V_{EXP}) and export quantity (Q_{EXP}) in the base metal sector but has a significant positive effect on export price (P_{EXP}). As trade travels further, transportation costs are added to the export price.

A positively significant coefficient of product grade (GRD) in export value for the raw mineral sector indicates that upgrading the quality of mineral commodities increases export value. This finding is perceptible despite the fact that the upgrading raises the export price (V_{EXP}). Therefore, the quality of raw materials is an essential determinant of export. Economic agents and the market have responded positively to the new stipulation regarding minimum mineral content for raw mineral products. The critical point, however, is the effect of determining minimum mineral content on export performance. The minimum processing level must be carefully calculated following the characteristics of minerals, technological advances, and market availability to continue promoting exports.

The coefficient estimates of the minimum mineral content (GRD) on the export of downstream metal products are significantly positive in the export value (V_{EXP}) and the export quantity (Q_{EXP}) regression. Export value and quantity increase with the grade requirement intended to upgrade the quality of mineral product exports. The minimum graded requirement transforms export orientation from raw materials to basic metal products by conducting domestic mineral processing. By setting the minimum limit requirement, the export taxes instrument received a positive response from the firms to process their value-added product domestically.

Besides metal prices (P_{MET}) in the stock market, this study also includes the metal market's business cycle (P_{CYC}) as the control variable. The supercycle phenomenon can affect production spikes in one period, which might be repeated following a particular pattern. However, the regression results show that this variable does not significantly affect the export performance of the raw mineral commodities. The metal price (P_{MET}) also has no significant influence on the sector's export performance. In Indonesia, the supercycle phenomenon cannot be well-captured because the mineral sector is driven by the demand side, while supply is fixed at any given period. However, for the base metal sector, coefficient estimates of metal price (P_{MET}) are positively significant in all three regressions in Model (4), (5), and (6). One percent increase of the London metal exchange price will enhance export value by 0.347 percent, export quantity by 0.125 percent, and export price by 0.265 percent.

P_{MET} and P_{EXP} do not move together in exact proportion due to these two prices being measured in different baskets of mineral products. Metal price (P_{MET}) includes a basket of metal products with much higher values than export price (P_{EXP}). Meanwhile, the D2014 dummy representing the entry into force of export taxes policy in the mineral sector showed a significant impact on the declining export value of raw material compared with the export quantity of value-added products.

Table 4 estimates the impact of different types of export taxes on export value (V_{EXP}), export quantity (Q_{EXP}), and export price (P_{EXP}). Two dummy variables are constructed to represent tier export tax (D_{TIER}) and flat export tax (D_{FLAT}). Estimation results are separated for the raw mineral and base metal products. The outputs of raw mineral products are presented in Model (7), (8), and (9). In comparison, those on the base metal products are delivered in Model (10), (11), and (12). For the two product groups, regressions of the export value (V_{EXP}), the export quantity (Q_{EXP}), and the Export price (P_{EXP}) equations are thus paired.

Table 4. Effect of Export Taxes Structure on Production Value Chain in the Indonesian Mineral Industry (Fixed-Effect Model)

Exp. Var.	Model (7) V_{EXP} (ln)	Model (8) Q_{EXP} (ln)	Model (9) P_{EXP} (ln)	Model (10) V_{EXP} (ln)	Model (11) Q_{EXP} (ln)	Model (12) P_{EXP} (ln)
D_{TIER}	-1.269***	-1.311***	0.083	0.126***	0.163***	-0.124***
	(0.418)	(0.472)	(0.090	(0.048)	(0.050)	(0.046)
D_{FLAT}	-1.338**	-1.406**	-0.022	0.112*	0.111*	0.118**
	(0.593)	(0.670)	(0.127)	(0.064)	(0.067)	(0.059)
MAN_{EXP}	-2.104**	-2.376**	-0.267	0.568**	1.133	-0.210
(ln)	(1.021)	(1.144)	(0.225)	(0.240)	(1.645)	(0.228)
MAN_{IMP}	0.073	0.438	-0.020	0.196**	-0.017	-0.021
(ln)	(0.693)	(0.733)	(0.156)	(0.094)	(0.096)	(0.095)
DIST	1.291	3.964*	-2.102***	3.590	-0.993	3.793***
(ln)	(2.482)	(2.291)	(0.530)	(2.222)	(0.758)	(1.168)
FDI	0.241***	0.174**	-0.008	0.056***	0.004	0.056***
(ln)	(0.079)	(0.088)	(0.017)	(0.019)	(0.020)	(0.018)
P_{MET}	0.131	-0.094	0.161***	0.348***	0.126***	0.277***
(ln)	(0.181)	(0.204)	(0.040)	(0.034)	(0.034)	(0.032)
GRD	0.026**	0.016	0.002	0.004***	0.004***	0.002*
(%)	(0.011)	(0.013)	(0.002)	(0.001)	(0.001)	(0.001)
D_{CYC}	0.132	0.134	-0.004	-0.079**	-0.047	-0.050
	(0.154)	(0.174)	(0.034)	(0.039)	(0.039)	(0.036)
D_{2014}	-0.726***	-0.508	-0.038	-0.073	-0.209***	0.098*
	(0.267)	(0.308)	(0.061)	(0.058)	(0.059)	(0.054)
Constant	-7.137	-28.889	20.233***	-36.854*	-11.825	-35.339***
	(22.894)	(21.184)	(4.892)	(20.424)	(14.885)	(10.245)
Fixed dummy	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	1,294	1,276	1,208	22,087	16,551	13,771

Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Linear regressions models are estimated using fixed effects and continuous variables are logarithmic.

In the raw mineral sector, both the tiered tax and the flat tax coefficient estimates are significantly negative in the export value (V_{EXP}) and the export quantity (Q_{EXP}) regressions. Imposing tier tax reduces the export value by 1.269 percent and export quantity by 1.311 percent, while imposing flat tax decreases the export value by 1.338 percent and export quantity by 1.406 percent. Both tax systems have a significant negative influence on the export value (V_{EXP}) and quantity (Q_{EXP}). When looking at the absolute size of the coefficients, the flat tax exerts a more significant influence on reducing exports than the tiered tax. The combination of the high cost of export duties and the low price of raw commodities exaggerated the sharp decline in products subject to the flat tax. However, neither the tiered tax nor the flat tax significantly impacts export price (P_{EXP}).

However, for the base metal sector, the tier and flat tax coefficient estimates are significantly positive in the export value and export quantity regressions. Imposing tier export taxes increase export value by 0.126 percent, export quantity by 0.163 percent, whereas imposing the flat tax increases export value by 0.112 percent and export quantity by 0.111 percent. Both tax regimes significantly positively impact export value (V_{EXP}) and export quantity (Q_{EXP}). Contrastingly, the tiered tax has a more significant impact on exports than the flat tax. In terms of export price (P_{EXP}), the tiered tax has a significantly negative influence, whereas the flat tariff has a substantially positive influence.

Estimation results show that the blunt of an export tax is absorbed by the raw mineral sector on which tax is imposed, regardless of tax types. However, the results show that the tax's effectiveness depends on tax types; the flat is more effective in the raw mineral sector, but the tiered tax is more effective in the base metal sector.

The imposition of export taxes (D_{TIER} and D_{FLAT}) in the upstream products does not significantly impact export prices. The export price of these commodities is more influenced by the metal price variable (P_{MET}). Export price formulation is calculated using metal prices on the international stock market such that they are vulnerable to metal prices fluctuation. For the downstream product, anomaly D_{TIER} negative coefficient is correlated with the economic agent behavior. Producers could absorb the excess taxes burden and reduce the export price by conducting efficiency steps.

Besides being affected by metal prices pressure (P_{MET}), the different impact of the imposition of tier tax (D_{TIER}) and flat tax (D_{FLAT}) in the upstream sector to the export prices in the downstream processed mineral products is caused by the market power factor of each commodity. Even though Indonesia imposes export taxes for its mineral commodities, global metal prices show a downward trend from 2014 to 2020 (World Bank, 2021a). This phenomenon indicates that Indonesia does not have substantial market power in all mineral sectors.

A country without market power cannot influence the market price. Therefore, imposing export taxes on small countries does not affect the global market. Indonesia's low market power can be seen from the entry into force period of export taxes policy in 2014. Exports decreased sharply, and the international metal prices moved in the opposite direction. The export composition of Indonesia's raw material mineral products in 2012 only covered 4 percent of world import demand, with nickel and bauxite having the highest proportions of 22 and 15 percent of world import value, respectively (Trademap, 2021).

Tax type selection is closely related to the comparative advantage of minerals. The Indonesian government tends to impose flat tariffs for high market power commodities (aluminum and nickel) from the number of resources and grade quality. Meanwhile, tier tariffs create less distortion in export value and volume. This tax creates wide-open space for the economic agent to choose whether the suitable scenario to catch up with the construction progress of the processing plant, collecting the capital, and at the same time can still generate profit.

Apart from differences in tariff types, export restriction through mineral content requirement (GRD) significantly affects export performance. The minimum level of mineral processing influences the decision of the company to conduct domestic downstream activities. Minerals have various derivative products that give economic agents flexibility to choose which products suit their company's characteristics. For instance, surging nickel export after the export taxes implementation is driven by the rapid growth of the downstream industry with ferronickel as the main product.

In contrast, commodities with limited downstream product types, such as copper, will be constrained to determine the final output product. In addition, producers also deal with market acceptance, technical feasibility and bear the burden of high investment costs for the development of the processing industry. Therefore, the effect of export taxes on mineral commodities differs and depends on the mineral characteristic.

For all the other control variables, coefficient estimates are comparable with the export taxes included as tax rate without any discernible difference.

IV. Conclusion and Recommendation

This study provides information for Indonesian policymakers with the impact of export taxes on trade performance. Furthermore, compelling evidence suggests a link between export taxes and trade performance, mainly applied to the raw minerals sector.

Since the Indonesian government imposes export taxes, trade performance on raw mineral commodities has declined, consistent with the theoretical basis. Exports of raw products have decreased, shifting to the upward trend of exports of downstream products. Transformation of export composition from raw mineral into processed products indicates the avoidance of export taxes. Exporters seem reluctant to absorb the excess burden from export taxes in the long run.

Export taxes policy potentially encourages the alteration of the export orientation of mining products towards value-added industries. This finding is signified by massive investment inflow in mining and metal industry sectors as the positive signal captured by economic agents. Consequently, the producer changing behavior has become a driving factor for the increasing production capacity of downstream mineral products, leading to rising exports performance.

Moreover, tariff segregation has a substantial influence on economic agents' decision-making. Tier tariff types significantly increase exports of downstream products compared to flat export taxes. Even though flat tariffs provide simplicity in the implementation, tier export taxes based on processing plant development give significant incentives for private entities to maximize their profits. Mining entities have various options for selecting appropriate tariffs for their business orientation and financial condition. However, the absence of consensus on domestic price standards is detrimental for raw mineral producers. They are forced to choose between selling domestically at a low price or exporting by absorbing the risk of additional export taxes.

Export taxes policy leads to trade creation for the downstream sector and trade diversion for the upstream sector. The average export value of the downstream product is higher than raw materials after implementing the export taxes policy. The output of separate panel regression reinforces shifting in the export commodities from raw commodities to intermediate processing products. As a result, the trade diversion effect of raw materials can be maintained proportionally, and the export taxes policy effectively boosts the export performance.

The effect of export taxes varies depending on the mineral type and processing level. Minerals with various types of derivative product options encourage creating a downstream industry compared to commodities whose intermediate products do not vary. Commodities with limited downstream product options, on the other hand, prefer to maximize existing metal processing and refining capacity.

The exporter manufacturing industry accounts for a sizable portion of export performance. The high percentage of a country's manufacturing to the GDP shows the ability of local industries to absorb domestically produced raw mineral commodities. High domestic demand reduces reliance on raw commodity exports and shifts export orientation towards value-added products.

The existence of cyclicality, which results in repeated price booms and boosts following a particular pattern and period, demonstrates the commodity's uniqueness. However, the effect of the business cycle is negligible compared with the metal exchange price, which has become one source of price referencing for Indonesian mineral commodity export.

Future research could enrich the export taxes literature on the mineral sector by establishing interlinkages between export taxes and production. Considering that the dataset used is aggregate data at the loading port level due to the limited resources of the author and unfavored pandemic conditions, future research is expected to utilize a micro database at the firm level.

Acknowledgments

The author would like to express sincere gratitude to Professor Kim Sangho from Ritsumeikan Asia Pacific University and M. H. Yudhistira, Ph.D., Director of MPKP FEB UI. Furthermore, the tremendous appreciation also goes to *Pusbindiklatren Bappenas*, which funded the author's research.

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