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What are the economic impacts of Indonesia's export ban? A Computable General Equilibrium Analysis

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Abstract

In encouraging domestic industrialization, Indonesia plans to stop exporting raw materials for other commodities, including bauxite, tin, coal and copper. This study aims to assess the economic impact of the mineral export ban on Indonesia and other countries. The comparative-static version of the computable general equilibrium model (Global Tarde Analysis Project (GTAP)) is used to analyse the economic impact of the export ban, with a particular focus on GDP, welfare, terms of trade and external trade. The most recent GTAP version 9 database was used for the modelling simulations of the export ban. The GTAP version 9 database has three reference years: 2004, 2007 and 2011. It already aggregates 140 regions and 57 sectors. The modelling simulation results show that the policy of bauxite, copper and tin export tyres benefits the Indonesian economy. Meanwhile, Indonesia's export ban policy harmed the economies of other countries, particularly China, Japan, India, Korea and the EU-28.

Keywords: International trade and finance, Computable General Equilibrium Models,
JEL classification: B17, C68

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1. INTRODUCTION

Indonesia has recently drawn international attention due to its nickel export ban policy. On 22 November 2019, the European Union requested consultations with Indonesia through the World Trade Organization (WTO) regarding various measures concerning certain raw materials. The European Union claims that Indonesia's actions to prohibit the export of raw materials, particularly nickel, appear to be inconsistent with Article XI:1 of the GATT 1994. On 22 February 2021, the WTO's Dispute Settlement Body convened a panel comprised of Brazil, Canada, China, India, Japan, Korea, Russia, Saudi Arabia, Singapore, China, Taipei,

Turkey, Ukraine, United Arab Emirates, United Kingdom, and the United States to examine the European Union's complaint about Indonesia's ban on nickel exports.

After banning nickel exports in 2019, the Indonesian government now intends to prohibit the export of other mineral raw materials. The imposition of this prohibition is intended to hasten the down-streaming of domestic industries based on new, renewable, and environmentally friendly energy sources. Exports of mineral raw materials will be halted, including bauxite, copper, and tin. The ban on the export of mineral raw materials is expected to boost investment in the smelter industry by US$555 billion, increase export value by US$268 billion, and create 2.5 million jobs in Indonesia (IRESS, 2022).

Several studies have been conducted to assess the impact of Indonesia's mineral export ban policy. According to UNCTAD (2017), the 2014 ban on Indonesian nickel exports resulted in losses in terms of export earnings, value added, job creation and government revenues, as well as an increase in international nickel prices. Another study from the Centre for Data and Information Technology of the Ministry of Energy and Mineral (2016) found that downstream bauxite provides an added value of 5.72 times when processed into alumina and 19.08 times to the regional economy of West Kalimantan. Meanwhile, Tui and Adachi (2021) confirmed the Indonesian government's decision to prohibit the export of mineral raw materials by using the 2010 Indonesian input–output table. They found that with an additional US$3 billion in demand because of the export ban's implementation, the total output impact on GDP is US$15 billion, the total employment impact is US$5 billion, and the total value-added impact is US$53 billion.

From several studies that have been conducted mainly in Indonesia, we focus on filling the literature gap by analysing the impact of this export ban policy not only on the Indonesian economy but also on mineral-importing countries. To analyse the impact of this policy, we employ the GTAP model with a multi-regional and multi-sector approach. We can use the GTAP model to track changes in GDP, the value of exports and imports, production output, and the magnitude of losses and aggregate welfare lost by Indonesia's mineral-importing countries.

Several studies employ the GTAP model to analyse the economic impact of export ban policies. For example, Rifin et al. (2020) assessed the economic impact of a ban on Indonesian palm oil exports to the EU on the world's palm oil-producing countries. The findings show that the suspension of Indonesian palm oil exports to the European Union has no effect on other producer countries (Thailand, Colombia, and Nigeria). Meanwhile, Aragie et al. (2016) examined the economic impact of Ethiopia's cereal export ban. They show that export bans can temporarily stabilise domestic food prices but cannot eliminate price increases. Furthermore, the ban hampered cereal production and reduced the welfare of rural households. Other studies, such as Zhai et al. (2022), analysed the economic consequences of grain export restrictions in Argentina, Russia, Pakistan, and Kazakhstan. They found that export restrictions distort world market prices, which distort consumption and production, harm the interests of consumers and farmers in some countries and threaten food security.

According to Rifin et al. (2020) the GTAP model has several advantages. First, the GTAP model is a frequently used analytical tool, any external shocks (like changes in trade accuracy

or policy) and the effects of changes in domestic policy brought on by the application of the trading rules can be quantitatively measured. These issues are related to the effects of trade liberalization and price policies in the agricultural sector. Second, when compared to alternative approaches, the GTAP model can offer suitable processes and procedures for changes in welfare because of trade liberalization policies. This model is capable of measuring changes in overall welfare as well as the welfare effects of altering trade laws in specific industries.

2. RESEARCH METHOD

2.1 Models

The comparative-static version of the computable general equilibrium (CGE) model GTAP developed by Purdue University in 1993 is used to analyse the economic impact of the export ban. It is widely used to examine the macroeconomic impact of trade policy (Kawasaki, 2024; de Menezes, Countryman, Agerman, & de Miranda, 2024; Ban & Fujikawa, 2023; Ha et al. 2017; Haddad et al. 2024; Nantembelele et al. 2023; Nurdianto & Resosudarmo, 2016 and Qiao et al. 2023). The GTAP model is a multi-region and multi-sector CGE model that assumes perfectly competitive markets with constant returns to scale and bilateral trade under the Armington assumption (Saini, 2012). According to Campoamor et al. (2018), every GTAP model consists of four main components: a) a database with information on social accounting matrices, input–output, taxes and trade flows, providing the necessary input information for the subsequent impact analysis; b) a mathematical model that mimics the workings of the world economy, integrated by equations linked to producers' cost minimisation, consumers' utility maximisation and market clearing conditions; c) macroeconomic closure conditions, which differentiate between endogenous and exogenous variables; and d) data on elasticities of substitution among primary factors, between domestic and imported goods and between imports from different geographical sources. For more details on the GTAP model, see Hertel and Tsigas (1997).

2.2 Database

The most recent GTAP version 9 database was used for the modelling simulations of the Indonesian export ban (Aguiar, et al., 2016). The GTAP version 9 database has three reference years, namely, 2004, 2007 and 2011, and it already aggregates 140 regions and 57 sectors. For the new reference years, domestic databases are combined with international datasets on macroeconomic aggregates, bilateral trade, energy, agricultural input–output and protection (Aguiar, et al., 2016).

We further aggregate based on the relevant region and sector, in accordance with the objective study of assessing the economic impact of Indonesia's minerals export ban. By region, we will use aggregation data from 12 countries, where Indonesia implements a mineral export ban and is the world's largest minerals exporter. Moreover, we aggregate 10 other countries as Indonesia's largest minerals export destination: Japan, China, India, Korean, Malaysia, Singapore, Brazil, the United Kingdom, the United States, and the European Union. Meanwhile, the remaining countries are classified as part of the Rest of the

World (ROW). Furthermore, based on research needs, the original 57 sectors were re-combined into four sectors: minerals n.e.c. containing minerals or mining of metal ores, manufacturing, transportation, and others. Table 1 provides a summary of regional and sectoral aggregation.

Table 1. Regional and Sectoral Aggregation

No.	Region	Sectoral
1	Indonesia	Minerals
2	Japan	Manufacturing
3	China	Transport
4	India	Others
5	Korea	
6	Malaysia	
7	Singapore	
8	Brazil	
9	United Kingdom (UK)	
10	United States of America (USA)	
11	European Union 28 (EU-28)	
12	Rest of world (ROW)	

Source: Own aggregation of the GTAP model

2.3 Simulation

In this study, we adapted Burfisher's (2016) approach to export quantity control. The export ban is represented by swapping the export tariff variable with the export quantity variable. By endogenising the export tariff and exogenising the export quantity, the model can zero out the export flow. scenarios or simulations are used in this study to assess the economic impact of Indonesia's mineral export ban:

1. Simulation 1 (SIM1): Indonesia stopped 50% of minerals exports to Japan, China, India, Korean, Malaysia, Singapore, Brazil, UK, USA, EU-28 and ROW.
2. Simulation 2 (SIM2): Indonesia stopped 100% of minerals exports to all regions Japan, China, India, Korean, Malaysia, Singapore, Brazil, UK, USA, EU-28 and ROW.

3. RESULTS AND DISCUSSION

3.1 Impact of the export ban on GDP

Figure 1 depicts the simulation results of the CGE modelling of the mineral export ban on changes in Indonesia's and other countries' real GDP. This mineral export ban raises Indonesia's real GDP by 0.54% and 1.07% in the 50% and 100% ban scenarios, respectively. This is consistent with the findings of Tui and Adachi (2021) from the previous IO analysis. However, this export ban resulted in a decrease in real GDP, particularly in Indonesia's largest mineral-importing countries, such as Japan (-0.05% and −0.10%), China (−0.06% and −0.13%), India (−0.05% and −0.09 %), Korea (−0.13 and 0.27%) and Singapore (−0.01% and −0.02%).

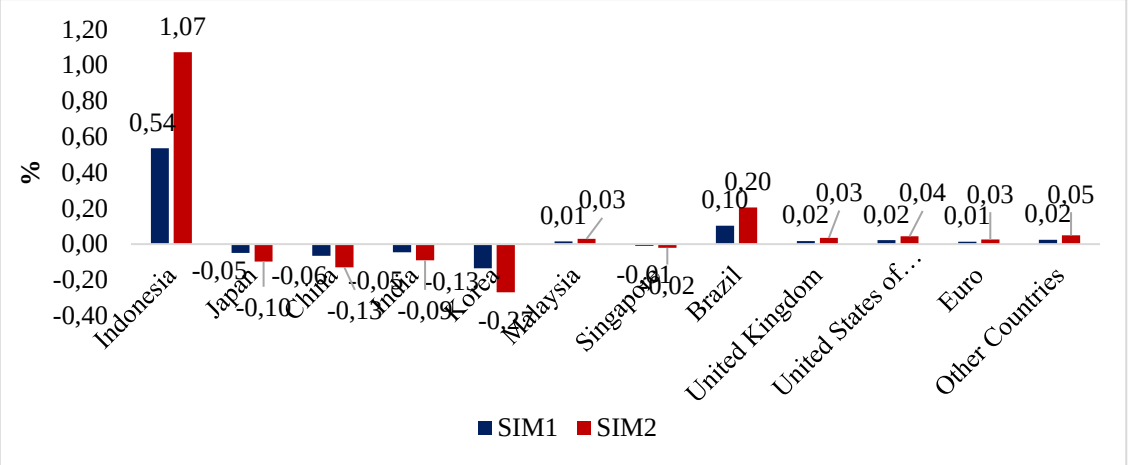

Figure 1. Impact of the export ban on GDP
Source: GTAP (processed)

3.2 Impact of the export ban on welfare

This section examines the impact of the ban on the overall welfare of Indonesia and importing countries. In the GTAP model, welfare changes are measured using the concept of equivalent variations (EV). EV measures how much the average consumer must be compensated to be as well-off as before the trade policy measures were implemented (Kutlina-Dimitrova, 2017).

Table 2 summarises the changes in aggregate welfare of the countries because of the export ban. The results show that Indonesia gained a significant advantage in terms of changes in consumer welfare, amounting to US$4,771.46 million and US$9,542.92 million. Meanwhile, the countries most harmed by the ban on mineral exports were China, Japan, Korea, India, and the Euro Union-28 (see Table 2). According to the GTAP model, the total EV gains and losses shown in Table 2 are primarily due to allocation efficiency and terms of trade (TOT) impact. The efficient allocation of mineral raw materials for industrial down-streaming is driving the increase in welfare in Indonesia. This extraordinary increase in welfare is primarily due to an increase in people's income, particularly those working in the downstream sector. Meanwhile, the decline in aggregate welfare was driven by the decline in TOT for the major importing countries.

Table 2. Impact of The Export Ban on Welfare

Region	Equivalent Variations	
	SIM1	SIM2
Indonesia	4,771.46	9,542.92
Japan	−976.53	−1,953.05
China	−3,158.54	−6,317.08
India	−706.96	−1,413.92

Region	Equivalent Variations	
	SIM1	SIM2
Korea	−946.91	−1,893.82
Malaysia	3.48	6.96
Singapore	−46.03	−92.05
Brazil	495.35	990.71
United Kingdom	31.43	62.85
United States of America	100.35	200.69
Euro	−480.64	−961.29
Other Countries	790.6	1,581.19

Source: GTAP (processed)

3.3 Impact of the export ban on terms of trade

This section discusses the impact of the export ban on Indonesia's TOT and importing countries. TOT reflects a comparison of two countries' relative prices of goods. This TOT depicts a product's or country's competitiveness. The simulation results show that the export ban increases Indonesia's competitiveness by 0.02% and 0.04% for the two SIM1 and SIM2 scenarios, respectively. The decision to prohibit mineral exports gives the Indonesian government impetus to improve and better prepare for the downstream metal industry. This enhancement is expected to boost the image of industrial metal products on the global market. Major importing countries such as China, India and Japan saw a drop in competitiveness, albeit a very small one, less than 0.01%.

Table 3. Impact of The Export Ban on Terms of Trade (TOT)

Region	TOT	
	SIM1	SIM2
Indonesia	0.0228	0.0456
Japan	−0.0009	−0.0019
China	−0.0018	−0.0037
India	−0.0013	−0.0027
Korea	−0.0013	−0.0027
Malaysia	0.0000	0.0000
Singapore	−0.0002	−0.0003
Brazil	0.0014	0.0028
United Kingdom	−0.0000	−0.0000
United States of America	0.0000	0.0000
Euro	−0.0001	−0.0001
Other Countries	0.0001	0.0002

Source: GTAP (processed)

3.4 Impact of the export ban on external trade

Table 4 provides the simulation results of the CGE modelling of the mineral export ban on imports by sector. The impact of the import ban, particularly in the mineral and manufacturing sectors, has been significantly reduced. The mineral sector fell by −4.95% and −9.91%, whereas the manufacturing sector decreased by −0.38% and −0.75%, This demonstrates that the export ban was successful in reducing Indonesia's import dependence, particularly on mineral and manufactured products.

Table 4. Impact of the Export Ban on Imports

Region	Imports (%)							
	Mineral nec		Manufacturing		Transport		Others	
	SIM 1	SIM 2	SIM 1	SIM 2	SIM 1	SIM 2	SIM 1	SIM 2
Indonesia	−4,6	−9,9	−0,4	−0,7	0,4	0,9	0,4	0,9
Japan	1,5	3,0	0,0	0,0	−0,1	−0,2	−0,1	−0,2
China	0,9	1,7	0,0	0,0	−0,1	−0,2	−0,1	−0,2
India	2,1	4,2	0,0	0,0	−0,1	−0,2	−0,1	−0,1
Korea	2,2	4,5	−0,0	−0,1	−0,1	−0,3	−0,14	−0,27
Malaysia	0,7	1,4	0,0	0,1	0,0	0,0	0,0	0,0
Singapore	7,0	14,1	0,0	0,1	−0,1	−0,2	0,0	0,0
Brazil	0,4	0,8	0,2	0,5	0,2	0,3	0,2	0,4
United Kingdom	0,4	0,8	0,0	0,1	0,0	0,0	0,0	0,0
United States of America	0,4	0,7	0,0	0,1	0,0	0,1	0,0	0,1
Euro	0,6	1,3	0,0	0,1	0,0	0,0	0,0	0,0
Other Countries	0,6	1,1	0,0	0,1	0,0	0,0	0,0	0,1

Source: GTAP (processed)

4. CONCLUSION

The planned mineral export ban policy in Indonesia benefits the Indonesian economy. This is reflected in an increase in macroeconomic indicators, such as GDP, welfare and TOT. This prohibition policy provides a good momentum for the Indonesian government to improve and better prepare for the down-streaming of mineral raw materials. Meanwhile, the export ban has a negative economic impact on importing countries, particularly China, Korea, Japan and India. They experienced a significant decrease in GDP, welfare and TOT as a result of this prohibition. Future research must analyse how the world's mineral-producing countries respond to this prohibition policy.

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