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Trump's trade protectionism and the vulnerability of Indonesia's export-oriented MSMEs

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ABSTRACT

This study investigates the impact of the United States' tariff policy during the Trump era of trade protectionism on MSME-intensive export sectors in Indonesia using the Global Trade Analysis Project (GTAP) model. The analysis focuses on three sectoral proxies for MSME-intensive export sectors: wearing apparel, leather products, and wood products. Three simulation scenarios are used: a 10% US global tariff, a 19% specific tariff on Indonesia, and an escalation of the US-China trade war with a 30% tariff on Chinese products. The results indicate that global tariffs have a moderate negative impact on the Indonesian economy, while specific tariffs on Indonesia result in the largest contraction, especially in the wearing apparel and leather products sectors. Conversely, the US-China trade war creates opportunities for trade diversion that improve the performance of several export MSME sectors. These findings emphasize the importance of diversifying export markets and strengthening MSME competitiveness.

1. Introduction

In recent years, the resurgence of trade protectionism has become a major source of uncertainty in the global economy (Alia & Pratamasari, 2026). After decades of international trade moving toward greater liberalization, the re-emergence of restrictive trade policies marks a significant shift in global economic dynamics. The United States, as a key player in international trade, has repositioned tariff policy as a strategic instrument to protect domestic industries, reduce the trade deficit, and strengthen its geopolitical position. Under President Donald Trump's trade agenda, import tariffs are no longer viewed solely as an economic instrument but also as a tool for political negotiation and a global competitive strategy, particularly with major trading partners (Jong, 2022). Increasing import tariffs can disrupt global supply chains, encourage trade relocation, and alter the flow of exports and imports between countries. This situation has consequences not only for large economies but also for developing countries with a high degree of trade openness. For countries like Indonesia, which are increasingly integrated into the global trade network, rising US protectionism could put significant pressure on export performance, particularly in manufacturing sectors oriented toward foreign markets and sensitive to changes in international trade policy (Robinson & Thierfelder, 2024).

Indonesia is a developing country with increasingly close ties to international trade, particularly through the export of manufactured

commodities and natural resources. In recent years, exports have become a key driver of national economic growth through their contribution to output formation, job creation, and foreign exchange earnings. Among Indonesia's major trading partners, the United States holds a strategic position as a major export destination, particularly for labor-intensive manufactured goods such as apparel, footwear, furniture, and wood-based products (T. Tambunan, 2020). Dependence on the United States market makes Indonesia vulnerable to changes in that country's trade policies, including more protectionist import tariffs. Tariff increases by the United States could reduce the price competitiveness of Indonesian exports in the global market, potentially suppressing export demand, reducing domestic production, and triggering adjustments in the labor market. These impacts are increasingly important to consider, given that the majority of Indonesia's export manufacturing sector is labor-intensive and contributes significantly to national employment (Larasati, 2025).

Micro, Small, and Medium Enterprises (MSMEs) have long been recognized as the backbone of the Indonesian economy for their significant contributions to domestic economic activity, job creation, and income equality (Rifa'i & Purwuharyono, 2026). However, not all MSMEs operate in the domestic market. Some Indonesian MSME-intensive export sectors have been integrated into international trade, either directly through exports or indirectly through the supply chains of export-oriented industries. These MSME-intensive export

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sectors are more vulnerable to external shocks, particularly those arising from changes in trade policies in key export-destination countries. In the Indonesian context, MSME-intensive export sectors are relatively concentrated in labor-intensive manufacturing sectors, particularly the apparel, leather and footwear, and wood-based products (Fadhilah et al., 2024). These sectors are generally characterized by labor-intensive production structures, relatively low barriers to entry, and the dominance of small and medium-sized businesses. Consequently, any decline in export demand due to tariff policies has the potential to put greater pressure on the business continuity, employment, and income of MSME-intensive export sectors.

Indonesian trade data shows that MSME-intensive export sectors play a significant role in the national manufacturing export structure. The wearing apparel sector has consistently been one of Indonesia's main labor-intensive manufacturing export commodities, although its growth has slowed in recent years due to weakening global demand, particularly in the United States and European markets (Aprilia Putri et al., 2024). On the other hand, the leather products and footwear sector has shown relatively stronger export performance, with an upward trend in export value supported by high demand from international markets, particularly the United States, as a major export destination. Meanwhile, the wood products sector continues to serve as an important export base, supplying value-added products such as processed wood, crafts, and raw materials for the furniture industry. The export performance of these three sectors demonstrates that Indonesian MSMEs not only play a role in domestic economic activity but are also increasingly integrated into the global market (Ardiyanto & Kudo, 2019). Therefore, changes in international trade policy, particularly increased import tariffs by the United States, have the potential to create significant pressure on the export performance and sustainability of MSME-intensive export sectors in Indonesia.

Although the impact of trade protectionism and tariff policies has been extensively studied in the international economic literature, most research focuses on aggregate macroeconomic implications, such as changes in gross domestic product, welfare, the trade balance, or national export performance. These studies generally place countries or economic sectors as the primary unit of analysis without paying specific attention to the heterogeneity of business actors within these sectors. Consequently, there is limited understanding of how global trade shocks affect specific business groups, particularly MSME-intensive export sectors. This gap is significant since MSMEs have distinct characteristics compared to larger firms, such as more limited capital capacity, lower production flexibility, and relatively weaker adaptability to external changes. In the Indonesian context, research specifically analyzing the impact of US tariff policies on MSME-intensive export sectors remains very limited. Yet understanding these sectors' vulnerabilities is crucial for developing more targeted mitigation policies amid increasing global trade uncertainty.

In addition, unlike previous studies that generally examine a single trade policy shock, this study compares three distinct forms of protectionist pressure within a consistent GTAP framework, namely a global tariff, an Indonesia-specific tariff, and the escalation of the US-China trade war. This comparative design enables a systematic assessment of how Indonesia's economy and MSME-intensive export sectors respond under different protectionist environments, distinguishing between direct tariff exposure and indirect trade diversion effects.

To overcome the limitations in analyzing the impact of cross-country and cross-sector trade policies simultaneously, this study applies a Computable General Equilibrium (CGE) model based on the Global Trade Analysis Project (GTAP), which allows a comprehensive analysis of the transmission of tariff shocks through international trade, relative price changes, sectoral output, and economic welfare. However, the GTAP model does not explicitly distinguish business actors by firm size. Therefore, this study focuses on sectors with a high concentration of MSMEs based on Statistics Indonesia (2025a, 2025b) data, namely wearing apparel, leather products, and wood products. These sectors are

therefore employed as proxies for MSME-intensive export sectors, enabling the analysis to capture the sectoral implications of tariff policies within the GTAP framework. Accordingly, the classification of these sectors as MSME-intensive export sectors is based on the concentration of micro and small business establishments and documented MSME participation in their production and export activities, rather than on a directly measured MSME share of sectoral output or exports, which is not separately identified in the GTAP database. Retaining wearing apparel, leather products, wood products, and textiles as separate sectors allows the analysis to capture heterogeneous responses across MSME-intensive export sectors that would otherwise be obscured in a purely aggregate or macroeconomic assessment.

Based on this framework, this study aims to investigate the impact of United States tariff policies on the performance of MSME-intensive export sectors in Indonesia, including exports, sectoral output, and other macroeconomic indicators. This study contributes to the literature by extending the analysis of trade protectionism beyond aggregate macroeconomic impacts to MSME-intensive export sectors. Furthermore, by comparing three alternative tariff scenarios, this study demonstrates that the effects of trade protectionism are conditional, asymmetric, and sector-specific.

2. Literature review

Trade protectionism refers to a set of policies designed to shield domestic industries from international competition through instruments such as import tariffs, quotas, subsidies, and non-tariff barriers (Fetzer & Schwarz, 2021). In international trade theory, the imposition of import tariffs increases trade costs by raising the price of imported goods in the domestic market, thereby reducing the competitiveness of foreign products and providing protection for domestic producers. While such policies may provide short-term benefits to certain sectors through increased output and protection of domestic jobs, the literature shows that protectionism can also cause significant economic distortions. Tariff increases can reduce the efficiency of resource allocation, lower consumer welfare due to higher prices, and undermine the benefits of specialization based on comparative advantage (Iqbal et al., 2022). In the context of an increasingly integrated global economy, protectionist policies not only affect importing countries but also create broad spill-over effects on trading partner countries through changes in relative prices, trade flows, and the configuration of international supply chains.

The wave of modern protectionism has again gained widespread attention since the escalation of the trade war between the United States and China in 2018 (Kwan, 2019; Li et al., 2020). Various empirical studies have shown that increases in import tariffs by the United States have led to declines in bilateral trade volumes, altered global trade patterns, and encouraged trade diversion to third countries. The literature also finds that tariff policies not only impact the directly targeted country but also affect other trading partners through changes in the structure of global demand and the relocation of production supply chains (Fajgelbaum & Khandelwal, 2022). In this context, developing countries with high levels of international trade integration may face significant indirect impacts, whether in the form of reduced exports, changes in relative prices, or shifts in sectoral competitiveness. These findings emphasize that trade policy shocks from a major country like the United States can have widespread economic consequences, even for countries not directly involved in trade conflicts.

To comprehensively analyze the impact of tariff policies, many studies use the CGE approach, including GTAP-based models, since it captures intersectoral and intercountry linkages simultaneously. GTAP-based studies generally show that increases in trade tariffs lead to a contraction in international trade volume, a decline in economic efficiency, and changes in the distribution of welfare across countries (Rifa'i, 2026). Furthermore, CGE models are widely used to assess the sectoral impacts of trade policies, including changes in output, relative prices, factor demand, and resource allocation. However, most previous

studies have focused on aggregate indicators at the macro and sectoral levels, such as gross domestic product, welfare, and the trade balance. This approach cannot fully explain how trade shocks affect heterogeneous groups of business actors within a sector, especially MSMEs, which are more vulnerable to external changes.

MSMEs play a central role in the economies of many countries, particularly developing countries, through their contributions to output formation, job creation, and poverty reduction (Setyawati et al., 2023). In various economic development literature, MSMEs are often viewed as drivers of inclusive growth due to their ability to absorb large numbers of workers with relatively low capital requirements. Furthermore, the existence of MSMEs also contributes to the equitable distribution of economic activity across regions through the widespread distribution of business units, including in areas not yet fully covered by large corporate investment. In the Indonesian context, the role of MSMEs is increasingly strategic, given that this sector dominates the national business unit structure and is a major source of labor absorption (Azhari & Konadi, 2025). Therefore, the stability and sustainability of MSMEs are crucial not only to economic growth but also to broader socioeconomic resilience.

Compared with large-scale companies, MSMEs generally have a more limited capacity to cope with external economic shocks. These limitations are reflected in relatively low access to financing, smaller production scales, limited market diversification capabilities, and weaker bargaining power within the supply chain (Viphindartin & Bawono, 2025). These conditions tend to leave MSMEs with limited room for adjustment when faced with rising production costs, declining demand, or price changes in international markets. Furthermore, low technological capacity and limited access to market information can also slow MSMEs' response to changes in the global business environment (Utami et al., 2025). As a result, external shocks stemming from trade policies, international price fluctuations, and disruptions to the global supply chain often place greater pressure on the operational continuity of MSMEs than on large companies, which generally have a greater capacity for adaptation.

The vulnerability of MSMEs to external shocks increases when these businesses are connected to international markets, either directly through exports or indirectly through participation in export-oriented industrial supply chains. In this context, higher import tariffs in export destination countries can reduce product price competitiveness, thereby reducing market demand and suppressing export volumes (Zulelli et al., 2025). For MSMEs, this decline in external demand can quickly translate into reduced production capacity, reduced labor requirements, and shrinking profit margins. Unlike larger companies, which generally have broader access to market diversification and risk-mitigation instruments, MSMEs often have less flexibility to shift target markets or adjust their production cost structures. Therefore, international trade shocks can disproportionately affect MSMEs, particularly in sectors heavily dependent on export demand.

Although most MSMEs in Indonesia are oriented towards the domestic market, a number have successfully integrated into international trade through export activities. MSME participation in Indonesian exports is generally concentrated in light manufacturing sectors characterized by labor-intensive activities, relatively low barriers to entry, and modest capital requirements (Suhaili & Sugiharsono, 2019). Literature on MSME-intensive export sectors in Indonesia indicates that these sectors are dominated by craft-based industries and value-added manufacturing, many of which are run by small and medium-sized enterprises. MSME involvement in this export sector occurs not only through direct exports but also through linkages with larger companies in the production supply chain. This suggests that shocks to international trade can affect MSME-intensive export sectors through various transmission channels, both directly via reduced export demand and indirectly via contractions in production activity in related industries.

Among the various MSME-intensive export sectors in Indonesia, the apparel, leather and footwear, and wood-based products sectors are the

most prominent. These three sectors demonstrate a relatively high level of MSME-intensive export participation in production and export activities. According to Statistics Indonesia (2025b), the apparel sector had approximately 594,597 micro and small business units, the leather and leather goods sector, including footwear, had approximately 53,333 business units, and the wood and wood-based products sector had approximately 526,854 business units. The large number of business units across these three sectors indicates the dominance of MSME-intensive export sectors in production.

Furthermore, the apparel sector is one of the main labor-intensive manufacturing industries in Indonesia, with a large number of micro and small businesses, particularly in the production of ready-made garments. This sector also exhibits a strong export orientation, with total global exports of approximately USD 6-7 billion annually, with the United States consistently the primary market, accounting for approximately USD 3-4 billion annually (Statistics Indonesia, 2025a). Similarly, the leather and footwear sector has a strong production base of small and medium-sized enterprises oriented towards export markets. Meanwhile, the wood-based products sector is developing through various local industrial clusters producing processed wood, crafts, and value-added components for the international market (Simangunsong et al., 2021). The characteristics of these three sectors, characterized by high labor intensity, the dominance of small-scale enterprises, and a relatively high dependence on external demand, make them relevant representatives of MSME-intensive export sectors in Indonesia. Although GTAP does not distinguish firms by size, these sectors are widely recognized in Indonesian trade statistics and the MSME literature as having substantial MSME participation in export production, either through direct exports or as suppliers within export-oriented value chains. Therefore, sectoral responses are interpreted as changes in MSME-intensive sectors rather than direct changes in MSME performance.

Based on the literature review, it can be concluded that studies on trade protectionism and tariff policies have developed quite extensively, particularly in analyzing their impact on macroeconomic indicators such as international trade, welfare, and sectoral output. On the other hand, the literature on MSMEs generally focuses on their role in domestic economic growth, job creation, and business resilience to economic shocks. However, research that specifically connects the two literatures remains limited, particularly on how international tariff policies affect export sectors dominated by MSME-intensive export sectors. In the Indonesian context, studies investigating the impact of United States tariff policies on MSME-intensive export sectors using a general equilibrium approach are still very limited. Therefore, this study seeks to fill this gap by analyzing the impact of United States tariff policies on MSME-intensive export sectors in Indonesia, proxied by the wearing apparel, leather products, and wood products sectors within the GTAP model framework.

3. Methodology and data

3.1. Model and database

The GTAP model is a multiregional, multisector general equilibrium model widely used in international trade analysis since it captures the interrelationships among producers, households, governments, and international markets within a consistent framework. Through this structure, the GTAP model allows for the simulation of trade policy shocks, such as changes in import tariffs, and estimates their impact on various economic indicators, including sectoral output, international trade, relative prices, factor utilization, and economic welfare (Dixon & Jorgenson, 2013). This approach is considered appropriate for this study since the United States tariff policy not only directly affects specific sectors but also creates spillover effects across sectors and countries through changes in global trade patterns.

This study employs the GTAP database version 12 as the primary

database for the simulation. The database is the latest version that provides a comprehensive representation of the global economic structure with seven reference years (2004, 2007, 2011, 2014, 2017, 2019, 2023). This database covers 145 countries, 18 composite regions, and 65 economic sectors, interconnected through a global social accounting matrix, enabling an integrated analysis of interactions among production, consumption, bilateral trade, and trade policies across countries. The database represents 99.2% of global GDP and 97.0% of the world population. In addition, the GTAP database contains information on tariff structures, subsidies, the use of production factors, and international trade flows that are very important for CGE-based trade policy analysis (Aguiar et al., 2025). This broad data coverage makes it well-suited for analyzing the impact of the United States' tariff policies on Indonesia, both through direct bilateral trade channels and through indirect changes in the global trade balance.

3.2. Closure

This study applies standard closure in the GTAP model, in which the total endowment of production factors at the national level is assumed to be fixed, while factor prices and allocations adjust endogenously to achieve a new equilibrium following a policy shock. In this framework, labor and capital are assumed to be mobile between domestic sectors and can thus move to sectors that offer higher rates of return, whereas specific factors such as land and natural resources have more limited mobility. In addition, external equilibrium is maintained through adjustments in relative prices and trade flows between countries. This closure assumption allows the model to capture the resource reallocation mechanisms that arise from changes in trade tariffs, including contractions in negatively affected sectors and expansions in sectors that benefit from changes in the structure of global trade. The use of a standard closure is chosen since this study focuses on analyzing static comparative equilibrium in the medium term, making it well-suited to capturing economic adjustments between sectors following a tariff policy shock without modeling long-term dynamic processes such as capital accumulation, technological change, or gradual investment reallocation (Corong et al., 2017; Hertel, 1997).

In the GTAP model, producer behavior is modeled on the assumption of cost minimization with a nested production technology (nested production structure), in which output is produced using a combination of primary factors and intermediate inputs. Primary factors generally include labor, capital, land, and natural resources, while intermediate inputs are derived from domestic and imported commodities. On the demand side, regional households allocate income to private consumption, government consumption, and savings through a utility function consistent with the general equilibrium framework. The GTAP model also adopts the Armington assumption, which treats domestic and imported goods as differentiated products based on the country of origin. This assumption is important in trade analysis since it allows for imperfect substitution between domestic and imported products when prices change due to tariff policies (Corong et al., 2017). In addition, this study adopts the standard behavioral elasticity parameters available in the GTAP Version 12 database, including the Armington elasticities, factor substitution elasticities, and transformation elasticities.

3.3. Aggregation

For simulation purposes, the database is aggregated into eight regional groups as shown in Table 1. This aggregation balances the need for comprehensive analysis with the model's computational efficiency. The United States is treated as the main source of tariff policy shocks, while Indonesia is the main focus of the analysis as an affected country. China is included as a separate region, given its role as one of Indonesia's main competitors in labor-intensive manufacturing exports, and to capture potential trade diversion arising from changes in the United States trade policy. In addition, ASEAN, the European Union, Japan, and

Table 1
Regional aggregation.

Region	Description
Indonesia	Country of interest and primary focus of the study
United States	Source of tariff shock and major export destination for Indonesia's MSME-intensive sector
China	Major global trading partner and key competitor in labor-intensive manufacturing exports; important for capturing trade diversion effects
ASEAN	Represents regional production networks and nearby export markets linked to Indonesia
European Union	One of Indonesia's major export destinations for manufactured products
Japan	Significant export market, particularly for wood-based and manufactured products
South Korea	Strategic Asian trade partner with strong industrial and supply-chain ties to Indonesia
Rest of World	Captures global spillover effects outside the main regions of interest

Source: Author specification based on the GTAP database

South Korea are separated to represent Indonesia's major trading partners and alternative export markets. Meanwhile, all other countries are aggregated into the rest of the world group to capture global economic spillovers beyond the main regions analyzed.

Furthermore, the 65 sectors in the GTAP version 12 database are aggregated into 10 sector groups, as shown in Table 2. This sectoral aggregation is carried out to simplify the model structure while retaining the sectors most relevant to the research objectives. The wearing apparel, leather products, and wood products sectors are retained as separate sectors since they represent MSME-intensive export sectors that are the primary focus of the analysis. In addition, the textile sector is also separated to capture the supply chain linkages with the apparel industry. Meanwhile, the other sectors are aggregated based on similar production characteristics and economic linkages to ensure the model can still adequately capture spillovers between sectors.

The regional and sectoral aggregation used in this study is designed to retain key elements relevant to analyzing the impact of US tariff policies on Indonesia. This aggregation structure allows the model to adequately capture the sources of policy shocks, interregional trade dynamics, and interconnectedness between economic sectors. Therefore, the aggregation approach is expected to strike a balance between computational efficiency and analytical rigor when assessing the vulnerability of Indonesia's MSME-intensive export sectors. In addition, the aggregation process is carried out using the GTAPAgg utility prior to the simulation stage. Regional and sectoral aggregations are developed to balance analytical relevance and computational efficiency while

Table 2
Sectoral aggregation.

Sector	Description
Wearing Apparel	The main sector of MSME exports is labor-intensive and tariff-sensitive
Leather Product	The main export of the MSME sector with a strong export orientation
Wood Product	Wood-based MSME sector with important contribution to exports
Textile	Separated to capture upstream linkages with the apparel sector
Agriculture	Primary sector and provider of raw material inputs for the downstream sector
Energy	Strategic sectors that influence exports and domestic production costs
Food Processing	Manufacturing processing sector with significant involvement of MSMEs
Heavy Manufacturing	Large non-SME manufacturing sectors to capture resource reallocation
Logistics	Logistics and distribution sector directly related to trade
Other Service	Other service sectors to capture macroeconomic adjustments

Source: Author specification based on the GTAP database

preserving the main trade relationships associated with the research objectives. The complete aggregation mapping is provided in the Supplementary Material to facilitate the reproducibility of the analysis.

3.4. Simulation scenario

To investigate the impact of US tariff policies on MSME-intensive export sectors in Indonesia, this study designed three simulation scenarios representing varying levels of escalation of trade protectionism. These scenarios include global US tariffs, specific tariffs against Indonesia, and an escalation of the trade war between the US and China.

- Simulation 1: Global tariff shock

The first simulation represents a moderate protectionist scenario in which the United States imposes a 10% import tariff on all trading partner countries (The White House, 2026). This scenario serves as a baseline for capturing the initial impact of the United States' global tariff policy on international trade and on the performance of MSME-intensive export sectors in Indonesia.

- Simulation 2: Indonesia-specific tariff shock

The second simulation represents a scenario in which the United States imposes a 19% import tariff specifically on products originating from Indonesia, based on the latest reported tariff arrangement between Indonesia and the United States (U.S. Embassy Jakarta, 2026). This scenario aims to capture the direct impact of the United States' tariff policy on Indonesia's export competitiveness, particularly in MSME-intensive export sectors.

- Simulation 3: US-China Trade War

The third simulation represents an escalating trade war between the United States and China. Although US tariffs on Chinese goods have fluctuated significantly, from around 20% in the most recent trade arrangement to 145% at the peak of the escalation, this study uses a 30% tariff rate as the moderate-high stress scenario (China Briefing, 2026). This scenario is chosen to capture the potential for trade diversion against Indonesia while maintaining the stability of the model simulation. A conceptual illustration of the tariff shock transmission mechanism within the GTAP framework is provided in Appendix Fig. 1.

The simulations are executed using the standard GTAP model with the GTAP version 12 database through the RunGTAP software environment. All policy simulations are conducted within the standard comparative-static framework of the GTAP model. In addition, all simulations implement tariff shocks using the import tariff variable *tms* in the GTAP model. The reported shock magnitudes (10%, 19%, and 30%) are specified as percentage changes in the benchmark import tariff rates for the designated bilateral imports and commodities included in the sectoral aggregation. Simulation 1 applies a 10% increase in import tariffs imposed by the United States on imports from all trading partners; Simulation 2 applies a 19% increase in import tariffs on imports from Indonesia into the United States; and Simulation 3 applies a 30% increase in import tariffs on imports from China into the United States.

4. Result and discussion

4.1. Global tariff shock

The following discussion focuses primarily on the comparative-static simulation outcomes generated by the GTAP model. Where appropriate, possible economic mechanisms are presented as interpretations rather than direct evidence from the reported model outputs.

Table 3 shows that the United States' global tariff policy exerts negative pressure on the domestic economy, albeit to a relatively

Table 3

Result of simulation 1: Global tariff shock.

Region	GDP (% change)	Welfare – Equivalent Variation (USD million)	Trade Balance (USD million)	Investment (% change)
Indonesia	−0.012	−22.256	−8.500	0.001
United States	0.044	942.007	424.914	−0.013
China	−0.029	−1050.506	−216.512	−0.006
ASEAN	−0.029	−224.280	355.319	−0.029
European Union	0.014	94.388	−98.526	0.024
Japan	−0.018	−145.879	−17.377	−0.001
South Korea	−0.012	−546.845	−27.605	−0.002
Rest of World	0.003	351.189	−411.714	0.007

Source: GTAP simulation result (processed)

moderate extent. Simulation results show that Indonesia's real GDP decreased by 0.012%, indicating a contraction in economic activity due to weakening external demand for Indonesian products. This decline is consistent with a negative equivalent variation value of USD 22.256 million, indicating a decline in aggregate economic welfare. From the trade side, Indonesia's trade balance also worsened by USD 8,500 million, suggesting a deterioration in Indonesia's net trade position under the simulated scenario. This condition indicates that although Indonesia is not a primary target of United States protectionist policies, the openness of the Indonesian economy to global trade makes it vulnerable to external shocks. Furthermore, investment increased only marginally by 0.001%, indicating that global tariff shocks have not created significant incentives for investment relocation to Indonesia. These results suggest that United States trade protectionism tends to undermine Indonesia's economic performance by weakening international trade and reducing welfare, although the magnitude of the impact remains limited in the moderate protectionist scenario.

Furthermore, the simulation results show that the impact of the United States' global tariff policy is uneven across regions. Meanwhile, it creates groups of countries that benefit and others that suffer losses. The United States actually benefits the most in this scenario, with a GDP increase of 0.044%, a welfare increase of USD 942.007 million, and a trade surplus of USD 424.914 million. These results suggest that a 10% global tariff may strengthen protection for the United States' domestic industry in the simulated scenario, thereby improving the external trade position in the short term. Conversely, China experiences the largest simulated negative impact with a welfare decrease of USD 1050.506 million and a GDP contraction of 0.029%; one possible explanation is China's relatively strong dependence on global export markets, particularly the United States, although this mechanism is not directly evaluated in the present study. A similar pattern is also seen in ASEAN, Japan, and South Korea, all of which experienced GDP contractions and welfare declines due to reduced export demand and weakened international trade flows. Interestingly, the European Union and the Rest of the World still recorded positive GDP growth of 0.014% and 0.003%, respectively, accompanied by improved economic welfare. These outcomes may indicate opportunities for trade adjustment and trade reallocation under the simulated protectionist scenario. These results suggest that the United States' global tariff policy tends to generate short-term economic benefits for the United States, but also creates significant pressure on major trading partners and weakens global trade efficiency.

The negative impact of the United States' global tariff policy on Indonesia is primarily transmitted through external trade channels and global supply chain linkages (Vasani & Abdulkareem, 2024). The United States' 10% import tariff is expected to increase the relative price of imported goods in the US market, which may reduce the

competitiveness of Indonesian exports and weaken demand for goods from export-oriented sectors under the simulated scenario. In addition to the direct impact on bilateral trade between Indonesia and the United States, Indonesia may also experience indirect effects from weaker economic performance in key trading partners such as China, ASEAN, Japan, and South Korea under the simulated scenario, which have also contracted as a result of these protectionist policies. Given these countries' crucial roles in Indonesia's regional supply chain, their economic downturns could reduce demand for both intermediate and final goods from Indonesia. From a policy perspective, these results indicate that although Indonesia is not a primary target of the United States' tariff policy, its high level of economic openness still makes the domestic economy vulnerable to external shocks. Therefore, the findings suggest that diversifying export markets and strengthening the competitiveness of labor-intensive manufacturing sectors, particularly MSME-intensive export sectors, could become important policy priorities to enhance Indonesia's resilience to rising global trade uncertainty (Pane & Patunru, 2023).

4.2. Indonesia-specific tariff shock

Table 4 results indicate that when the United States imposed a 19% import tariff specifically on Indonesian products, the impact on the Indonesian economy was much greater than the global tariff scenario in the first simulation. Indonesia's real GDP contracted by 0.075%, about six times the decline in Simulation 1, indicating the Indonesian economy's high sensitivity to trade barriers targeting national exports. This decline was followed by a substantial fall in economic welfare, as reflected in an equivalent variation of USD 187.112 million, indicating a loss of economic surplus due to weaker trade activity and reduced resource allocation efficiency in the simulated scenario. Interestingly, Indonesia's trade balance recorded a surplus of USD 43.770 million, suggesting that imports declined more than exports under the simulated scenario. One possible explanation is weaker domestic demand and consumption adjustment following the tariff shock, although this mechanism is not directly examined in the present study. On the other hand, investment fell by 0.027%, indicating reduced incentives for business expansion amid heightened trade uncertainty and weakening profit prospects for export-oriented sectors.

Next, the simulation results reveal that tariff policies specifically targeting Indonesia have a more concentrated impact on Indonesia, while the effects on other countries are relatively small and, in some cases, even positive. The United States experienced only a very marginal increase in GDP of 0.002%, but its welfare decreased slightly by USD 5.267 million, indicating that the benefits of protection for Indonesian products are relatively limited and insufficient to substantially improve domestic economic efficiency. In contrast, several countries, such as

China, Japan, and South Korea, experienced welfare increases of USD 63.032 million, USD 38.307 million, and USD 13.403 million, respectively. These results are consistent with a trade diversion effect, whereby part of Indonesia's market share in the United States may shift toward competing countries offering similar substitute products. ASEAN and the Rest of the World also recorded economic impacts that were generally neutral to slightly positive, suggesting that the bilateral tariff shock generated relatively limited spillover effects on the broader global economy under the simulated scenario. Thus, unlike Simulation 1, which triggered systemic pressures on global trade, Simulation 2 more clearly depicts a redistribution of competitiveness between countries due to a focused tariff shock.

The negative impact of the US-specific tariff may be associated with reduced export market access and weaker price competitiveness of Indonesian products in the United States market. The 19% tariff increase is expected to raise the effective price of Indonesian goods in the United States market, which may encourage importers to source similar products from alternative suppliers such as China, Japan, or other ASEAN countries. This mechanism may be particularly relevant for labor-intensive manufacturing sectors, including MSME-intensive export sectors, which generally have more limited price-adjustment flexibility than larger firms (Lin et al., 2022). These findings suggest that reducing dependence on a single export market, such as the United States, through export market diversification could strengthen Indonesia's resilience to discriminatory trade policies. Furthermore, strengthening the integration of MSME-intensive export sectors into regional and global markets could help mitigate the risks associated with discriminatory trade policies imposed by major trading partners (Tanoto et al., 2025).

4.3. US-China trade war

Table 5 shows a different pattern compared to the two previous simulations. Unlike the global tariff scenario and the specific tariff scenario against Indonesia, which depressed domestic economic performance, the escalation of the trade war between the United States and China actually had a positive impact on Indonesia. Indonesia's real GDP increased by 0.038%, accompanied by an increase in economic welfare of USD 94.198 million, indicating economic opportunities arising from changes in the structure of global trade. These results suggest that Indonesia may benefit from changes in international demand when Chinese products become less competitive in the United States market under the simulated scenario. In other words, part of China's export market share may shift to alternative suppliers, including Indonesia, under the simulated scenario. However, Indonesia's trade balance still decreased by USD 20.073 million, indicating that the increase in economic activity did not fully translate into a trade surplus. One possible

Table 4
Result of simulation 2: Indonesia-specific tariff shock.

Region	GDP (%) change)	Welfare – Equivalent Variation (USD million)	Trade Balance (USD million)	Investment (%) change)
Indonesia	−0.075	−187.112	43.770	−0.027
United States	0.002	−5.267	−6.918	0.000
China	0.002	63.032	−7.065	0.001
ASEAN	0.000	5.348	−17.813	0.001
European Union	0.000	−1.328	−0.314	0.000
Japan	0.003	38.307	−5.103	0.002
South Korea	0.001	13.403	−3.308	0.000
Rest of World	0.001	11.434	−3.249	0.000

Source: GTAP simulation result (processed)

Table 5
Result of simulation 3: US-China trade war.

Region	GDP (%) change)	Welfare – Equivalent Variation (USD million)	Trade Balance (USD million)	Investment (%) change)
Indonesia	0.038	94.198	−20.073	0.016
United States	0.049	451.870	804.701	−0.021
China	−0.123	−4394.580	274.428	−0.044
ASEAN	0.012	113.258	−281.641	0.023
European Union	0.013	85.973	−68.549	0.019
Japan	0.055	677.082	−164.597	0.055
South Korea	0.014	238.489	−18.750	0.004
Rest of World	0.025	2057.168	−525.521	0.014

Source: GTAP simulation result (processed)

explanation is an increase in demand for imported intermediate inputs associated with the expansion of domestic production, although this mechanism is not directly examined in the present study. Furthermore, investment increased by 0.016%, suggesting a positive response of the production sector to the simulated changes in global trade patterns.

Globally, the simulation also reveals that the escalation of the trade war creates a clearer pattern of winners and losers than the previous two scenarios. The United States still recorded a 0.049% increase in GDP and a substantially increased trade surplus of USD 804.701 million, suggesting that the tariff policy against *China* may improve the United States' external trade position in the short term under the simulated scenario. However, China was the most adversely affected country, experiencing a 0.123% contraction in GDP and a substantial decline in welfare of USD 4394.580 million. One possible explanation is China's relatively strong dependence on the United States export market, although this relationship is not directly evaluated in the present study. On the other hand, several countries actually benefited from the shift in global trade flows. Japan recorded the highest GDP growth outside the United States at 0.055%, with welfare increasing by USD 677.082 million, while ASEAN, South Korea, the European Union, and the Rest of the World also showed improvements in economic indicators. This pattern is consistent with a trade diversion effect, whereby countries other than *China* may have greater opportunities to fill supply gaps in international markets, particularly in the United States.

For Indonesia, the simulation results are consistent with potential gains associated with trade diversion and export market substitution under the simulated scenario. When higher tariffs reduce the competitiveness of Chinese products in the United States market, importers may seek alternative suppliers offering similar products at more competitive prices. This situation may create opportunities for selected MSME-intensive export sectors, particularly wearing apparel and leather products, while the response of wood-based products remains relatively limited under the simulated scenario (Pertiwi et al., 2025). These findings suggest that the effects of escalating trade wars are conditional and heterogeneous across countries. Under the simulated scenario, Indonesia records positive macroeconomic outcomes, although the benefits are not uniform across all sectors and indicators. However, these opportunities are not automatically sustainable without adequate domestic policy support. Therefore, the findings suggest that strengthening production capacity, improving logistics efficiency, and enhancing the competitiveness of MSME-intensive export sectors could help Indonesia capitalize on potential opportunities arising from changes in the international trading environment (T. T. H. Tambunan, 2021).

4.4. Sectoral output response

Table 6 indicates that the impact of US tariff policy on Indonesia is

heavily concentrated in MSME-intensive export sectors, particularly wearing apparel, leather products, and, to a lesser extent, wood products. In Simulation 1, a 10% global tariff caused a 0.773% contraction in output in the wearing apparel sector and 0.445% in leather products, indicating the high sensitivity of both sectors to weakening global demand. A much larger impact was seen in Simulation 2, when a 19% tariff was applied specifically to Indonesia. Output in the wearing apparel sector fell sharply by 4.067%, while leather products experienced the deepest contraction of 4.607%, making it the sector most vulnerable to direct trade barriers from the United States. These results suggest that both sectors may be more exposed to export market disruptions, particularly those associated with the United States market. In contrast, the wood products sector indicated comparatively smaller adverse effects, with very little change in output, or even a slight increase (0.069%) in Simulation 2, which may reflect a broader export market orientation or relatively lower dependence on the United States market, although this mechanism is not directly examined in the present study. In Simulation 3, the pattern of impacts reversed. The escalation of the US-China trade war has driven output growth in Indonesia's MSME-intensive export sectors, particularly in wearing apparel (1.760%) and leather products (3.076%), suggesting potential opportunities associated with changes in global demand under the simulated scenario, which may indicate stronger linkages between textile production and downstream manufacturing activities under the simulated scenario.

In the United States, sectoral responses showed a different pattern than in Indonesia. In Simulation 1, global tariff policies substantially increased output in domestic labor-intensive manufacturing sectors, particularly wearing apparel (1.460%) and leather products (1.833%). These results suggest that protectionist measures may provide short-term support for US domestic producers by reducing competitive pressure from imports in the simulated scenario. However, when tariffs were applied solely to Indonesia (Simulation 2), US sector output was substantially smaller, with wearing apparel increasing by only 0.172% and leather products by 0.283%. These results suggest that Indonesia is not the only important supplier to the United States market and that restricting imports from Indonesia alone may be insufficient to generate substantial domestic production expansion. In Simulation 3, output in US labor-intensive sectors again increased more strongly, particularly wearing apparel (1.724%), leather products (2.677%), and textiles (0.844%). These results are consistent with a reduction in the competitiveness of Chinese products in the United States market, which may create greater opportunities for domestic production under the simulated scenario.

Sectorally, the transmission of tariff policy impacts occurs primarily through changes in relative prices and international trade competitiveness. MSME-intensive export sectors, such as wearing apparel and leather products, are the most sensitive due to their labor-intensive nature, relatively thin profit margins, and high dependence on

Table 6
Impact on Sectoral Output (% change).

Sector	Sim 1		Sim 2		Sim 3	
	Indonesia	US	Indonesia	US	Indonesia	US
Wearing Apparel	-0.773	1.460	-4.067	0.172	1.760	1.724
Leather Product	-0.445	1.833	-4.607	0.283	3.076	2.677
Wood Product	-0.013	0.008	0.069	0.003	-0.072	0.022
Textile	-0.200	0.508	-0.689	0.015	0.256	0.844
Agriculture	0.004	-0.002	0.019	0.000	-0.010	-0.010
Energy	0.028	-0.034	0.152	-0.003	-0.059	-0.027
Food Processing	0.010	0.034	0.034	0.000	-0.013	0.010
Heavy Manufacturing	0.010	-0.014	0.088	-0.002	-0.062	-0.022
Logistics	0.001	-0.001	0.008	0.000	-0.002	0.000
Other Service	0.002	0.003	0.005	0.000	0.000	0.004

Source: GTAP simulation result (processed)

Note: Red indicates negative values, green indicates positive values, and darker shades represent larger absolute changes.

external demand (Hasran et al., 2024). When the United States increased import tariffs on Indonesian products, the effective price of Indonesian exports in the United States market is expected to rise, which may reduce their competitiveness and potentially shift market share toward competing suppliers. Conversely, when higher tariffs were imposed on China, some Indonesian MSME-intensive export sectors, particularly wearing apparel and leather products, may gain opportunities to partially replace Chinese suppliers in selected export markets, although the responses remain heterogeneous across sectors. These findings suggest that the impacts of tariff shocks on Indonesia's MSME-intensive export sectors are asymmetric. Tariffs directly targeting Indonesia generate substantially larger adverse effects, whereas tariffs imposed on major competitors may create opportunities for selected export sectors. These findings suggest the importance of a dual policy strategy that strengthens the resilience of MSME-intensive export sectors while enhancing their capacity to capture potential opportunities arising from trade diversion. Efforts such as upgrading product quality, strengthening integration into global value chains, and diversifying export markets are key to enabling Indonesia's leading MSME sectors to be more adaptive to changes in the international trade landscape (T. T. H. Tambunan, 2024).

4.5. Domestic market response

Table 7 shows changes in domestic sales in Indonesia, indicating that MSME-intensive export sectors have limited ability to shift from exports to domestic markets in response to trade shocks. In Simulation 1, the impact of global tariffs on domestic sales was relatively small, but the wearing apparel and textile sectors still recorded declines of 0.008% and 0.204%, respectively, indicating that weakening external demand also depressed domestic market activity through reduced production and revenue. A more pronounced impact was seen in Simulation 2, when tariffs were specifically imposed on Indonesia. The leather products sector experienced the largest domestic sales contraction at 1.099%, followed by the textile sector at 0.911%, while wearing apparel declined only marginally (0.015%). These results suggest that increased domestic sales may not fully offset the decline in exports, particularly in sectors that are more closely integrated with international markets. Conversely, in Simulation 3, the escalation of the US-China trade war had a more mixed impact. The leather products sector recorded a 0.639% increase in domestic sales, suggesting that higher production activity may also be associated with stronger domestic demand under the simulated scenario. However, wearing apparel and wood products still recorded slight declines in domestic sales, which may indicate that the potential gains associated with trade diversion were reflected more strongly in export-oriented activities than in domestic consumption, although this mechanism is not directly examined in the present study.

In the United States, tariff policies led to a more consistent increase in domestic sales, particularly in manufacturing sectors that had previously faced high import competition. In Simulation 1, domestic sales in the wearing apparel sector increased by 1.929%, while leather products increased by a further 2.626%. These results suggest that global tariffs may encourage substitution from imported to domestically produced goods in the simulated scenario. In Simulation 2, although tariffs were imposed only on Indonesia, the positive impact on the United States domestic market was still evident, albeit much smaller, with increases of 0.217% in wearing apparel and 0.392% in leather products. These results suggest that restricting imports from a single supplier country may be insufficient to substantially alter the structure of the United States domestic market. The largest impact again emerged in Simulation 3, where the trade war with China drove a substantial surge in domestic sales in the wearing apparel sector (2.313%) and, especially, leather products (3.776%). This increase is consistent with reduced competitiveness of Chinese products in the United States market, which may provide greater opportunities for domestic producers to expand their market share under the simulated scenario.

From an economic perspective, changes in domestic sales may reflect

how sectors respond to external shocks through adjustments between export and domestic markets. For Indonesia, simulation results show that MSME-intensive export sectors, such as those producing wearing apparel and leather products, are highly dependent on foreign demand. Accordingly, when exports are disrupted, the simulation results suggest that the domestic market may not be sufficiently large to absorb excess supply, particularly in MSME-intensive export sectors. This may indicate limited substitution between export and domestic markets under the simulated scenario (Hardini et al., 2025). Conversely, the simulation results suggest that tariff policies may encourage a shift in consumption from imported to domestically produced goods, particularly in sectors competing directly with imports from Asia. These findings suggest that strengthening MSME-intensive export sectors should focus not only on export expansion but also on developing a deeper and more resilient domestic market. Increasing domestic purchasing power, expanding access to distribution, and strengthening MSME-intensive export sectors' connectivity with the national supply chain can be important strategies to reduce excessive dependence on external markets and increase the MSME-intensive export sectors' resilience to global trade shocks (Hutapea, 2025).

4.6. Export performance across sectors

Table 8 presents the impact of the three tariff scenarios on sectoral exports in Indonesia and the United States. For Indonesia, the simulation results indicate that MSME-intensive export sectors exhibit markedly different responses across the three scenarios. In Simulation 1, the 10% global tariff reduced exports in wearing apparel (−1.545%), leather products (−0.529%), wood products (−0.129%), and textiles (−0.204%), reflecting the contraction in global trade demand. The largest export losses occurred in Simulation 2, when the United States imposed a 19% tariff specifically on Indonesian products. Wearing apparel and leather products experienced the sharpest export declines of 8.150% and 5.465%, respectively, while exports of wood products and textiles also contracted, although to a lesser extent. Conversely, Simulation 3 generated a different pattern. Exports of wearing apparel (3.539%) and leather products (3.653%) increased, suggesting that these sectors may benefit from trade diversion under the simulated scenario. However, the wood products sector continued to record a slight decline (−0.094%), indicating that the positive effects of trade diversion were not uniform across all MSME-intensive export sectors.

In contrast, export responses in the United States were generally negative across all three simulations. In Simulation 1, exports of wearing apparel, leather products, and textiles declined despite the introduction of global tariffs, suggesting that increased domestic protection was accompanied by weaker export performance. A similar pattern was observed in Simulation 2, although the magnitudes were relatively small because the tariff was directed solely at Indonesian products. Under Simulation 3, exports from most United States sectors continued to contract, including wearing apparel (−0.947%), leather products (−0.996%), and textiles (−0.512%). These results suggest that although the United States improved its domestic market position under higher tariff protection, this did not necessarily translate into stronger export performance under the simulated scenarios.

From an economic perspective, the sectoral export results suggest that tariff policies primarily influence export performance through changes in international price competitiveness and shifts in global sourcing patterns (Vasani & Abdulkareem, 2024). MSME-intensive export sectors directly targeted by tariffs experience the largest export contractions, whereas trade diversion may create opportunities for selected export sectors when competing countries become less competitive in major destination markets. However, the heterogeneous responses across sectors, particularly the comparatively weaker performance of wood products, indicate that trade diversion should not be interpreted as uniformly beneficial. These findings reinforce the importance of export market diversification and improving the

Table 7
Impact on Domestic Sales (% change).

Sector	Sim 1		Sim 2		Sim 3	
	Indonesia	US	Indonesia	US	Indonesia	US
Wearing Apparel	-0.008	1.929	-0.015	0.217	-0.010	2.313
Leather Product	-0.135	2.626	-1.099	0.392	0.639	3.776
Wood Product	0.007	0.026	0.083	0.004	-0.062	0.042
Textile	-0.204	0.697	-0.911	0.019	0.301	1.115
Agriculture	0.004	0.024	0.015	0.000	-0.007	0.008
Energy	0.010	-0.010	0.061	-0.001	-0.032	-0.010
Food Processing	0.001	0.048	-0.001	0.001	0.005	0.018
Heavy Manufacturing	0.002	0.027	0.028	-0.001	-0.026	0.023
Logistics	0.000	0.004	-0.001	0.000	0.001	0.003
Other Service	0.001	0.006	-0.001	0.000	0.002	0.006

Source: GTAP simulation result (processed)

Note: Red indicates negative values, green indicates positive values, and darker shades represent larger absolute changes.

Table 8
Impact on Sectoral Export (% change).

Sector	Sim 1		Sim 2		Sim 3	
	Indonesia	US	Indonesia	US	Indonesia	US
Wearing Apparel	-1.545	-0.666	-8.150	-0.033	3.539	-0.947
Leather Product	-0.529	-0.812	-5.465	-0.085	3.653	-0.996
Wood Product	-0.129	-0.234	-0.072	-0.013	-0.094	-0.258
Textile	-0.204	-0.436	-0.259	-0.003	0.179	-0.512
Agriculture	-0.009	-0.131	0.139	-0.003	-0.100	-0.106
Energy	0.101	-0.270	0.506	-0.021	-0.153	-0.178
Food Processing	0.047	-0.151	0.143	-0.010	-0.075	-0.079
Heavy Manufacturing	0.041	-0.242	0.317	-0.006	-0.206	-0.271
Logistics	0.015	-0.089	0.172	-0.002	-0.049	-0.050
Other Service	0.033	-0.091	0.217	-0.002	-0.062	-0.040

Source: GTAP simulation result (processed)

Note: Red indicates negative values, green indicates positive values, and darker shades represent larger absolute changes.

competitiveness of MSME-intensive export sectors through productivity enhancement, product upgrading, and stronger integration into global value chains to better respond to future trade policy shocks (Lin et al., 2022).

In addition, to assess whether the main findings are sensitive to the baseline tariff assumptions, an additional set of simulations was conducted using higher tariff rates while keeping the regional and sectoral aggregation, closure, behavioral parameters, and other model settings unchanged. Specifically, the tariff rates were increased from 10% to 15% for the global tariff scenario, from 19% to 25% for the Indonesia-specific scenario, and from 30% to 40% for the China-specific scenario. The results suggest that the higher tariff rates amplify the magnitude of the simulated effects but preserve the main qualitative patterns. Indonesia remains negatively affected under the global and Indonesia-specific tariff scenarios, while the US-China scenario continues to generate a positive GDP response for Indonesia. At the sectoral level, wearing apparel and leather products remain the most responsive sectors, whereas wood products exhibit comparatively smaller responses.¹

5. Conclusion

This study investigates the impact of US tariff policies under Trump-era trade protectionism on Indonesia's MSME-intensive export sectors using the GTAP model. By comparing three alternative protectionist scenarios: a global tariff, an Indonesia-specific tariff, and the escalation

of the US-China trade war, the findings demonstrate that the economic consequences of trade protectionism depend strongly on the scope and change of the tariff policy. Tariffs directly targeting Indonesian exports generate the largest adverse impacts, whereas trade conflicts involving major competitors may create potential opportunities through trade diversion. Nevertheless, these opportunities remain conditional and heterogeneous, as the simulation results reveal mixed outcomes across macroeconomic indicators and MSME-intensive export sectors.

At the sectoral level, the analysis reveals that the effects of trade protectionism cannot be inferred solely from macroeconomic indicators. Instead, MSME-intensive export sectors exhibit heterogeneous responses depending on their exposure to export markets and the nature of the tariff shock. The simulation results also indicate that Indonesia's domestic market has only a limited capacity to absorb export losses during external trade shocks, highlighting the importance of strengthening domestic demand alongside export market diversification. Accordingly, policy efforts should prioritize expanding export destinations beyond traditional markets, improving logistics and trade facilitation, strengthening access to export financing, supporting product upgrading, and enhancing the integration of MSME-intensive export sectors into global value chains to improve their capacity to respond to future trade disruptions.

The findings suggest that the effects of tariff shocks are conditional, asymmetric, and sector-specific, implying that the economic consequences of trade protectionism vary according to the policy target and the resulting changes in global trade patterns. The simulation results should be interpreted as comparative-static scenario outcomes within the GTAP framework and therefore do not represent firm-level impacts on individual MSMEs. A key contribution of this study lies in the

¹ Detailed results are provided in the Supplementary Material at https://sl.ut.ac.id/supplementary_rifai.

comparative evaluation of three alternative protectionist scenarios within a single GTAP framework, enabling a systematic assessment of the contrasting effects of direct tariff exposure and indirect trade diversion on Indonesia's MSME-intensive export sectors. Future research could extend this analysis by incorporating firm-level data, alternative model specifications, or dynamic CGE approaches to further examine the long-term implications of global trade protectionism.

6. Research limitation

This study has several limitations. First, the analysis uses sectoral proxies in the GTAP database to represent MSME-intensive export sectors because the GTAP model does not distinguish firms by size. Consequently, the simulation results reflect changes in aggregate sectoral performance rather than firm-level outcomes for individual micro, small, and medium enterprises. Therefore, the findings should be interpreted as indicating the potential exposure of MSME-intensive export sectors rather than as direct estimates of MSME-level impacts. Second, the static nature of the GTAP model limits its ability to capture dynamic adjustment processes, such as long-term investment reallocation, technological upgrades, and business actors' adaptation over time. Future research could address this limitation by integrating firm-level microdata or using a dynamic CGE approach to gain a more comprehensive understanding of MSME-intensive export sectors' responses to long-term trade policy shocks. In addition, this study adopts the standard GTAP model specification, including the standard closure and behavioral elasticity parameters, which are widely adopted in GTAP-based policy simulation studies. This framework provides a consistent basis for comparative-static analysis, but alternative closure rules and elasticity specifications may generate different quantitative outcomes. A focused robustness check using higher tariff rates was conducted to assess the sensitivity of the findings to the baseline tariff assumptions. The results broadly preserve the direction and relative pattern of the main macroeconomic and sectoral responses, although the magnitude of the effects increases with higher tariff rates. Future research could extend this assessment by examining alternative closure rules and elasticity specifications.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssaho.2026.103728>.

Appendix

Table A1
Regional Aggregation Mapping

Region	Description
Indonesia	Indonesia
United States	The United States of America
China	China
ASEAN	Brunei Darussalam, Cambodia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia
European Union	Germany, France, Italy, Spain, Netherlands, Belgium, Poland, Sweden, Austria, Denmark, Finland, Ireland, Portugal, Greece, Czech Republic, Hungary, Romania, Bulgaria, Slovakia, Slovenia, Croatia, Lithuania, Latvia, Estonia, Luxembourg, Cyprus, Malta
Japan	Japan
South Korea	Korea, Republic of
Rest of World	All remaining regions in the database

Source: Author
specification based
on the GTAP
database

Data availability

Various sources are used to collect data for the analysis. Each source of data and materials is available and referred to in the study, where appropriate.

Ethics approval and consent to participate

Ethical approval is not applicable to this manuscript.

Consent for publication

Not applicable.

Author contribution

I am the sole author.

Declaration of AI-assisted technologies

During the preparation of this study, the author used AI-assisted technology for language refinement, grammar checking, and improving readability. The authors reviewed and edited the output as necessary and take full responsibility for the content of this publication.

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Declaration of competing interest

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Not applicable.

Table A2
Sectoral Aggregation Mapping

Sector	Description
Agriculture	Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Bovine cattle, sheep and goats, horses; Animal products nec;
Energy	Raw milk; Wool, silk-worm cocoons; Forestry; Fishing Coal; Oil; Gas; Minerals nec; Petroleum, coal products; Electricity; Gas manufacture, distribution; Water
Food Processing	Bovine meat products; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec; Beverages and tobacco products
Textile	Textiles
Wearing Apparel	Wearing apparel
Leather Product	Leather products
Wood Product	Wood products
Heavy Manufacturing	Chemical products; Basic pharmaceutical products; Rubber and plastic products; Mineral products nec; Ferrous metals; Metals nec; Metal products; Computer, electronic and optical products; Electrical equipment; Machinery and equipment nec; Motor vehicles and parts; Transport equipment nec; Manufactures nec; Construction; Paper products, publishing
Logistics	Trade; Accommodation, Food and service activities; Transport nec; Water transport; Air transport; Warehousing and support activities; Communication
Other Service	Financial services nec; Insurance; Real estate activities; Business services nec; Recreational and other services; Public Administration and defense; Education; Human health and social work activities; Dwellings

Source: Author specification based on the GTAP database

Table A3
Model Closure Specification

Market equilibrium	All commodity and factor markets clear through endogenous price adjustments
Labor	Total labor endowment is fixed, while labor is fully mobile across domestic sectors
Capital	Total capital stock is fixed, while capital is fully mobile across domestic sectors
Land	Total land endowment is fixed, and land is imperfectly mobile across agricultural sectors
Natural resources	Total natural resource endowment is fixed and sector-specific
Investment	Regional investment is savings-driven and adjusts to available regional savings
Regional savings	Regional household savings adjust endogenously according to changes in regional income
External balance	The current account balance is fixed, while the real exchange rate adjusts endogenously to restore external equilibrium
Government demand	Real government expenditure is fixed
Private consumption	Private consumption adjusts endogenously according to changes in regional income and prices

Source: GTAP closure standard model

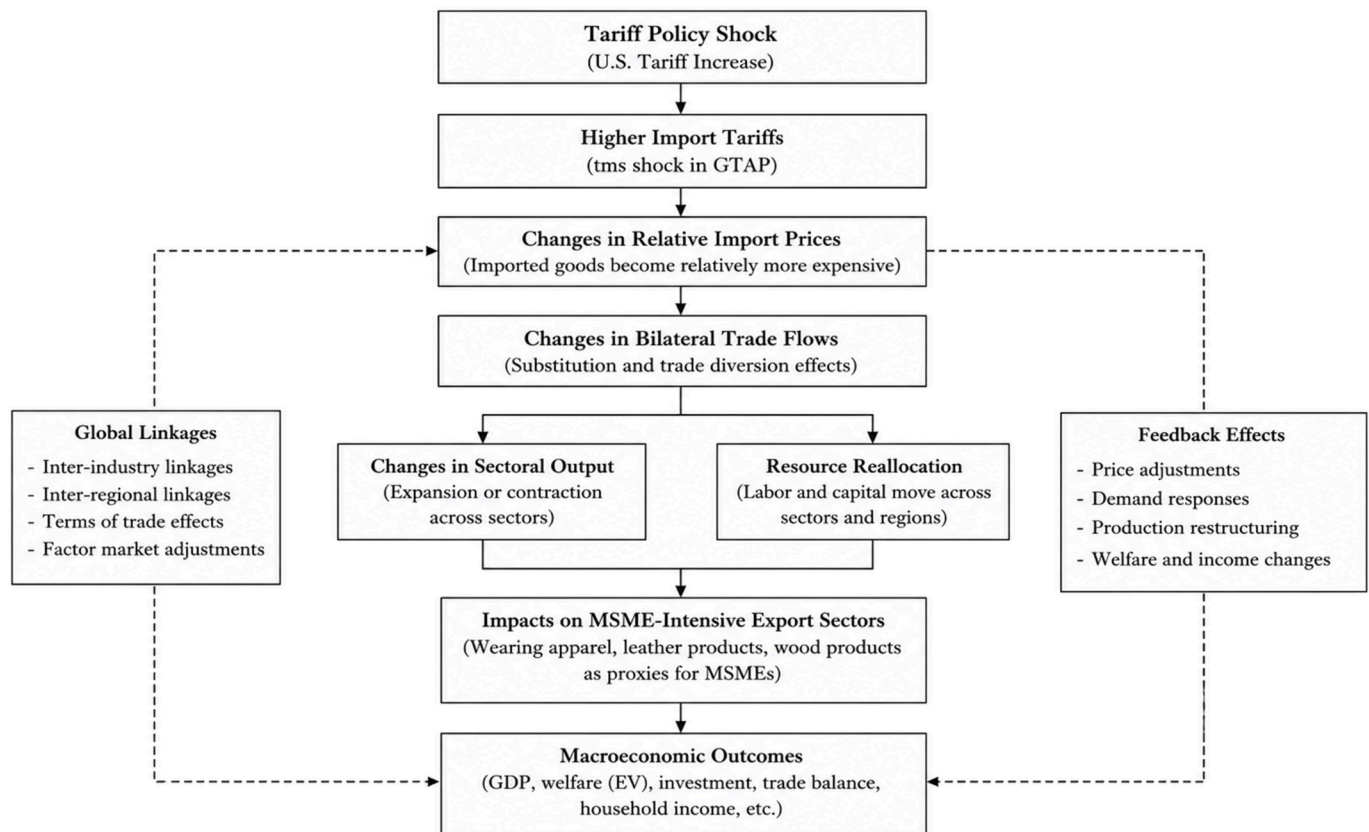


Fig. A1. Tariff Shock Transmission Mechanism in the GTAP Framework.

Source: Author's illustration based on the GTAP framework. Note: The figure presents a simplified conceptual representation of the transmission mechanism. In the GTAP model, all endogenous variables are simultaneously determined through general equilibrium interactions.

The supplementary file can be accessed through the link https://sl.ut.ac.id/supplementary_rifai.

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