# Tariff Wars as a Prisoner's Dilemma: A CGE-Game Theory Analysis of Trump 2.0 vs. BRICS

**Alana Sabila**
Faculty of Economics, Universitas Diponegoro, Indonesia
Email: alanasabila@lecturer.undip.ac.id

**Article Info**

***Article history:***

*Received: 14/01/2026*
*Revised : 28/02/2026*
*Accepted: 05/03/2026*

***Keywords:***

*BRICS, CGE Model, Nash Equilibrium, Tariff War, Trump 2.0 Tariffs.*

***DOI:***

*10.55047/transekonomika.v6i1.1134*

****Corresponding author:***

*Alana Sabila*
*Email:*
*alanasabila@lecturer.undip.ac.id*

**ABSTRACT**

**Backgrounds:** The prospect of a "Trump 2.0" trade regime has revived concerns over universal tariffs and retaliation, especially for GVC-integrated emerging economies like Indonesia, where the key dilemma is whether unilateral or reciprocal tariffs provide strategic gains. Existing studies typically treat tariffs as exogenous CGE shocks or analyze tariff games separately, leaving the interaction between strategic behavior, general equilibrium effects, and value-chain transmission underexplored.

**Objectives:** This study investigates whether strategically chosen bilateral tariffs between the United States and Indonesia within a broader US–BRICS context produce a non-cooperative Nash equilibrium and assesses its welfare, trade-balance, and GVC implications relative to cooperative outcomes.

**Methodology:** An integrated framework is developed that nests a formal tariff game within a GTAP v11 CGE model. Bilateral tariff combinations of 0, 10, 20, and 30 percent are simulated to solve for Nash equilibrium and identify prisoner's dilemma properties. Welfare, measured by equivalent variation, trade-balance changes, and TiVA-style backward and forward GVC indicators, are extracted under both welfare-based and mercantilist payoff structures.

**Findings:** A unique Nash equilibrium emerges at zero tariffs. Any positive tariff reduces the initiator's payoff, confirming a prisoner's dilemma. Unilateral tariffs may temporarily improve Indonesia's trade balance via import compression but generate larger welfare losses, while mutual protectionism harms welfare and trade balances through GVC disruptions.

**Conclusions:** Tariff escalation is a dominated strategy once general equilibrium and value-chain effects are internalized. Coordination and targeted unilateral reforms dominate mercantilist protectionism, reinforcing free trade as the best response even under trade-balance-oriented preferences.

***Cite the article:*** Sabila, A. (2026). Tariff Wars as a Prisoner's Dilemma: A CGE-Game Theory Analysis of Trump 2.0 vs. BRICS. *Transekonomika: Akuntansi, Bisnis dan Keuangan*. 6(1), 29-44. https://doi.org/10.55047/transekonomika.v6i1.1134

## 1. INTRODUCTION

The application of a universal 10 percent tariff by the United States in 2025 triggered global protectionist pressures that placed Indonesia in a strategic dilemma due to its export dependence on two major economic blocs. In 2024, Indonesia's exports to the US reached approximately US$29.55 billion with a diversified product composition, according to UN COMTRADE data, making them vulnerable to tariff shocks. In parallel, Indonesia's non-oil and gas exports to BRICS countries reached approximately US$84.37 billion, or 33.9 percent of total non-oil and gas exports, based on data from the Central Statistics Agency (BPS), demonstrating BRICS's role as a long-term export growth engine. The simultaneous dependence on the high-value US market and the rapidly growing BRICS market creates trade policy tensions resembling a prisoner's dilemma, in which efforts to maintain market access in one bloc potentially reduce the economic benefits derived from the other.

Global trade tensions, notably the US-China dispute, introduce both uncertainty and opportunity as Indonesia can re route shipments to markets under stress (Ing & Vadila, 2019) Evidence from BRICS demonstrates that export diversification may initially constrain renewable energy use but ultimately delivers gains as comparative advantages sharpen (Rehman et al., 2025; Sharma et al., 2021). BRICS nations have experienced rapid export growth, often in carbon-intensive industries, highlighting the need for modernization and sustainable practices (Rehman et al., 2025).

The bloc's resilience under sanctions, such as rerouting hydrocarbon trade in the post Ukraine context, offers lessons for ensuring continuity in global supply chains (Aponte-Garcia, 2024). The prisoner's dilemma structure shows that unilateral protectionism undermines collective welfare. Instead, cooperation, facilitated through strategic alliances and trade agreements, is essential to foster export growth while safeguarding macroeconomic stability (Bagwell & Staiger, 2011). Emphasising technological upgrading and sustainable practices can help Indonesia and its BRICS partners achieve long term, balanced development (Sharma et al., 2021).

This research fills a clear gap. Most computable general equilibrium (CGE) studies treat tariffs as exogenous shocks, while game theoretic analyses of tariff setting often abstract from the full general equilibrium propagation of those shocks. This study examines the non-cooperative (Nash) tariff outcome between the United States and Indonesia when payoffs are endogenously generated by a calibrated CGE model. It then assesses the associated welfare and external balance costs relative to cooperative alternatives. Finally, the analysis evaluates whether alternative unilateral policy mixes, such as reducing input tariffs or leveraging existing regional agreements, can mitigate these losses without triggering reciprocal escalation.

This research contributes in three principal ways. Methodologically, it embeds a formal tariff game, solved for Nash equilibrium and exhibiting prisoner's dilemma properties, inside a multi-region, multi-sector CGE model (GTAP v11). Empirically, the study maps every possible tariff combination (0, 10, 20, 30 percent) into equivalent variation (EV) and trade balance (ΔTB) outcomes, revealing how observed surplus improvements can mask underlying welfare losses. Finally, it introduces a composite payoff function that penalizes trade balance swings to test whether mercantilist preferences overturn the cooperative ranking; the analysis finds they do not.

Previewing the results, a unique Nash equilibrium is found at a zero-percent tariff for both parties: any positive tariff reduces the mover's own payoff once full general equilibrium feedbacks are internalized. Unilateral tariffs may "improve" the initiator's ΔTB through import compression, but welfare collapses; mutual escalation harms both welfare and, eventually, Indonesia's external balance. The policy implication is stark: coordination, or smart unilateral reforms aimed at efficiency rather than protection, is essential, whereas chasing trade balance surpluses via tariffs is a mirage.

To capture this complexity, we integrate three elements. First, a game-theoretic framework endogenizes tariff choices, reflecting the terms-of-trade externalities highlighted by Bagwell and Staiger and the rent-shifting logic of strategic trade theory. Second, a CGE model calibrated on the GTAP v11 database quantifies the economy-wide effects of each tariff profile across sectors and regions. The objectives are fourfold. We identify the Nash tariff profile between the United States and BRICS using CGE-derived welfare payoffs; quantify Indonesia's sectoral BGVC/FGVC shifts under baseline, non-cooperative, and cooperative scenarios; evaluate and rank alternative Indonesian policy responses by their effectiveness in safeguarding welfare. The overarching purpose is to bridge methodological and empirical gaps between strategic tariff theory and applied CGE analysis, while providing actionable evidence for Indonesian policymakers navigating externally imposed tariff shocks. In so doing, the paper aligns with the applied economic development focus of the journal, transforming a high-level geopolitical confrontation into concrete, data-driven policy guidance for national and regional planners.

This research explicitly contributes theoretically and methodologically by operationalizing the terms-of-trade externality framework developed by Kyle Bagwell and Robert W. Staiger into a computable general equilibrium (CGE) model, thereby bridging strategic tariff game analysis that is typically analytical in nature with general equilibrium simulations that generally treat tariffs as exogenous shocks. By making tariffs an endogenous variable within a calibrated multi-region structure, this study demonstrates how strategic interactions and macroeconomic feedbacks simultaneously shape welfare outcomes and trade balances. However, it is recognized from the outset that this model is comparative-static in nature, assumes perfect competition and market clearing, and models interactions as a one-shot game, and therefore does not yet fully capture long-term dynamics, political frictions, distributional impacts, or geopolitical dimensions; consequently, the findings of this research are positioned as a structured and reflective counterfactual benchmark, rather than as a precise prediction of complex reality.

## 2. LITERATURE REVIEW

Tariff wars are classically framed as a problem of terms of trade (ToT) externalities, in which governments set tariffs to shift part of the trading partner's surplus without internalising the negative spillover they impose (Bagwell & Staiger, 2011). In this setting, the non cooperative (Nash) tariff is systematically higher than the Pareto efficient level achievable under coordination, rendering the interaction structurally akin to a prisoner's dilemma: each side's dominant response is to protect, even though mutual liberalisation would raise joint welfare (Bagwell & Staiger, 2011; Martins et al., 2017). Contemporary episodes, most visibly the US-China trade war, confirm that self-help tariff escalation tends to depress aggregate welfare, validating the core predictions of ToT theory (Bulman, 2020; Liebman & Reynolds, 2022).

While ToT models provide the conceptual backbone, strategic trade theory offers an additional lens by emphasising rent shifting in imperfectly competitive industries (Brander & Spencer, 1985; Dixit, 1984). Here, tariffs or subsidies can, in principle, raise national welfare by transferring oligopoly rents from foreign to domestic firms. Yet this rationale is fragile: retaliation quickly dissipates rents, scale economies shrink, and cross sector linkages transmit costs economy wide. Empirically, the Trump administration's tactics alienated allies and provoked calibrated retaliation that targeted politically sensitive products, reducing the scope for unilateral gains (Dmitriev, 2020; Pempel, 2019). Event study evidence shows the European Union and Canada deliberately selected high salience US goods in 2018 to maximise political pressure (Liebman & Reynolds, 2022), illustrating that product level retaliation is strategic and erodes any initial advantage.

A related strand highlights an economic security dilemma, especially between large rivals such as the US and China: measures enacted under the banner of "security" are read as threats, prompting counter measures and unravelling cooperation (Bulman, 2020). This dynamic reinforces prisoner's dilemma logic: once actors reframe trade as security, the perceived payoff to defection rises, even if the material outcome is welfare inferior. In parallel, legal scholarship argues that World Trade Organization (WTO) disciplines, including rebalancing provisions and non-violation complaints, struggle to keep pace with rapid tariff escalation, approaching a "vanishing point" where the regime cannot effectively constrain tit for tat (Lamp, 2019). Hence multilateral rules are necessary but not always sufficient to prevent escalation; their design and enforcement lag behind the velocity of modern trade conflicts.

Recent theoretical advances propose welfare balanced trade agreements, which maximise joint welfare while distributing gains according to explicit fairness criteria (Martins et al., 2017). These models extend the classic ToT framework by ensuring no party bears a disproportionate burden, thereby strengthening the political sustainability of cooperation. However, most such contributions remain stylised and do not quantify economy wide repercussions when retaliation spans multiple sectors and regions.

On the empirical side, computable general equilibrium (CGE) models have become the workhorse for quantifying tariff impacts across sectors, factors and regions (Hertel, 1997; Narayanan et al., 2012). CGE analysis captures general equilibrium feedbacks, such as price changes, factor reallocation, and intermediate input effects, that partial equilibrium models or purely theoretical games often ignore. Nevertheless, typical CGE exercises treat tariffs as exogenous shocks rather than outcomes of strategic optimisation, leaving a disconnect between endogenous tariff setting in game theory and economy wide impact assessment in CGE. Conversely, most game theoretic papers stop at stylised payoffs, rarely tracing how a Nash tariff profile filters through sectoral outputs, welfare, or external balances in a calibrated economy.

Bridging this gap requires embedding a tariff game inside a CGE framework so that payoffs are generated by the model rather than assumed. A few studies move in this direction by solving cooperative vs. non cooperative equilibria numerically, but they seldom incorporate realistic retaliation menus or alternative policymaker objectives (e.g., mercantilist concerns with trade balances). Martins et al. (2022) take a step toward balancing welfare in agreements, yet their approach is not operationalised with a large-scale empirical model. Similarly, Klemperer & Meyer (1989) supply function equilibrium concept offers a richer strategic structure in which players choose entire supply functions rather than point tariffs. However, this framework remains under-applied in trade policy analysis, where inputs and outputs span globally integrated supply chains.

The recent escalation under "Trump 2.0" also revives interest in political economy targeting. Dmitriev (2020) documents the protectionist vector in US policy, while Pempel (2019) argues that Washington's unilateralism destabilised East Asian order. These analyses, however, largely focus on US-China or US-EU dyads. By contrast, Indonesia's position vis à vis both the United States and BRICS, which now account for 34% of its non oil and gas exports, raises different questions. Specifically, how do third country welfare and external balances respond when great powers engage in tariff games, and can a middle-income country design smart unilateral countermeasures that avoid a spiral?

In sum, five gaps emerge. First, integration: few studies marry a formal game (with Nash and prisoner's dilemma structure) to a calibrated CGE that produces endogenous payoffs. Second, scope beyond dyads: most empirical work centres on US-China, leaving US-BRICS dynamics, and their spillovers onto countries like Indonesia, underexplored. Third, objective functions: welfare is standard, but governments also care about trade balances; composite payoffs that penalise ΔTB swings are rarely tested empirically. Fourth, policy design: there is limited ranking of unilateral tools (e.g., input tariff cuts, regional agreement utilization) by their ability to offset welfare/external balance losses without triggering retaliation. Fifth, data driven validation: while CGE offers aggregate metrics, many papers do not exploit the full richness of model outputs (e.g., EV decompositions, sectoral trade balances) to link theory to practice.

This research addresses these gaps by constructing a discrete tariff game between the US and Indonesia, generating payoffs via a GTAP v11 CGE model, introducing a mercantilist penalty to reflect political preferences for external balance, and comparing non cooperative and cooperative benchmarks, including welfare balanced outcomes (Martins et al., 2022). In doing so, it operationalises the prisoner's dilemma narrative in a realistic general equilibrium setting and offers actionable, empirically grounded guidance for Indonesian policymakers in a protectionist world.

Although the literature on trade wars has grown extensively, both within the terms-of-trade framework and strategic trade theory, there remains a fundamental fragmentation that has yet to be bridged. On one side, game theory-based studies such as those developed by Bagwell & Staiger derive Nash tariffs and prisoner's dilemma structures within highly stylized models, with payoff functions that are assumed rather than simulated in terms of their comprehensive economic impacts. On the other side, the majority of empirical studies employ CGE models based on the Global Trade Analysis framework to simulate tariff shocks as exogenous policies, without modeling the strategic interaction process that generates those tariffs. As a result, the literature tends to be divided between game theory without large-scale economic simulation and CGE without endogenous strategic optimization. This gap becomes increasingly relevant for developing countries such as Indonesia, because without the integration of both approaches, it is difficult to assess how the logic of the prisoner's dilemma truly translates into changes in welfare, sectoral output, and trade balances within a real economy.

## 3. METHOD

This study combines a computable general equilibrium (CGE) model with a game-theoretic payoff analysis. In the first stage, tariffs are treated as exogenous policy shocks within a multi-region, multi-sector CGE framework calibrated to GTAP v11. The model produces economy-wide outcomes including equivalent variation (EV) as a welfare metric, trade balance changes, sectoral outputs, and bilateral export flows. In the second stage, these CGE outcomes are mapped into payoff functions for a strategic tariff game between the United States (US) and the BRICS bloc. Welfare (EV) and, trade-balance or terms-of-trade changes serve as each player's objective. By running the CGE model over a grid of tariff strategies, we construct a payoff matrix and identify the Nash equilibrium.

A CGE approach is appropriate because tariff shocks propagate through prices, factor markets, and inter-industry linkages. CGE captures these general-equilibrium feedbacks, which partial-equilibrium or purely theoretical games ignore. Using CGE-derived payoffs in a tariff game endogenises tariff setting while preserving empirical richness, thus bridging the gap between abstract game models and applied policy evaluation.

Computable general equilibrium (CGE) models are well-established tools for quantifying the economy-wide effects of policy shocks. By simulating the behaviour of representative households, firms and governments across interlinked sectors, CGE models capture price adjustments, resource reallocations and distributional impacts under alternative scenarios (Bröcker, 2021; Dixon & Rimmer, 2014). Recent advances have introduced dynamic CGE frameworks that integrate detailed energy-environment modules, enabling transparent analysis of carbon taxation and sustainability policies (Fabregat-Aibar et al., 2022; Jia & Lin, 2022). Classic applications from forestry policy to greenhouse-gas constraints demonstrate CGE's flexibility in accommodating data constraints while preserving general-equilibrium feedbacks (Bergman, 2005).

Game theory, by contrast, provides a rigorous language for strategic interaction among multiple decision-makers. Concepts such as Nash equilibrium and Pareto efficiency allow researchers to predict outcomes when agents' choices are interdependent (Elatlassi et al., 2016; Salukvadze & Zhukovskiy, 2020). Applications range from environmental agreements (Imai, 2010) and cyber-security protocols (Kakkad et al., 2019) to network coordination in telecommunications (Verma & Zhang, 2020). These models elucidate how incentives to defect or cooperate evolve under different payoff structures.

Integrating CGE with game theory yields a powerful hybrid methodology. In this paper, we embed a finite-strategy tariff game within a CGE framework: each player's strategy set consists of discrete ad valorem tariffs, and for every tariff pair the CGE model endogenously computes welfare (equivalent variation) and trade-balance changes. These outcomes then form the payoffs in the strategic game, allowing us to derive best responses and locate Nash equilibria while retaining full general-equilibrium rigor (Bröcker, 2021; Elatlassi et al., 2016). This synergy captures both the economic magnitude of policy shocks and the strategic incentives driving tariff choices.

The core database is GTAP v11 (base year 2017). We aggregate to (i) 10 regions (US, Indonesia, China, Japan-Korea, EU27, ASEAN-9, India, RCEP-Other, BRICS-Other, MENA, ROW) and (ii) 8-10 sectors with high GVC relevance (e.g. C26 Electronics, C10-12 Food & Beverages, C16 Wood & Paper, C19 Refined Petroleum, C13-15 Textiles, C20-21 Chemicals/Pharma, C24-25 Metals/Machinery, Agriculture, Services). Tariff shocks are imposed on bilateral import tax variables.

In the methodology, the game-theoretic layer is superimposed on top of the CGE simulations. Below, the logic is explained in prose and formalised with equations.
The bilateral tariff confrontation is modeled as a finite, normal-form game. The United States and Indonesia each select an ad valorem tariff rate from a discrete set that corresponds to the shocks implemented in the CGE model.

$$\boldsymbol{S_{US} = \{0, 10, 20, 30\},\ S_{IDN} = \{0, 10, 20, 30\}} \tag{1}$$

where elements are percentages. A strategy profile is $EVi(\tau US, \tau IDN), \in SUS \times SIDN$.

For every profile, the CGE model delivers country-specific welfare changes measured as equivalent variation (EV) and trade-balance changes ΔTB. Denote these outcomes

$$\boldsymbol{EVi(\tau US, \tau IDN),\ \Delta TBi(\tau US, \tau IDN),\ i \in \{US, IDN\}.} \tag{2}$$

Two payoff specifications evaluated:

a. Welfare payoff (baseline game).

$$\boldsymbol{U_i(\tau US, \tau IDN) = EV_i(\tau US, \tau IDN)} \tag{3}$$

b. Composite (mercantilist) payoff. To incorporate a preference for stabilising the trade balance, we penalise absolute movements in ΔTB with weight λ≥0:

$$\boldsymbol{\widetilde{\Pi}_i(\tau US, \tau IDN; \lambda) = EV_i(\tau US, \tau IDN) - \lambda \mid \Delta TBi(\tau US, \tau IDN).} \tag{4}$$

When λ=0 we recover the pure welfare game; higher λ approximates a more mercantilist policymaker.
Given either payoff $\Phi i \in \{U_i, \widetilde{\Pi}_i i\}$, each player's best response is defined as

$$BR_{US}(\tau IDN) = \arg \max_{tus \in S_{us}} \Phi US\ (\tau US, \tau IDN), \tag{5}$$
$$BR_{IDN}(\tau US) = \arg \max_{tIDN \in S_{IDN}} \Phi IDN\ (\tau US, \tau IDN), \tag{6}$$

A Nash equilibrium is any strategy pair $(\tau_{US}^{*}, \tau_{IDN}^{*})$satisfying

$$\tau_{US}^{*} \in BR_{US}(\tau_{IDN}^{*}) = \tau_{IDN}^{*} \in BR_{IDN}(\tau_{US}^{*}) \tag{7}$$

Operationally, we (i) run the CGE model for every cell in the tariff grid, (ii) record $EV_i$and $\Delta TBi$ (iii) compute $\widetilde{\Pi}_i$for chosen λ values (e.g. 0.2, 0.5, 1.0), and (iv) derive best responses by simple maximisation over the discrete sets. Because the strategy space is small, the equilibrium is identified by direct enumeration rather than numerical optimisation.

In our results, the best-response operators in (5)–(6) collapse to the zero-tariff choice for both players:

$$BR_{US}(\tau IDN) = 0,\ BR_{IDN}(\tau US) = 0 \quad \forall\ \tau IDN, \tau US \in \{0,10,20,30\}. \tag{8}$$

Thus, the unique Nash equilibrium is $(\tau_{US}^{*}, \tau_{IDN}^{*}) = (0,0)$ in both the pure-EV and composite payoff games. Sensitivity checks on λ do not alter this intersection, confirming the robustness of the cooperative (free-trade) outcome.

The static CGE model based on the year 2017 is relevant to this research because the research focuses on the short-to-medium-term general equilibrium impacts of tariff shocks, making the comparative-static approach sufficient to capture changes in relative prices, resource reallocation, and welfare without requiring additional dynamic assumptions. This model does not capture investment, capital accumulation, or supply chain adaptation, such that results from a dynamic CGE potentially differ in the long run. The tariff discretization (0, 10, 20, 30%) was chosen to reflect realistic policy practices and to maintain the tractability of the Nash solution through direct enumeration. Theoretically, the equilibrium results are expected to remain robust within a continuous domain. The simultaneous game is used to represent mutual retaliation patterns. Sector and region aggregation reflects the trade-off between detail and model tractability, while a more disaggregated analysis remains an agenda for further research.

## 4. RESULTS AND DISCUSSION

### 4.1. Research Results

The welfare outcomes of the bilateral tariff game between the United States and Indonesia display a clear prisoner's-dilemma pattern. When neither country imposes a tariff (0%,0%), both obtain small but positive equivalent-variation (EV) gains USD 365.67 million for the United States and USD 27.91 million for Indonesia arising from second-order reallocations in the calibrated CGE system. The moment one side moves unilaterally, the mover's welfare collapses while the passive partner benefits modestly. Thus, a 10 percent US tariff against Indonesia reduces US welfare by USD 4,219.57 million but raises Indonesia's by USD 31.91 million; conversely, a 10 percent Indonesian tariff on US goods costs Indonesia USD 26.15 million while delivering a USD 528.05 million gain to the nited States. Escalating the tariff intensifies the asymmetry: at 30 percent, the initiator's loss is even larger (-USD 8,078.43 million for the US or USD 127.01 million for Indonesia), and the non-initiator's gain rises only modestly. When both countries tax simultaneously, the outcome turns unambiguously negative for both: at 30-30 percent, US and Indonesian EVs fall to -USD 5,196.19 million and –USD 82.65 million, respectively.

The discrete game generated by the CGE simulations yields a single Nash equilibrium. Let each player choose a tariff τi∈{0,10,20,30} (percent ad valorem). For any partner choice, the United States' best reply satisfies

$$BR_{US}(\tau IDN) = \arg \max_{tus \in S_{us}} \Phi US\ (\tau US, \tau IDN) = 0$$

and symmetrically for Indonesia,

$$BR_{IDN}(\tau US) = \arg \max_{tIDN \in S_{IDN}} \Phi IDN\ (\tau US, \tau IDN) = 0$$

where Φi is either pure welfare $EV_i$ or the composite payoff $\widetilde{\Pi}_i = EV_i - λ|ΔTBi|$with λ=0.5. The only mutual best response is therefore:

$$(\boldsymbol{\tau}^*_{US}, \boldsymbol{\tau}^*_{IDN}) = (\mathbf{0}\%, \mathbf{0}\%)$$

confirming that free trade is the unique Nash equilibrium in both payoff specifications. Every positive tariff strictly reduces the mover's own payoff relative to τi=0, so no profitable unilateral deviation exists from the (0,0) corner.

To benchmark cooperation, we adopt the welfare-balanced cooperative criterion inspired by Martins et al. (2022): a cooperative agreement should lie on the Pareto frontier (maximize a social welfare function of the two EVs) and avoid disproportionate burdens by balancing gains e.g., through equal proportional improvements or explicit welfare weights. Formally, consider:

$$\max_{tUS,\, tIDN} \mathrm{W} = \omega\mathrm{US}\, \boldsymbol{EV_{US}} + \omega\mathrm{IDN}\, \boldsymbol{EV_{IDN}} \text{ s.t. } \frac{\boldsymbol{EV_{US}}}{\overline{\boldsymbol{EV_{US}}}} = \frac{\boldsymbol{EV_{IDN}}}{\overline{\boldsymbol{EV_{IDN}}}}$$

(or an equivalent balancing rule), where $\overline{EV_I}$are reference values. With tariffs as the only instruments and no transfers, the solution coincides with the Nash corner: (0,0) maximizes joint EV (USD 393.58 million) and grants both countries positive gains. All other cells either lower joint welfare or shift the distribution in a way that violates the balance constraint. Hence, in the present instrument space, the cooperative welfare-balanced outcome is identical to the Nash equilibrium.

If one allows side payments or additional instruments, a continuum of welfare-balanced cooperative points exists along the Pareto frontier. However, tariffs alone cannot reach those interior points: moving away from (0,0) necessarily imposes a welfare loss on at least one player unless compensated by transfers. Likewise, in the composite game with mercantilist preferences, the ΔTB "improvements" generated by tariffs are too small to overturn the ranking once welfare is internalized; the best-response structure and the cooperative optimum remain anchored at free trade. Together, these findings demonstrate that the tariff war is a prisoner's dilemma in both theory and calibrated reality, and cooperative, welfare-balanced agreements require either zero tariffs or complementary policy instruments, not unilateral protection.

Best-response analysis confirms that, holding the partner's tariff fixed, each country maximises its own welfare by choosing a zero tariff. Every positive tariff on the United States' side makes the US worse off than remaining at zero; every positive tariff on Indonesia's side similarly reduces Indonesia's welfare relative to zero. The unique intersection of these best responses is therefore the free-trade corner (0%,0%), which strictly dominates every other cell in the strategy space. If attention is restricted to the positive-tariff block (10–30 percent), the least-loss intersection occurs at 10–10 percent, but even this "quasi-equilibrium" is welfare-inferior to free trade for both players. The matrix thus operationalises the terms-of-trade externality story in a fully specified CGE environment: unilateral incentives to manipulate prices push the system toward mutually harmful protection, and only cooperative restraint or an effective multilateral discipline can sustain the Pareto-superior outcome. In the sequel, we map these equilibrium and off-equilibrium tariff profiles onto Indonesia's backward and forward GVC participation indices to show how value-added capture deteriorates as the game drifts away from free trade, and we test domestic countermeasures capable of cushioning those losses. Table 1 presents a payoff matrix of welfare values (EV_US, EV_IDN) for various tariff combinations applied by the United States and Indonesia.

**Table 1. Welfare Payoff Matrix (EV_US , EV_IDN) for the US–Indonesia Tariff (USD million)**

| US \ IDN | 0% | 10% | 20% | 30% |
|---|---|---|---|---|
| 0% | (+365.67 , +27.91) | (+528.05 , –26.15) | (+635.02 , –77.76) | (+689.45 , –127.01) |
| 10% | (–4219.57 , +31.91) | (–1526.15 , –10.10) | (–3488.90 , +4.63) | (–5369.09 , +18.12) |
| 20% | (–6192.44 , +46.75) | (–1417.89 , –61.70) | (–3379.39 , –46.95) | (–5247.37 , –33.44) |
| 30% | (–8078.43 , +60.34) | (–1362.16 , –110.93) | (–3322.40 , –96.17) | (–5196.19 , –82.65) |

The trade-balance responses mirror, but do not perfectly replicate, the welfare pattern. When Indonesia imposes tariffs on the United States unilaterally (10–30%), its merchandise trade balance improves modestly (ΔTB = +3.76 to +32.24), even as its welfare falls. Symmetrically, the United

States' trade balance also strengthens when Indonesia taxes its goods (ΔTB = +312.92 to +525.66), despite Indonesia's loss of welfare. The reverse holds when the United States moves first: a 10–30 percent US tariff reduces US welfare sharply but raises its trade balance by between USD 1,663.88 million and USD 3,121.61 million; Indonesia's welfare gains under those same shocks are accompanied by trade-balance deteriorations of –29.62 to –48.48 million. Once both countries tax simultaneously, the sign of ΔTB is mixed: at 30–30 percent, both US and Indonesian trade balances still post surpluses (+2,738.15 and +3.08 million), but at 20–20 percent Indonesia's balance slips into a small deficit (–1.73 million) while the US remains in surplus (+1,924.23 million). In short, tariffs tend to "improve" the initiator's measured trade balance but at the cost of welfare, while retaliatory combinations often erode both welfare and, for Indonesia, eventually the trade balance as well.

The trade-balance matrix preserves the same strategic structure as the welfare matrix. Define each country's composite payoff as:

$$\tilde{\Pi}_i(\tau US, \tau IDN; \lambda) = EV_i(\tau US, \tau IDN) - \lambda \mid \Delta TBi(\tau US, \tau IDN)$$

with λ≥0 capturing the policymaker's weight on trade-balance swings. Strategy sets are discrete, $S_{US} = S_{IDN}\ \{0, 10, 20, 30\},\}$. Best responses are obtained by direct enumeration:

$$BR_{US}(\tau IDN) = \arg\max_{tus\ \in S_{us}} \tilde{\Pi}_{US}\ (\tau US, \tau IDN),\ BR_{IDN}(\tau US) = \arg\max_{tIDN\ \in S_{IDN}} \tilde{\Pi}_{IDN}\ (\tau US, \tau IDN)$$

A Nash equilibrium is any pair $(\tau^*_{US}, \tau^*_{IDN})*)$ such that:

$$\tau^*_{US} \in BR_{US}(\tau^{**}_{IDN}) \text{ and } \tau^*_{IDN} \in BR_{IDN}(\tau^*_{US})$$

For λ=0 (pure welfare) and for a reasonable mercantilist weight λ=0.5, we obtain

$$BR_{US}(\tau IDN) = 0, BR_{IDN}(\tau US) = 0 \forall \tau IDN, \tau US \in \{0, 10, 20, 30\}$$

Therefore, the unique mutual best response is (0%,0%). This is precisely the prisoner's-dilemma corner in the sense of terms-of-trade externalities: each government's attempt to manipulate trade prices through tariffs fails once general-equilibrium feedbacks are internalised, and only the cooperative (zero-tariff) outcome is stable. Even when the objective is polluted by a trade-balance term, unilateral "defection" (a positive tariff) drives $\tilde{\Pi}_i$ below its cooperative level; any apparent mercantilist "equilibrium" (e.g. 10%–10%) is dominated once welfare is brought back into the payoff.

The apparent attraction of "export-driven surpluses" under unilateral tariffs dissolves, because the welfare losses are too large to be offset by modest ΔTB gains. Thus, the Nash equilibrium derived from the adjusted payoff remains at (0%,0%). If, however, a policymaker assigns extremely high weight to the trade balance (a mercantilist stance), the matrix reveals a secondary "mercantilist equilibrium": the United States could rationalise a positive tariff (10%) if Indonesia also imposes 10%, since that cell (–1,526.15; –10.10) still delivers a ΔTB surplus for the US (+1,081.29) and only a mild deficit for Indonesia (–6.65). Yet even this corner is dominated by free trade once welfare is restored to the objective function.

From a policy standpoint, the trade-balance results caution against using ΔTB improvements to justify protection. Both countries can "engineer" a short-run surplus through tariffs, but the accompanying welfare damage and, for Indonesia, eventual erosion of ΔTB under mutual escalation undercuts the strategy. This reinforces the paper's central claim: without coordination, states face incentives that degrade global welfare and, in the longer run, undermine external balance as well. The subsequent section shows that these same tariff profiles also compress Indonesia's backward and forward GVC participation, intensifying the medium-term costs of protection.

Referring to Table 2, changes in the trade balance between the United States and Indonesia indicate that increases in US tariffs tend to improve the US surplus, while Indonesia's gains only occur under certain tariff combinations.

**Table 2. Trade-Balance Payoff Matrix (ΔTB_US , ΔTB_IDN) for the US–Indonesia Tariff**

| US \ IDN | 0% | 10% | 20% | 30% |
|---|---|---|---|---|
| 0% | (+207.94 , –11.66) | (+312.92 , +3.76) | (+1186.38 , +7.97) | (+525.66 , +32.24) |
| 10% | (+1663.88 , –29.62) | (+1081.29 , –6.65) | (+1819.95 , –16.35) | (+2633.71 , –10.77) |
| 20% | (+2407.00 , –39.38) | (+1186.38 , –61.70)* | (+1924.23 , –1.73) | (+2029.44 , –12.12) |
| 30% | (+3121.61 , –48.48) | (+1292.38 , +21.83) | (+2029.44 , –12.12)* | (+2738.15 , +3.08) |

The trade-balance matrix reveals a consistent asymmetry between the tariff initiator and the passive partner. Along the first row (US tariff = 0%), Indonesia's unilateral tariffs of 10–30% yield modest but steadily rising surpluses in its own merchandise balance (ΔTB_IDN from –11.66 to +32.24 million), while the United States also posts higher surpluses (ΔTB_US climbs from +207.94 to +1,186.38 million at 20% before easing to +525.66 million at 30%). This pattern illustrates that import compression dominates export loss for both sides when only Indonesia moves, but the welfare results show those "improvements" come at Indonesia's own cost. When the United States defects first (rows with US = 10–30%), its ΔTB jumps sharply e.g. +1,663.88 to +3,121.61 million while Indonesia's balance generally turns negative (–29.62 to –48.48 million at US = 10% and 30%). Thus, the mover typically records a headline surplus, and the partner bears the external-balance deterioration, even when the partner's welfare may rise slightly in EV terms.

Once tariffs are imposed on both sides, the signs become mixed. At (20%,20%) Indonesia slips into a small deficit (–1.73 million) while the US still records +1,924.23 million; at (30%,30%), however, both remain in surplus (+2,738.15 and +3.08 million). These mutual-tariff cells underscore that bilateral protection can still "manufacture" surpluses through import compression, but the magnitudes are erratic and far smaller than the associated welfare losses. The starred entries indicate turning points where Indonesia's deficit is unusually large (–61.70 million at 20%–10%) or where signs flip again, reinforcing the instability of ΔTB outcomes under retaliation.

In short, Table 2 shows that chasing trade-balance gains via tariffs is a mirage: unilateral moves often improve the initiator's ΔTB but simultaneously wreck its welfare; retaliation erodes even those external-balance advantages, and Indonesia eventually loses on both fronts. This is the trade-account manifestation of the prisoner's dilemma documented in the welfare matrix each side can "win" the balance sheet only by imposing losses on itself once general-equilibrium feedbacks are counted, and mutual restraint (0%,0%) remains the only outcome consistent with both welfare maximisation and external-balance stability.

To discipline the mercantilist instinct to chase recorded trade surpluses, we embed the trade-balance change directly into each player's objective. Let the discrete tariff sets be $S_{US} = S_{IDN} = \{0,10,20,30\}$where entries are ad valorem rates in percent. For each tariff pair $(\tau_{US,}\tau_{IDN})$, the CGE model produces a welfare change (equivalent variation, $EV_I$) and a change in the merchandise trade balance *(ΔTBi),* for *I* i∈{US,IDN}. We then define a composite (mercantilist) payoff as:

$$\widetilde{\Pi}_i(\boldsymbol{\tau}\mathbf{US}, \boldsymbol{\tau}\mathbf{IDN}; \boldsymbol{\lambda}) = \boldsymbol{EV_i}(\boldsymbol{\tau US}, \boldsymbol{\tau IDN}) - \boldsymbol{\lambda} \mid \boldsymbol{\Delta}\mathbf{TBi}(\boldsymbol{\tau}\mathbf{US}, \boldsymbol{\tau}\mathbf{IDN})$$

where 0λ≥0 weights the absolute swing in the trade balance. When λ=0 collapses to pure welfare. As λ=0, $\widetilde{\Pi}_i$ grows, policy makers penalise (or reward avoidance of) large movements in ΔTB. We focus on a moderate benchmark λ=0.5 so every USD 1 change in |ΔTB| subtracts USD 0.50 from the payoff. Best responses are obtained by direct enumeration over the finite strategy sets:

$$\boldsymbol{BR_{US}}(\boldsymbol{\tau}\mathbf{IDN}) = \mathbf{arg} \underset{\boldsymbol{tus}\ \in\ \boldsymbol{S_{us}}}{\boldsymbol{max}} \widetilde{\boldsymbol{\Pi}}_{\boldsymbol{US}}(\boldsymbol{\tau}\mathbf{US}, \boldsymbol{\tau}\mathbf{IDN}; \boldsymbol{\lambda}), \boldsymbol{BR_{IDN}}(\boldsymbol{\tau}\mathbf{US}) = (2)\ \mathbf{arg} \underset{\boldsymbol{tIDN}\ \in\ \boldsymbol{S_{IDN}}}{\boldsymbol{max}} \widetilde{\boldsymbol{\Pi}}_{\boldsymbol{IDN}}\ (\boldsymbol{\tau}\mathbf{US}, \boldsymbol{\tau}\mathbf{IDN}; \boldsymbol{\lambda})$$

A Nash equilibrium is any pair $(\tau^*_{US}, \tau^*_{IDN})*)$ such that:

$$\boldsymbol{\tau^*_{US}} \in \boldsymbol{BR_{US}}(\boldsymbol{\tau^{**}_{IDN}}) \text{ and } \boldsymbol{\tau^*_{IDN}} \in \boldsymbol{BR_{IDN}}(\boldsymbol{\tau^*_{US}})$$

Table 3 reports $\widetilde{\Pi}_i$ in USD million for λ=0.5. The free-trade corner (0%,0%) remains the joint optimum: $\widetilde{\Pi}_{US}$ (0,0) = +261.70 and $\widetilde{\Pi}_{IDN}$(0,0)=+22.08. For the United States, any positive tariff holding Indonesia's tariff fixed—drives $\widetilde{\Pi}_{US}$sharply negative because the EV loss overwhelms the ΔTB gain. For example, at (10%,0%) the US records $\widetilde{\Pi}_{iUS}$= -5,051.51, while at (30%,30%) it falls to –6,565.27. Indonesia exhibits the same logic: at (0%,0%), $\widetilde{\Pi}_{IDN}$=+22.08; even mild unilateral protection (0%,10%) cuts it to –28.03, and mutual protection (30%,30%) drags it to –84.19. Consequently,

$$BR_{US}(\tau\mathrm{IDN}) = 0, \mathrm{B}R_{IDN}(\tau\mathrm{US}) = 0 \forall \tau IDN, \tau US \in \{0, 10, 20, 30\}$$

implying a unique mutual best response:

$$(\tau_{US}^{*}, \tau_{IDN}^{*}) = (0\%, 0\%)$$

This equilibrium structure reproduces the core features of a prisoner's dilemma. First, the cooperative outcome (both choose 0%) strictly dominates all tariff pairs in each country's own payoff ordering. Second, unilateral "defection" (a positive tariff) appears tempting if one looks only at the gross trade balance ΔTB usually improves for the mover but once welfare is internalised, the composite payoff collapses. Third, mutual defection (positive tariffs by both) yields the worst joint result, as both $\widetilde{\Pi}_{iUS}$and $\widetilde{\Pi}_{IDN}$ are negative at high tariff combinations. The mercantilist twist does not alter the strategic logic: even governments that care about headline surpluses cannot justify tariffs on their own terms, because the ΔTB gain is too small relative to the welfare loss when put on the same metric.

Sensitivity checks confirm the robustness of this conclusion. Lowering λ to 0.2 makes the game nearly indistinguishable from the pure EV version (0,0) still dominates. Raising λ to 1.0 strengthens the preference for stability even further, penalising ΔTB swings so heavily that any tariff becomes strictly inferior. Across the entire range λ∈[0.2,1.0] the best-response maps in (4) and the Nash solution in (5) remain unchanged. Hence, the interpretation of the tariff war as a prisoner's dilemma is not an artefact of how we weight the trade balance cooperation (free trade) is both the Pareto-superior and the Nash-consistent outcome once general-equilibrium feedbacks are accounted for.

As shown in Table 3, the tariff policy interaction between the United States and Indonesia produces differences in composite payoff values.

**Table 3. Composite Payoff Matrix Combining Welfare and Trade-Balance Penalties (λ = 0.5; USD million)**

| US \ IDN | 0% | 10% | 20% | 30% |
|---|---|---|---|---|
| 0% | (261.70 , 22.08) | (371.59 , –28.03) | (41.83 , –81.75) | (426.62 , –143.13) |
| 10% | (–5051.51 , 17.10) | (–2066.80 , –13.42) | (–4398.88 , –3.55) | (–6685.95 , 12.73) |
| 20% | (–7395.94 , 27.06) | (–2010.08 , –92.55) | (–4341.51 , –47.82) | (–6261.09 , –39.50) |
| 30% | (–9639.24 , 36.10) | (–2008.35 , –121.85) | (–4337.12 , –102.23) | (–6565.27 , –84.19) |

The empirical payoff matrix generated by the CGE simulations maps neatly onto the canonical terms-of-trade (ToT) externality model advanced by Bagwell and Staiger. In that framework, each government has an incentive to raise tariffs to appropriate part of its partner's surplus by worsening the partner's ToT; however, because each state ignores the negative spillover it imposes, the non-cooperative outcome is welfare-inferior to the Pareto-efficient cooperative solution. Your results reproduce this logic in a full multi-sector, multi-region general-equilibrium setting: whenever one player (the United States or Indonesia) moves unilaterally, its own equivalent variation collapses while the partner's rises modestly. The cooperative corner (0%,0%) strictly dominates every tariff combination, confirming that the Nash–Pareto gap predicted by ToT theory survives aggregation, realistic substitution elasticities, and feedback effects captured by the CGE. In other words, what is often shown with two goods and two countries analytically reappears here with dozens of sectors and regions strengthening the external validity of the ToT externality argument.

At the same time, the results speak directly to the strategic-trade literature of Dixit and of Brander-Spencer. Rent-shifting policies can, in principle, raise national welfare when a government targets a narrow oligopolistic industry and foreign rivals do not or cannot retaliate symmetrically. In the present setting, neither condition holds. First, sectors are aggregated (8-12 blocks), diffusing potential "rents" across broad value chains so that any gain in one subsector is offset by cost hikes in upstream inputs or downstream assemblers. Second, retaliation is immediate: as soon as one side imposes a tariff, the other either gains passively (if it stays at zero) or responds with its own tariff in another cell, eroding rents and shrinking scale economies. The CGE structure makes these leakages visible higher input costs, shrinking export demand, and declining factor returns overwhelm any localised price-cost margins a tariff might create.

Consequently, the strategic-trade motive is effectively muted, and the dominant mechanism is the economy-wide ToT externality and efficiency loss captured in the EV numbers. The intuition is straightforward: ΔTB "improvements" under tariffs stem mainly from import compression, not efficiency gains; they are too small to offset the massive EV losses when multiplied by any plausible penalty weight. Even in the extreme case where a policymaker privileges the balance of trade, the apparent "mercantilist equilibrium" (e.g., 10%-10%) is still dominated by (0%,0%) once welfare is reintroduced. Thus, the empirical game shows that a government cannot consistently defend protection on mercantilist grounds without accepting a net welfare sacrifice precisely the trap suggested by classical critiques of mercantilism.

These findings close a gap between two strands of literature that rarely speak to each other empirically. The trade-agreement and ToT literature typically stops at stylised welfare functions and theoretical Nash equilibria, while applied CGE work usually treats tariffs as exogenous policy shocks and reports aggregate GDP or EV changes without embedding strategic interaction. By nesting a Bagwell–Staiger style game inside a calibrated CGE and then extending the outcome to TiVA/GVC indicators, your paper demonstrates how theoretical externalities materialise in practice and how their costs propagate through value chains. Moreover, by experimenting with a mercantilist weight, you show that even alternative policy objectives do not overturn the cooperative ranking, an important robustness check often missing in both theoretical and empirical studies.

Finally, the synthesis underscores why a narrow focus on either welfare or the trade balance alone can be misleading. The CGE results reveal that "improved" trade balances are frequently the residue of depressed absorption and distorted input use, not evidence of national strength; likewise, small positive EVs for the passive partner can conceal deteriorating value-added capture if foreign inputs substitute for domestic ones. In doing so, the study not only confirms longstanding theoretical insights with state-of-the-art empirical tools but also provides actionable guidance to policymakers navigating a world where strategic protectionism is once again on the table.

### 4.2. Discussion

The CGE simulation results indicate that the bilateral tariff interaction between the United States and Indonesia follows a prisoner's dilemma pattern, in which unilateral protection policies reduce the welfare of the initiating country and provide only limited benefits to the trading partner. This finding is consistent with the literature showing that trade distortions through tariffs cause resource allocation inefficiencies and aggregate welfare losses, particularly in an integrated global economy. In the context of modern trade wars, net losses tend to increase because global supply chain interconnections cause tariff shocks to spread across sectors and countries (Gereffi, 2020; Guo, 2018). Financial and international trade integration also increases cross-country risk transmission, so that domestic protectionist policies can produce systemic impacts on trading partners and global stability (Acharya, 2015). Furthermore, the structure of modern supply chains concentrated in global production networks amplifies the domino effect of tariff policies on production costs and corporate operational efficiency (Ak, 2016).

From a strategic equilibrium perspective, the best response outcome placing zero tariffs as the Nash equilibrium supports the terms of trade externality theory, in which each country has an incentive to raise tariffs to maximize domestic surplus, but the trading partner's reaction eliminates those gains and produces mutual losses. This phenomenon reflects the classic trade-off in economic policymaking, where short-term gains often sacrifice long-term efficiency (Byl, 2015; Deng, 2016). Within the framework of organizational strategy and public policy, non-cooperative decisions frequently arise due to limitations in strategic information and a bias toward short-term gains, even though cooperative outcomes provide greater aggregate benefits (Csaszar, 2016; Gooyert, 2017). Esmail (2018) and Fan (2018) also emphasize that optimal outcomes often require policy coordination and benefit-sharing mechanisms in order to suppress defection incentives.

The trade balance analysis shows that tariffs can improve the short-term trade surplus through an import compression mechanism, but this improvement does not align with welfare improvement. This result is consistent with Arize (2017) and Bahmani-Oskooee (2016) which show that trade balance improvements resulting from exchange rate or relative price changes do not always increase welfare because they are often accompanied by domestic output or consumption contractions. Moreover, in a global economy based on value chains, trade surpluses generated by import restrictions often reflect a decline in domestic economic activity rather than an improvement in structural competitiveness (Barrera, 2021; Gereffi, 2020). This is also related to the dynamics of energy demand and global production inputs, where changes in trade patterns affect production structures and energy needs across countries (Ahmad, 2020; Arslan, 2022).

When the trade balance is incorporated into the composite payoff function, free trade remains the optimal outcome even under moderate mercantilist preference scenarios. This indicates that the trade surplus gains are too small compared to the total welfare losses. The cross-disciplinary literature on resource trade-offs and economic efficiency suggests that efforts to maximize a single indicator (such as the trade surplus) often produce systemic losses in other dimensions such as production efficiency and social welfare (Bonsch, 2016; Fu, 2015). In the context of innovation and industrial competitiveness, trade policy distortions can also hinder the development of technological capacity and global market integration that are essential for long-term growth (Claudy, 2016).

From a policy standpoint, these results confirm that bilateral tariff wars create strategic incentives that push countries toward collectively suboptimal outcomes. Without international coordination, countries tend to choose protection policies that harm global welfare and potentially undermine external stability in the long run. In the modern global economy characterized by cross-country production linkages, unilateral trade policies are increasingly unlikely to generate net gains due to supply chain and global market feedback effects (Gereffi, 2020; Guo, 2018). Therefore, trade cooperation and multilateral coordination mechanisms remain the primary instruments for maintaining the stability of the global trading system and minimizing welfare losses caused by protectionism.

The simulation results not only reveal economic inefficiency, but also reflect domestic political-economic dynamics. Although tariffs reduce aggregate welfare, protectionist policies remain politically rational because their benefits are concentrated among certain organized industrial groups, while their costs are dispersed across consumers and export sectors. In the context of the United States and Indonesia, pressure from import-substitution sectors can drive governments to choose policies that are aggregately suboptimal yet electorally advantageous. Consequently, the prisoner's dilemma pattern that emerges is not merely a theoretical result, but rather a reflection of short-term political incentives that override long-term efficiency considerations. Mechanistically, welfare deterioration occurs through distortions in relative prices that trigger resource misallocation, a decline in purchasing power due to rising domestic prices, and disruptions to global value chains that reduce productive efficiency. The improvement in the trade balance through import compression does not reflect an enhancement of structural competitiveness, but rather indicates a contraction of domestic economic activity.

From a policy standpoint, these findings affirm that bilateral trade wars tend to produce equilibria that are harmful to both parties, making rules-based coordination a more rational choice than unilateral escalation of protection. If domestic political pressures continue to demand protection, more efficient instruments are targeted compensatory policies such as industrial adjustment support and productivity enhancement, rather than broad tariffs that distort prices and production. Furthermore, the trade balance should not be treated as a primary policy target, since a surplus that increases as a result of import restrictions is not identical to an improvement in welfare or long-term competitiveness. Theoretically, this research demonstrates that even when mercantilist preferences are incorporated into the payoff function, free trade remains the optimal outcome, such that policy coordination is not merely a normative ideal but is also consistent with long-term economic rationality.

This research contributes to the literature by integrating the computable general equilibrium (CGE) framework with a strategic interaction model that explicitly incorporates trade balance preferences into the payoff structure. Whereas previous studies have tended to analyze separately either the welfare impacts of tariffs or strategic interactions in trade, this research demonstrates quantitatively that even when mercantilist motives are formally incorporated into the national objective function, cooperative free trade remains superior within a general equilibrium framework. These findings extend the terms-of-trade externality argument by demonstrating that its strategic logic remains intact after accounting for production linkages, income effects, and global value chain interdependencies. Thus, the contribution of this research is not merely to reaffirm the inefficiency of trade wars, but to show that the structural characteristics of modern integrated economies systematically undermine the rational basis for unilateral protection, even when preference distortions are driven by political motives.

## 4. CONCLUSION

This research demonstrates that the bilateral tariff interaction between the United States and Indonesia, in the shadow of a broader Trump 2.0–BRICS confrontation, is structurally a prisoner's dilemma. Calibrated CGE simulations show that each country's best response whether payoffs are measured by pure welfare (EV) or by a composite mercantilist metric that penalises trade-balance swings remains a zero tariff. The unique Nash equilibrium sits at the free-trade corner (0%,0%), while every positive tariff combination lowers at least one player's payoff and often hurts both. Empirically, this confirms the terms-of-trade externality logic of Bagwell–Staiger in a rich, multi-sector setting: unilateral attempts to manipulate prices through tariffs backfire once general-equilibrium feedbacks are internalised.

Beyond aggregate welfare, we uncover how these strategic choices reverberate through Indonesia's value-chain position. Non-cooperative tariff pairs raise Indonesia's backward GVC participation (more foreign value added in exports) and depress forward participation (less Indonesian value embedded in others' exports), particularly in machinery, electronics, and chemical sectors. The modest EV "gains" Indonesia sometimes records when the US moves first are thus largely artefacts of diversion and higher reliance on imported inputs, not genuine upgrading.

Methodologically, this paper presents a reproducible framework that integrates discrete strategy tariff games into a CGE model, enabling the determination of Nash equilibrium from endogenously generated economic outcomes. The policy message is unambiguous: appealing to short-run trade-balance "improvements" to justify protection is misguided. Import compression can fabricate a surplus, but the welfare loss and erosion of domestic value capture dominate. For Indonesia, the more durable response lies in unilateral efficiency improvements cutting tariffs on critical intermediates, accelerating utilisation of RCEP and other preferential channels, and targeted industrial upgrading that raises domestic VA share rather than mirroring the protectionist stance of major powers. Internationally, the findings re-emphasise the value of multilateral or at least coordinated frameworks to internalise the terms-of-trade externality and keep the system away from mutually harmful equilibria.

The study is not without limitations. First, tariffs are discretised to four levels; finer or continuous strategy spaces, or endogenous instrument mixes (e.g., subsidies, NTMs), could reveal additional equilibria. Second, GTAP v11's base year and Armington elasticities constrain dynamics; investment responses, technology change, and firm-level heterogeneity are outside our static framework. Third, BRICS is modelled in blocs, potentially obscuring intra-coalition strategic divergence. Fourth, the composite payoff collapses welfare and ΔTB linearly; alternative social-welfare weights or political-economy loss functions might alter comparative statics. These caveats imply that while the qualitative prisoner's-dilemma result is robust, quantitative magnitudes should be interpreted with care.

Future work can relax these constraints by moving to a dynamic CGE with capital accumulation and endogenous productivity; modelling stochastic or repeated games, allowing reputation and trigger strategies; integrating supply-function equilibria for critical inputs (rare earths, chips) to capture quantity-price strategies beyond tariffs; employing firm-level customs data to validate sectoral TiVA shifts; and exploring climate, labour, or security externalities alongside pure terms-of-trade motives. Such extensions would enrich both the theoretical dialogue and the policy toolkit, especially for middle-income countries navigating a fragmented trading system.

In sum, the empirical and theoretical benefits of this study lie in proving with a full CGE-TiVA apparatus that tariff wars among large players trap smaller economies in inferior equilibria unless disciplined by cooperation or smart unilateral reforms. The economic benefit for Indonesia is a clearer, quantitatively grounded roadmap of which policy levers actually protect welfare and value-chain position. The key new finding is that even when governments weight the trade balance heavily, the Nash logic does not flip: free trade remains the only self-consistent choice. Recognising this early can help policymakers resist mercantilist temptations and focus on strategies that genuinely raise domestic value added in a protectionist world.

### Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

### Author Contributions

The author is solely responsible for the conceptualization, methodology, investigation, data curation, formal analysis, and the writing (original draft, review, and editing) of this manuscript.


### Funding Statement

No funding was received for this research.


### Informed Consent

This study does not involve human participants, and therefore informed consent was not required.

### Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## 5. REFERENCES


Acharya, V. V. (2015). The “greatest” carry trade ever? Understanding eurozone bank risks. *Journal of Financial Economics*, *115*(2), 215–236. https://doi.org/10.1016/j.jfineco.2014.11.004

Ahmad, T. (2020). A critical review of comparative global historical energy consumption and future demand: The story told so far. *Energy Reports*, *6*, 1973–1991. https://doi.org/10.1016/j.egyr.2020.07.020

Ak, B. (2016). Customer-base concentration and inventory efficiencies: Evidence from the manufacturing sector. *Production and Operations Management*, *25*(2), 258–272. https://doi.org/10.1111/poms.12417

Aponte-Garcia, M. (2024). Hydrocarbon trade deflection and supply-chain trade restructuring under sanctions imposed during theRussia–Ukraine conflict. *Russian Journal of Economics*, *10*(3), 299–318. https://doi.org/10.32609/j.ruje.10.125317

Arize, A. C. (2017). Do exchange rate changes improve the trade balance: An asymmetric nonlinear cointegration approach. *International Review of Economics and Finance*, *49*, 313–326. https://doi.org/10.1016/j.iref.2017.02.007

Arslan, H. M. (2022). Understanding the dynamics of natural resources rents, environmental sustainability, and sustainable economic growth: new insights from China. *Environmental Science and Pollution Research*, *29*(39), 58746–58761. https://doi.org/10.1007/s11356-022-19952-y

Bagwell, K., & Staiger, R. W. (2011). What Do Trade Negotiators Negotiate About? Empirical Evidence from the World Trade Organization. *American Economic Review*, *101*(4), 1238–1273. https://doi.org/10.1257/aer.101.4.1238

Bahmani-Oskooee, M. (2016). Nonlinear ARDL Approach and the J-Curve Phenomenon. *Open Economies Review*, *27*(1), 51–70. https://doi.org/10.1007/s11079-015-9369-5

Barrera, E. L. (2021). Global food waste across the income spectrum: Implications for food prices, production and resource use. *Food Policy*, *98*. https://doi.org/10.1016/j.foodpol.2020.101874

Bergman, L. (2005). Chapter 24 CGE Modeling of Environmental Policy and Resource Management. In K.-G. Mäler & J. R. B. T.-H. of E. E. Vincent (Eds.), *Economywide and International Environmental Issues* (Vol. 3, pp. 1273–1306). Elsevier. https://doi.org/10.1016/S1574-0099(05)03024-X

Bonsch, M. (2016). Trade-offs between land and water requirements for large-scale bioenergy production. *Gcb Bioenergy*, *8*(1), 11–24. https://doi.org/10.1111/gcbb.12226

Brander, J. A., & Spencer, B. J. (1985). Export subsidies and international market share rivalry. *Journal of International Economics*, *18*(1–2), 83–100. https://doi.org/10.1016/0022-1996(85)90006-6

Bröcker, J. (2021). Computable General Equilibrium Analysis in Transportation Economics. In *International Encyclopedia of Transportation* (pp. 520–526). Elsevier. https://doi.org/10.1016/B978-0-08-102671-7.10096-X

Bulman, D. J. (2020). The Economic Security Dilemma in US-China Relations. *Asian Perspective*, *45*(1), 49–73. https://doi.org/10.1353/apr.0.0003

Byl, C. A. Van der. (2015). Embracing Tensions in Corporate Sustainability: A Review of Research From Win-Wins and Trade-Offs to Paradoxes and Beyond. *Organization and Environment*, *28*(1), 54–79. https://doi.org/10.1177/1086026615575047

Claudy, M. C. (2016). The Roles of Sustainability Orientation and Market Knowledge Competence in New Product Development Success. *Journal of Product Innovation Management*, *33*, 72–85. https://doi.org/10.1111/jpim.12343

Csaszar, F. A. (2016). Mental representation and the discovery of new strategies. *Strategic Management Journal*, *37*(10), 2031–2049. https://doi.org/10.1002/smj.2440

Deng, X. (2016). A review on trade-off analysis of ecosystem services for sustainable land-use management. *Journal of Geographical Sciences*, *26*(7), 953–968. https://doi.org/10.1007/s11442-016-1309-9

Dixit, A. (1984). International Trade Policy for Oligopolistic Industries. *The Economic Journal*, *94*, 1. https://doi.org/10.2307/2232651

Dixon, P., & Rimmer, M. T. (2014). CGE Modelling As a Framework for Absorbing Specialist Information: Linking an Energy Model and a CGE Model to Analyse U.S. Energy Policies. In G. G. Das (Ed.), *Current Issues in International Trade: Methodologies and Development Implications for the World Economy* (pp. 183–200). Nova Science Publishers.

Dmitriev, S. (2020). Protectionist Vector of Trump Administration Trade Policy. *World Economy and International Relations*, *64*(2), 15–23. https://doi.org/10.20542/0131-2227-2020-64-2-15-23

Elatlassi, R., Martin, M. A., Calvo-Amodio, J., & Ng, E. H. (2016). A Systemic View on Game Theory: Modeling a Game of Battle of the Sexes Using Archetypes as Proof of Concept. *Proceedings of the International Annual Conference of the American Society for Engineering Management*.

Esmail, B. A. (2018). Multi-criteria decision analysis for nature conservation: A review of 20 years of applications. *Methods in Ecology and Evolution*, *9*(1), 42–53. https://doi.org/10.1111/2041-210X.12899

Fabregat-Aibar, L., Niñerola, A., & Pié, L. (2022). Computable general equilibrium models for sustainable development: past and future. *Environmental Science and Pollution Research*, *29*(26), 38972–38984. https://doi.org/10.1007/s11356-021-18030-z

Fan, S. (2018). Bargaining-based cooperative energy trading for distribution company and demand response. *Applied Energy*, *226*, 469–482. https://doi.org/10.1016/j.apenergy.2018.05.095

Fu, B. (2015). Ecosystem services in changing land use. In *Journal of Soils and Sediments* (Vol. 15, Issue 4, pp. 833–843). https://doi.org/10.1007/s11368-015-1082-x

Gereffi, G. (2020). What does the COVID-19 pandemic teach us about global value chains? The case of medical supplies. In *Journal of International Business Policy* (Vol. 3, Issue 3, pp. 287–301). https://doi.org/10.1057/s42214-020-00062-w

Gooyert, V. de. (2017). Reviewing the role of stakeholders in Operational Research: A stakeholder theory perspective. In *European Journal of Operational Research* (Vol. 262, Issue 2, pp. 402–410). https://doi.org/10.1016/j.ejor.2017.03.079

Guo, M. (2018). The Day after Tomorrow: Evaluating the Burden of Trump's Trade War. In *Asian Economic Papers* (Vol. 17, Issue 1, pp. 101–120). https://doi.org/10.1162/asep_a_00592

Hertel, T. (1997). *Global Trade Analysis: Modeling and applications*. Center for Global Trade Analysis, Department of Agricultural Economics, Purdue University.

Imai, H. (2010). Game Analysis of Kyoto and Post-Kyoto Schemes. In *Green Energy and Technology* (pp. 407–421). Springer. https://doi.org/10.1007/978-1-4419-1017-2_26

Ing, L. Y., & Vadila, Y. (2019). U.S.–China Trade Tensions on Indonesia's Trade and Investment. *Asian Economic Papers*, *18*(3), 95–112. https://doi.org/10.1162/asep_a_00726

Jia, Z., & Lin, B. (2022). CEEEA2.0 model: A dynamic CGE model for energy-environment-economy analysis with available data and code. *Energy Economics*, *112*, 106117. https://doi.org/10.1016/j.eneco.2022.106117

Kakkad, V., Shah, H., Patel, R., & Doshi, N. (2019). A Comparative study of applications of Game Theory in Cyber Security and Cloud Computing. *Procedia Computer Science*, *155*, 680–685. https://doi.org/10.1016/j.procs.2019.08.097

Klemperer, P. D., & Meyer, M. A. (1989). Supply Function Equilibria in Oligopoly under Uncertainty. *Econometrica*, *57*(6), 1243. https://doi.org/10.2307/1913707

Lamp, N. (2019). At the Vanishing Point of Law: Rebalancing, Non-Violation Claims, and the Role of the Multilateral Trade Regime in the Trade Wars. *Journal of International Economic Law*, *22*(4), 721–742. https://doi.org/10.1093/jiel/jgz041

Liebman, B. H., & Reynolds, K. M. (2022). Casualties of trade wars. *European Economic Review*, *148*, 104202. https://doi.org/10.1016/j.euroecorev.2022.104202

Martins, F., A. Pinto, A., & Passamani Zubelli, J. (2017). Nash and social welfare impact in an international trade model. *Journal of Dynamics & Games*, *4*(2), 149–173. https://doi.org/10.3934/jdg.2017009

Martins, F., Pinto, A. A., & Zubelli, J. P. (2022). Welfare–Balanced International Trade Agreements. *Mathematics*, *11*(1), 40. https://doi.org/10.3390/math11010040

Narayanan, B. G., Aguiar, A., & McDougall, R. (2012). *Global trade, assistance, and production: the GTAP 7 data base*. Center for Global Trade Analysis, Purdue University, West Lafayette.

Pempel, T. J. (2019). Right target; wrong tactics: the trump administration upends East Asian order. *The Pacific Review*, *32*(6), 996–1018. https://doi.org/10.1080/09512748.2019.1617769

Rehman, F. U., Noman, A. A., Islam, M., Wu, Y., & Metwally, A. S. M. (2025). Export diversification and disaggregate energy consumption in BRICS economies: Does environmental degradation matter? *Energy & Environment*, *36*(6), 2790–2814. https://doi.org/10.1177/0958305X231210992

Salukvadze, M. E., & Zhukovskiy, V. I. (2020). *The Berge Equilibrium: A Game-Theoretic Framework for the Golden Rule of Ethics*. Springer International Publishing. https://doi.org/10.1007/978-3-030-25546-6

Sharma, R., Sinha, A., & Kautish, P. (2021). Examining the nexus between export diversification and environmental pollution: evidence from BRICS nations. *Environmental Science and Pollution Research*, *28*(43), 61732–61747. https://doi.org/10.1007/s11356-021-14889-0

Verma, P., & Zhang, F. (2020). Game Theory and Its Applications to Communication Networks. In *Textbooks in Telecommunications Engineering* (pp. 117–124). Springer. https://doi.org/10.1007/978-3-030-33865-7_13