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Forecasting the Impact of U.S. Tariff Hikes on Malaysian Palm Oil Exports: A Scenario-Based Approach

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Abstract

This study investigates the potential economic impact of the United States' decision to raise import tariffs on Malaysian palm oil from 10% to 19%, effective August 1, 2025. Utilizing scenario-based forecasting and univariate time-series models, the analysis evaluates Malaysia's palm oil export value and the corresponding U.S. import value from 1989 to 2024, with forecasts extending through 2030. Two scenarios are simulated: a baseline scenario assuming the continuation of a 10% tariff and a shock scenario reflecting the 19% tariff hike. The results indicate significant projected revenue losses under the shock scenario—approximately USD 434,950 in export earnings and USD 2.69 million in U.S. import value over the six-year forecast period. These findings highlight the vulnerability of Malaysia's palm oil industry to protectionist trade policies and emphasize the need for strategic diversification, value-added export development, and proactive trade diplomacy. The study contributes empirical evidence to inform policy decisions in the face of external trade shocks.

Keywords: Palm Oil Exports, Trade Tariff, Malaysia–U.S. Trade, Time-Series Forecasting, Scenario Analysis

Introduction

The global palm oil industry, a vital component of international agricultural trade, has increasingly been subject to geopolitical and protectionist pressures. Malaysia, as one of the world's top palm oil producers, relies heavily on international markets to sustain its economic performance in the agribusiness sector. In July 2025, the United States initially announced an intention to raise its import tariff on Malaysian palm oil to 25%**,** replacing the existing 10% baseline. However, following diplomatic negotiations, the tariff was revised to 19% and officially implemented on August 1, 2025, as part of a broader trade recalibration under former President Donald Trump's "reciprocal tariff" agenda (Reuters, 2025; Malay Mail, 2025; USTR, 2025).

This 19% tariff applies broadly to Malaysian exports, including palm oil, while exempting certain sectors like semiconductors and pharmaceuticals. Though framed as a move toward fairer trade, the measure presents clear risks to Malaysia's palm oil export volumes, market competitiveness, and macroeconomic stability. Recent figures show that Malaysian palm oil exports to the U.S. increased by 51.8% from January to May 2025, year-on-year (MPOB, 2025). However, the new tariff introduces considerable uncertainty in terms of pricing, revenue, and long-term demand elasticity. In response, Malaysian policymakers and industry stakeholders are increasingly turning to forecasting tools and scenario simulations to anticipate potential trade disruptions and policy risks.

Scenario analysis, when combined with time-series forecasting techniques such as ARIMA**,** VAR**,** or machine learning models, enables a structured examination of how key variables—such as trade volumes, export revenues, and price indices—might evolve under varying assumptions. This study constructs two primary simulations:

1. A *baseline scenario***,** assuming the 10% tariff remains unchanged.
2. A *shock scenario*, incorporating the updated 19% tariff from August 2025 onward**.**

This methodology supports counterfactual modeling, allowing researchers and stakeholders to evaluate market volatility, revenue fluctuations, and policy impacts (Pesaran et al., 2001; Celasun et al., 2006).

Prior empirical studies have used similar approaches to examine trade policy shocks. Tokarick (2014) developed a partial equilibrium model to measure the effects of tariff liberalization, while Sahoo et al. (2022) applied structural time-series models to study trade uncertainty in South Asia. In the palm oil context, Abdul Rahman et al. (2017) utilized ARDL models to assess the impact of EU sustainability regulations. However, little research has addressed the implications of a U.S.-imposed tariff on Malaysia's palm oil exports using forward-looking scenario-based forecasting.

This study addresses this gap by modeling forecasted Malaysian palm oil exports values from 2025 to 2030 under both the 10% and 19% tariff conditions. For robustness check, the study also uses data of palm oil imported values by the U.S. within similar range of years. By comparing outcomes across the two scenarios, we provide insights into the potential fiscal impacts, market share shifts, and policy response strategies that Malaysia may consider in managing external trade shocks.

The structure of this paper is as follows. Section 2 reviews past studies on related issues. Section 3 outlines the methodology which includes data description and method of estimation for the analysis. Section 4 presents the empirical findings and section 5 concludes.

Literature Review

Tariffs are a widely studied trade policy instrument, often imposed to protect domestic industries or address trade imbalances. The impact of tariffs on export performance has been analyzed through various lenses—macroeconomic, industry-level, and product-specific. In general, empirical studies indicate that higher import tariffs reduce the competitiveness of exporting countries**,** resulting in trade diversion, volume contraction, or substitution effects (Tokarick, 2014).

Kee et al. (2009) show that trade restrictiveness indices increase significantly with ad valorem tariffs, impacting developing economies reliant on commodity exports. Likewise**,** Hufbauer and Lowry (2012) demonstrate how U.S. tariffs on Chinese solar panels led to retaliatory actions and a measurable decline in bilateral trade. These studies emphasize the importance of anticipating the second-order effects of tariffs, including price volatility and structural shifts in trade patterns.

For agricultural commodities**,** Grant et al. (2018) found that tariffs imposed by major economies on food products have disrupted global value chains, affecting exporters in Southeast Asia, including Malaysia. The introduction of non-tariff barriers and sustainability certification requirements has further complicated the export landscape, particularly for palm oil (Rasiah et al., 2015).

Time-series forecasting and scenario-based modeling have gained traction in empirical economic research, especially for analyzing the effects of external shocks such as tariffs, sanctions, or commodity price changes. These models enable policymakers to simulate counterfactual scenarios**,** improving the quality of forward-looking policy decisions. Pesaran et al. (2001) introduced a global error-correcting macroeconometric model (GVAR) that allows for regional interdependencies in forecasting exercises. Similarly, Celasun et al. (2006) used fan-chart projections to estimate primary surplus behavior under varying risk scenarios, helping fiscal authorities prepare for uncertainty.

In trade-focused studies, Sahoo et al. (2022) applied a structural time-series model to evaluate export fluctuations in response to trade policy uncertainty in South Asia. Their findings suggest that even marginal changes in tariff schedules can lead to measurable short-run and long-run effects on export behavior, exchange rate volatility, and capital flows.

Scenario analysis is particularly valuable in the context of commodities subject to both market and policy volatility**,** such as palm oil. It allows researchers to quantify the impact of alternative policy regimes—e.g., different tariff levels—on export revenue, trade flows, and market access. Abdul Rahman et al. (2017) investigated the impact of EU sustainability policies on Malaysian palm oil exports using an ARDL approach. Their findings show that both policy-related and market-related variables significantly affect export demand. Ismail et al. (2019) extended this by analyzing how certification compliance influences palm oil trade with

Western countries, underlining the importance of non-tariff considerations in export dynamics.

However, few studies have specifically modeled the U.S.-Malaysia palm oil trade under tariff shock conditions using forecast-based simulation. This gap highlights the relevance of your study in applying AR or ARMA-based models to simulate baseline vs. shock conditions, especially following the recent U.S. tariff increase from 10% to 19%.

In sum, the literature supports the use of scenario-based forecasting and time-series models to evaluate the effects of trade policy shocks on export performance. While previous studies have explored tariff impacts and palm oil trade, this research contributes uniquely by simulating the effect of a U.S.-imposed 19% tariff on Malaysian palm oil exports using forecasting models tailored to trade data. This approach is both timely and policy-relevant, given the geopolitical sensitivity and economic stakes of the palm oil industry.

Methodology

This study adopts a scenario-based time-series forecasting approach to evaluate the potential impact of the United States increasing its import tariff on Malaysian crude palm oil from 10% to 19%, which took effect on August 1, 2025. The analysis focuses on two primary variables: EXUSV, representing Malaysia's export value of crude palm oil to the U.S., and IUSV, capturing the corresponding import value recorded by the U.S., both expressed in thousands of U.S. dollars (1,000 USD). The time-series data spans from 1989 to 2024, and forecasts are generated for the period 2025 to 2030 under two conditions: a baseline scenario (10% tariff maintained) and a shock scenario (19% tariff imposed).

To ensure the robustness and reliability of the results, this study complements the primary analysis based on EXUSV (Malaysia's recorded export values) with a parallel forecast using IUSV—the U.S.-reported import values of Malaysian palm oil. This cross-reference acts as a robustness check, helping validate the consistency of trends and estimated impacts across independent reporting sources. Since trade data may vary slightly due to reporting standards, valuation methods (e.g., FOB vs. CIF), or time lags, incorporating IUSV strengthens the empirical integrity of the findings. By demonstrating similar tariff-induced effects on both datasets, the study confirms that the projected revenue losses are not an artifact of a single data source, but reflect a broader underlying trade reality.

Data were obtained from official trade source, World Integrated Trade Solution (WITS), World Bank. The raw data was cleaned and processed to maintain consistency and reflect actual trade behavior, including years with zero trade flows due to bans, voluntary restrictions, or low demand. These data characteristics—marked by intermittency, sharp jumps, and extended periods of zero trade—necessitate a careful modeling strategy that can accommodate high volatility.

To determine the appropriate forecasting models, stationarity tests were first conducted using the Augmented Dickey-Fuller (ADF) test. Where necessary, data were differenced to achieve stationarity. It is found that both variables are stationary at level. Then, model selection proceeded using visual inspection of autocorrelation (ACF) and partial autocorrelation (PACF) plots, as well as selection criteria such as the Akaike Information

Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The EXUSV series displayed extremely limited autocorrelation, suggesting no persistent trend or seasonal structure. As such, the best-fit model for EXUSV was an ARMA(0,0), a white noise process. This reflects the erratic nature of Malaysian palm oil exports to the U.S., which have been historically influenced by non-market forces such as trade bans and sustainability requirements. An ARMA(0,0) model is equivalent to a white noise or constant mean model, meaning the time series is best described by a constant value with random noise around it. The model can be written as:

$$EXUSV_t = \mu + \varepsilon_t \quad (1)$$

Where $EXUSV_t$ is the export value of Malaysian palm oil to the U.S. at time t, μ is the constant mean of the series (estimated from 1989–2024), and ε_t is a white noise error term with mean 0 and constant variance σ^2.

In contrast, the IUSV series demonstrated weak but notable autocorrelation at lag 1, supporting the use of a simple AR(1) **or** ARMA(1,0) model. An ARMA(1,0) model is simply an autoregressive model of order 1. It assumes that the current value depends on its immediate past value and a random error term. The following is the model:

$$IUSV_t = \phi_1 \cdot IUSV_{t-1} + \mu + \varepsilon_t \quad (2)$$

Where $IUSV_t$ is U.S. imports of Malaysian palm oil at time t, ϕ_1 is autoregressive coefficient, μ is constant (intercept), ε_t is white noise error term.

Forecasts were estimated in EVIEWS 12**,** using the identified univariate time-series models for each variable. Two scenarios were constructed. The *baseline scenario* assumes that the 10% U.S. import tariff remains unchanged throughout the 2025–2030 forecast horizon. The *shock scenario* incorporates the increase in tariff to 19% beginning in 2025**,** as officially announced and implemented by the U.S. Trade Representative. This policy shock is modeled as a proportional reduction in forecasted export and import values. Specifically, the post-2024 baseline forecasts are adjusted downward using a fixed 19% reduction factor. This simulates the loss in trade value resulting from reduced price competitiveness due to the higher tariff. The assumption is that most of the tariff burden falls on the Malaysian exporter rather than being passed on to U.S. consumers, a common outcome in commodity markets with elastic demand and readily available substitutes.

The forecasting simulations are presented graphically to highlight the divergence between the baseline and shock trajectories. These charts make it possible to estimate the potential impact of the tariff hike on Malaysia's export earnings and the U.S.'s import behavior. While this approach does not include a formal demand elasticity estimate, it provides a pragmatic counterfactual analysis to guide policy decisions.

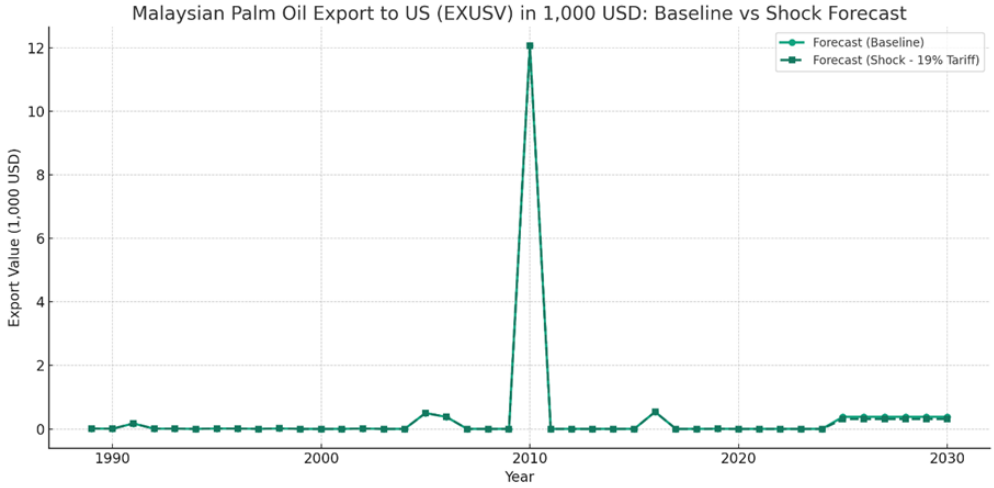
The methodology acknowledges several limitations. It assumes *ceteris paribus*, that all other macroeconomic and geopolitical factors remain unchanged. It does not model global palm oil prices, exchange rates, or competition from Indonesia and other producers. Nevertheless, this focused time-series simulation offers an empirical framework to assess the isolated impact of a tariff policy change, helping stakeholders anticipate revenue risks and inform market diversification or negotiation strategies.

Findings and Discussion

This section presents the results of the scenario-based forecasting analysis conducted on Malaysian palm oil exports to the United States. The focus is on estimating the projected export revenues under two trade policy scenarios: the *baseline scenario*, which assumes the continuation of a 10% import tariff, and the *shock scenario*, which incorporates a revised 19% tariff imposed by the U.S. beginning on August 1, 2025. Forecasts were generated using univariate time-series models (ARMA) for both EXUSV (Malaysian export value to the U.S.) and IUSV (U.S. import value from Malaysia), with historical data covering the period 1989–2024 and forecast projections for 2025–2030.

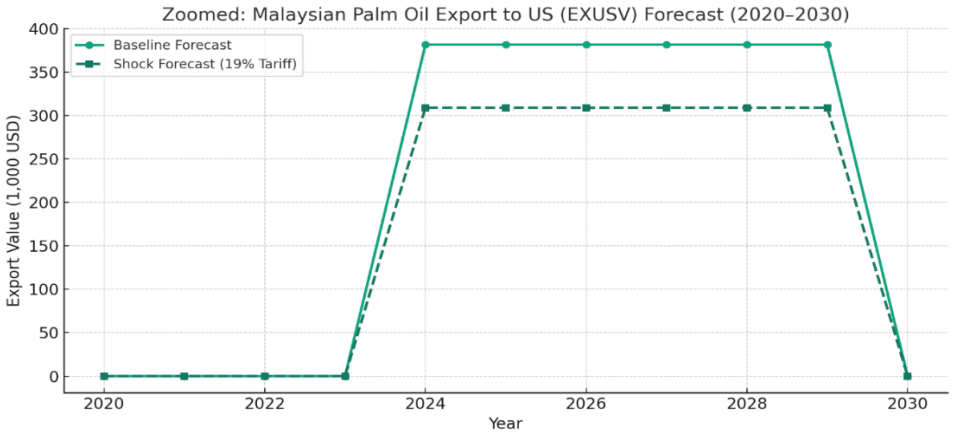
Forecast Comparison: EXUSV

The forecasts for EXUSV under the baseline and shock scenarios reveal a consistent gap in projected export values beginning in 2025 (refer to Figure 1 and 2). Under the 10% tariff baseline, the forecasted annual export value is USD 381,555 from 2025 to 2030. In the shock scenario with the 19% tariff, this value drops to approximately USD 309,059 annually. The revenue loss for each year is USD 72,496, resulting in a total projected loss of USD 434,950 over the six-year period.



Source: Authors' computation and simulation

Figure 1. Baseline vs. shock forecasts for Malaysian export value to the U.S



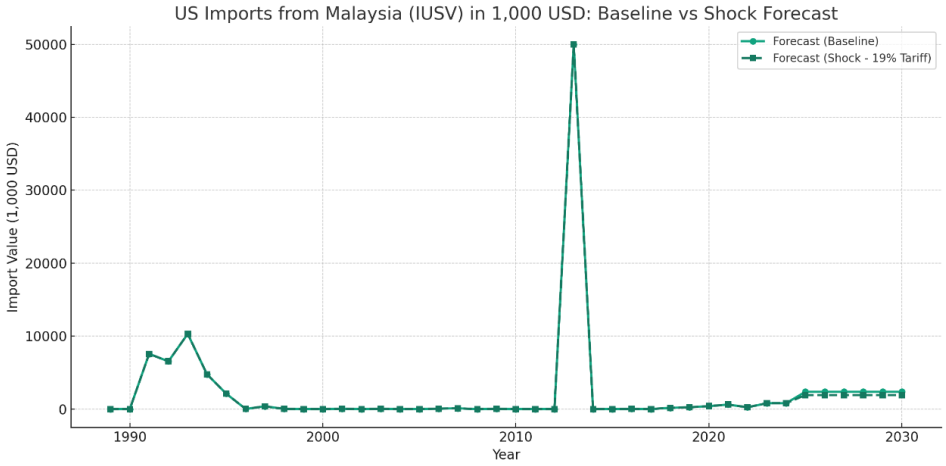
Source: Authors' computation and simulation

Figure 2. Baseline vs. shock forecasts for Malaysian export value to the U.S (zoom version from 2025 to 2030)

This reduction reflects the simulated response of the U.S. market to higher import costs, assuming that demand elasticity leads to reduced purchases from Malaysia. Given the historically volatile and policy-sensitive nature of palm oil trade with the U.S., this forecast suggests that even modest tariff hikes can significantly affect Malaysia's export performance in this niche but strategic market.

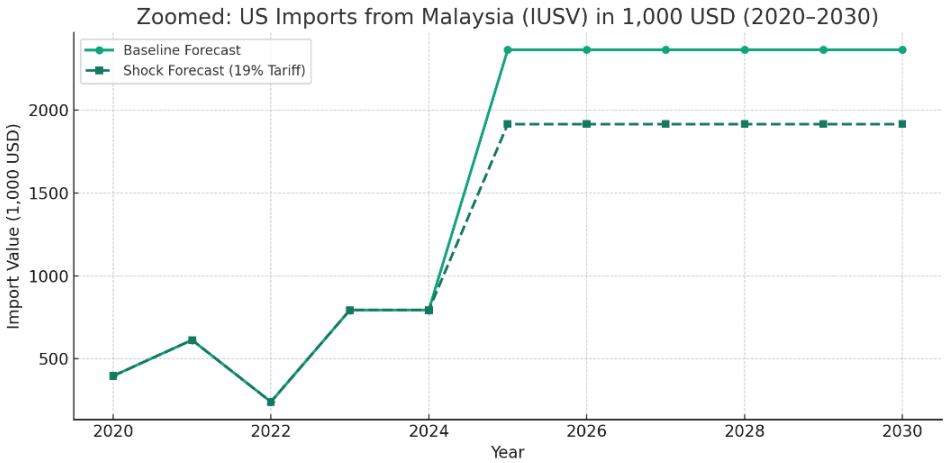
Forecast Comparison: IUSV

The IUSV projections—based on U.S. import records—provide a complementary view of trade flows and reinforce the magnitude of potential losses. Under the baseline scenario, the annual import value from Malaysia is forecasted at USD 2,363,989 from 2025 to 2030 (see Figure 3 and 4). This falls to USD 1,914,831 in the shock scenario, implying an annual reduction of USD 449,158. Cumulatively, this results in an estimated revenue loss of USD 2,694,960 over the forecast horizon.



Source: Authors' computation and simulation

Figure 3. Baseline vs. shock forecasts for U.S. imports value from Malaysia



Source: Authors' computation and simulation

Figure 4. Baseline vs. shock forecasts for U.S. imports value from Malaysia (zoom version from 2025 to 2030)

The larger loss estimate in the IUSV forecast may reflect differences in valuation methods (e.g., CIF vs. FOB), as well as additional components such as logistics and insurance costs embedded in U.S. import data. Nevertheless, both measures consistently indicate that the

19% tariff would result in a notable contraction in trade value, directly affecting Malaysia's palm oil revenue from the U.S. market.

Implications and Discussion

These findings reflect the vulnerability of Malaysian palm oil exports to trade policy shifts in destination markets, especially the U.S., which has intermittently used tariffs as tools of economic leverage. The projected losses are significant not only in absolute monetary terms but also in signalling potential risks to Malaysia's broader trade strategy and market diversification goals.

The scenario analysis also illustrates the value of counterfactual forecasting in policymaking. By simulating different tariff conditions using historical trade behavior, stakeholders can quantify the economic impact of foreign trade decisions and develop preemptive mitigation strategies. For instance, Malaysia could respond by redirecting exports to alternative markets, improving bilateral trade diplomacy, or enhancing value-added processing to maintain competitiveness despite higher tariffs.

The findings of this study align with prior literature emphasizing the disruptive effects of trade protectionism on developing-country exports, particularly in commodity-based sectors. The observed revenue losses under the tariff shock scenario are consistent with the theoretical frameworks proposed by Tokarick (2014), who used partial equilibrium modeling to demonstrate how tariff increases reduce trade volumes and welfare in exporting countries. Similarly, Sahoo et al. (2022) highlighted how policy uncertainty, including tariff changes, leads to significant export fluctuations in South Asian economies—mirroring the potential instability faced by Malaysia in the wake of the U.S. tariff revision. The application of univariate time-series models in this study echoes the methodological approach of Abdul Rahman et al. (2017), who employed ARDL models to simulate the impact of EU sustainability policies on palm oil exports, concluding that policy shocks lead to material export losses.

Furthermore, the use of both EXUSV and IUSV datasets in a dual-model robustness check builds on the best practices outlined by Celasun et al. (2006), who recommend incorporating multiple data sources and counterfactual simulations to assess the macroeconomic implications of external shocks. This dual-variable approach also helps to mitigate the reporting bias concerns raised in studies such as Gaulier and Zignago (2010), which discuss discrepancies in international trade data due to valuation or timing differences.

Overall, this study extends prior work by applying scenario-based forecasting to quantify the trade policy impact in a real-world bilateral context, namely the U.S.–Malaysia palm oil trade. It contributes new empirical evidence on the magnitude of export vulnerability in a high-stakes commodity market, while reinforcing the broader economic argument that tariff-induced shocks carry both short-term financial costs and long-term strategic consequences.

Conclusion and Policy Recommendations

The current study employed a scenario-based forecasting approach using univariate time-series models to assess the economic impact of the U.S. import tariff increase on Malaysian palm oil exports. By analyzing historical data from 1989 to 2024 and projecting trade flows for 2025 to 2030 under two policy scenarios—a baseline 10% tariff and a shock 19% tariff—

the study quantified the potential revenue loss for Malaysia. The results indicate that Malaysia could face a revenue shortfall of approximately USD 434,950 (based on EXUSV data) and USD 2.69 million (based on IUSV data) over the forecast horizon due to the tariff hike. These projections highlight the sensitivity of Malaysia's palm oil exports to trade policy changes in key markets like the United States. While the U.S. may not be the largest buyer of Malaysian palm oil, shifts in its trade policy can signal broader geopolitical and protectionist trends that could affect Malaysia's global trade standing.

The volatility in historical trade flows and the observed inconsistency in annual export values also highlight structural vulnerabilities in the palm oil trade—ranging from sustainability concerns and non-tariff barriers to over-reliance on a limited set of export destinations.
As for policy recommendations, few are suggested:

Diversification of Export Markets
Malaysia should intensify efforts to diversify its palm oil export markets, particularly toward emerging economies in Africa, the Middle East, and Central Asia, which may offer growing demand with fewer protectionist restrictions. Trade agreements under ASEAN, RCEP, or bilateral pacts with countries outside the traditional Western bloc could help reduce over-reliance on the U.S. and EU markets.

Strengthening Trade Diplomacy
The government should engage in targeted trade diplomacy with the United States to negotiate exemptions, tariff reductions, or special treatment under strategic commodity frameworks. This could involve demonstrating improved sustainability compliance or offering reciprocal trade benefits in sectors of interest to the U.S.

Value-Added Upgrading
To mitigate the impact of tariffs on raw palm oil exports, Malaysia should promote downstream processing and value-added palm-based products, such as oleochemicals, cosmetics, and biofuels. These products are less likely to face the same tariff structure and could provide higher profit margins, cushioning the impact of volume-based revenue declines.

Development of Trade Forecasting Systems
This study underlines the usefulness of empirical, scenario-based forecasting tools. Institutionalizing such models within trade ministries or export councils could enhance Malaysia's preparedness for future shocks—whether tariff-related, geopolitical, or environmental. Capacity-building in economic modeling, data analytics, and risk simulation should be prioritized.

Enhancing Domestic Industry Resilience
In addition to export-oriented strategies, domestic policies should focus on improving efficiency, sustainability, and productivity within the palm oil sector. Investments in research and development, labor mechanization, and sustainable certification (e.g., MSPO, RSPO) can help the industry remain globally competitive in the face of increasing trade scrutiny.

Thus, the imposition of a 19% U.S. tariff on Malaysian palm oil in 2025 presents a critical case study in how trade policy shocks can affect export performance and economic resilience.

Through proactive policy responses grounded in empirical forecasting and international engagement, Malaysia can not only mitigate current risks but also position its palm oil industry for more sustainable and diversified long-term growth.

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