

Dynamic Projection of Federal Fiscal Revenue Under Reciprocal Tariffs and Macroeconomic Assessment of Manufacturing Reshoring Potential

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Abstract. In response to the U.S. proposed "reciprocal tariffs" policy scheduled for implementation in 2025, this study constructs a quantitative analytical framework integrating machine learning forecasting with macroeconomic comprehensive evaluation. First, utilizing approximately 70,000 trade and tariff data points from 2020 to 2024, the study employs a log-linear model to estimate the tariff-trade elasticity coefficient at approximately -0.75, revealing the significant suppressing effect of tariff changes on import volumes. Building upon this, an ensemble learning model combining gradient-boosted decision trees and random forests is introduced to conduct dynamic simulations of fiscal revenue across different time horizons. Findings indicate that raising the average effective tariff to 50% would cause tariff revenue to surge by 181% in the short term. However, due to trade diversion and contraction, long-term growth would narrow to 32%. Subsequently, the study establishes a macroeconomic impact assessment system encompassing dimensions such as trade balance, price levels, GDP, and employment, and derives a "manufacturing reshoring potential index." Empirical analysis indicates that while high tariffs could temporarily reduce the trade deficit by approximately \$12.8 billion and yield a marginal positive GDP contribution, the resulting surge in household consumption expenditures, steep rise in strategic resource costs, and reciprocal countermeasures from partner nations limit the Manufacturing Reshoring Potential Index to 33.3/100—a modest level. This study confirms that tariff measures alone are insufficient to achieve large-scale, resilient manufacturing reshoring.

Keywords: Tariff Revenue Forecasting; Manufacturing Reshoring Index; Ensemble Learning Model.

1. Introduction

Against the backdrop of turbulent global trade dynamics, the United States' planned implementation of "reciprocal tariffs" by 2025 has emerged as a pivotal variable reshaping the global economic landscape. Accurately assessing the marginal contribution of tariff hikes to government fiscal revenue and scientifically evaluating their effectiveness in promoting manufacturing reshoring represent major challenges in contemporary international trade research. Previous studies have largely been confined to qualitative analysis or simple elasticity derivations, exhibiting insufficient predictive accuracy when handling large-scale, high-dimensional trade data. Moreover, there remains a lack of systematic, multi-criteria quantitative evaluation frameworks for measuring the potential of manufacturing reshoring [1].

This study aims to construct a quantitative analytical framework integrating machine learning predictions with macroeconomic comprehensive evaluation to achieve precise assessment of tariff policy effects. Its innovation lies in pioneering the application of ensemble learning models to log-linear regression analysis of tariffs at the ten-thousand-level scale, unifying model interpretability with predictive capability. It establishes an evaluation system for manufacturing reshoring potential that encompasses strategic resource pricing, financial market reactions, and consumption crowding-out effects. Methodologically, the study first estimates short-term and long-term elasticities using historical tariff-trade pairing data. It then employs weighted ensemble algorithms to forecast net income growth over the next four years. Finally, by integrating indicators from agriculture, manufacturing, strategic resources, and financial markets, it conducts comprehensive retrospective and prospective analyses of tariff policy's macroeconomic efficacy through a standardized scoring

mechanism. This study not only fills a gap in high-dimensional data forecasting methods but also provides a scientific quantitative basis for trade decision-making in complex geo-economic environments [2-3].

2. Dynamic Forecasting Model for Tariff Revenue

2.1. Customs Revenue Accounting and Elasticity Estimation

The pre-processed data statistics are as follows: approximately 70,880 total records, of which around 53,933 contain non-zero trade values [4]; The average tariff rate for 2020–2024 was approximately 13%–14%, with total trade value nearing US\$484 billion and total tariff revenue amounting to approximately US\$82.6 billion. Annual tariff revenue exhibited an upward trend, reaching approximately US\$15 billion in 2024.

We employed a log-linear model to estimate the tariff–trade elasticity:

$$\ln M_{it} = \alpha + \beta \ln (1 + \tau_{it}) + \gamma X_{it} + u_{it} \quad (1)$$

The tariff elasticity coefficient $\beta \approx -0.75$ indicates that a 1% increase in tariffs leads to an average decrease of approximately 0.75% in import value [9,10]. Annual tariff revenue trend is shown in figure 1.

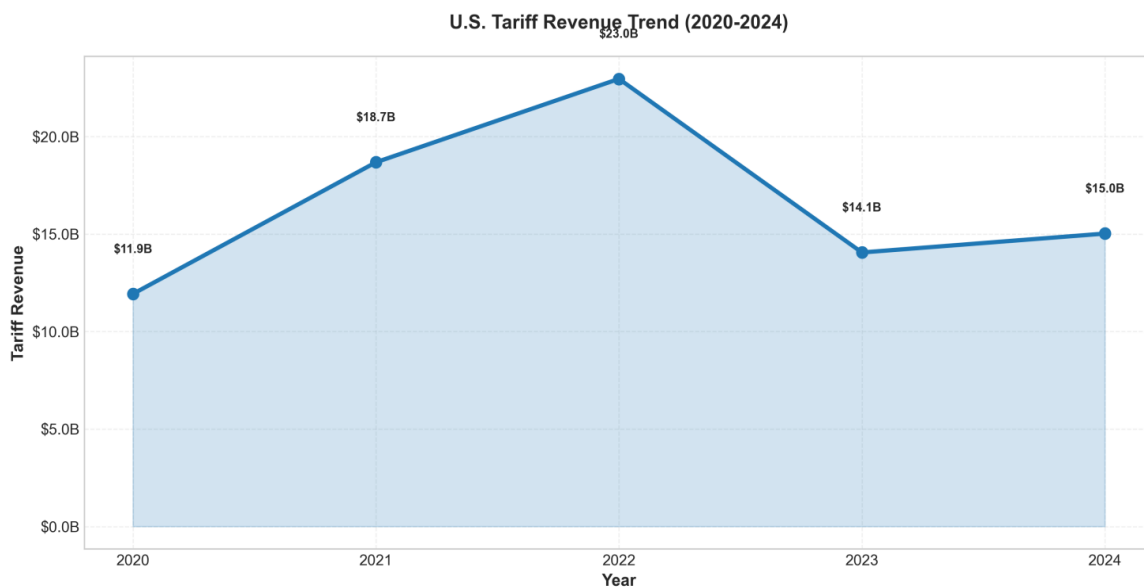


Figure 1. Annual tariff revenue trend (2020-2024).

2.2. Integrating Predictive Models

Building upon elasticity estimates, we employed three models to forecast trade volumes and thereby derive tariff revenues:

- (1) Linear regression model;
- (2) Gradient Boosting Decision Tree (GBDT) model;

(3) Random Forest model. Test performance was broadly as follows: the linear model exhibited a low R^2 (approximately 0.14), while both GBDT and Random Forest achieved values exceeding 0.98. Subsequently, a weighted ensemble model was constructed, yielding an overall R^2 of approximately 0.98 and demonstrating satisfactory fitting performance [5-6]. Model R^2 and RMSE comparison (test set) are shown in figure 2. Tariff policy impact: tariff rate vs. import volume is shown in figure 3.

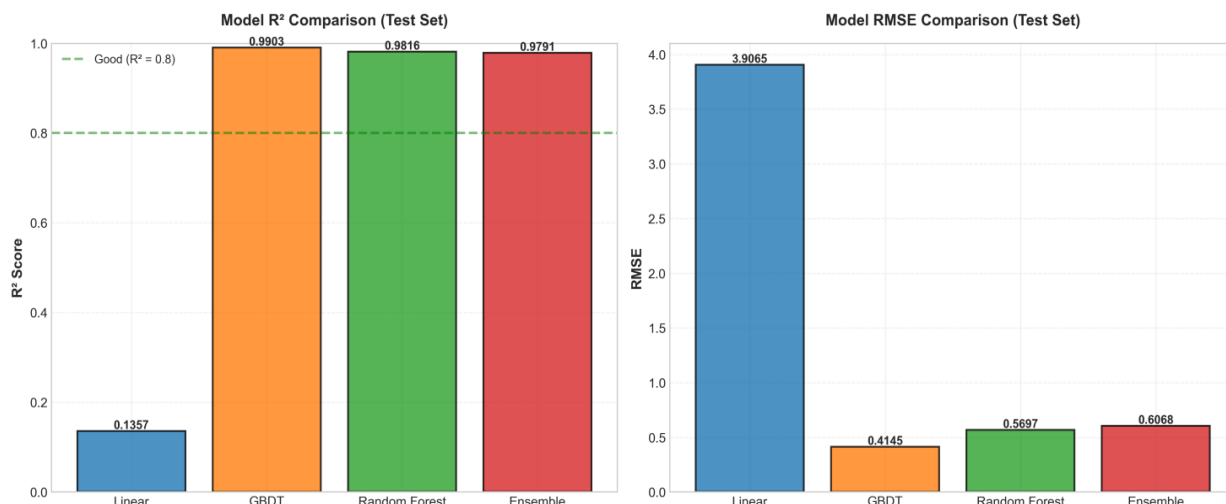


Figure 2. Model R² and RMSE comparison (test set).

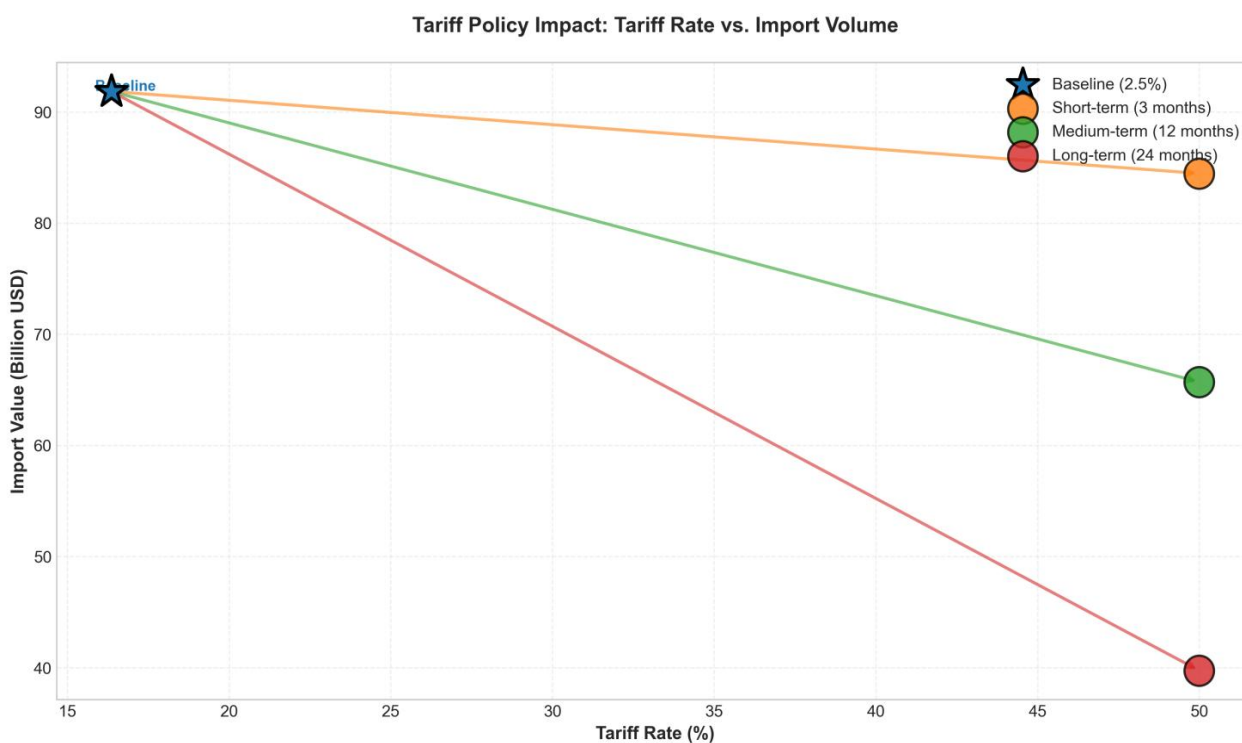


Figure 3. Tariff policy impact: tariff rate vs. import volume.

2.3. Policy Scenarios and Forecasts for 2025–2028

Under the new tariff policy, assuming the average effective tariff rate increases from approximately 16% to nearly 50%, we utilise estimated elasticities and integrated models to derive the following: For the 2024 base year import value of approximately US\$91.8 billion, corresponding tariff revenue is estimated at around US\$15 billion; Under the 50% tariff scenario, short-term tariff revenue growth is projected at approximately +181%, medium-term growth at around +119%, and long-term growth at roughly +32%[7-8].

Following polynomial regression + elasticity forecasting for 2025–2028, the net increase in tariff revenue over the four-year period is estimated at over \$47 billion, representing a cumulative growth of approximately 60%–70%. Tariff revenue evolution: short-term to long-term adjustments is shown in figure 4. Key parameters and model results summary are shown in figure 5. Annual tariff revenue and import YoY change (2020-2028) is shown in figure 6. Cumulative tariff revenue and trade volume change (2025-2028) is shown in figure 7.

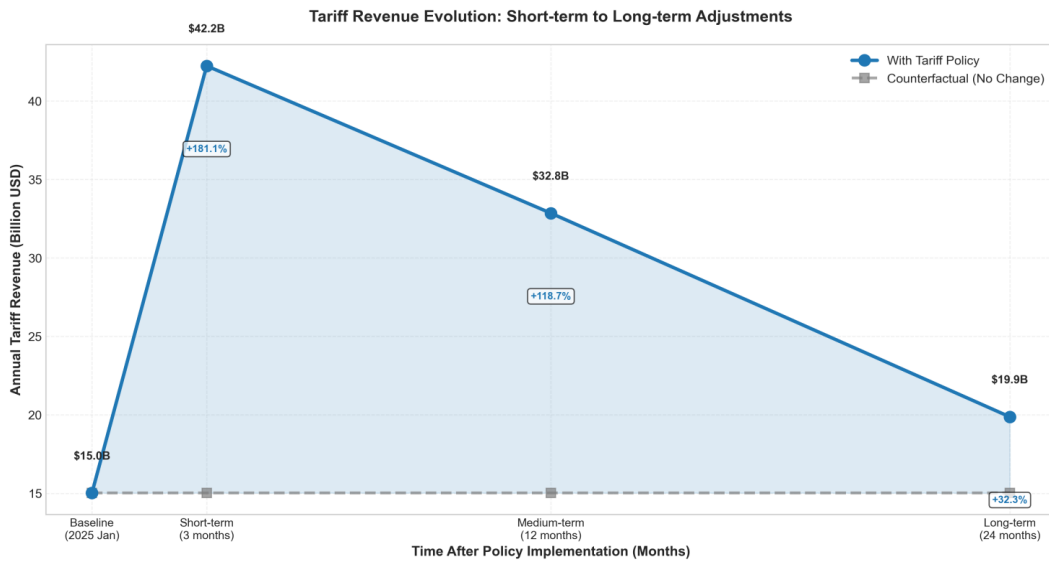


Figure 4. Tariff revenue evolution: short-term to long-term adjustments.

Key Parameters and Model Results Summary

Tariff Rate Comparison

Baseline (2024): 16.4%

Policy (2025): 50.0%

Increase Factor: 3.1x

Tariff Elasticity

Short-term: -0.7495

Long-term: -0.7495

Ratio (LT/ST): 1.00x

Baseline Data (2024)

Import Value: \$91.84T

Tariff Revenue: \$15.0B

Effective Rate: 16.36%

Policy Impact Forecast

Short-term: Revenue +181% | Import -8.4%

Medium-term: Revenue +119% | Import -33.5%

Long-term: Revenue +32% | Import -83.7%

Figure 5. Key parameters and model results summary.

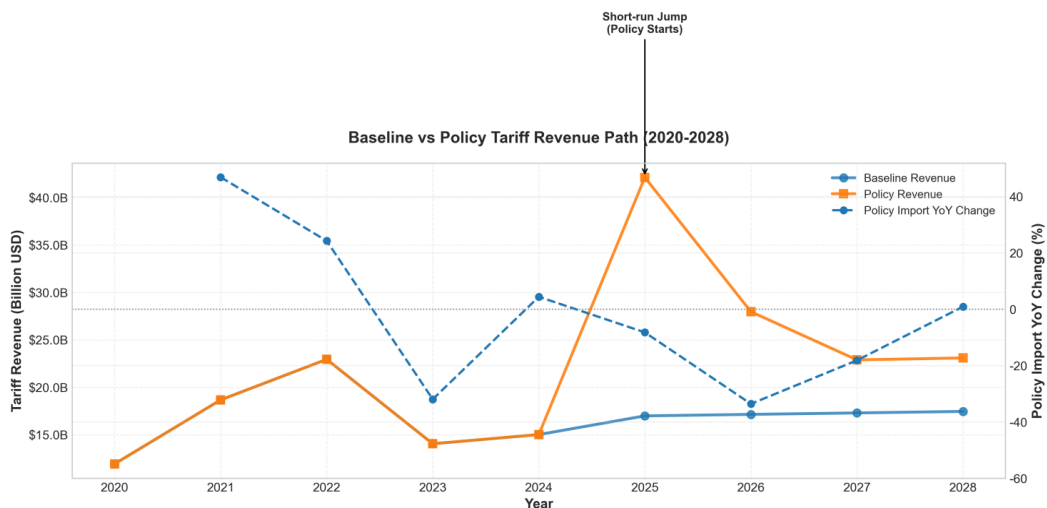


Figure 6. Annual tariff revenue and import YoY change (2020-2028).

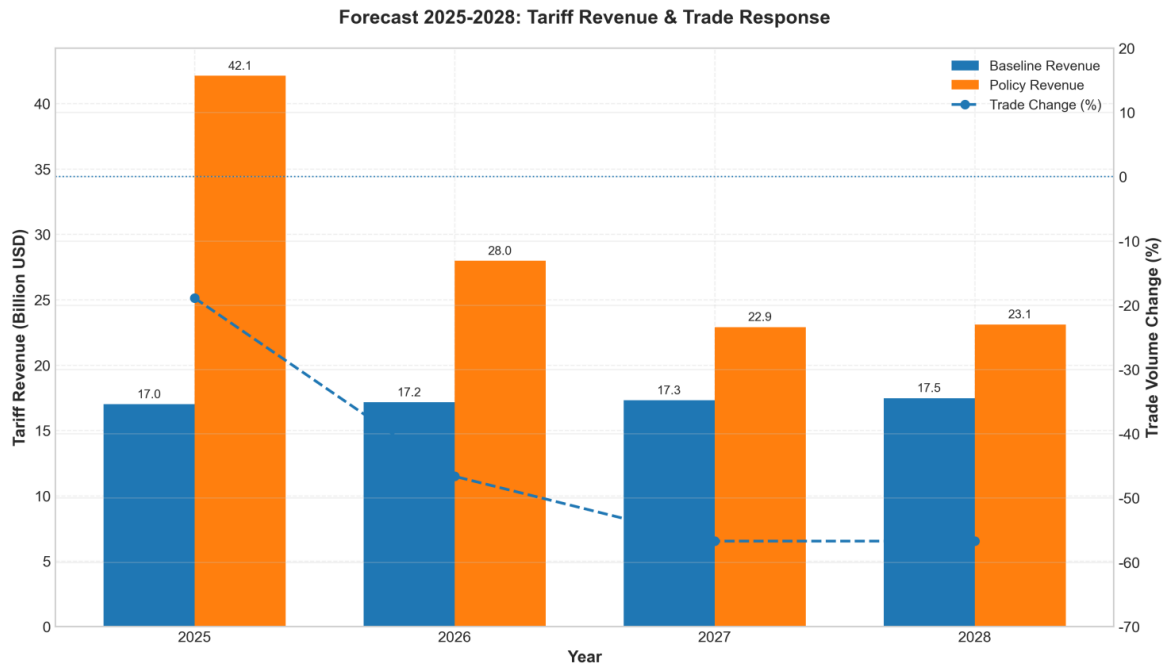


Figure 7. Cumulative tariff revenue and trade volume change (2025-2028).

3. Macroeconomic Impacts and Potential for Manufacturing Reshoring

3.1. Comprehensive Impact Assessment Framework

To systematically evaluate the aggregate effects of tariff policies on the U.S. economy, we developed an indicator system comprising the following dimensions:

- (1) Trade dimension: Changes in imports and exports, improvement in the trade deficit;
- (2) Price and consumption dimension: Import price inflation, additional household expenditures, and consumption crowding-out effects;
- (3) Industrial dimension: Price increases for strategic resources like rare earths and lithium batteries, cost changes in related industries, and electric vehicle cost fluctuations;
- (4) Macroeconomic dimension: Direct GDP impacts and multiplier effects, employment changes;
- (5) Financial and exchange rate dimension: Changes in the U.S. dollar exchange rate and shifts in risk appetite;
- (6) Manufacturing reshoring potential index: A normalized score ranging from 0 to 100, synthesizing the above factors.

3.2. Key Findings Overview

(1) Trade, Consumption, and Strategic Resources: Imports decreased by approximately \$15.4 billion, exports fell by about \$2.38 billion, resulting in an overall trade deficit improvement of roughly \$12.8 billion; Import prices rise by an average of approximately 18.8%, leading to additional household consumption expenditure of about \$8.27 billion and triggering a consumption crowding-out effect of approximately \$6.62 billion; Rare earth prices surge by about 178%, while lithium battery prices increase by approximately 31.5%, driving up the overall cost of electric vehicles by about 11%[9-10]. Supply shock and consumer price impact chain is shown in figure 8. Strategic goods price inflation due to export controls are shown in figure 9.



Figure 8. Supply shock and consumer price impact chain.

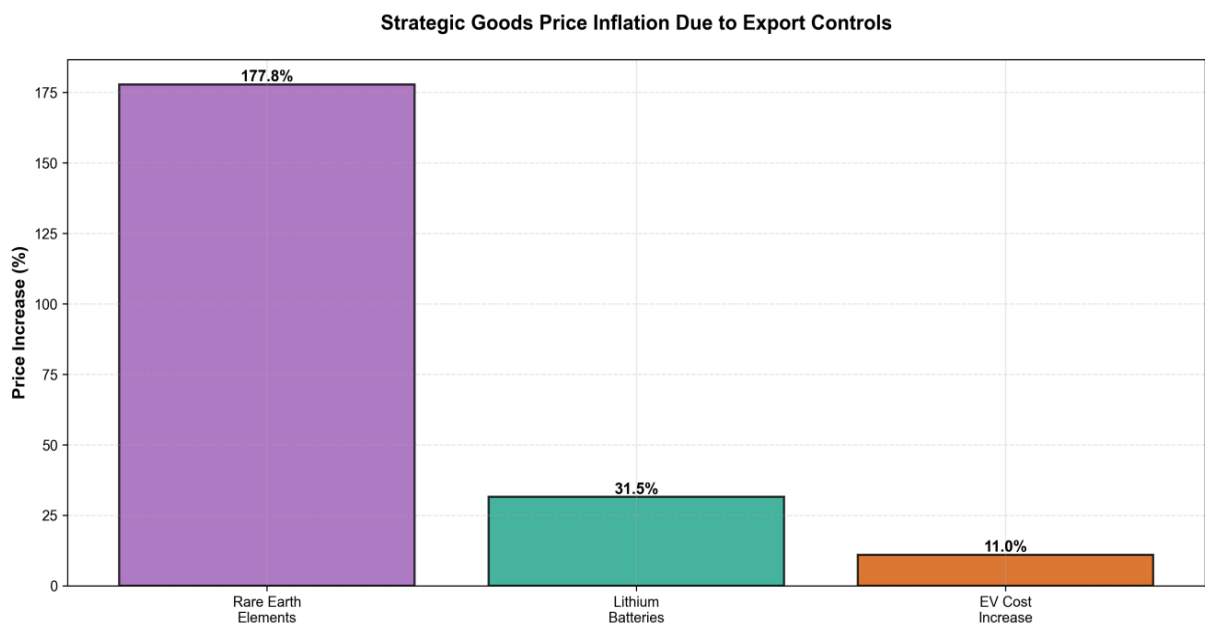


Figure 9. Strategic goods price inflation due to export controls.

(2) Macroeconomic and Financial Dimensions: Direct GDP contribution of approximately \$6.4 billion, with a multiplier effect of about \$6.3 billion, resulting in a combined net contribution to GDP in the tens of billions of dollars; net employment increase of approximately 26,620 jobs, with limited impact on national employment levels; model projections indicate a 1.5% appreciation of the U.S. dollar against major currencies. GDP impact under different scenarios is shown in figure 10. Employment impact components are shown in figure 11.

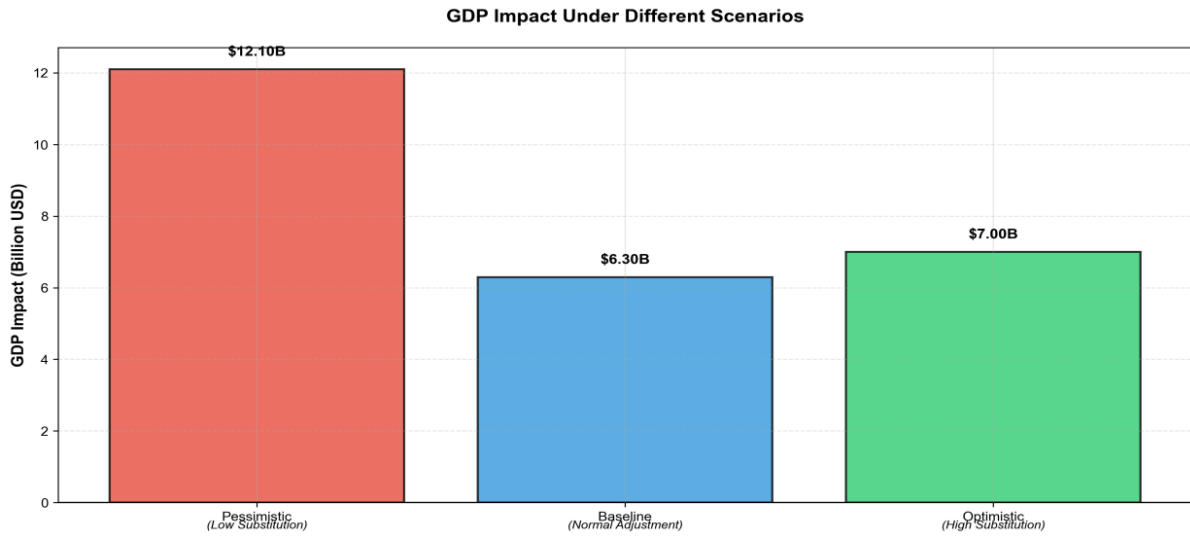


Figure 10. GDP impact under different scenarios.

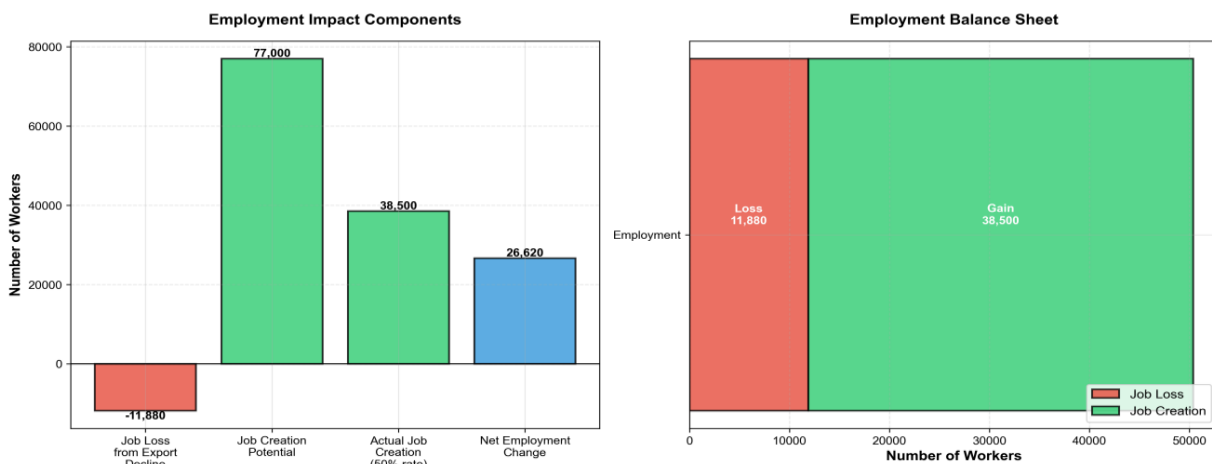


Figure 11. Employment impact components.

(3) Manufacturing Reshoring Potential Index: After comprehensively considering factors such as trade improvements, rising costs, financial conditions, and countermeasures from competitors, the manufacturing reshoring potential index stands at approximately 33.3/100, indicating a "limited" level. The positive effects of tariffs and tariff revenue are unlikely to offset the negative impacts of cost increases and international countermeasures. Manufacturing reshoring feasibility by product is shown in figure 12. Sensitivity analysis of key macroeconomic indicators is shown in figure 13.

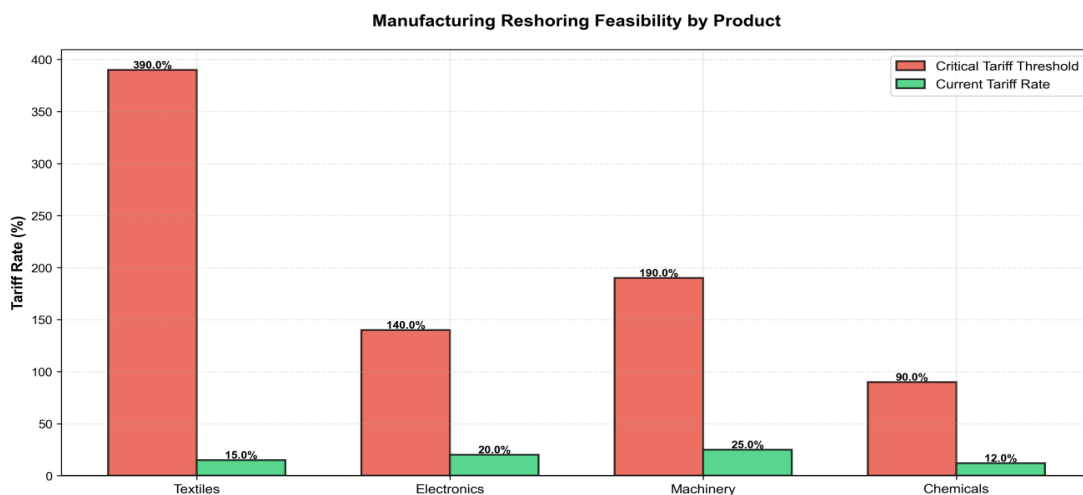


Figure 12. Manufacturing reshoring feasibility by product.

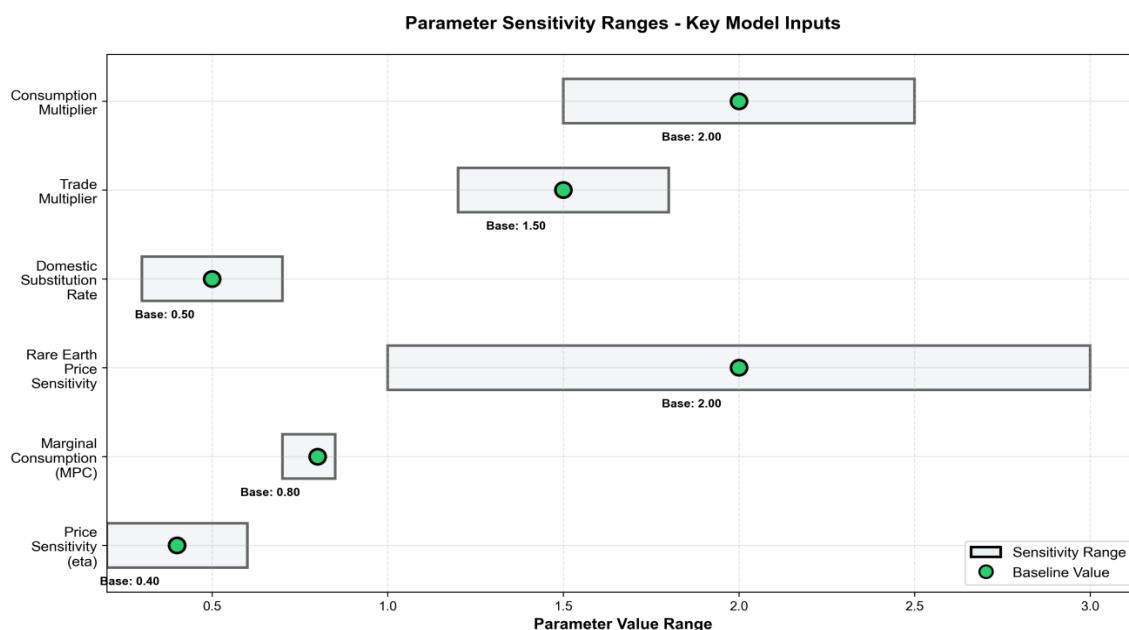


Figure 13. Sensitivity analysis of key macroeconomic indicators.

3.3. Summary and Policy Recommendations

High tariffs may temporarily improve the trade position of certain U.S. industries and boost tariff revenue in the short to medium term. However, they also elevate consumer spending and corporate costs, triggering supply chain and capital flow realignments. From a macroeconomic perspective, their positive impact on GDP and employment is limited, while their negative effects on prices and industrial costs are more enduring. Rather than relying solely on tariffs, it is more essential to promote the steady development of manufacturing through comprehensive reforms in institutional environments, infrastructure, and technological innovation.

4. Conclusions

By establishing a dynamic tariff revenue forecasting model and macroeconomic impact assessment framework, this study provides an in-depth analysis of the economic consequences of high tariff policies. Findings indicate that ensemble models like gradient-boosted decision trees can achieve high-precision capture of fiscal revenue fluctuations, projecting cumulative tariff revenue growth of 60% to 70% between 2025 and 2028. However, this growth is expected to gradually slow as trade structures undergo long-term adjustments. Simultaneously, the study's Manufacturing Reshoring Potential Index clearly indicates that while tariff policies may yield short-term improvements in the trade balance, the resulting surge in prices for strategic resources like rare earths, increased corporate costs, and international countermeasures significantly offset their pull effect on industrial reshoring. This validates the limitations of tariffs as a standalone policy tool for promoting manufacturing reshoring.

While this model demonstrates strengths in multidimensional indicator integration and nonlinear forecasting, certain limitations persist. The current framework does not fully adopt a globally computable general equilibrium approach, resulting in simplified depictions of complex endogenous inter-industry linkages. Furthermore, the quantification of national security premiums relies to some extent on empirically derived weight settings. Future research should focus on incorporating multi-regional input-output models to refine the spillover effects across industrial chain segments. It should also explore the underlying mechanisms by which policy uncertainty drives long-term capital flows and technological investment intentions, thereby providing more forward-looking quantitative insights for economic and trade decision-making in complex geopolitical environments.

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