

The Impact of Sino-US Trade Friction on the Total Factor Productivity of Manufacturing Enterprises in China

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Abstract

This study examines the impact of the 2018 Sino-US trade friction on the total factor productivity (TFP) of manufacturing firms. Employing a multi-period difference-in-differences model and drawing on theories of creative destruction and growth options, we analyze data from A-share listed manufacturing firms in China from 2014 to 2023. Our findings indicate that: (1) The trade friction exerted a significant forcing effect, compelling firms to improve their TFP. (2) The underlying mechanisms include enhanced asset operational efficiency, intensified innovation efforts, and increased competitive pressure within industries. This research provides micro-level evidence and policy insights for governments to design targeted and differentiated policies aimed at stimulating firms' endogenous dynamism and systematically strengthening the resilience of the manufacturing sector in complex international trade environments.

Keywords

Sino-US Trade Friction; Total Factor Productivity; Manufacturing; Difference-In-Differences Mode

1. Introduction

Manufacturing constitutes the cornerstone of a nation's economy and the foundation of its strength. The report of the 20th National Congress of the Communist Party of China explicitly identified "promoting the high-end, intelligent, and green development of manufacturing" as a core task in building a modernized industrial system. Currently, China's manufacturing sector has developed the world's most comprehensive and largest industrial system, with its Manufacturing Power Development Index consistently ranking within the second global tier. However, amid a global economic slowdown and rising unilateralism and trade protectionism, China's rapid manufacturing ascendance has triggered strategic

vigilance and containment from Western developed nations, most notably the United States. Since 2018, the U.S. has unilaterally initiated a trade dispute with China under the pretext of trade imbalance, frequently implementing sanctions such as tariff hikes, export controls, and market access restrictions. These measures pose severe challenges to the stability of global industrial and supply chains and the high-quality development of China's manufacturing sector. In this context, delving into the micro-level impact of external trade shocks on the core competitiveness of China's manufacturing enterprises carries significant theoretical and practical relevance.

Total Factor Productivity serves as a core, comprehensive indicator for measuring technological progress, resource allocation efficiency, and management effectiveness within enterprises, and is a key driver of high-quality economic development. Existing research on the economic effects of Sino-US trade friction has predominantly focused on macroeconomic growth, industrial structural adjustments, financial market volatility, and specific firm behaviors such as exports and innovation. Comparatively less attention has been directed toward assessing the net impact on TFP—a comprehensive measure of enterprise efficiency—or the underlying transmission mechanisms. Furthermore, a more nuanced investigation is needed regarding the heterogeneous effects of trade friction across different types of enterprises. Accordingly, this study treats the four rounds of tariff lists targeting Chinese exports issued by the U.S. Trade Representative (USTR) between 2018 and 2019 as a quasi-natural experiment. Grounded in theories of creative destruction and growth options, a multi-period difference-in-differences (DID) model is constructed to systematically examine the causal effect, transmission channels, and heterogeneous patterns of the Sino-US trade friction on the TFP of China's manufacturing firms. The aim is to provide robust empirical evidence for evaluating the micro-level economic consequences of external shocks, clarifying enterprise response mechanisms, and formulating precise and effective industrial and trade policies.

The potential contributions of this paper are threefold: First, from a research perspective, it integrates the analysis of international trade friction with enterprise comprehensive efficiency, offering a fresh viewpoint for understanding the long-term micro-level impacts of external shocks. Second, in terms of mechanism elucidation, it establishes a systematic mediation analysis framework encompassing asset operation efficiency, enterprise innovation, and industry competition pressure, thereby revealing the multiple pathways through which trade friction forces enterprises to enhance TFP. Third, regarding policy implications, the multi-dimensional heterogeneity analysis clarifies the structural characteristics and boundary conditions of policy effects, providing an empirical basis for implementing targeted and differentiated support for manufacturing enterprises.

2. Literature Review

2.1. Research on Enterprise Total Factor Productivity

The study of enterprise Total Factor Productivity is relatively mature in academia. In terms of measurement methods, the field has evolved from Ordinary Least Squares (OLS) and Fixed Effects (FE) models to semi-parametric estimation methods tiveness in mitigating endogeneity and sample selection bias (Lu and Lian, 2012). Regarding influencing factors, research is primarily divided into external macroeconomic environments and internal corporate behaviors. External factors include market competition and government policies (Cao and Zeng, 2024), while internal factors focus on corporate innovation, organizational management optimization, and resource allocation efficiency (Lei et al., 2024).

2.2. Research on Sino-US Trade Friction

Regarding the causes of Sino-US trade friction, the academic consensus is that it results from a combination of economic factors, technological factors and political factors. Its impact effects are extensive. Macro-economically, it shocks global value chains and financial markets. Micro-economically, it directly affects corporate performance and exports. Its impact on corporate innovation is debated, with arguments both for suppression and for a "forcing" effect (Lang and Li, 2024). In terms of empirical methods, macroeconomic studies commonly use Computable General Equilibrium (CGE) and Global Trade Analysis Project (GTAP) models, while research at the firm level widely employs the Difference-in-Differences (DID) method and its multi-period forms.

2.3. Research on Sino-US Trade Friction and Enterprise TFP

Literature directly exploring the relationship between the two is relatively limited. Some studies approach the topic from a trade policy perspective, suggesting that trade liberalization promotes TFP, while restrictive policies may inhibit it (Zeng et al., 2023). Other research analyzes from the angle of uncertainty, proposing that a reduction in trade policy uncertainty can promote TFP. However, the uncertainty brought by external shocks itself may also compel firms to adjust through a pressure mechanism, thereby enhancing productivity. Concerning transmission channels, existing studies sporadically mention that trade friction may affect TFP by influencing corporate innovation, resource allocation, and industry competition, but have not yet integrated these into a systematic analytical framework. Furthermore, research on the heterogeneous impacts across firms with different characteristics requires further deepening.

3. Theoretical Analysis and Research Hypotheses

3.1. Theoretical Foundation and Overall Effect Hypothesis

The theory of creative destruction posits that the economy evolves through a discontinuous process of "destruction-creation." The shocks constituted by the 2018

Sino-US trade friction, such as tariffs and technology blockades, violently disrupted firms' existing cost structures, technological pathways, and market dependencies, creating immense survival pressure. According to growth options theory, in this context, abandoning efficiency reforms means permanently forfeiting future competitiveness, while proactively making strategic investments to realize "growth options" becomes the rational choice. To survive, firms are forced to initiate a series of "creative" defensive and transformative measures, such as optimizing resource allocation, increasing R&D investment, and restructuring supply chains, thereby driving the reshaping of the production function and TFP improvement.

3.2. Mechanism Analysis and Sub-hypotheses

Trade friction intensifies business risks and cash flow constraints for firms, altering the incentive structure for management and forcing the alignment of their personal interests with the firm's long-term value. This motivates management to curb agency problems, enhance asset operation efficiency by revitalizing idle assets, optimizing processes, and accelerating turnover, thereby improving TFP (Tan and Zhang, 2017).

External technology blockades and market competition pressure cut off paths for technology import, stimulating an urgent need for independent innovation. Concurrently, subsidies and policy support provided by the government to counter the friction reduce innovation costs for firms. To build long-term advantages, firms will increase R&D investment, directly boosting TFP through technological innovation and digital application (Lang and Li, 2024).

Tariff barriers lead to export obstruction, causing many firms to compete for the domestic market, thereby intensifying industry competition. The risk of key intermediate goods supply disruption also forces downstream firms to accelerate domestic substitution, further competition. Intense competitive pressure compels firms to optimize production processes and achieve technological breakthroughs to maintain market share, thereby driving TFP improvement.

4. Model Specification

Given that the U.S. imposed tariffs on Chinese goods in four rounds during 2018-2019, this study employs a multi-period Difference-in-Differences (DID) model for empirical testing. The benchmark model is specified as follows:

$$TFP_{it} = \beta_0 + \beta_1 Treat_{it} + \beta_2 X_{it} + \eta_t + \lambda_i + \varepsilon_{it} \quad (1)$$

To examine the underlying mechanisms, the following models are constructed:

$$Channel_{it} = \beta_0 + \beta_1 Treat_{it} + \beta_2 X_{it} + \eta_t + \lambda_i + \varepsilon_{it} \quad (2)$$

$$TFP_{it} = \beta_0 + \beta_1 Treat_{it} + \beta_2 Channel_{it} + \beta_3 X_{it} + \eta_t + \lambda_i + \varepsilon_{it} \quad (3)$$

Firm financial data are sourced from the CSMAR database; U.S. tariff lists are from the USTR website; and industry matching data are from the UN Comtrade database.

The sample covers A-share listed manufacturing firms in the Shanghai and Shenzhen stock exchanges from 2014 to 2023. Continuous variables are winsorized at the 1st and 99th percentiles.

5. Empirical Analysis

5.1. Baseline Regression Results

Table 1 presents the baseline regression results estimating the impact of Sino-US trade friction on manufacturing firm TFP based on Equation (1). For robustness, we compare results using Ordinary Least Squares (OLS) and Fixed Effects (FE) estimators alongside the primary LP method.

Focusing on the widely used LP method results, column (1) shows the baseline regression without controls, and column (2) includes the full set of control variables. The coefficient on the core explanatory variable *Treat* remains positive and significant after controlling for firm and year fixed effects. In the full specification (column 2), the *Treat* coefficient is 0.0487 and significant at the 5% level. Columns (3) to (6) present results using the FE and OLS methods for TFP measurement. Although FE, LP, and OLS methods address endogeneity and estimation bias differently, the coefficient for *Treat* is consistently positive and significant across all specifications. The significance level and magnitude of the *Treat* coefficient are highly consistent, further confirming Hypothesis 1 (H1): Sino-US trade friction forces enterprises to improve their TFP. This indicates that while the trade friction imposed a severe and persistent external shock, disrupting firms' cost structures, technology paths, and market dependencies in the short term, it also provided critical pressure that compelled firms to undertake reforms and optimize production efficiency from a dynamic perspective.

Table 1. Impact of Sino-US Trade Friction on TFP.

	(1)	(2)	(3)	(4)	(5)	(6)
	TFP_LP	TFP_LP	TFP_FE	TFP_FE	TFP_OLS	TFP_OLS
<i>Treat</i>	0.0799** (0.0370)	0.0487** (0.0248)	0.1112*** (0.0430)	0.0634*** (0.0232)	0.1057** (0.0412)	0.0612*** (0.0228)
<i>LEV</i>		-0.0509 (0.0500)		0.0422 (0.0466)		0.0218 (0.0455)
<i>Growth</i>		-0.0114 (0.0070)		-0.0170** (0.0066)		-0.0160** (0.0066)
<i>CFlow</i>		0.7552*** (0.0594)		0.8134*** (0.0567)		0.8042*** (0.0558)
<i>Size</i>		0.5450*** (0.0171)		0.7915*** (0.0165)		0.7364*** (0.0160)
<i>Inage</i>		-0.0998*** (0.0201)		0.0005 (0.0179)		-0.0162 (0.0176)
<i>Constant</i>	7.8947*** (0.0198)	-3.7253*** (0.3666)	11.4728*** (0.0230)	-5.8674*** (0.3564)	10.7413*** (0.0220)	-5.3370*** (0.3450)
<i>N</i>	21021	17185	21021	17185	21021	17185
<i>R-squared</i>	0.8768	0.9312	0.9138	0.9679	0.9098	0.9643

5.2. Robustness Tests

To ensure the reliability of the findings, a series of robustness tests were conducted: (1) Parallel Trends Test: The TFP trends of the treatment and control groups showed no significant difference before the policy shock, satisfying the parallel trends assumption. The TFP-enhancing effect in the treatment group emerged and strengthened progressively after the shock. (2) Placebo Test: A simulation with 500 random assignments of the treatment group showed that the actual treatment effect from the baseline regression far exceeded the 95% confidence interval of the random distribution, indicating the result is not coincidental. (3) Controlling for Concurrent Policies: The coefficient for Treat remained significantly positive after sequentially controlling for the potential impacts of policies such as the "Business Tax to VAT Reform," "Merger of National and Local Tax Bureaus," "Streamlining Administration and Delegating Power" reforms, and the "VAT Credit Refund" policy. (4) Alternative Dependent Variable: Re-estimating the model using TFP measured by the OP method yielded unchanged conclusions. (5) PSM-DID Test: Re-estimation using a matched sample constructed via Propensity Score Matching (PSM) for the treatment and control groups also supported the core conclusion. These tests collectively confirm the robustness of the baseline regression results.

5.3. Mechanism Test Results

Table 2 reports the results of the mediation effect tests. Columns (1) and (2) show that Treat has a significant positive effect on Turnover, and the interaction term between Turnover and Treat in the subsequent regression is significantly positive, confirming the mediating role of asset operation efficiency. Columns (3) and (4) indicate that Treat significantly promotes corporate R&D investment (RD), and the mediating effect of RD is significantly positive, supporting the corporate innovation channel (H3). Columns (5) and (6) show that Treat significantly reduces the HHI index, and the mediating effect of HHI is significantly negative. This suggests that increased industry competition pressure is an important external channel through which trade friction forces TFP improvement.

Table 2. Mechanism Test Results.

	(1)	(2)	(3)	(4)	(5)	(6)
	RD	TFP_LP	Turnover	TFP_LP	HHI	TFP_LP
Treat	0.0017*** (0.0004)		0.0238*** (0.0086)		-0.0181*** (0.0044)	
LEV	-0.0007 (0.0013)	-0.0379 (0.0546)	0.0763*** (0.0277)	-0.0225 (0.0505)	-0.0128 (0.0112)	-0.0401 (0.0548)
Growth	-0.0006*** (0.0001)	-0.0052 (0.0075)	-0.0119*** (0.0026)	-0.0035 (0.0072)	-0.0024** (0.0009)	-0.0068 (0.0076)
CFlow	0.0033* (0.0017)	0.9621*** (0.0641)	0.4888*** (0.0289)	0.8203*** (0.0598)	0.0219* (0.0116)	0.9532*** (0.0633)
Size	-0.0028*** (0.0004)	0.5541*** (0.0165)	-0.0507*** (0.0088)	0.5496*** (0.0155)	0.0169*** (0.0039)	0.5564*** (0.0167)
Inage	0.0015*** (0.0003)	-0.1248*** (0.0195)	-0.0140** (0.0059)	-0.0852*** (0.0185)	-0.0184*** (0.0030)	-0.1114*** (0.0198)

Treat_mes		2.5637***				
		(0.4584)				
Treat_turn				0.4576***		
				(0.0278)		
Treat_HI						-0.1299**
						(0.0609)
Constant	0.0821***	-4.1516***	1.6749***	-4.2485***	-0.1290	-4.1753***
	(0.0085)	(0.3545)	(0.1926)	(0.3343)	(0.0833)	(0.3586)
N	36101	20916	36235	21006	34624	20316
R-squared	0.8642	0.9169	0.8085	0.9247	0.7839	0.9167

6. Conclusion and Implications

6.1. Research Conclusions

Using the 2018 Sino-US trade friction as a quasi-natural experiment, this paper empirically examines the impact of external trade shocks on the TFP of China's manufacturing enterprises. The main conclusions are as follows: First, the Sino-US trade friction exerted a significant "forcing" effect that enhanced the TFP of China's manufacturing firms. This effect emerged gradually after the shock and displayed persistence. Second, the trade friction primarily drove firm efficiency improvements through three channels: optimizing internal asset operation efficiency, increasing R&D and innovation investment, and responding to intensifying external industry competition pressure. Third, this "forcing" effect exhibits significant heterogeneity, being more pronounced for small-scale enterprises, state-owned enterprises, and capital-intensive enterprises.

6.2. Policy Implications

First, implement tiered policies to stimulate endogenous firm dynamism. For small and medium-sized enterprises, support should focus on enhancing operational efficiency through lean management and lightweight digital tools. For large enterprises, especially state-owned enterprises, performance evaluation mechanisms should be optimized to incentivize long-term strategic R&D and supply chain resilience building. For capital- and technology-intensive firms, continuity in innovation policies is crucial to support breakthroughs in key core technologies.

Second, foster industrial chain integration to promote synergy and healthy competition. Industry associations and leading firms should play a greater role in establishing industry risk early-warning systems and platforms for joint R&D on common technologies. This can help avoid cut-throat price competition and steer competition from a "cost war" towards a "value war" and "innovation war."

Finally, strengthen policy coordination to solidify the foundation of the industrial innovation system. Enhanced cross-departmental coordination among S&T, industrial, and financial policies is needed to provide stable, long-term funding and a

tolerant environment for core technology. Furthermore, establishing regional public innovation service platforms can help reduce innovation costs for SMEs, accelerate the industrialization of innovation outcomes, and systematically the resilience and core competitiveness of the manufacturing sector in a complex external environment.

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