How External Forces Reshape the Performance of Chinese Manufacturing Firms

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Abstract: This study examines the impact of external macroeconomic shocks on the quarterly profits of Chinese manufacturing firms. In the context of an increasingly complex and volatile global supply chain system, the transmission mechanisms of RMB exchange rate fluctuations, interest rate changes, international oil price movements, China's GDP growth, tariff policy shocks, and the COVID-19 pandemic require systematic micro-level empirical analysis. To address the gap in the literature on the joint effects of multiple external shocks and industry heterogeneity, this paper uses a fixed-effects regression model based on quarterly panel data from 47 listed manufacturing firms (2017–2023), applying the inverse hyperbolic sine transformation (asinh) to handle profit variables while retaining negative values.

The results show that RMB depreciation significantly reduces manufacturing firm profits, with the effect particularly strong in the automobile and parts industry. China's GDP growth has a significantly positive effect on profitability. In contrast, oil prices, interest rates, tariff shocks, and epidemic shocks do not show significant short-term impacts, revealing the heterogeneous nature of shock transmission across variables. The findings also confirm the moderating role of industry structure in shaping firm-level responses and enrich theoretical understanding of how macro variables affect financial outcomes through microeconomic channels.

Keywords: Chinese Manufacturer; Macroeconomic Shocks; Panel Regression; Exchange Rate Depreciation; Profitability

1. Introduction

China's manufacturing sector occupies a key position in the global supply chain system, but in recent years, under the impact of RMB exchange rate volatility, rising interest rates, soaring international energy prices, intensifying trade frictions between China and the United States, and the COVID-19 pandemic, corporate profitability has experienced unprecedented instability. Although existing studies have focused on macroeconomic fluctuations, there is still a lack of systematic micro-empirical analysis of how macro shocks are transmitted to corporate profits through the cost side, demand side, and policy side, especially regarding the effect of heterogeneity across industries. Most of the existing literature focuses on the impact of a single shock on the macro or industry level, ignoring the comprehensive response of corporate profits under the combined effect of multiple shocks. In view of this, based on quarterly data at the micro level, this paper systematically assesses the joint effect of multiple macro shocks on manufacturing firms' profits and explores the differences in industry responses and internal adjustment mechanisms.

This paper constructs a fixed effects panel regression model using quarterly data from 47 listed manufacturing companies from 2017 to 2023. The core explanatory variables include the first-order lagged logarithmic difference of Brent crude oil prices, the renminbi exchange rate against the U.S. dollar, and the 3-Month or 90-Day Interbank Rates for China; the policy shocks are captured by a four-period tariff dummy variable and a COVID-19 dummy variable. The model controls for both China's quarterly GDP growth rate and quarterly fixed effects. The study assumes that external shocks are exogenous to firms' profits, with limitations including possible measurement errors in the data and the failure to observe firms' internal adjustment behaviors. The scope of the study is limited to listed companies in the Chinese manufacturing industry. In the empirical analysis section, this paper first conducts regression estimation based on the overall manufacturing sector sample and then further uses the automobile industry as a sub-sample to refine

and explore the heterogeneous responses among industries.

2. Literature Review

Existing research shows that external shocks significantly impact the revenues and profitability of manufacturing firms. Yang (2022) finds that the early decline in international orders during COVID-19 severely affected firms with high export dependence[12]. Jamal and Bhat (2022) show that falling consumer confidence and delayed purchases compressed global demand, exacerbating revenue volatility[5]. The CICC Global Institute (2024) indicates that durable goods were more vulnerable, while basic consumer goods and pharmaceuticals demonstrated resilience, highlighting the role of sectoral characteristics in shock responses[13].

Beyond epidemics, exchange rate volatility also influences manufacturing revenues. Narayan (2022) notes that although RMB depreciation boosts export competitiveness, its effect is limited during global demand shortfalls[4]. Auboin and Ruta (2013) emphasize that the impact of exchange rate changes depends largely on effective demand[6]. Bown and Zhang (2023) find that GDP fluctuations in the U.S. and China correlate with China's manufacturing exports, with revenues declining during slowdowns despite price advantages[14]. Xu (2021) points out that GDP changes affect high-value-added industries more strongly, while lower-end industries respond with a lag[15].

On the cost side, fuel price volatility affects supply chain efficiency and profitability. Milewska and Milewski (2022) highlight that rising fuel prices increase logistics costs, reducing supply chain efficiency[1]. Allen et al. (2018) find that fuel price volatility raises direct costs and worsens supply chain instability[3]. Trade policy shocks also threaten the sector. Jiao et al. (2023) show that tariffs during the U.S.-China trade war reduced export orders and profit margins, especially in home appliances and electronics[9]. Chor and Li (2021) verify, using nighttime lighting data, that export-oriented regions experienced significant economic declines during tariff periods[10].

Moreover, exchange rate uncertainty, combined with external shocks, intensifies revenue and profit volatility. Liu and Nagurney (2011) point out that without financial hedging, exchange rate volatility amplifies risks in pricing, procurement, and investment, affecting financial outcomes[7].

Although existing studies reveal the effects of fuel prices, exchange rates, GDP growth, tariffs, and epidemics on manufacturing revenues, systematic micro-level tests on profit responses to multiple shocks and industry heterogeneity remain limited[8]. This study, based on quarterly panel data, comprehensively incorporates six major external variables-oil price, exchange rate, interest rate, GDP growth, tariff shocks, and epidemic shocks-to explore the micro-mechanisms driving changes in manufacturing profits[11].

3. Research Method

This study adopts a fixed-effects panel regression model to systematically analyze the impact of external macroeconomic variables and policy shocks on the profitability of Chinese manufacturing firms. The dependent variable is the inverse hyperbolic sine transformation of quarterly profits (asinh (Profit_it)), which addresses possible negative values in the profit data while maintaining similar interpretability to the logarithmic transformation[2].

The empirical model is specified as follows:

$$asinh(Profit\_it) = \alpha\_i + \beta_1 \Delta log(Brent\_\{t-1\}) + \beta_2 \Delta log(Exchange\_\{t-1\}) + \beta_3 \Delta log(Interest\_\{t-1\}) + \beta_4 \Delta log(CN\_GDP\_t) + \gamma_1 Tariff1\_t + \gamma_2 Tariff2\_t + \gamma_3 Tariff3\_t + \gamma_4 Tariff4\_t + \delta Covid\_t + \theta_2 Q2\_t + \theta_3 Q3\_t + \theta_4 Q4\_t + \varepsilon\_it \quad (1)$$

Where:

Δlog(Brent_{t-1}): First-order lagged log change in Brent crude oil price

Δlog(Exchange_{t-1}): First-order lagged log change in the RMB/USD exchange rate

Δlog(Interest_{t-1}): First-order lagged log change in 3-Month Interbank Rate for China

Δlog(CN_GDP_t): Log change in China's quarterly real GDP

Tariff1–Tariff4_t: Dummy variables for the four quarters following the onset of U.S.-China tariff measures (starting 2018Q3)

Covid_t: Dummy variable for the COVID-19 period (2020Q1–2023Q1)

Q2_t, Q3_t, Q4_t: Quarterly dummies (Q1 as the reference category)

α_i: Firm-specific fixed effects

ε_it: Error term

4. Data

This study utilizes data from multiple sources, detailed as follows:

●Exchange Rate (Exchange): The RMB to USD spot exchange rate is obtained from FRED (Federal Reserve Economic Data) and is used to capture currency fluctuations impacting international trade.
●Interest Rate (Interest): The Chinese Interbank 90-Day Rate is sourced from FRED, reflecting changes in capital costs.
●Fuel Prices (Brent): The global Brent crude oil price, sourced from FRED, captures input and logistics cost pressures.

●China GDP (CNGDP): Data on China's Gross Domestic Product (GDP) is obtained from the Bureau of Statistics of China, serving as an indicator of demand-side growth.
●Tariff Policy (Tariff): A dummy variable constructed based on key US and China trade policy announcements, reflecting changes in export and import restrictions.
●COVID-19 (Covid): A dummy variable constructed based on key dates of lockdowns and supply chain disruptions, capturing pandemic-related shocks.
●Firm Profits (Profit): Quarterly firm-level data from 32 publicly listed Chinese manufacturing firms, covering the period from 2017 to 2023.
Among these, the Tariff and Covid variables are manually constructed dummy variables, where a value of 1 is assigned if a relevant policy event or disruption occurs, and 0 otherwise.
All monetary variables, such as firm profits, are adjusted for inflation to 2020 US dollars using the Consumer Price Index (CPI) provided by the U.S. Bureau of Labor Statistics, ensuring consistency across years.

5. Data Exploration

Table 1. Summary Statistics of Selected Variables

Variable	Min	Max	Mean	Median	SD	N
Interest	2.33	5.00	3.37	3.09	0.79	28
Exchange	6.35	7.24	6.78	6.83	0.27	28
Brent	33.38	111.99	69.45	68.34	17.93	28
CN.GDP	185274.40	357224.80	268230.61	266672.90	46017.42	28
Guangqi_Profit	-81.91	3880.05	1932.29	2096.08	1078.42	28
DongfengTech_Profit	-61.62	124.13	36.29	38.12	33.92	28
Haier_Profit	433.39	4432.04	2432.26	2599.04	1021.26	28
SAIC_Profit	1120.85	9771.70	6060.40	6656.88	2562.63	28
Midea_Profit	2285.51	10190.44	6456.99	6293.88	2201.30	28
Fuyao_Profit	459.96	1921.73	939.27	856.82	366.59	28

Table 1 presents the results of descriptive statistics for the core variables of this study. In terms of macroeconomic variables, the interest rate (Interest) ranges from 2.33% to 5.00%, with a mean of 3.37% and a standard deviation of 0.79, indicating that interest rate fluctuations were relatively small during the sample period. The mean value of the Renminbi to U.S. dollar exchange rate (Exchange) is 6.78, with a standard deviation of 0.27, indicating relatively smooth exchange rate fluctuations. The Brent crude oil price (Brent) fluctuates more widely, ranging from a low of $33.38 per barrel to a high of $111.99 per barrel, with a mean of $69.45 and a standard deviation of 17.93, reflecting significant price volatility in the international energy market during the sample period. China's quarterly GDP (CN_GDP) has a mean value of approximately RMB 26,823 billion with a standard deviation of 46,017.42, indicating that the level of macroeconomic aggregates fluctuates from quarter to quarter.
At the enterprise level, considering length and representativeness, this paper selects six representative enterprises from a sample of 47 listed manufacturing companies for presentation. The selected firms cover different sizes and industry categories, and their quarterly profit levels are quite different.

6. Empirical Analysis

6.1 Analysis of Regression Results for all Manufacturing Firms

Table 2. Regression Results-All Manufacturing Firms

Variable	Coefficient	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Constant	6.3324	0.6468	9.7899	0.0000***	5.0628	7.6021

dlog_Brent_lag1	-0.0212	0.6918	-0.0307	0.9755	-1.3792	1.3368
dlog_Exchange_lag1	-9.4887	4.7874	-1.9820	0.0478**	-18.8860	-0.0915
dlog_Interest_lag1	-1.3229	1.3654	-0.9689	0.3329	-4.0030	1.3571
dlog_CN_GDP	13.9270	3.4965	3.9832	0.0001***	7.0641	20.7900
Tariff.1	-0.4501	0.7182	-0.6268	0.5310	-1.8598	0.9595
Tariff.2	0.3062	0.4721	0.6486	0.5168	-0.6205	1.2330
Tariff.3	-0.8242	0.5540	-1.4877	0.1372	-1.9116	0.2633
Tariff.4	-0.2579	0.4950	-0.5211	0.6025	-1.2296	0.7138
Covid	-0.2587	0.2072	-1.2485	0.2122	-0.6655	0.1481
Q.2	-3.5787	0.9898	-3.6155	0.0003***	-5.5216	-1.6358
Q.3	-2.9834	0.8534	-3.4959	0.0005***	-4.6585	-1.3083
Q.4	-3.9165	0.9723	-4.0279	0.0001***	-5.8251	-2.0079

Note:*** p <0.01,** p <0.05,* p <0.1. Robust standard errors reported.

In the full manufacturing sector sample, the impact of RMB-dollar exchange rate change (dlog_Exchange_lag1) on corporate profits is significantly negative (coefficient = -9.4887, p-value = 0.0478), indicating that RMB depreciation significantly compresses the quarterly profits of manufacturing firms. Specifically, every 1% depreciation of the RMB leads to a decrease in profit level by about 9.49% on average. This result validates the high sensitivity of the manufacturing sector as a whole to exchange rate fluctuations, with export-oriented firms in particular being directly affected in terms of higher raw material import costs and lower price competitiveness in overseas sales, as shown in Table 2.

China's quarterly GDP growth rate (dlog_CN.GDP) has a significantly positive impact on profits (coefficient = 13.9270, p-value = 0.0001), which is statistically highly significant ($p < 0.01$), suggesting that domestic macroeconomic expansion has a strong supportive impact on the profitability of manufacturing firms. For every 1% of GDP growth, quarterly profit levels are expected to improve by about 13.93%, emphasizing the importance of macro demand recovery for firms' performance.

In contrast, oil prices (dlog_Brent_lag1) and interest rates (dlog_Interest_lag1) have insignificant impacts on profits with small coefficients (p-values of 0.9755 and 0.3329, respectively), suggesting that, at the overall manufacturing level, the direct transmission of these variables on profit volatility in the short run is limited and may be offset by industry diversity, cost-shifting capacity, or supply chain elasticity.

The tariff shock (Tariff 1-4) and epidemic shock (Covid) variables also do not show statistical significance, suggesting that firms may have effectively buffered external policy shocks through market shifts, supply chain adjustments, or government policy interventions (e.g., tax cuts, subsidies, etc.). The quarterly dummy variables (Q2, Q3, Q4) are all significantly negative ($p < 0.01$) and the coefficients range from -2.9 to -3.9, reflecting the existence of systematic seasonal fluctuations in the manufacturing sector, where profits are usually concentrated in the first quarter and decline significantly in subsequent quarters.

Overall, exchange rate and GDP growth are the core external variables affecting profits at the industry-wide level, while other macro shock effects are somewhat attenuated or absorbed in the overall sample.

6.2 Analysis of Regression Results for the Automobile and Parts Industry

Table 3. Regression Results-Auto Parts Firms

Variable	Coefficient	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Constant	6.9515	0.6461	10.759	0.0000***	5.6829	8.2200
dlog_Brent_lag1	0.6878	0.6899	0.9970	0.3191	-0.6668	2.0424
dlog_Exchange_lag1	-14.1350	4.6245	-3.0566	0.0023***	-23.2150	-5.0553
dlog_Interest_lag1	-1.7250	1.3105	-1.3163	0.1885	-4.2981	0.8481
dlog_CN.GDP	15.1770	3.6352	4.1751	0.0000***	8.0397	22.3140

Tariff.1	0.1589	0.6389	0.2486	0.8037	-1.0955	1.4132
Tariff.2	0.5236	0.4356	1.2019	0.2298	-0.3317	1.3789
Tariff.3	-0.7560	0.5521	-1.3694	0.1713	-1.8399	0.3279
Tariff.4	-0.2560	0.5117	-0.5004	0.6170	-1.2607	0.7486
Covid	-0.4116	0.1993	-2.0655	0.0393**	-0.8029	-0.0203
Q.2	-4.2504	1.0077	-4.2181	0.0000***	-6.2289	-2.2720
Q.3	-3.3274	0.8693	-3.8278	0.0001***	-5.0341	-1.6207
Q.4	-4.1720	0.9871	-4.2266	0.0000***	-6.1101	-2.2340

Note:*** p <0.01,** p <0.05,* p <0.1. Robust standard errors reported.

The subsample regression for the automobile and parts industry shows that the transmission effect of macro shocks on industry profits is more significant and sensitive, as shown in Table 3. The coefficient of the change in the exchange rate of RMB against the US dollar (dlog_Exchange_lag1) is -14.1350 (p-value = 0.0023), which is larger in absolute value than that of the whole industry and is highly statistically significant ($p < 0.01$), indicating that the industry is particularly sensitive to RMB depreciation. For every 1% exchange rate depreciation, quarterly profits of automobile and parts companies fall by as much as 14.14%, mainly due to the industry's high dependence on the supply of imported parts and components as well as the expansion of its export market, which makes its response to changes in the external exchange rate more direct and drastic.

China's quarterly GDP growth rate (dlog_CN.GDP) has a significantly positive impact on profits (coefficient = 15.1770, p-value = 0.0000), and the coefficient is slightly higher than for the industry as a whole, which further indicates that the automotive and parts industry has a higher sensitivity to the recovery of domestic demand, especially in the consumption of new energy vehicles and infrastructure investment-driven stimulus policies, with macro-demand growth directly promoting the profitability of the industry.

The interest rate (dlog_Interest_lag1) affects profits in a negative direction (coefficient = -1.7250), but the p-value is 0.1885, which does not reach the traditional significance level ($p < 0.1$). Nonetheless, given the capital-intensive nature of the industry, the medium- to long-term pressure from rising financing costs remains a concern.

Tariff shocks (Tariff 1-4) remain insignificant, while the COVID-19 dummy exhibits a statistically significant negative effect on profits (coefficient = -0.4116, p-value = 0.0393). This suggests that, despite potential adjustments in supply chains or market diversification strategies, the automobile and parts industry remains vulnerable to large-scale public health disruptions. Such vulnerability may stem from the industry's reliance on complex global production networks and its exposure to demand-side shocks during pandemic periods.

Quarterly dummy variables (Q2, Q3, Q4) are significantly negative (p-value less than 0.01) and the absolute value of the coefficients is larger than that for the whole industry, further indicating that seasonal fluctuations in profits in the automotive industry are more intense, emphasizing the need to fully take into account the cyclical impact of quarterly factors in financial budgeting and operational management. Overall, the automobile and parts industry is not only more sensitive to RMB depreciation but also shows stronger profit fluctuation characteristics in macro demand changes.

6.3 Summary

Analyzing the two sets of regression results together, RMB exchange rate depreciation and China's GDP growth are the most important external factors explaining the quarterly profit changes of manufacturing firms. Among them, the negative impact of exchange rate depreciation on the profits of the automobile and parts industry is particularly significant, and GDP growth shows a stable and strong positive pulling effect on both the whole industry and the sub-industries.

The direct impacts of oil prices, interest rates, tariff policies, and epidemic shocks in the short term do not show statistical significance, suggesting that the actual transmission path may be more complex, involving lags, hedges, or structural adjustment mechanisms. This may be due to the fact that their effects are not immediately reflected in quarterly profit changes, but could gradually appear in subsequent

quarters. It is also possible that firms have already implemented various buffer mechanisms-such as cost pass-through strategies, supply chain reconfiguration, or financial hedging-to offset these external shocks. Moreover, government support policies like tax reliefs or subsidies may have further weakened the direct statistical effects.

These results not only validate the research hypothesis that macroeconomic shocks affect the profitability of different types of firms in a heterogeneous way but also provide insights into actual management and policymaking. Notably, although COVID-19 shocks are not significant in the full industry sample, they exhibit a statistically significant negative effect in the automobile and parts industry, indicating the sector's particular vulnerability to large-scale public health events due to its reliance on global production networks and sensitivity to demand-side disruptions.

7. Discussion and Conclusion

The findings show that RMB depreciation significantly reduces the profits of manufacturing firms, with this effect being more pronounced in the automobile and parts industry. China's GDP growth significantly enhances corporate profitability. In contrast, the direct impacts of oil prices, interest rates, tariffs, and epidemic shocks on quarterly profits do not exhibit short-term significance. This may reflect lagged effects in profit response or the role of internal firm-level buffers. Enterprises may mitigate such shocks through internal adjustments like supply chain flexibility, cost shifting, or financial instruments, while government measures such as tax breaks and subsidies may also have cushioned the impact.

These results suggest that macro fundamentals play an important role in supporting corporate profitability and that there is significant response heterogeneity across industries when facing external shocks. In particular, while COVID-19 shows no significant effect at the aggregate level, it has a statistically significant negative impact in the automobile and parts industry, highlighting the need for more resilient supply chain systems and risk management strategies in sectors highly exposed to international disruptions.

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