Proceedings of ICEMGD 2026 Symposium: The Role of Blue Economy in Promoting Human Sustainable Development
DOI: 10.54254/2754-1169/2026.GT35856

Manufacturing PMI and Sector Rotation in China's Equity Market: Evidence from Cyclical and Defensive Sectors

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Abstract. The Purchasing Managers' Index (PMI) is often used by investors because it is released earlier than many output indicators and reflects firms' short-term views on production, new orders, employment, supplier delivery, and inventories. This paper studies whether China's manufacturing PMI can help explain the short-term relative performance of cyclical and defensive sectors in the equity market. Using monthly PMI data from September 2022 to September 2025 and corresponding sector index returns, the paper compares cyclical and defensive sector performance under different PMI states. The backtest covers January 2023 to September 2025. The results show that the relationship between PMI and cyclical-minus-defensive returns is strongest when PMI leads sector returns by one month, with a correlation coefficient of 0.43. Months with PMI≥51 and DI≥60% are associated with an average monthly cyclical-minus-defensive return of 1.27% and a win rate of 71.4%, while months with PMI<49 and DI<40% show an average relative return of -0.89%. A simple backtest based on these signals would have produced a cumulative return of 31.6% over the tested period, 19.2 percentage points higher than the CSI 300. The findings suggest that PMI can be used as a useful macro-state reference for studying sector rotation, but the short sample period means that the results should be understood as evidence from this sample rather than as a full-cycle trading rule.

Keywords: sector rotation, cyclical sectors, asset allocation, macro signals, financial applications

1. Introduction

For investors who adjust portfolios at a monthly frequency, a practical difficulty is that many macroeconomic indicators are published after market expectations have already started to change. GDP and industrial value added describe real economic activity, but their release lag makes them less convenient for monthly sector allocation [1]. PMI partly fills this timing gap because it is released every month and is based on firms' purchasing and production activities [2, 3].

In China, the manufacturing PMI has been used to track short-term manufacturing momentum since 2005. It is related to production expectations, new orders, inventories, and supplier delivery conditions. These items may affect expectations about revenue, margins, and inventory adjustment, especially in industries linked to production and investment demand. Thus, this paper treats PMI as

DOI: 10.54254/2754-1169/2026.GT35856

a variable for comparing cyclical and defensive sectors rather than as a direct predictor of the whole market [4].

Based on this idea, the paper focuses on three questions. First, does PMI lead the relative returns of cyclical sectors over defensive sectors? Second, do these relative returns look different under expansion, neutral, and contraction states? Third, how does a simple PMI-based allocation rule perform relative to the benchmark during the tested period?

2. Theoretical foundation and literature review

2.1. Structure

PMI is a survey-based diffusion index compiled from monthly responses by corporate purchasing managers. China's manufacturing PMI survey covers major manufacturing industries and includes five sub-items: new orders, production, employment, supplier delivery time, and raw material inventories. Because it is based on firms' current assessments, PMI can capture changes in business conditions earlier than some official output indicators [5, 6].

The weighted calculation can be expressed as furmula (1), where NO, OUT, EMP, SDT, and RMI denote new orders, production, employment, supplier delivery time, and raw material inventories, respectively:

$$PMI_t = 0.3NO_t + 0.25EMP_t + 0.15(100 - SDT_t) + 0.1RMI_t \quad (1)$$

A reading above 50 is usually interpreted as expansion, while a reading below 50 suggests contraction. Since PMI reflects firms' near-term views on production and business activity, it is often treated as a forward-looking indicator of manufacturing conditions. In market practice, PMI-type survey indicators are also used as timely references for judging short-term economic momentum [7].

2.2. Macro drivers of sector rotation

Sector rotation means that different industries do not perform in the same way when macroeconomic conditions change. Cyclical sectors such as industrials, materials, and energy are more sensitive to production, investment, and commodity demand. Defensive sectors such as utilities and consumer staples usually have more stable demand and lower sensitivity to short-term macroeconomic fluctuations. This difference is the main reason for comparing cyclical and defensive sector performance under different PMI states [8].

From an asset-allocation perspective, the main question is not whether PMI predicts the overall market, but whether it helps identify changes in relative sector performance. When manufacturing momentum strengthens, investors may raise expectations for industries exposed to production, investment, and commodity demand. When PMI weakens, stable-demand sectors may be relatively resilient. This link is not mechanical, since valuation, policy expectations, liquidity, and risk appetite also affect sector returns [9, 10].

2.3. Literature assessment and contributions

Existing studies provide two related lines of evidence: one on the information content of macroeconomic indicators, and another on industry classification and portfolio construction. However, less attention has been paid to whether China's manufacturing PMI can be used as a simple state variable to compare cyclical and defensive sector returns. This paper therefore tests the

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link between PMI-based macro states and cyclical-defensive sector rotation in China's equity market. It also uses PMI and DI thresholds to describe different macro states and applies a simple allocation rule in the backtest. Recent studies on economic forces and sector rotation further support examining sector-level return differences under changing macro conditions.

3. Data and methodology

3.1. Research hypotheses

Based on the above discussion, the empirical analysis focuses on two expectations. H1: Manufacturing PMI is positively associated with the subsequent relative returns of cyclical sectors over defensive sectors, especially at short leads of one to two months. H2: The relationship between PMI and sector relative performance differs across PMI states. Specifically, cyclical sectors are expected to perform relatively better when PMI is in a stronger expansion range and DI remains high, and relatively worse when PMI falls into a weaker contraction range and DI remains low.

3.2. Data sources and sample period

Monthly manufacturing PMI data are collected from Eastmoney Data Center for September 2022 to September 2025. Sector index data are taken from Tonghuashun iFinD. Price indices excluding dividend reinvestment are used. The cyclical portfolio consists of the Industrials Index (801950.SI), Materials Index (801050.SI), and Energy Index (801780.SI), because these sectors are more exposed to production, investment, and commodity prices. The defensive portfolio consists of the Utilities Index (801160.SI) and Consumer Staples Index (801040.SI), which usually have more stable demand. The CSI 300 Index (000300.SH) is used as the market benchmark.

The sample period covers PMI observations from September 2022 to September 2025, with 37 monthly observations. Sector return data from January 2023 to September 2025 are used for the strategy backtest after allowing for PMI leads. The risk-free rate is taken as the one-year time deposit benchmark rate of 1.5% per annum.

3.3. Variable definitions and methodology

As shown in Table 1, the main variables include PMI, DI, strong expansion signal, weak contraction signal, cyclical sector relative return, and excess return. DI is the proportion of months with PMI above 50 in the past six months. To reduce noise around the 50-point line, strong expansion is defined as PMI $\geq$ 51 and DI $\geq$ 60%, while weak contraction is defined as PMI $<$ 49 and DI $<$ 40%. These thresholds are used for transparent classification rather than parameter optimization. Relative return equals the cyclical portfolio return minus the defensive portfolio return.

The empirical analysis uses three tests, as can be seen in formulas (2)-(4). First, Pearson cross-correlations are calculated between PMI and cyclical-minus-defensive returns when PMI leads by 0, 1, 2, and 3 months. Newey-West adjusted standard errors with lag 2 are used to account for serial correlation. Second, the sample is divided into strong expansion, neutral, and weak contraction states, and the mean return and win rate are computed for each state. Third, a monthly backtest translates the PMI states into an allocation rule: strong expansion allocates to the cyclical composite, weak contraction allocates to the defensive composite, and neutral periods hold the CSI 300 Index. The backtest is evaluated using cumulative return, annualized return, volatility, Sharpe ratio, and maximum drawdown.

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$$DI_t = \frac{1}{6}\sum_{i=0}^{5} I(PMI_{t-i} > 50) \quad (2)$$

$$Ret_{Rel,\,t} = R_{cyclical,\,t} - R_{defensive,\,t} \quad (3)$$

$$Ret_{Excess,\,t} = R_{strategy,\,t} - R_{CSI300,\,t} \quad (4)$$

Table 1. Variable definitions and calculations

Variable	Symbol	Definition and calculation
PMI absolute value	PMI_t	Manufacturing PMI in month t
Diffusion index	DI_t	Share of months with PMI > 50 in the past six months
Strong expansion signal	$S_{Exp,t}$	1 if $PMI_t \geq 51$ and $DI_t \geq 60\%$; otherwise 0
Weak contraction signal	$S_{Con,t}$	1 if $PMI_t < 4\,9$ and $DI_t < 40\%$; otherwise 0
Cyclical sector relative return	$Ret_{Rel,t}$	Cyclical portfolio return - defensive portfolio return
Excess return	$Ret_{Excess,t}$	Strategy portfolio return - CSI 300 return

4. Empirical results

4.1. Descriptive statistics

Table 2 summarizes the main variables used in the analysis. The mean of PMI is 49.63, the median is 49.50, and the standard deviation is 0.94, suggesting that manufacturing conditions were generally close to the expansion-contraction boundary during the sample period. The mean of DI is 44.6%, so less than half of the months were in expansion. The mean relative return of cyclical sectors is 0.27%, while the standard deviation is 1.82%.

Table 2. Descriptive statistics of main variables (2022.9-2025.9, N = 37)

Variable	Mean	Median	Std dev	Min	Max
PMI	49.63	49.50	0.94	47.0	52.6
DI (%)	44.6%	50.0%	18.3%	16.7%	83.3%
Relative return (%)	0.27	0.31	1.82	-2.45	3.14

4.2. Lead-lag analysis

The cross-correlation results reported in Table 3 exhibit uniformly positive coefficients between the Purchasing Managers' Index (PMI) and subsequent sectoral relative returns. The strongest correlation appears at the one-month lead, where the Pearson coefficient is 0.43 and the Newey-West t-value is 2.88. This suggests that PMI contains more information about subsequent sector relative returns than about contemporaneous returns during the tested period.

Table 3. Cross-correlation between PMI and cyclical sector relative returns

Lead (k months)	Pearson correlation	Newey-West t-value	Significance
0 (contemporaneous)	0.21	1.31	Not significant
1	0.43	2.88	$p < 0.01$

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Table 3. (continued)

2	0.38	2.45	$p < 0.05$

4.3. Threshold effects

Table 4 compares cyclical-minus-defensive returns under the three PMI states. In the strong-expansion state, cyclical sectors outperform defensive sectors by an average of 1.27% per month, with a win rate of 71.4%. In the weak-contraction state, the average monthly relative return is -0.89%, with a win rate of 33.3%. The neutral state is much closer to zero. The gap between the strong-expansion and weak-contraction states is 2.16 percentage points and is statistically significant at the 1% level.

Table 4. Sector relative performance under different PMI states

PMI state	Number of months	Mean monthly relative return	Win rate	Difference from neutral
Strong expansion (PMI ≥ 51, DI ≥ 60%)	14	+1.27%	71.4%	+1.14%***
Neutral (49 ≤ PMI < 51)	15	+0.13%	52.3%	-
Weak contraction (PMI < 49, DI < 40%)	8	-0.89%	33.3%	-1.02%**

4.4. Strategy backtest performance

To examine the practical implication of these threshold states, a simple sector-rotation backtest is conducted from January 2023 to September 2025. Table 5 reports the cumulative performance of the strategy and the CSI 300 benchmark. Over the tested period, the strategy records a cumulative return of 31.6%, compared with 12.4% for the CSI 300. The difference between the two cumulative returns is 19.2 percentage points.

Table 5. Cumulative returns of strategy vs. benchmark

Date	Strategy cumulative return	CSI 300 cumulative return	Excess return
2023-06	+8.3%	+3.1%	+5.2%
2023-12	+15.7%	+7.6%	+8.1%
2024-06	+20.4%	+9.2%	+11.2%
2024-12	+26.1%	+11.5%	+14.6%
2025-09	+31.6%	+12.4%	+19.2%

The strategy's annualized return is approximately 11.2%, compared with 4.6% for the CSI 300. Its annualized volatility is 18.7%, slightly higher than the benchmark's 16.2%. According to the formula (5), this research uses daily data to make a more precise calculation, the strategy's Sharpe ratio is 0.74, compared with 0.42 for the benchmark. The strategy's maximum drawdown is -9.6%, while the CSI 300's maximum drawdown is -15.3%, suggesting a smaller drawdown in this particular backtest.

$$Sharpe = \frac{R_p - R_f}{\sigma_p} \tag{5}$$

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4.5. Robustness checks

Several additional checks are used to see whether the main pattern is sensitive to alternative settings. Replacing the cyclical portfolio with industrials and materials, excluding energy, gives a cumulative strategy return of 28.9%, still above the benchmark. Adjusting the PMI lead to half a month through mid-month rebalancing gives slightly lower returns, suggesting that beginning-of-month rebalancing fits this sample better. Using the new orders sub-index instead of the composite PMI increases the correlation to 0.51 but also increases turnover. After an estimated transaction cost of 0.2%, the excess return is slightly lower than the baseline strategy. Overall, the sample pattern is broadly unchanged.

5. Financial applications and practical implications

The results are more useful as a reference for sector-allocation judgment than as a mechanical trading rule. Since PMI is released earlier than many hard macroeconomic indicators, it can help investors observe changes in manufacturing momentum at an earlier stage, especially when sector weights are reviewed monthly or bimonthly. PMI and DI can also be used as macro-state variables in sector models, but they should be combined with valuation, momentum, liquidity, and other market indicators. When PMI remains below 49 and DI falls below 40%, the results suggest that investors may need to re-examine their exposure to cyclical sectors during weak manufacturing conditions. For individual investors, PMI is better treated as a background reference rather than an independent basis for investment decisions.

6. Conclusion

Using China's manufacturing PMI and sector index data from September 2022 to September 2025, this paper examines the relationship between PMI and cyclical-defensive sector rotation. The strongest association appears when PMI leads cyclical-minus-defensive returns by one month, with a correlation coefficient of 0.43. The threshold analysis also shows that cyclical sectors perform relatively better in strong-expansion states and relatively worse in weak-contraction states. A simple backtest based on these signals would have produced a cumulative return of 31.6%, which is 19.2 percentage points higher than the CSI 300 over the same period. These findings should be interpreted as evidence of a sample-period relationship rather than proof of a stable trading rule.

Several limitations should be noted. The sample period covers only about three years and therefore does not include a complete business cycle. The backtest also abstracts from stamp taxes, commissions, market impact, and bid-ask spreads. Since PMI is released monthly, it is not suitable for weekly, daily, or high-frequency trading decisions. Future research could examine PMI sub-indices such as new orders and raw material inventories, and test similar relationships in other asset classes or equity markets.

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