中国金融四十人研究院
CHINA FINANCE 40 INSTITUTE

CF40 Policy Brief

The Power of Depreciation

ZHU He
CF40 Institute

Abstract: *Any policy aimed at stimulating demand for manufacturing equipment renewals can be understood at the macro level as "increasing short-term investment demand by raising the current depreciation rate in the manufacturing sector". This brief attempted to provide an "anchor" for assessing the effectiveness of the manufacturing equipment renewal policy, namely, how much of the annual new investment in China's manufacturing sector reflects investment demand driven by depreciation, without additional policy support. The scale of depreciation in the manufacturing sector and the share of depreciation-induced investment in new investment were estimated through three methods, and the preliminary conclusion is that the natural depreciation scale of China's manufacturing capital stock will reach 8 trillion yuan in 2024. In other words, the scale of "passive" investment driven by the depreciation of capital stock in China is larger than anticipated, and the "5 trillion yuan of equipment investment" cannot be simply understood as the incremental part of China's manufacturing investment for 2024.*

Over the past two years, China's real estate market has undergone volatile corrections, with a noticeable contraction in real estate investment. At the same time, investment in China's manufacturing sector has expanded sharply, offsetting to a considerable extent the negative impact of the decline in real estate investment on aggregate investment and demand. Thus far, there is still no clear sign of recovery in China's real estate market, with the year-on-year growth rate of real estate investment remaining negative. Looking ahead, the continued expansion of manufacturing investment is key to stabilizing investment and growth.

Against this backdrop, the State Council recently issued the *Action Plan to Promote Large-scale Equipment Renewals and the Trade-ins of Consumer Goods*, which immediately attracted widespread attention in the market. At the press conference on economic issues of the second session of the 14th National People's Congress, Zheng Shanjie, Chairman of the National Development and Reform Commission, further clarified, "The equipment renewal initiative will focus on seven sectors: industry, agriculture, construction, transportation, education, culture and tourism, and healthcare," and "it is preliminarily estimated to be a huge market with an annual scale of over 5 trillion yuan." Among these key areas, the demand for manufacturing equipment renewals is undoubtedly the most noteworthy.

Given that machinery and equipment have a limited lifespan, even without any policy support, there would still be demand for a certain scale of equipment renewal in the manufacturing sector each year. This falls within the macroeconomic category of capital depreciation. Meanwhile, the necessary investment in equipment renewal each year is also part of the total new investment for that year. Therefore, **policies aimed at stimulating demand for manufacturing equipment renewals can be understood at the macro level as "increasing short-term investment demand by raising the current depreciation rate in the manufacturing sector."**

The brief attempted to provide an "anchor" for assessing the effectiveness of the manufacturing equipment renewal policy, that is, in the absence of additional policy support, how much of the annual new investment in China's manufacturing sector reflects investment demand driven by

depreciation. Built on this, the brief discussed how to view the potential effects of related policies, as well as other macroeconomic and policy implications.

I. Understanding the Scale of New Investment

Economists pay particular attention to new investment not only because they are an important part of current aggregate demand but also, more importantly, because they are key to the accumulation of capital stock, which is crucial for long-term growth.

However, not all new investment can be converted into an increase in the stock of capital. Machinery and equipment are exposed to natural wear and tear, and as technology advances, the relative efficiency of older machines declines, causing the machines to depreciate. Thus, there is always a natural depreciation of capital, generally referred to as capital depreciation. The amount of new investment that can form capital stock is closely related to the scale of capital depreciation. This process can be expressed by the following formula:

Change in Capital Stock = New Investment - Capital Depreciation

In this formula, **capital depreciation equals the depreciation rate multiplied by the capital stock.**

The formula indicates that, with a given depreciation rate, as the capital stock increases, the corresponding scale of capital depreciation will also increase. Capital stock can only increase when new investment exceeds capital depreciation.

Following the logic outlined above, we will estimate the annual depreciation scale of China's manufacturing sector through three different methods. Based on these estimates, we will determine how much of the annual new

investment in the manufacturing sector actually comes from depreciation-induced investment, and how much ultimately reflects an increase in fixed capital.

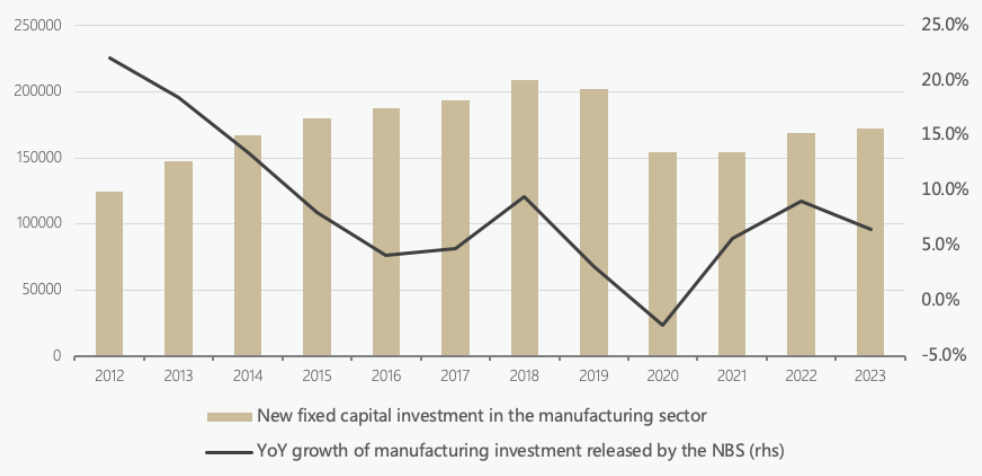
Before estimating the scale of depreciation, the first step is to obtain the absolute value sequence of new investment in the manufacturing sector. Starting from 2018, the National Bureau of Statistics (NBS) only releases the absolute values of urban fixed asset investment and real estate development investment, and no longer publishes absolute values for fixed asset investment in other industries. If 2017 is used as the base year to retrodict the investment scale of other industries, the resulting investment scale will appear significantly larger because the total investment scale of these industries far exceeds the overall fixed asset investment.

To obtain the absolute value sequence of manufacturing investment after 2018, the approach is to work backward to calculate a total investment absolute value sequence based on the total investment growth rate released by the NBS after 2018. Then, the retrodicted sequence is compared with the actual total investment absolute value sequence by the NBS to calculate a conversion coefficient. Lastly, the coefficient is employed to correct the retrodicted absolute manufacturing investment value sequence after 2018. This ensures that the absolute investment value sequence derived from the growth rate is consistent with the total investment scale published by the NBS on an aggregate level.

As shown in Figure 1, according to the year-on-year growth rate of manufacturing investment released by the NBS, the average year-on-year growth of China's manufacturing investment from 2021 to 2023 is 7.1%, higher than the average level of 5.7% from 2016 to 2019. In terms of absolute scale, it seems that the peak of China's manufacturing investment scale over the past decade since 2012 occurred in 2018. After that, China's manufacturing investment scale has been significantly lower than the peak around 2018-2019. The National Bureau of Statistics has provided a detailed technical explanation for the divergence between the year-on-year growth rate and absolute values, including sample adjustments, statistical method optimization, and strengthened

statistical enforcement. Although there has been a decline from the high points in absolute values, the magnitude remains significant. **According to our estimate, the cumulative value of China's manufacturing investment from 2021 to 2023 is 49.5 trillion yuan.**

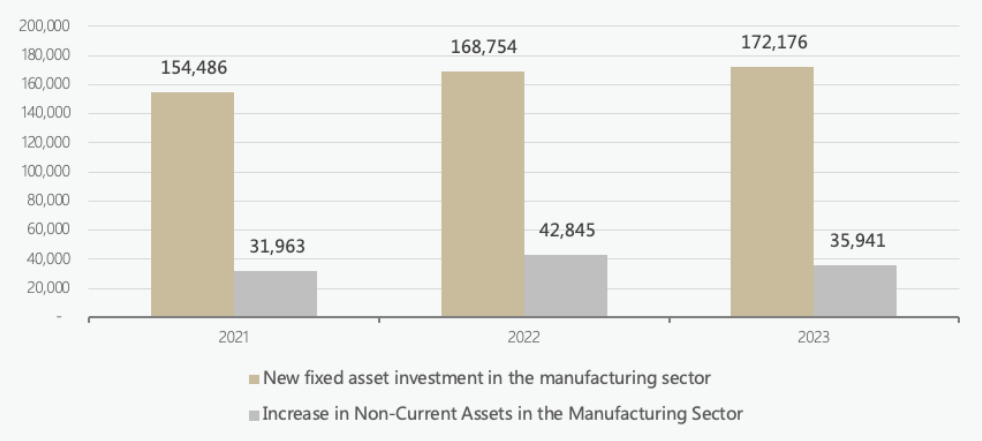
Figure 1: Scale of New Manufacturing Investment and YoY Growth (lhs: 100 million yuan)



Sources: wind; author's own calculation

II. The "Disappearing" Manufacturing Investment

Figure 2: New Fixed Asset Investment and the Increase in Non-Current Assets in the Manufacturing Sector (100 million yuan)



As mentioned earlier, the cumulative new investment in the manufacturing sector from 2021 to 2023 was around 50 trillion yuan, yet most of this new investment did not manifest as an increase in fixed capital. We derived the data for non-current assets in the manufacturing sector by subtracting

the average size of current assets at year-end from the total assets at year-end released by the NBS, and according to the definition, these assets fall into the category of fixed assets. As shown in Figure 2, the scale of non-current assets in China's manufacturing sector from 2021 to 2023 rose by only 11 trillion yuan, far less than the cumulative value of manufacturing investments during the same period. On average, more than 10 trillion yuan of new fixed asset investments in manufacturing "disappeared" each year.

Where did the "disappearing" manufacturing investment go? The preliminary explanation is that in recent years, China's manufacturing investment has increasingly concentrated in capital-intensive industries. The expansion of these industries requires massive capital accumulation, and the accumulation of capital stock means that the absolute scale of rigid depreciation increases annually given a set depreciation rate. **In essence, a considerable portion of manufacturing investment offsets the depreciation of existing capital and thus does not reflect an increase in the capital stock.**

We ranked 28 manufacturing sub-industries according to their fixed asset size in 2023, with the top 10 sub-industries being: computer, communication, and other electronic equipment manufacturing, chemical materials and chemical products manufacturing, ferrous metal smelting and rolling processing industry, electrical machinery and equipment manufacturing, automotive manufacturing, non-metallic mineral products industry, non-ferrous metal smelting and rolling processing industry, petroleum, coal, and other fuel processing industry, pharmaceutical manufacturing, and general equipment manufacturing.

The results, shown in Tables 1 and 2, indicate that **from 2017 to 2023, both new investment and fixed asset stock have shown a trend towards concentration in capital-intensive industries.** Specifically, industries with a higher ranking in fixed capital stock have gradually increased their share of new investment and fixed assets. By the end of 2023, the top 5 manufacturing sub-industries accounted for 50% of the total fixed assets in the manufacturing sector, with these 5 sub-industries accounting for 37.1% of total new manufacturing investment. The top 10 manufacturing sub-industries accounted for 73.7% of the

total fixed assets in the sector, with their new investments accounting for 59.1% of the total new manufacturing investment.

Table 1: Share of the Top 5 Manufacturing Sub-Industries by Fixed Asset Size (100 million yuan)

Year	New investment combined	Total new manufacturing investment	Share	Fixed asset scale combined	Total fixed asset scale in the manufacturing sector	Share
2017	57,068	189,009	30.2%	164,135	387,165	42.4%
2018	62,818	206,668	30.4%	165,776	372,010	44.6%
2019	65,753	211,630	31.1%	173,881	380,142	45.7%
2020	66,493	205,256	32.4%	182,497	397,119	46.0%
2021	76,876	234,140	32.8%	199,848	429,082	46.6%
2022	92,932	269,001	34.5%	224,032	471,927	47.5%
2023	108,200	291,704	37.1%	253,207	507,868	49.9%

Table 2: Share of the Top 10 Manufacturing Sub-Industries by Fixed Asset Size (100 million yuan)

Year	New investment combined	Total new manufacturing investment	Share	Fixed asset scale combined	Total fixed asset scale in the manufacturing sector	Share
2017	100,969	189,009	53.4%	258,990	387,165	66.9%
2018	111,869	206,668	54.1%	255,063	372,010	68.6%
2019	117,452	211,630	55.5%	267,628	380,142	70.4%
2020	118,778	205,256	57.9%	280,791	397,119	70.7%
2021	134,920	234,140	57.6%	306,476	429,082	71.4%
2022	155,822	269,001	57.9%	340,725	471,927	72.2%
2023	172,390	291,704	59.1%	374,073	507,868	73.7%

Sources: Wind; author's own calculation. The new investment data in Table 1 and 2 have not been adjusted by conversion coefficient.

If the above explanation holds, then subtracting the increase in fixed assets from the new manufacturing investment would generate the corresponding depreciation investment scale of 38.5 trillion yuan, representing 77.8% of the new investment scale during the same period. This proportion appears exceedingly high, which might be partly explained by the lack of precise data on the scale of new fixed asset investments in manufacturing. Even after processing with a conversion coefficient, the retrodicted investment data might still be overestimated, which would exaggerate the share of depreciation-induced investment in new investment.

III. Two Alternative Dimensions of the Depreciation Scale

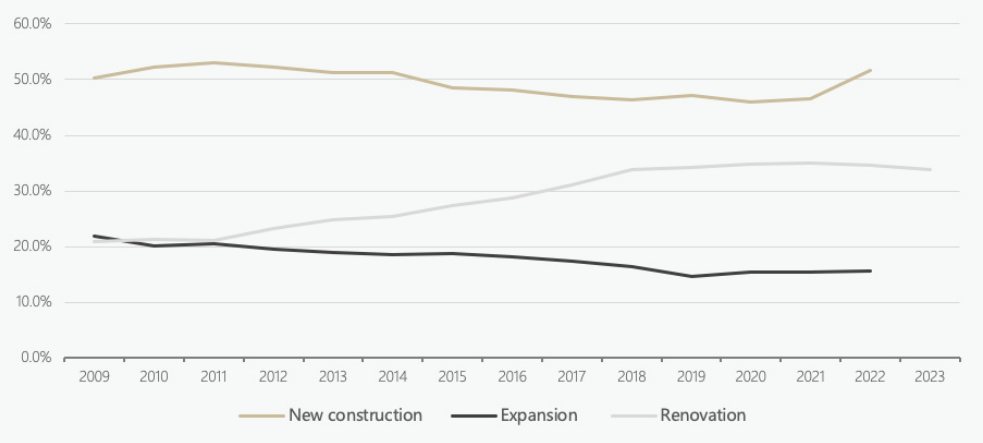
Next, the brief attempted to examine the depreciation scale in the manufacturing sector and its proportion relative to new fixed asset investment from two alternative dimensions.

The first dimension involves using the proportion of renovation and technological transformation investment to estimate the share of depreciation-induced investment. According to the classification by the NBS, fixed asset investment can be divided into three categories: a. new construction, b. expansion, and c. renovation and technological transformation. By definition, **new construction** investment refers to projects that are built from scratch. **Expansion** investment refers to projects that add production workshops (or major projects), branches, or independent production lines at a factory or other location to increase the production capacity (or efficiency) of existing products or to add new production capabilities. **Renovation and technological transformation** investment refers to projects involving technological transformation or upgrades (including ancillary production and welfare facilities) at existing enterprises or public institutions.

From the definition, it is clear that renovation and technological transformation investment aligns more closely with the concept of equipment renewals and is likely to correspond to some capital depreciation or obsolescence, with less impact on capacity compared to new construction and expansion investments. Based on data published by the NBS, we have calculated the share of renovation and technological transformation investment in manufacturing investment. As shown in Figure 3, since 2018, the share of renovation and technological transformation investment in manufacturing investment has been relatively stable at 34%, **implying that at least one-third of the annual new manufacturing investment is related to asset depreciation.** It is worth noting that this calculation method underestimates the actual depreciation rate, because for the industry, the exit of companies is also a form of depreciation, and the more companies that exit, the higher the proportion of asset depreciation. For instance, if one company exits an industry while another enters with the same production capacity, the investment of the new entrant is counted as new investment, but

from an industry perspective, the production capacity remains unchanged, which seems more akin to the notion of depreciation.

Figure 3: Share of New Investment in Manufacturing by Nature of Construction



The second dimension involves using data from publicly listed manufacturing companies to estimate the proportion of depreciation-induced investment in new investment. According to the industry classification by the China Securities Regulatory Commission, the depreciation rate for sample companies is calculated based on three indicators from their financial statements: "Total Fixed Assets", "Depreciation of Fixed Assets, Depreciation of Productive Biological Assets", and "Cash Paid for the Acquisition of Fixed Assets, Intangible Assets, and Other Long-term Assets", based on which the proportion of depreciation-induced investment in new fixed asset investment. The depreciation rate = current year's depreciation scale / previous year's fixed asset scale. We measured the sample's depreciation rate through two approaches: first, the median depreciation rate of publicly listed manufacturing companies, and second, the total depreciation of all manufacturing companies divided by their total fixed assets.

The results, as illustrated in Figures 4 and 5, show that the two calculation methods do not differ significantly. Both methods demonstrate that the proportion of depreciation-induced investment in new fixed asset investment is very close, with the median and aggregated averages in 2014 being 45.3% and 45.6%, respectively. Similarly, since 2014, the depreciation rate measured by both methods for publicly listed manufacturing companies has

been in the range of 10%-12%, with the median measured depreciation rate and the aggregated depreciation rate averaging 11.4% and 10.6% during this period. Furthermore, since 2012, both methods have shown a rising trend in the measured depreciation rates.

Figure 4: Share of Depreciation-induced Investment in New Fixed Asset Investment of Publicly Listed Manufacturing Companies

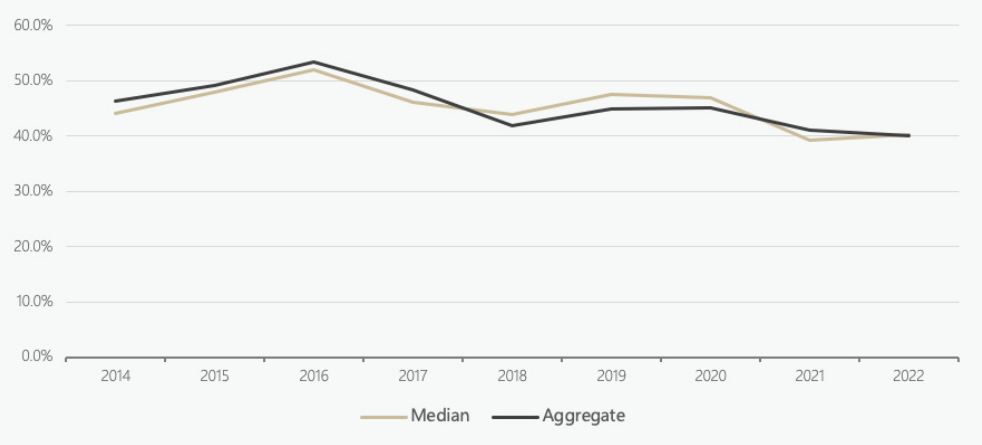
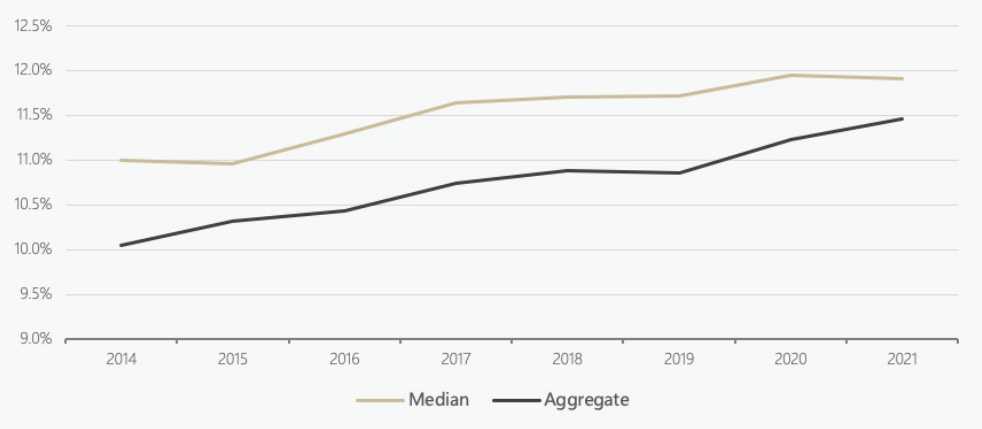


Figure 5: Natural Depreciation Rate of Fixed Assets for Publicly Listed Manufacturing Companies



IV. Conclusion and Policy Implications

We estimated the depreciation scale and its share of new investments in the manufacturing sector through three methods. The first method, based on the increased fixed assets and new fixed asset investments of manufacturing enterprises, suggests that the depreciation-induced investment ratio is as

high as 77%. However, due to various data issues, this clearly overestimates the proportion of depreciation. The second method, employing renovation and technological transformation investment to indirectly measure the scale of depreciation, indicates that depreciation-induced rigid investment accounts for 34% of new investment in manufacturing. However, this method excludes some investments that are depreciation-induced. The third method, which utilizes data from publicly listed manufacturing companies, finds that depreciation-induced investment accounts for 45% of new fixed asset investment. Compared to the first two methods, the third method is supported by more robust financial data and yields results that lie between the two previous calculations, with a corresponding depreciation rate that aligns closely with settings found in some academic research.

Assuming that the third method gives a more precise measurement of the depreciation-induced investment share in the manufacturing sector, we can infer that from 2021 to 2023, investment related to natural depreciation in China's manufacturing sector would be 22.3 trillion yuan, averaging 7.4 trillion yuan per year. During the same period, the average fixed asset scale in China's manufacturing sector was 46.9 trillion yuan, with a corresponding depreciation rate of approximately 15.7%. **In 2023, with the fixed asset scale of China's manufacturing at 50.8 trillion yuan, a 15.7% depreciation rate implies that the natural depreciation of existing capital in the manufacturing sector for 2024 would reach 8 trillion yuan.** In other words, to maintain the current output levels of the manufacturing sector, the corporate sector would need at least 8 trillion yuan in new investment annually to offset this capital depreciation.

The estimation of this brief has at least three policy implications:

First, **the scale of "passive" investment driven by the depreciation of capital stock in China is larger than anticipated. The "5 trillion yuan in equipment investment" should not be simply interpreted as the incremental part of China's manufacturing investment for 2024.** The findings of this brief suggest that the manufacturing investment demand driven by natural capital depreciation may significantly exceed the 5 trillion yuan scale. Indeed, the proportion of this depreciation-induced investment

reflected as equipment renewal investment deserves further discussion. However, considering both accounting standards and natural conditions, the depreciation rate of machinery and equipment is always significantly higher than that of factory buildings, making it seem more reasonable that most depreciation-related investment is reflected as equipment renewal. Additionally, technological advancement accelerates the depreciation rate of machinery and equipment but does not affect the depreciation rate of buildings.

Furthermore, given such a large scale of depreciation, it may not be easy to increase the pace of equipment renewal (depreciation rate) through subsidy policies. For micro entities, whether it's adding machines or upgrading equipment, purchasing machinery and equipment is a typical long-term investment, depending on the entrepreneur's assessment of key factors such as market demand and the pace of technological progress over a longer future period. Therefore, whether entrepreneurs choose to upgrade equipment is an intertemporal optimization issue. To change this optimal solution, the key is to adjust entrepreneurs' current and future expectations of relative prices for output and capital goods. For example, if entrepreneurs anticipate a significant increase in future product prices or a significant reduction in current investment costs, choosing to upgrade equipment sooner might become the new optimal solution.

Second, **China's economy is becoming "heavier". As the scale of savings consumed to maintain the capital stock is gradually increasing, the efficiency of national wealth accumulation is declining.** Depreciation can be understood from two perspectives: on one hand, it is the natural wear and tear of capital, which is difficult to avoid and thus often exogenously manifest in mainstream macroeconomic models, but it determines the final equilibrium level of per capita capital stock and output level. The higher the depreciation rate, the lower the corresponding equilibrium per capita capital stock and output level. On the other hand, new investment is needed to compensate for depreciation in order to maintain the capital stock and output level. In the equilibrium state of the Solow model, all savings transformed into investment essentially offset the erosion of capital stock

by capital depreciation. In this sense, depreciation-induced depreciation is passive investment. Thus, as capital accumulates, the scale of depreciation associated with capital stock also increases, pushing up the "passive" investment required to maintain the capital stock and output level rises and thereby consuming a large amount of savings.

Third, **given the capital return rate, an increase in the depreciation rate implies a reduction in the profit margins, thereby lowering the equilibrium interest rate.** Depreciation can be understood both as the wear and tear of capital stock and as the gradual transformation of previous investment into product profits. When the NBS formulates the flow of funds accounts, it labels the sum of fixed asset depreciation and operating surplus as total operating surplus, without separately measuring the fixed asset depreciation and operating surplus of each sector. Given the capital return rate, an increase in the depreciation rate means a decrease in the profit margins. As shown in Figure 5, the past decade has seen a rising trend in the depreciation rate of publicly listed manufacturing companies in China, and as pointed out in our previous brief (see *The Impact of Narrowing Spreads of the Private Sector on Credit Expansion*"), the capital return of publicly listed companies has also been on a continuous downward trend. In other words, the business sector is currently facing a "double whammy" of falling capital return and rising depreciation rate, which will gradually lower China's equilibrium interest rate. Therefore, when considering the impact of corporate financing costs on corporate investment, it is necessary not only to consider changes in the capital return but also to incorporate changes in the depreciation rate to more objectively assess the actual impact of financing cost reduction on enterprises.

Disclaimer