

# Broad Money Growth, R&D Investment and Corporate Performance

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**Abstract**—Taking 672 companies in Shanghai and Shenzhen as research samples, Empirically analyzes of the relationship between growth of broad money supply, R&D investment and corporate performance, and Grouping study from before and after the financial crisis and whether it was manufacturing. Full sample study shows: Broad money supply growth has a positive effect on R&D investment, Broad money supply growth has a positive effect on corporate performance, R&D investment has an incentive for corporate performance, Corporate Performance Supports R&D Investment, Positive influence has hysteresis on Broad money supply growth influencing R&D investment and corporate performance, R&D investment and corporate performance are two-way promotion relations. Group inspection results show: Before positive effect on broad money supply growth influencing R&D investment and corporate performance was significant after the financial crisis, there are differences in incentive effects between growth of Broad money supply influencing manufacturing Enterprise performance and growth of Broad money supply influencing non-manufacturing Enterprise Performance.

**Keywords**—*broad money supply; R&D investment; corporate performance*

## I. INTRODUCTION

The money supply is the intermediate goal of China's monetary policy. The money supply plays a decisive role in the monetary policy system. The level of money supply is a major target for the regulation of a country's monetary policy. The change in the supply of money is one of the main basis for formulating monetary policy. China's supply of broad money (M2) grew rapidly in the past 20 years. In December 1995, the balance of M2 was 6.075 trillion Yuan. By December 2017, the balance of M2 was 167.68 trillion Yuan, and the scale of social financing in 2017 was 174.64 trillion Yuan, China's current money supply base has been relatively high, and M 2 has ranked first in the world in terms of balance and increment. The rapid growth of broad money supply has led to a modest increase in the scale of loans and social financing. Finance has effectively supported the steady development of the national economy and structural adjustment, and has also effectively eased corporate financing difficulties and financing constraints. At the same time, high-speed growth and high-quality development are major turning points in China's economic

transformation. Completing this major change as soon as possible is a fundamental guarantee for China's smooth realization of the two hundred-year goals and the great rejuvenation of the Chinese nation. The fundamental condition of this economic transformation is the continuous improvement of economic efficiency, and the fundamental driving force is the increasing intensity of science and technology in the production process. The enterprise is the main body of science and technology to invest in the production process. The R&D investment of the enterprise is one of the important ways for science and technology to be put into production. The R&D investment of the enterprise is closely linked with the external financing environment. The external financing environment of the enterprise is often affected by the monetary policy. At the same time, increasing R&D investment is the key to promoting the emergence and development of new technologies, and it is also the key for enterprises to obtain core competitiveness. Core competitiveness is the driving force for improving corporate performance. Although there are numerous literatures that have separately studied how loose monetary policy and tightening monetary policy affect corporate R&D investment, they also summarize the R&D investment characteristics of companies under different monetary policies, but how broad money supply growth affects corporate R&D investment and broad money As supply growth and R&D investment affect corporate performance, the theoretical community has seldom discussed this issue. In view of this, this paper takes China's A-share listed company as the research object, discusses the mechanism of broad money growth and corporate R&D investment affecting corporate performance, and provides theoretical support for corporate R&D investment and corporate performance.

## II. LITERATURE REVIEW

The relationship between monetary policy and corporate R&D investment has long attracted the attention of the academic community. Many scholars have conducted extensive research on this issue. The previous year's asset-liability ratio of U.S. companies is negatively related to current R&D investment (Bhagat Sanjai, Welch Ivo, 1995). Liability and R&D for technology-based companies there is a negative correlation between inputs, and a positive correlation for non-scientific enterprises (Chiao Chaoshin, 2002). In the absence of credit constraints, the proportion of

R&D investment in investment has anti-periodic characteristics (Aghion&Howitt, 2007). Banks have R&D The support role has been continuously strengthened (Hall, B.H. and Van Reenan, 2000). .

Whether monetary policy affects corporate performance has been discussed by many scholars. Monetary policy indirectly affects the performance of real estate companies (Kearl, Mishkin, Frederic, 1977) the change in money supply is positively related to corporate performance (Chant, 1980). Monetary policy may affect sales revenue by affecting the financial status of the company (Gertler&Gilchrist, 1994) the monetary policy tightening will lead to a higher growth of corporate performance in the next year. Loose monetary policy environment will weaken the inverse N-type relationship between the magnitude of strategic change and corporate performance (Yang Yan, Chen Yujie, Chen Shou, 2015), and monetary policy tightening has a significant negative impact on firm performance.

The relationship between R&D investment and corporate performance has long drawn the attention of the academic community. Scholars at home and abroad have conducted extensive research on this issue. Some scholars believe that R&D investment and corporate performance are linear, and some scholars believe that R&D investment and corporate performance are non-linear. The research conclusions of linear relationship between R&D investment and corporate performance are again divided into positive correlation, negative correlation, and irrelevance. The representative results in these research literatures are: there is a significant linear relationship between the increase in enterprise technology R&D and the market value of the firm (Libik, 1969), and R&D investment is significantly positively related to corporate performance (Young & Jordan, 2008). There is a clear positive correlation between R&D investment and corporate performance. Relevance, R&D investment has a significant role in promoting corporate performance (Luo Fubi, Liu Lu, 2017), R&D investment has a significant inhibitory effect on financial performance indicators (Lantz J S., Sahut, 2005), and R&D intensity has a significant negative correlation with the company's operating performance for the year. R&D investment has no significant impact on corporate performance (Lin, Lee, Hung, 2006). There is no significant relationship between R&D investment and corporate financial performance (Rubin, 2008). R&D input intensity has a significant three-fold effect on the impact of different ownership enterprise performance (Han Xianfeng, Hui Ning, 2016). There is a nonlinear relationship between R&D investment and corporate performance. R&D investment has no obvious inhibitory effect on current performance. It has a significant inhibitory effect on lag phase 1 performance and has no positive effect on lag phase 2 performance (Jia Mingqi, Zhang Yuzhen, 2017).

In summary, the academic community has rich research results on the relationship between monetary policy and R&D investment, the relationship between monetary policy and corporate performance, and the relationship between

R&D investment and corporate performance. However, there are significant differences in research conclusions. It is necessary to conduct in-depth exploration of these relationships. Expand. Therefore, in view of the fact that fewer scholars examine the two-way interaction mechanism between R&D investment and corporate performance from the perspective of broad money supply growth, this paper incorporates broad money supply growth, R&D investment and corporate performance into the research framework, and explores the interaction mechanism between the three.

### III. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

#### A. Growth of Broad Money Supply and Corporate R&D Investment

In the historical intersection of the revolution in science and technology, industrial transformation, and China's transformation of development methods, corporate R&D investment has become one of the key approaches to technological advancement. Through technological advancement, responding to the rapidly changing business environment outside the company has become a guarantee for the survival and development of the company. R&D investment is a long-term investment that requires continuous investment by enterprises. Insufficient funds often lead to the termination or failure of R&D. Adequate funding is the key to R&D activities of enterprises. It is difficult to support long-term, high-input, high- Venture R&D investment and corporate external financing have become one of the important sources of funding for R&D activities. Exogenous financing is highly dependent on indirect financing due to the underdevelopment of China's direct financing market. Indirect financing will create new deposits and currencies in the form of loans. For the foreign financing funds required for investment, bank-led financial structures are better than financial markets. Leading financial structures add more currencies. The external financing environment is also affected by monetary policy. Loose monetary policy reduces the degree of corporate finance constraints. The tightening monetary policy increases the level of corporate finance constraints. The loose monetary policy and the dynamic changes in tightening monetary policy have brought about the failure of monetary policy. Certainty and volatility, this uncertainty and variability often affect corporate R&D investment expectations. When the uncertainty of the monetary policy is low, the company can form a relatively stable expectation and make R&D investment decisions accordingly. When the monetary policy tightens, the company will reduce the R&D investment scale, and expand the R&D investment scale when the monetary policy is loose. China's monetary policy is the result of a series of comprehensive trade-offs. The money supply is the intermediate goal of China's monetary policy and it plays a decisive role in the monetary policy system. The level of money supply is the main object of the adjustment of a country's monetary policy, and its change is one of the main basis for formulating monetary policy. The significant impact of the broad money supply on output means that the Central Bank should use M2 as an intermediate goal to

control and operate the correct monetary policy, pay close attention to M2 changes, detect changes in M2, and use M2 as the focus of monetary policy. Object (Gao Honghai, 2012). The change in the broad money growth rate will eventually be fully reflected in the nominal economic growth rate, because the broad money growth rate of the wealth reserve means of money exceeds the sum of the real economic growth rate and the inflation rate. The growth of broad money supply amplifies the money multiplier and expands the money supply by the currency multiplier. The rise of the currency multiplier is also an important factor affecting the growth of M2. In the modern credit economy, most of the credit currency is also obtained through the issuance of loans to the circulation. The issuance of loans essentially means the provision of means of purchase to the applicant loaner. M2 growth rate is faster, then the investment and the middle market are active. High investment is the reason for high credit, and high credit is the reason for high M2 or high money growth. The growth of broad money supply has increased the liquidity of money and the stock of market currencies, making it easier for companies to obtain loans, and companies can get more loans to invest in R&D.

Hypothesis 1: The growth of broad money supply in the current period, the growth of broad money lagging behind in one period, the increase of broad money supply in the second period, and the increase of broad money supply in the third period will have a positive impact on R&D investment in the current period.

#### *B. Broad Money Supply Growth and Corporate Performance*

The monetary policy environment is an important external environment that affects the development of enterprises. Changes in monetary policy have exacerbated the complexity and dynamics of the corporate environment. Under the loose monetary policy, the broad money supply has increased, the broad money growth has brought about the rise of the money multiplier, and the broad money growth has appeared through debt expansion. The increase in the currency multiplier can be exactly the same as the debt leverage. With broad money growth, lower interest rates and debt expansion will make it easier for companies to obtain support for bank credit financing. Enterprises can obtain loans at relatively low interest rates. This can ease corporate financing constraints and reduce financial costs. It can also be used by enterprises. Expansion provides adequate financial support. Enterprises have sufficient financial support, can improve equipment and improve production efficiency, new investment projects will be more profitable, companies will have good profit opportunities and profitability levels, loose monetary policy will weaken the effect of financial flexibility on corporate performance. . Under the tightening monetary policy, the broad money supply will decrease, the currency liquidity will weaken, the interest rate will increase, the financing environment will deteriorate, the financing cost will increase, the industry demand will decrease, the industry competition will intensify, and consumers' willingness to consume in the current period will weaken. As a result, the company's sales revenue

declines, tightening monetary policy will reduce loan supply and affect corporate investment, and companies that reduce long-term loans and short-term investments to reduce financing costs will increase long-term capital surplus of the company. Short-term loans and long-term investment will negatively affect corporate performance. The role is also large, but companies with high financial flexibility can reduce the external financing constraints of the company, and improve corporate performance by rationally arranging business activities and seizing valuable investment opportunities.

Hypothesis 2: Growth of broad money supply in the current period, broad money supply lagging behind in one period, growth of broad money supply in lagging period two, growth of broad money supply lagging in three periods have a positive impact on current company performance.

#### *C. R&D Investment and Corporate Performance*

Sustained and relaxed money supply can theoretically provide sufficient financial support for corporate R&D investment. High growth rate of broad money supply can theoretically ease corporate financing constraints. Coupled with the continuous interest rate cut by the Central Bank, R&D investment will be greatly reduced. With regard to the cost of capital, companies have the opportunity to provide financial support for R&D investment through internal financing and external financing. Corporate R&D investment is also the main way to obtain intangible assets that are valuable, difficult to imitate, and difficult to replace. Companies that develop new products through R&D investment can better meet the needs of existing and potential customers, acquire new customer groups, develop new markets, increase market share, increase brand awareness, reduce production costs or increase sales revenue, and The use of technology or the launch of new products will bring new competitive advantages to the company.

R&D investment is a dynamic process in which new technologies, new products and markets are combined, and R&D investment paths are mainly embodied in product innovation and process innovation. Enterprise R&D investment can also improve product production processes through process innovation, technological innovation, etc., be able to discover new production methods, improve existing production technologies, thereby reduce the company's production costs and increase the company's production efficiency; R&D investment is also conducive to resources. To reorganize and optimize the company's technological process and shorten the product development cycle, it can also bring new growth opportunities to the company through the formation of differentiated, heterogeneous and exclusive products and services. R&D investment is more conducive to the enhancement of the adaptability of business organizations and can improve the ability of enterprises to acquire, absorb and utilize external knowledge. The technical advantages and knowledge gained by R&D investments in different years can enhance the level of corporate performance in the coming years.



R&D investment can establish a bridge between growth of broad money supply and corporate performance. Corporate R&D investment is the fundamental source of sustaining the company's sustainable development. Adequate funding is a necessary condition for guaranteeing the successful completion of R&D activities. The actual application of R&D results will in turn promote the improvement of technological efficiency of enterprises and help companies obtain a comparison with other companies. Advantages, promote enterprises to obtain excess profits, and then enhance corporate performance. After the continuous improvement of corporate performance, companies have more resources to invest in R&D activities.

Hypothesis 3: The R&D investment lagging behind in the first phase, the R&D investment in the second phase of lagging behind, and the R&D investment in the lagging three phases all have a promoting effect on the current corporate performance.

Hypothesis 4: Corporate performance in the current period, corporate performance lagging behind in the first phase, corporate performance lagging behind in the second phase, and corporate performance lagging behind in the third phase all have an incentive effect on current R&D investment.

#### IV. RESEARCH DESIGN

##### A. Sample Selection and Data Sources

This article takes a sample of A-share companies listed on the Shanghai and Shenzhen Stock Exchanges from 2004 to 2017. The sample has been selected as follows: 1) Remove companies with data missing and companies with abnormal data; 2) Remove special financial companies; 3) Remove real estate industry Listed companies; 4) deleted companies that are insolvent, ST; 5) companies listed more than 10 years. After screening, there are 672 companies that meet the sample conditions. The financial data used in this paper is mainly derived from the CSMAR and CCER databases. The monetary policy data comes from the website of the People's Bank of China and the "China Financial Statistics Yearbook" and was manually compiled. This article performs winsorize processing on 1% and 99% quantiles for continuous variables. Data processing uses Stata 14.0 and Excel 2016.

##### B. Model Design and Variable Definition

With reference to the relevant experience of existing literature, this paper will examine the basic quantitative regression model for the impact of monetary policy on R&D investment as follows:

$$RD_{i,t} = \mu_0 + \mu_1 MP_t + \mu_2 MP_{t-1} + \mu_3 MP_{t-2} + \mu_4 MP_{t-3} + \sum \kappa_j control_{i,t-1} + \varepsilon \quad \text{Model (1)}$$

R&D investment ( *RD* ) definitions and metrics. The domestic and foreign existing documents mainly measure the R&D investment on the basis of total assets, main business income, and market value. This article draws on the practice of most documents and selects the R&D capital investment

intensity to measure corporate R&D investment. The intensity of investment in R&D funds refers to the proportion of R&D investment in total operating revenue.

Broad money growth is measured by the broad money growth rate (*M2*).

Control variables ( *control* ) definitions and metrics. ①

The cash flow ( *Cashflow* ) is measured by "net cash flow from operating activities/total assets at the end of the period"; ② the liquidity of assets ( *Assetsflow* ) is measured by the ratio of corporate liquid assets to total assets; ③ the market power ( *Marketforæs* ) represents the enterprise's profit margin. Market power, margin of profit is measured by "sales/(sales-operating profit)"; ④ long-term capital yield ( *LTCR* ) is measured by "(total profit + financial expenses)/(average of long-term liabilities + average value of owner's equity)"; ⑤ Operational risk ( *Bu sin essrisk* ) is measured by "operating cost/operating income"; ⑥ enterprise scale ( *Size* ) is measured by the natural logarithm of the employee's scale; ⑦ the company's age ( *Age* ) is measured by the natural logarithm of the years of establishment of the enterprise.

Where *i* represents the company, *t* represents the year, *j* = 0,1,2,3,4,5,6,7,..., and *ε* represents the random error term. Same as below.

$$Performance_{i,t} = \alpha_0 + \alpha_1 MP_t + \alpha_2 MP_{t-1} + \alpha_3 MP_{t-2} + \alpha_4 MP_{t-3} + \sum_1^n \lambda_j Control_{i,t-1} + \varepsilon \quad \text{Model (2)}$$

Enterprise performance ( *Performance* ) definition and measurement. Corporate performance refers to the operating efficiency and performance of the business operators during a certain period of operation. In order to fully and objectively reflect the performance of a company, this paper selects the main business profit margin (net profit/main business income), net assets yield (net profit/average net assets), return on assets (net profit/average total assets), Equity-to-equity ratio (equity/liabilities), asset-liability ratio (total liabilities/total assets), current assets turnover (net income from main operations/average current assets), total assets turnover (core of main operations income) (Amount/Average Assets), Capital Accumulation Rate ((Equity at End of Period - Equity at Start of the Year)/Equity at Start of the Year), Total Asset Growth Rate (Total Assets at the Period-Total Assets at Beginning / At Beginning of Assets), Business The income growth rate ((current operating income - previous operating income) / previous operating income) consists of a total of ten indicators. The principal component analysis method is used to calculate the score coefficient of each component, forming a linear equation with three principal components, using linearity of three principal components. The equations calculate the company's comprehensive performance index, and finally use the company's comprehensive performance index as the proxy variable for corporate performance.

With reference to the relevant experience of the existing literature, this paper will examine the basic quantitative regression model for R&D investment impact on corporate performance as follows:

$$\begin{aligned} Performance_{i,t} = & \beta_0 + \beta_1 RD_{i,t} + \\ & \beta_2 RD_{i,t-1} + \beta_3 RD_{i,t-2} + \beta_4 RD_{i,t-3} \\ & + \sum \lambda_j control_{i,t-1} + \varepsilon \end{aligned} \quad \text{Model (3)}$$

With reference to the relevant experience of existing literature, this paper will examine the basic quantitative regression model for the impact of corporate performance on R&D investment as follows:

$$\begin{aligned} RD_{i,t} = & \phi_0 + \phi_1 Performance_{i,t} + \\ & \phi_2 Performance_{i,t-1} + \phi_3 Performance_{i,t-2} \\ & + \phi_4 Performance_{i,t-3} \\ & + \sum \delta_j control_{i,t} + \varepsilon \end{aligned} \quad \text{Model (4)}$$

## V. EMPIRICAL ANALYSIS

### A. Descriptive Statistics

"Table I" shows the descriptive statistics of the main variables. The average enterprise performance was 0.0401, the median was 0.0352, the minimum value was -0.0018, and the maximum value was 0.2137, which showed that the sample companies had large differences in corporate performance; the sample company's average R&D investment was 0.0302, and there was a large gap between the maximum and minimum values. It shows that there is a big difference in the R&D investment of the sample companies; the mean value of the monetary policy variables is 0.0712, and there is a big difference between the maximum and minimum values, which indicates that there is a large fluctuation in the monetary policy; the minimum value of long-term capital return is 0.0137, the largest The value is 0.8781, and the mean value is 0.6456. This shows that there is a significant difference in long-term capital investment return. From the perspective of business risks, the average value is 0.7154, the maximum value is 0.8934, and the minimum value is 0.0928, which indicates that the sample companies have large differences in operating risks.

TABLE I. DESCRIPTIVE STATISTICS OF MAJOR VARIABLES

variable	mean	median	Maximum	Min
<i>Performance</i>	0.0401	0.0352	0.2137	0.0018
<i>RD</i>	0.0302	0.0268	0.4246	0.0002
<i>MP</i>	0.0712	0.0678	0.1904	0.0217
<i>Cashflow</i>	0.0216	0.0164	0.1714	-0.017
<i>Assetsflow</i>	0.8012	0.7334	0.9312	0.0267
<i>Marketfores</i>	2.6323	2.0156	10.3467	0.9845
<i>LTCR</i>	0.6456	0.6972	0.8781	0.0137
<i>Bu sin essrisk</i>	0.7154	0.7448	0.8934	0.0928

### B. Analysis of Empirical Results

Using panel data, a fixed effect model was selected to test Hypothesis 1. The test results are shown in "Table II".

"Table II" lists the regression results of the full-sample cross-section data. It can be seen that the estimated coefficient of growth of the broad money supply in the current period is 0.021 and significant at the 5% level. The estimated coefficient is 0.142 and it is significant at the 1% level. The estimated coefficient of the broad money supply growth in the second phase is 0.091 and it is significant at the 1% level. The estimated coefficient of the broad money supply growth in the third phase is 0.001. It is significant at the level of 10%, which shows that the growth of broad money supply has a supporting effect on corporate R&D investment. The growth effect of the broad money supply with lag phase I and lag phase II is greater than the growth and lag of broad money supply in the current period. The growth of the broad money supply in the third period reflects the lagging effect of the increase in broad money supply on corporate R&D investment. From the regression results of the control variables, the cash flow, asset liquidity, enterprise size, and enterprise age are all significantly negatively related to corporate R&D investment at the 1% level, indicating that the cash flow, asset liquidity, enterprise scale, and enterprise age are lagging behind. It has an inhibitory effect on current R&D investment; market power, long-term capital yield, and business risk are all significantly positively related to R&D investment at the 1% level, indicating that the market power, long-term capital yield, and business risk lagging behind in the current period are relatively positive to the current period. The R&D investment has a catalytic effect.

In order to further analyze the impact of broad money supply growth on corporate R&D investment before and after the 2008 financial crisis, the samples were divided into 2004-2007 sample groups and 2008-2017 sample groups and fixed-effect models were selected for testing. In order to further analyze the impact of broad money supply growth on R&D investment in manufacturing and non-manufacturing companies, this paper divides the sample into sample groups for manufacturing companies and non-manufacturing companies, and then selects fixed-effect models for testing. The empirical results are shown in "Table II". Through the regression results of the two sample groups before and after the financial crisis, the growth effect of the broad money supply before the financial crisis on corporate R&D investment is better than the promotion effect of the broad money supply growth on R&D investment after the financial crisis, which indicates that the financial year 2008 The rapid growth of the broad money supply after the crisis has had a huge impact on the company's expectations and has changed the strength of corporate R&D investment. Through the regression results of the sample groups of manufacturing enterprises and non-manufacturing enterprises, the effect of growth of broad money supply on the R&D investment of manufacturing companies is superior to the effect of broad money supply growth on R&D investment of non-manufacturing companies. It shows that manufacturing companies pay more attention to R&D investment, and the growth of broad money supply stimulates the R&D investment of manufacturing companies by alleviating the financing constraints of manufacturing companies. In summary, hypothesis 1 is verified.

TABLE II. EMPIRICAL RESULTS OF BROAD MONEY SUPPLY GROWTH AND CORPORATE R&amp;D INVESTMENT

Variable name	Full sample	2004-2007 Sample group	2008-2017 Sample group	Manufacturing Enterprise Sample Group	Non- manufacturing Corporate sample group
$MP_t$	0.021** (3.35)	0.051*** (4.59)	0.001* (3.07)	0.041** (3.74)	0.002* (2.97)
$MP_{t-1}$	0.142*** (4.73)	0.231*** (5.89)	0.002** (3.21)	0.031** (4.18)	0.001** (3.13)
$MP_{t-2}$	0.091*** (4.03)	0.017*** (4.63)	0.001* (3.03)	0.054** (3.84)	0.004* (2.98)
$MP_{t-3}$	0.001* (2.95)	0.046** (3.12)	0.006* (3.01)	0.037** (3.83)	0.004* (3.07)
<i>Cashflow</i>	-0.003*** (-2.92)	-0.001*** (-3.45)	-0.004** (-2.97)	-0.048*** (-3.17)	-0.003** (-2.98)
<i>Assetsflow</i>	-0.005** (-3.72)	-0.003** (-3.83)	-0.002** (-3.16)	-0.073** (-3.68)	-0.007** (-3.01)
<i>Marketforæs</i>	0.016*** (4.75)	0.064*** (4.18)	0.005** (3.08)	0.053*** (4.24)	0.008** (3.05)
<i>LTCR</i>	0.015*** (3.02)	0.061*** (3.53)	0.001** (3.07)	0.032*** (3.48)	0.004** (3.14)
<i>Businessrisk</i>	0.024*** (3.64)	0.003*** (3.79)	0.001** (3.12)	0.036*** (3.03)	0.007** (3.05)
<i>Size</i>	-0.002* (-3.35)	-0.035* (-3.96)	-0.009* (-2.98)	-0.026* (-3.35)	-0.002* (-2.97)
<i>Age</i>	-0.007* (-2.81)	-0.013* (-3.14)	-0.004* (-2.94)	-0.061* (-3.18)	-0.001* (-2.95)
<i>Constant</i>	-0.017** (-3.42)	-0.014** (-3.64)	-0.006** (-3.04)	-0.021** (-3.24)	-0.003** (-3.01)
<i>industry</i>	control	control	control	control	control
<i>years</i>	control	control	control	control	control
<i>Adj - R<sup>2</sup></i>	0.312	0.378	0.286	0.323	0.297
<i>F Statistics</i>	48.2	79.6	51.4	64.3	50.2
<i>Number of samples</i>	672	314	672	459	213

<sup>a</sup> Note: \*\*\*, \*\*, \* indicate the significant level of the coefficient passing 1%, 5%, and 10% respectively, and the t-statistic after the correction of the heteroscedasticity is in the bracket.

Using panel data, a fixed effect model was chosen to test Hypothesis 2. The test results are shown in "Table III". "Table III" lists the regression results of the cross-sectional data of the entire sample. It can be seen that the estimated growth rate of the broad money supply in the current period is 0.011 and it is significant at the 5% level. The estimated coefficient is 0.213 and significant at the 1% level. The estimated coefficient for the broad money supply growth in the second phase is 0.074 and is significant at the 1% level. The estimated coefficient for the broad money supply growth in the third phase is 0.032 and Significant at the 5% level, indicating that the growth of broad money supply has a positive effect on corporate performance. The effect of broad money supply growth at the end of lag phase I and delay phase 2 is greater than that of the current and late three-stage broad money supply. The role of growth in the promotion of corporate performance reflects the growth of broad money supply, which provides companies with the opportunity and possibility to obtain more operating funds. Enterprises use these funds to improve their performance by improving their business operations. From the regression results of the control variables, cash flow, asset liquidity, firm size, and firm age are all significantly negatively related to firm performance at the 1% level, indicating that the cash flow, asset liquidity, firm size, and firm age are lagging behind in the first phase. In the current period, corporate performance has an inhibitory effect; market power, long-term capital yield, and business risk are all positively related to corporate performance at a level of 1%, indicating that the market

forces, long-term capital yields, and business risks lagging behind in the current period Performance has a supporting role.

In order to further analyze the impact of broad money supply growth on corporate performance before and after the 2008 financial crisis, this paper will divide the full sample into sample groups from 2004 to 2007 and sample groups from 2008 to 2017. In order to further analyze the impact of broad money supply growth on the performance of manufacturing companies and non-manufacturing companies, this paper will divide the entire sample into sample groups of manufacturing companies and non-manufacturing companies, and select the fixed effect model pairs for these four. The empirical results are shown in "Table III". From the regression results of the two sample groups, the effect of broad money supply growth on corporate performance before the financial crisis in 2008 was better than the effect of broad money supply growth on corporate performance after the financial crisis, indicating the broad money supply after the financial crisis. The optimization of the business environment for the company gives the company performance. The improvement provided support. From the regression results of the sample groups of manufacturing firms and non-manufacturing firms, the effect of growth in broad money supply on the performance of non-manufacturing firms is better than the effect of broad money supply growth on the performance of manufacturing firms. In summary, Hypothesis 2 is verified.

TABLE III. EMPIRICAL RESULTS OF BROAD MONEY SUPPLY GROWTH AND FIRM PERFORMANCE

Variable name	Full sample	2004-2007 Sample Group	2008-2017 Sample group	Manufacturing Enterprise Sample Group	Non-manufacturing enterprise sample group
$MP_t$	0.011** (4.23)	0.067** (5.34)	0.002* (3.05)	0.046** (3.76)	0.003** (4.12)
$MP_{t-1}$	0.213*** (5.76)	0.352*** (6.18)	0.031** (4.08)	0.197** (4.24)	0.031*** (5.15)
$MP_{t-2}$	0.074*** (4.86)	0.098*** (5.86)	0.012** (4.17)	0.064** (4.16)	0.002*** (4.19)
$MP_{t-3}$	0.032** (4.32)	0.064** (5.12)	0.032* (4.02)	0.051** (4.76)	0.004*** (5.09)
<i>Cashflow</i>	-0.001*** (-3.14)	-0.021*** (-4.17)	-0.041*** (-4.06)	-0.002*** (-3.25)	-0.071** (-4.16)
<i>Assetsflow</i>	-0.001*** (-3.35)	-0.053*** (-4.54)	-0.036*** (-3.76)	-0.003*** (-3.64)	-0.056** (-3.96)
<i>Marketforæs</i>	0.009*** (3.51)	0.041*** (4.57)	0.037*** (3.76)	0.001*** (3.62)	0.027** (3.86)
<i>LTCR</i>	0.011*** (3.14)	0.314*** (4.17)	0.115*** (4.34)	0.153*** (4.11)	0.017** (4.75)
<i>Bu sin essrisk</i>	0.017*** (2.92)	0.047*** (3.23)	0.032*** (3.35)	0.035*** (3.27)	0.022** (3.85)
<i>Size</i>	-0.001*** (-3.25)	-0.003*** (-3.73)	-0.002*** (-3.42)	-0.004*** (-3.24)	-0.006* (-3.78)
<i>Age</i>	-0.001*** (-3.41)	-0.002*** (-3.57)	-0.006*** (-3.31)	-0.003*** (-3.14)	-0.003* (-3.75)
<i>Constan t</i>	-0.048** (-4.85)	-0.016** (-4.78)	-0.012** (-4.12)	-0.017** (-4.18)	-0.003** (-4.05)
<i>industry</i>	control	control	control	control	control
<i>years</i>	control	control	control	control	control
<i>Adj - R<sup>2</sup></i>	0.347	0.376	0.302	0.316	0.306
<i>F Statistics</i>	49.3	76.3	59.6	63.1	65.3
<i>Number of samples</i>	672	314	672	459	213

a. Note: \*\*\*, \*\*, \* indicate the significant level of the coefficient passing 1%, 5%, and 10% respectively, and the t-statistic after the correction of the heteroscedasticity is in the bracket.

Using panel data, a fixed effect model was selected to test Hypothesis 3. The test results are shown in "Table IV". The regression results of the full-sample cross-section data are listed in column (1) of "Table IV" and it can be found that the regression coefficients of the current, late-lasting, late-lasting, and late-lasting R&D investments are 0.013 and 0.034, respectively. 0.152, 0.171, and the estimated coefficient of R&D investment for the current period, one stage of lag, two stages of lag, and three stages of lag were significantly positively correlated at the levels of 5%, 5%, 1%, and 1% respectively, indicating R&D. Investment has a catalytic effect on corporate performance, and R&D investment has a significant effect on corporate performance over time. From the regression results of the control variables, the lag phase 1 cash flow, asset liquidity, company size, and company age are all negatively correlated with the current corporate performance at the 1% level, indicating that the cash flow and asset liquidity are lagging behind. The size of the company and the age of the company will inhibit the performance of the company in the current period; market forces, long-term capital yields, and operating risks in the first phase will all positively correlate positively with corporate performance at the 1% level, indicating a lagging market power and long-term capital gains. The rate and operating risk have a catalytic effect on the current corporate performance.

In order to further analyze the impact of R&D investment on corporate performance before and after the financial crisis, this paper will divide the entire sample into sample groups from 2004 to 2007 and sample groups from 2008 to 2017. In order to further analyze the impact of R&D investment on the performance of manufacturing companies and non-manufacturing companies, this paper divides the entire sample into sample groups of manufacturing firms and non-manufacturing firms. Select a fixed-effects model for each of these four sample groups. The empirical results are shown in "Table IV". From the regression results of the two sample groups, the effect of R&D investment on corporate performance before the financial crisis was greater than the effect of R&D investment on corporate performance after the financial crisis, indicating that major changes have taken place in the business environment before and after the financial crisis. From the regression results of sample groups of manufacturing companies and non-manufacturing enterprises, the effect of R&D investment on the performance of manufacturing companies is better than the effect of R&D investment on the performance of non-manufacturing companies, indicating the knowledge gained from R&D investment. The positive incentives for technology companies and manufacturing companies outweigh the positive incentives for non-manufacturing companies. In summary, Hypothesis 3 is verified.



TABLE IV. EMPIRICAL RESULTS OF R&amp;D INVESTMENT AND FIRM PERFORMANCE

Variable name	Full sample	2004-2007 Sample Group	2008-2017 Sample group	Manufacturing Enterprise Sample Group	Non-manufacturing enterprise sample group
$RD_t$	0.013** (3.32)	0.76** (4.13)	0.001* (3.04)	0.012** (3.21)	0.002* (3.01)
$RD_{t-1}$	0.034** (3.72)	0.142*** (4.84)	0.021** (3.54)	0.029** (3.69)	0.003* (3.22)
$RD_{t-2}$	0.152*** (4.36)	0.112*** (4.65)	0.002* (3.12)	0.098*** (4.18)	0.001* (3.06)
$RD_{t-3}$	0.171*** (4.56)	0.135*** (4.87)	0.001* (3.03)	0.139*** (4.96)	0.004* (2.91)
<i>Cashflow</i>	-0.063*** (-4.45)	-0.031*** (-4.32)	-0.013** (-4.02)	-0.023*** (-4.03)	-0.023** (-3.15)
<i>Assetsflow</i>	-0.051*** (-4.35)	-0.064*** (-4.17)	-0.002** (-3.76)	-0.031*** (-4.04)	-0.051** (-3.52)
<i>Marketfores</i>	0.049*** (3.16)	0.057*** (3.84)	0.003** (3.04)	0.034*** (3.24)	0.031** (3.07)
<i>LTCR</i>	0.062*** (4.52)	0.071*** (4.31)	0.002** (4.03)	0.041*** (4.01)	0.032** (3.12)
<i>Bu sin essrisk</i>	0.023*** (3.15)	0.036*** (3.42)	0.005** (3.21)	0.0015*** (3.12)	0.013** (3.01)
<i>Size</i>	-0.008*** (-3.17)	-0.001*** (-3.42)	-0.003** (-3.23)	-0.004*** (-3.23)	-0.002*** (-3.01)
<i>Age</i>	-0.003*** (-2.90)	-0.002*** (-2.98)	-0.001** (-2.94)	-0.001*** (-2.96)	-0.001*** (-2.93)
<i>Cons tan t</i>	-0.079** (-3.91)	-0.083** (-3.89)	-0.009** (-3.17)	-0.021** (-3.83)	-0.011** (-3.13)
<i>industry</i>	control	control	control	control	control
<i>years</i>	control	control	control	control	control
<i>Adj - R<sup>2</sup></i>	0.375	0.389	0.314	0.336	0.301
<i>F Statistics</i>	47.6	56.7	46.8	55.3	46.2
<i>Number of samples</i>	672	314	672	459	213

a. Note: \*\*\*, \*\*, \* indicate the significant level of the coefficient passing 1%, 5%, and 10% respectively, and the t-statistic after the correction of the heteroscedasticity is in the bracket.

b.

Using panel data, a fixed effect model was chosen to test Hypothesis 4. The test results are shown in "Table V". The regression results of the full-sample cross-section data are listed in column (1) of "Table V", and it can be found that the estimated coefficients of the current period, the lagging period, the lagging period, and the lagging period are 0.047, 0.125, 0.065 respectively, 0.006, and the estimated coefficient of corporate performance in the current period, lagging by one period, lagging by two periods, and lagging by three periods are significantly positively correlated at the levels of 5%, 1%, 1%, and 10%, respectively, indicating the company's performance. Supporting corporate R&D investment, the lagging phase I and lagging phase II corporate performance supports R&D investment during the current period more than the current corporate performance and lags behind the three phases of corporate performance support for the current R&D investment. This reflects the Corporate performance is one of the major intrinsic sources of financing for R&D investment. Internal source financing is also an internal driving force for corporate R&D investment. From the regression results of the control variables, the current cash flow, asset liquidity, company size, and company age are all significantly negatively related to the next phase of R&D investment at the 1% level, indicating current cash flow, asset liquidity, and firm size. The age of the enterprise has a deterrent effect on the next phase of R&D investment; the current market power, long-term

capital yield, and operational risk are all positively related to the next phase of R&D investment at the 1% level, indicating that the current market power, long-term The return on capital and operating risk will support the R&D investment in the next period.

In order to further analyze the impact of corporate performance on R&D investment before and after the financial crisis, this paper will divide the entire sample into sample groups from 2004 to 2007 and sample groups from 2008 to 2017. In order to further analyze the impact of corporate performance on manufacturing and non-manufacturing R&D investment, this paper will divide the entire sample into manufacturing enterprise sample groups and non-manufacturing enterprise sample groups. Select the fixed effect model to test the four sample groups separately. The empirical results are shown in "Table V". From the regression results of the two groups of samples, the support effect of corporate performance on R&D investment before the financial crisis is greater than the support effect of corporate performance on corporate R&D investment after the financial crisis. From the regression results of the sample groups of manufacturing enterprises and non-manufacturing enterprises, the support for R&D investment by manufacturing companies' corporate performance is stronger than that of non-manufacturing companies. In summary, Hypothesis 4 is verified.



TABLE V. EMPIRICAL RESULTS OF CORPORATE PERFORMANCE AND CORPORATE R&amp;D INVESTMENT

Variable name	Full sample	2004-2007 Sample Group	2008-2017 Sample group	Manufacturing Enterprise Sample Group	Non-manufacturing enterprise sample group
<i>Performance<sub>t</sub></i>	0.047** (4.21)	0.067** (4.57)	0.001* (3.01)	0.021** (3.71)	0.007* (3.11)
<i>Performance<sub>t-1</sub></i>	0.125*** (5.36)	0.221*** (5.67)	0.002* (3.03)	0.106*** (4.37)	0.025* (3.16)
<i>Performance<sub>t-2</sub></i>	0.065*** (4.13)	0.073** (4.43)	0.004* (3.03)	0.032** (3.83)	0.015* (3.13)
<i>Performance<sub>t-3</sub></i>	0.006* (3.27)	0.001* (3.13)	0.005* (3.07)	0.004* (3.02)	0.002* (3.17)
<i>Cashflow</i>	-0.347*** (-3.59)	-0.031*** (-3.47)	-0.071** (-3.03)	-0.041*** (-3.59)	-0.030** (-3.91)
<i>Assetsflow</i>	-0.061*** (-3.57)	-0.023*** (-3.86)	-0.012** (-3.05)	-0.041*** (-3.47)	-0.001** (-3.27)
<i>Marketforæs</i>	0.029*** (4.64)	0.019*** (4.45)	0.002** (3.24)	0.029*** (3.61)	0.209** (3.14)
<i>LTCR</i>	0.018*** (3.12)	0.019*** (3.75)	0.001** (3.02)	0.108*** (3.12)	0.013** (3.02)
<i>Bu sin essrisk</i>	0.037*** (4.15)	0.071*** (4.34)	0.036** (3.14)	0.307*** (4.25)	0.031** (3.13)
<i>Size</i>	-0.009*** (-4.17)	-0.006*** (-4.23)	-0.002** (-3.12)	-0.001*** (-4.27)	-0.001** (-3.11)
<i>Age</i>	-0.005*** (-3.19)	-0.003*** (-3.56)	-0.001** (-3.09)	-0.002*** (-3.39)	-0.001** (-3.09)
<i>Constant</i>	-0.026** (-4.14)	-0.032** (-4.31)	-0.002** (-3.11)	-0.206** (-3.14)	-0.023** (-3.04)
<i>industry</i>	control	control	control	control	control
<i>years</i>	control	control	control	control	control
<i>Adj - R<sup>2</sup></i>	0.361	0.372	0.301	0.331	0.301
<i>F Statistics</i>	48.7	49.8	45.3	45.6	45.1
<i>Number of samples</i>	672	314	672	459	213

a. Note: \*\*\*, \*\*, \* indicate the significant level of the coefficient passing 1%, 5%, and 10% respectively, and the t-statistic after the correction of the heteroscedasticity is in the bracket.

### C. Robustness Test

In order to verify the reliability of the foregoing research findings, the following robustness tests were performed: ① Using the total return on assets index (ROA, net profit/total assets) to measure corporate performance; ② Adopting the “natural logarithm of the amount of corporate R&D investment” R & D investment; ③ change the treatment of extreme values, change 1% and 99% winsorize processing to 5% and 95% winsorize processing. On the basis of the previous econometric model, a new empirical test, the results of the robustness test showed that the signs and significance of the coefficients of the variables did not change, and the above conclusions were robust.

## VI. CONCLUSIONS AND SUGGESTIONS

After the reform and opening up, the super-currency of money is a normal state, and the large-scale growth of the broad money supply has great controversy on whether there is a positive impact on R&D investment and corporate performance. This paper selects non-real estate companies and companies that have been listed for more than 10 years as research samples, examines the internal relationship between growth of broad money supply, R&D investment and corporate performance, and draws five conclusions. First, the growth of broad money supply will have a positive impact on R&D investment through currency transmission, taking into account the lagging effect of broad money supply growth on companies, lagging behind the growth of broad

money supply in the first phase and the broad money supply behind the second phase. The positive impact of quantitative growth on R&D investment is even more significant; the positive effect of broad money supply growth on R&D investment before the financial crisis exceeds the positive impact of broad money supply growth on R&D investment after the financial crisis; broad money supply The accelerating effect of quantitative growth on R&D investment in manufacturing companies exceeds the effect of broad money supply growth on R&D investment of non-manufacturing firms. Second, the growth of broad money supply is positively correlated with corporate performance. Considering the currency transmission mechanism, the growth of broad money lagging behind in one phase and the increase of broad money supply in lagging phase two have a more significant effect on improving corporate performance; broad money supply The positive effect of quantitative growth on corporate performance before the financial crisis surpassed that of corporate performance after the financial crisis, implying that the super-currency of money does not necessarily improve corporate performance significantly; broad money supply growth for non-manufacturing The positive effect of corporate performance exceeds the positive effect of broad money supply growth on the performance of manufacturing firms. Third, R&D investment is positively correlated with corporate performance. The significant effect of R&D investment on corporate performance is lagging behind; R&D investment has a greater effect on corporate performance before the financial crisis than on the corporate performance after the financial crisis; R&D investment The

promotion effect of manufacturing enterprise performance is greater than the promotion effect of non-manufacturing enterprise performance. Fourth, corporate performance has an incentive effect on R&D investment; corporate performance is the internal driving force of R&D investment; corporate performance has a greater incentive to R&D investment before financial crisis than R&D investment's incentive to R&D investment after financial crisis; corporate performance. The supporting role of R&D investment in manufacturing enterprises is greater than the supporting role of corporate performance in R&D of non-manufacturing companies. Fifth, the growth of broad money supply provides external support for corporate R&D investment, corporate performance provides internal support for R&D investment; R&D investment enhances corporate performance level through obtaining technological advantages and knowledge information; R&D investment and corporate performance are a kind of The two-way relationship that promotes mutual influence; a broad closed-loop is formed in the growth of broad money supply, R&D investment, and corporate performance.

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