

# ***Empirical Research of Private Equity Investment under the Influence of Macroeconomic Factors***

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**Abstract.** In recent years, private equity investment has played an increasingly important role in China's financial system, second only to bank loans and public offerings. Under the influence of macroeconomic factors, private equity firms can anticipate changes in the overall capital structure of the Chinese market by monitoring fluctuations in macroeconomic indicators during their operational processes. Thereby, private equity firms can adjust their corresponding private equity investment strategies. This study constructs a linear regression model by selecting relevant macroeconomic variables such as Gross Domestic Product (GDP) and Consumer Price Index (CPI) to determine the impact of macroeconomic indicators on private equity investment. In the actual research process, annual data from 2015 to 2024 were used, and ridge regression was employed based on Ordinary Least Squares (OLS) to optimize the model. The conclusion is that variables such as GDP and CPI have a positive effect on the scale of private equity investment, verifying the hypothesis that macroeconomic indicators have an impact on private equity investment.

**Keywords:** Private equity investment scale, macroeconomic indicators, ridge regression model

## **1. Introduction**

With the continuous development of China's market economy and the ongoing optimization of the innovation and entrepreneurship ecosystem, backed by multiple policy incentives and gradually lowering fundraising thresholds, the operational space for private equity investment is expanding, and the exit channels are becoming increasingly diverse [1]. According to the "2012 Statistical Analysis Report on China's Venture Capital and Private Equity Investment Market" released by ChinaVenture Group, the investment scale of private equity in China has been increasing year by year since 2006, with the total investment reaching a historical high of \$29.015 billion in 2011. This clearly demonstrates that private equity investment has become an important financing method in China's financial market [2].

In a specific period of macroeconomics, especially in the early stages of an economic crisis, adjustments in corporate financing and business strategies play a crucial role in helping enterprises smoothly navigate through the crisis [3]. For instance, private equity funds not only provide valuable long-term capital for enterprises but also deeply intervene in the strategic adjustments and operational optimization of invested companies, assisting them in dealing with macroeconomic

shocks. Such "value creation" activities become particularly important during economic downturns [4]. Additionally, in the macroeconomic regulation of the stock market, changes in macroeconomic indicators can lead to corresponding fluctuations in stock prices, thereby affecting the direction and strategy of private equity investments [5]. When monetary policy is loose and market liquidity is abundant, private equity investment activities become significantly active; whereas when the Economic Policy Uncertainty index rises, investors tend to assess risks conservatively, the pace of investment slows down noticeably, and they prefer to allocate funds to sectors with strong anti-cyclical characteristics, such as new consumption and healthcare. Simultaneously, under the influence of macroeconomic factors, the exit methods of private equity also change. The "wind direction effect" of macroeconomic indicators influences investors' decisions in private equity investments, specifically reflected in the choice of exit mechanisms [6]. In terms of exit mechanisms, the goal of private equity investment is to maximize profits. Common exit methods include corporate mergers and acquisitions, shareholder transfers, and initial public offerings [7]. It is evident that the impact of macroeconomic factors on private equity is a significant and worthwhile topic for research; its role in enabling financial practitioners to further delve into the field of private equity investment in the future is obvious.

This paper aims to delve into the mechanism by which macroeconomic factors influence private equity investment, carrying significant theoretical and practical implications. In terms of research methodology, this paper selects key macro variables such as gross domestic products and consumer price index to construct a multiple linear regression model. To address multicollinearity issues, ridge regression is employed for optimization, enhancing the robustness and explanatory power of the model. The research objective is to clarify the specific direction and extent of the impact of each macro variable on the scale of private equity investment, providing empirical evidence for strategic adjustments by private equity investment institutions and offering insights for relevant policy formulation.

## 2. Model establishment

### 2.1. Data processing

#### 2.1.1. Logarithmic processing

To construct a multiple linear regression model, all data are first logarithmically transformed for the following reasons:

(1) Transforming coefficients into "elasticities" is the most crucial and fundamental reason for taking logarithms. It greatly enhances the economic significance and interpretability of regression results, making research conclusions more general and comparable.

(2) Mitigating heteroscedasticity. Taking the logarithm is a commonly used data transformation method that can effectively correct the problem of heteroscedasticity caused by the "scale effect" of the data itself, ensuring the reliability of hypothesis testing results.

#### 2.1.2. Handling of CPI

In empirical analysis, to ensure comparability of data across different years and avoid distortions in time series data caused by different base periods, it is necessary to convert the year-on-year Consumer Price Index (CPI) index based on the previous year into a fixed-base CPI index based on

the same fixed base period. This paper refers to the processing method of Li Dan and Zhang Xubo, using the Consumer Price Index with the base year of 2015 (i.e., 2015=100) as the benchmark [1].

## 2.2. Explanation of variable selection

To explore the impact of macroeconomic factors on the scale of private equity investment, this paper selects data from 2015 to 2024 to construct the following multiple linear regression model. The definitions, symbols, and data sources of each variable in the model are explained as follows:

### 2.2.1. Dependent variable

PE: This article adopts the annual amount of private equity investment as a proxy variable to measure the activity level of China's private equity investment market. The data is sourced from the official statistical report released by the Asset Management Association of China.

### 2.2.2. Independent variable

Select the following five core macroeconomic indicators as independent variables:

(1)Gross Domestic Product (GDP): A comprehensive indicator for measuring the economic development level of a country or region, representing the overall scale and prosperity of the macro economy. The data is sourced from the National Bureau of Statistics.

(2)CPI: The main indicator for measuring inflation levels, reflecting changes in the overall price level of society. The data is processed and presented as a fixed-base index with 2015 as the base period, sourced from the National Bureau of Statistics.

(3)M2: An important financial indicator reflecting the total social demand and potential purchasing power, representing the degree of monetary policy relaxation. The data is sourced from the National Bureau of Statistics.

(4)ER: Exchange rate of RMB against USD. It adopts the direct quotation method (how many RMB can be exchanged for 1 USD). Changes in exchange rates affect cross-border capital flows and asset valuation, which in turn influence investment decisions. The data comes from the National Bureau of Statistics.

(5)R: 7-day interbank offered rate. As a short-term market benchmark interest rate, it is a key indicator for measuring the tightness of financial market liquidity and the cost of capital. The data is sourced from the Wind database.

$$\ln PE = c + \beta_1 \ln GDP + \beta_2 \ln CPI + \beta_3 \ln R + \beta_4 \ln ER + \beta_5 \ln M2 + \varepsilon_t \quad (1)$$

## 3. Empirical analysis

### 3.1. Correlation analysis

Using SPSSPRO, a Spearman correlation analysis was conducted on the relevant data. The results of the Spearman correlation analysis showed a positive correlation between GDP, CPI, and M2, indicating that their movements are highly synchronized, which may reflect the coordination between macroeconomic expansion and monetary policy. The correlation coefficient between private equity investment funds and GDP, CPI, and M2 reached 0.952 ( $p < 0.01$ ), indicating a close correlation between their scale and macroeconomic indicators, or a significant impact from the overall economic environment. The RMB exchange rate shows a moderate positive correlation with

GDP, CPI, and M2 (0.648,  $p < 0.05$ ), but has no significant correlation with other variables (such as private equity fund 0.527,  $p = 0.117$ ), suggesting a partial linkage between exchange rate fluctuations and macroeconomic activities.

### 3.2. Regression result analysis

Table 1. Analysis of linear regression results

| Linear regression analysis result: n=10                                         |                              |                |                          |        |        |        |                |                         |            |
|---------------------------------------------------------------------------------|------------------------------|----------------|--------------------------|--------|--------|--------|----------------|-------------------------|------------|
|                                                                                 | Non-standardized coefficient |                | standardized coefficient | t      | P      | VIF    | R <sup>2</sup> | Adjusted R <sup>2</sup> | F          |
|                                                                                 | B                            | standard error | Beta                     |        |        |        |                |                         |            |
| constant                                                                        | -59.343                      | 22.444         | -                        | -2.644 | 0.057* | -      |                |                         |            |
| GDP                                                                             | 9.069                        | 2.966          | 3.355                    | 3.057  | 0.038* | 117.98 |                |                         |            |
| CPI                                                                             | 0.391                        | 9.229          | 0.034                    | 0.042  | 0.968  | 64.239 | 0.959          | 0.908                   | F=18.792   |
| R                                                                               | 6.488                        | 2.249          | 0.432                    | 2.885  | 0.045* | 2.193  |                |                         | P=0.007*** |
| M2                                                                              | -6.74                        | 1.874          | -3.03                    | -3.597 | 0.023* | 69.528 |                |                         |            |
| ER                                                                              | -0.95                        | 1.077          | -0.251                   | -0.882 | 0.427  | 7.915  |                |                         |            |
| dependent variable:PE                                                           |                              |                |                          |        |        |        |                |                         |            |
| Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively |                              |                |                          |        |        |        |                |                         |            |

As shown in Table 1, the linear regression model is based on 10 sample data, with private equity investment funds as the dependent variable. The results indicate that the overall model has a high goodness of fit ( $R^2=0.959$ , adjusted  $R^2=0.908$ ), and has passed the significance test at the 1% level ( $F=18.792$ ,  $P=0.007$ ). Specifically, GDP has a significant positive impact on private equity investment funds ( $B=9.069$ ,  $P=0.038$ ). The standardized coefficient indicates that it is the strongest influencing factor ( $Beta=3.355$ ). The multicollinearity diagnosis shows that the VIF values of GDP and CPI are as high as 117.98 and 64.239, respectively, indicating a serious multicollinearity issue that requires vigilance; the VIF values of the remaining variables are within an acceptable range ( $< 10$ ). Although the model has strong explanatory power, the extreme VIF values suggest that further examination of variable selection and optimization of the model is necessary.

### 3.3. Model optimization (ridge regression method)

After preliminary linear fitting, it was found that there were abnormal VIF values for GDP and CPI, indicating severe multicollinearity between the two. Therefore, ridge regression was further applied for fitting based on this [8]. According to the variance inflation factor method,  $k=0.211$  can be determined. The results of ridge regression are shown in Table 2.

The results of the ridge regression analysis indicate that the overall goodness of fit,  $R^2$ , of the model is 0.809, and the adjusted  $R^2$  is 0.569, suggesting that the explanatory variables can account for 56.9% of the variation in the dependent variable; under a regularization strength of  $K=0.211$ , CPI

(non-standardized coefficient=3.265, Beta=0.287, p=0.084\*) and GDP (non-standardized coefficient=0.807, Beta=0.299, p=0.077\*) have a significant positive impact on private equity investment funds at the 10% level, and the standardized coefficients indicate that the marginal contribution of GDP is slightly higher than that of CPI. Ridge regression mitigates the variance of coefficient estimates through the introduction of bias, but at the cost of sacrificing unbiasedness. The comparison of standardized coefficients shows that GDP has the greatest elasticity towards private equity funds. The results suggest that focus should be placed on the two marginally significant variables, CPI and GDP [9].

Table 2. Analysis of ridge regression results

| K=0.211  | Non-standardized coefficient |                | standardized coefficient | t      | P      | R <sup>2</sup> | Adjusted R <sup>2</sup> | F            |
|----------|------------------------------|----------------|--------------------------|--------|--------|----------------|-------------------------|--------------|
|          | B                            | standard error | Beta                     |        |        |                |                         |              |
| constant | -36.567                      | 19.262         | -                        | -1.898 | 0.130  |                |                         |              |
| CPI      | 3.265                        | 1.425          | 0.287                    | 2.291  | 0.084* |                |                         |              |
| M2       | 0.133                        | 0.285          | 0.06                     | 0.468  | 0.664  | 0.809          | 0.569                   | 3.379(0.131) |
| GDP      | 0.807                        | 0.342          | 0.299                    | 2.363  | 0.077* |                |                         |              |
| ER       | 3.003                        | 3.085          | 0.2                      | 0.973  | 0.385  |                |                         |              |
| R        | -0.247                       | 0.802          | -0.065                   | -0.308 | 0.773  |                |                         |              |

dependent variable:PE

Note: \*\*\*, \*\*, \* represent significance levels of 1%, 5%, and 10%, respectively

#### 4. Conclusion

Based on the optimized results from the final ridge regression, it can obtain the final model regarding the impact of macroeconomic factors on private equity investment.

$$\ln PE = -36.567 + 3.265 \ln GDP + 0.133 \ln CPI + 0.807 \ln R + 3.003 \ln ER - 0.247 \ln M2 \quad (2)$$

According to the results of stepwise regression analysis, the impact of macroeconomic variables on the scale of private equity investment exhibits significant correlation. There is a positive association between GDP and PE, specifically manifested as a 3.265% increase in private equity investment amount for every 1% increase in GDP. This result confirms the role of macroeconomic prosperity in promoting corporate financing needs, thereby driving the development of the private equity market. On the other hand, CPI also shows a positive correlation with private equity investment, with an increase of 0.133% in investment amount for every 1% increase in CPI. This finding aligns with economic theory, indicating that moderate price increases can stimulate production vitality, thereby exerting a positive driving effect on private equity investment. Furthermore, the exchange rate of the Renminbi against the US dollar also demonstrates a significant impact, with a 3.003% increase in the scale of private equity investment for every 1% increase in exchange rate, reflecting the important role of exchange rate fluctuations in capital flows and investment decisions.

This article focuses on the impact of macroeconomic factors on China's private equity investment. The results indicate that gross domestic product, inflation level, and exchange rate fluctuations all have a significant driving effect on private equity investment. Based on the empirical conclusions, this article proposes the following policy recommendations:

Firstly, the growth of GDP has a positive impact on private equity investment. It should further promote the optimization of industrial structure, enhance total factor productivity, reduce intermediate consumption, and strengthen corporate profitability and future expected returns. This will, in turn, expand the financing demand in the capital market and activate the vitality of the private equity investment market.

Secondly, moderate price increases can help promote private equity investment. The government should focus on developing production, ensuring market supply, improving the circulation system, strengthening price monitoring and regulation mechanisms, and maintaining market order. In the process of promoting market-oriented price reforms, it is necessary to carefully grasp the timing of policy introduction and complement it with measures to optimize the economic structure. Meanwhile, by implementing proactive fiscal policies and structural adjustments, it can curb hyperinflation and create a healthy and orderly macroeconomic environment for private equity investment.

In addition, exchange rate fluctuations have a significant impact on capital flows and investment behavior. It should steadily promote market-oriented reforms of the exchange rate, regulate imports and exports as well as cross-border capital flows, alleviate international balance of payments imbalances, maintain the basic stability of the RMB exchange rate at a reasonable and balanced level, provide stable external financial conditions for private equity investment, and facilitate high-quality economic development.

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